GHI
TEMPERATURMESSTECHNIK

INDUSTRY BROCHURE

# Automotive & Test bench

Temperature sensors for brake and engine testing, road testing and validation

On the test bench different things matter than in the plant: short response time, reproducible installation, traceable accuracy – and sensors that can be made in small batches exactly as the test set-up requires.

### Over 30 years of test benches

Brake, engine, gearbox, weathering – sensors that stand up to testing

### Custom design from 1 piece

to sample, drawing or sketch, quotation within one working day

### In-house calibration laboratory

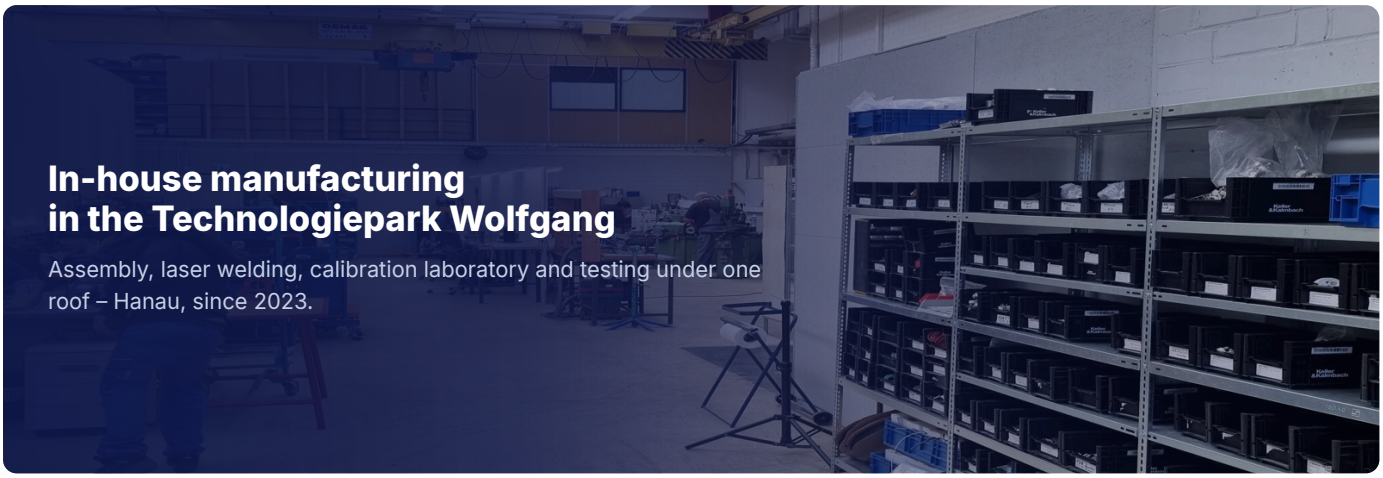
Factory and DAkkS calibration, test points as you specify

### Made in Hanau

Assembly, welding and testing under one roof

# Temperature sensors Made in Germany – since 1970

We develop and manufacture temperature sensors for industry, laboratory and test bench. Starting in the 1970s with the first resistance thermometers, today with over 1,500 versions – from the standard Pt100 to ATEX-certified custom designs. All manufacturing takes place exclusively in-house in Hanau.



## In-house manufacturing in the Technologiepark Wolfgang

Assembly, laser welding, calibration laboratory and testing under one roof – Hanau, since 2023.

| 50+ | 600+ | 1,500+ | 1 |
|---|---|---|---|
| years of experience | customers | Products | piece minimum quantity |

## Our promise

- **Quotation within one working day** – also for special versions
- **No minimum order value** – single pieces and series
- **In-house manufacturing** – Hanau – Made in Germany
- **In-house calibration laboratory** – factory and DAkkS calibration, CQI-9
- **Replicas and replacements** – of third-party and legacy products to sample or drawing

## Our history

| | |
|---|---|
| 1970 | Founded as Thiel Elektrotechnik Gerätebau GmbH |
| 2009 | Takeover by GHI GmbH |
| 2021 | Generational change |
| 2023 | Move to the Technologiepark Wolfgang, Hanau |
| 2024 | ATEX audit to Directive 2014/34/EU |
| 2025 | Takeover of the temperature measurement business of Schramm GmbH |

## Certificates and certification

**EN ISO 9001:2015**
Quality management, certified by DMSZ

**ATEX 2014/34/EU**
EPS 25 ATEX 1 060 X (Bureau Veritas, NB 2004)

**IECEx**
IECEx EPS 25.0012X

**CQI-9 / calibration**
Test equipment monitoring and calibration in our own laboratory

### Over 30 years of test bench experience

Rubbing thermocouples for brake test benches, exhaust gas sensors for engine test benches, black standard thermometers for weathering chambers: these series have been in use at vehicle manufacturers, suppliers and test bench builders for decades. Since January 2025 the Schramm GmbH range has been added – with identical installation dimensions under new GHI type designations.

# Where we measure on the test bench

Four fields of application in which our sensors have been in use for over 30 years – at vehicle manufacturers, suppliers and test bench builders.

### BRAKE TEST BENCH

**TAM-1 · TAM-4 · TAM-3**

Disc, pad and brake fluid – rubbing, spring-loaded or screwed in. Type K, class 1, miniature thermocouple connector to IEC or ANSI.

### ENGINE AND GEARBOX TEST BENCH

**TML · WML · WF · TF**

Exhaust gas up to +1,300 °C, oil and cooling circuits, bearings and housings. Sheathed sensors with compression fitting or screw-in sensors with sealed thread.

### ROAD TESTING AND VALIDATION

**TAM-4 · WST · WMT · TML**

Sensors that are mounted in the vehicle and changed between runs: pluggable, strain-relieved, with reproducible insertion length.

### WEATHERING AND CLIMATE CHAMBER

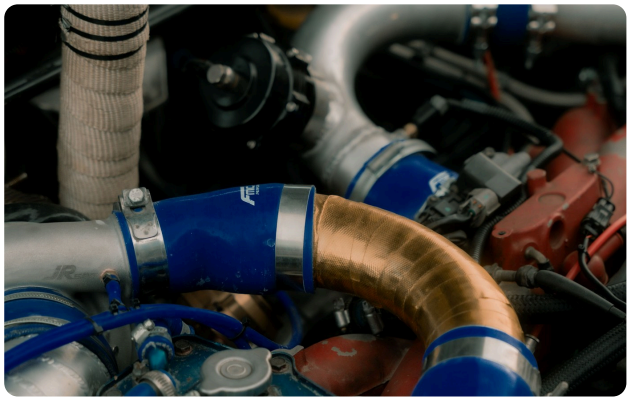
**WSS · WML · TML**

Black standard temperature to ISO 4892-1, air and component temperature in climate and solar simulation chambers.

## Response time

Guide values for sheathed sensors, insulated junction

| Sheath Ø | $t_{0.5}$ water 0.4 m/s | $t_{0.9}$ water | $t_{0.5}$ air 1 m/s |
|---|---|---|---|
| **Ø 0.5 mm** | 0.05 s | 0.15 s | 1.5 s |
| **Ø 1.0 mm** | 0.1 s | 0.4 s | 3 s |
| **Ø 1.5 mm** | 0.2 s | 0.8 s | 5 s |
| **Ø 3.0 mm** | 0.6 s | 2.5 s | 12 s |
| **Ø 6.0 mm** | 2.0 s | 8 s | 40 s |

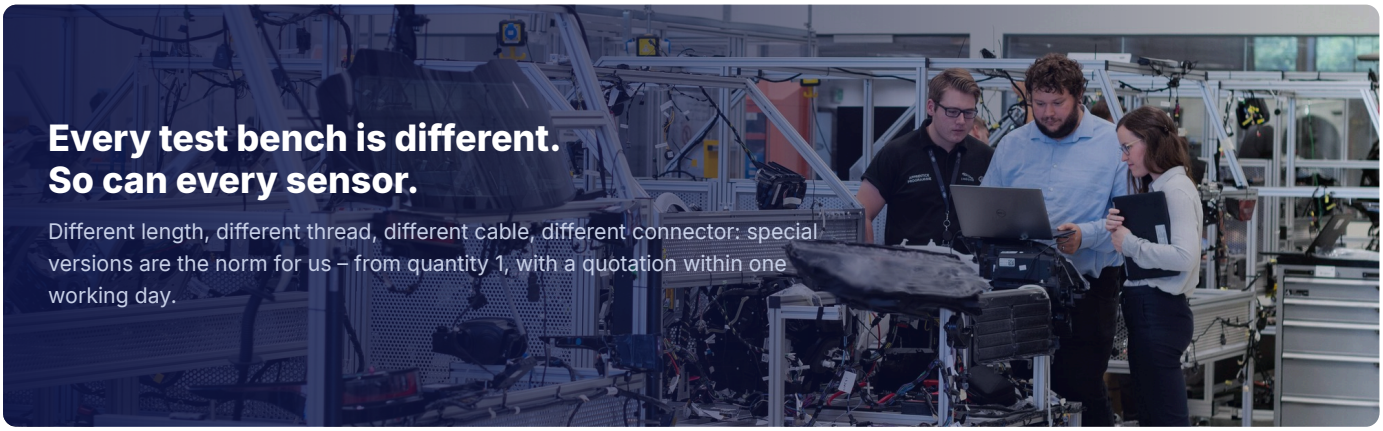


### GROUNDED OR INSULATED?

The grounded junction is around 30 % faster because the bead sits directly on the sheath. However, it brings the test object's potential onto the measuring chain – with many channels or frequency converters it is therefore better to measure insulated.

### WHAT ELSE WE SUPPLY

Calibration with freely selectable test points, serial number per sensor, compensating cables and connectors, compression fittings and weld sockets – all from one source.



## Every test bench is different. So can every sensor.

Different length, different thread, different cable, different connector: special versions are the norm for us – from quantity 1, with a quotation within one working day.

# Selection guide

All series in this brochure at a glance. The complete order code of every type as well as protective-tube, high-temperature and Ex versions can be found in the GHI product catalogue Temperature Sensors.

| Type | Designation | Sensor | Measuring range | Termination | S. |
|---|---|---|---|---|---|
| **Rubbing and insertion sensors** | | | | | |
| **TAM-1** | Rubbing thermocouple for brake systems | TC type K | Brake disc | Cable, miniature connector | **5** |
| **TAM-2** | Insertion, hammer-in and chisel-in sensors | TC type K | up to +1,000 °C | Cable, miniature connector | **5** |
| **Brake fluid and brake disc** | | | | | |
| **TAM-3** | Brake fluid sheathed thermocouple | TC type K / N | up to +300 °C | Threads M6–M10, 3/8" | **6** |
| **TAM-4** | Brake disc thermocouple with spring clip | TE K, J, T | up to +800 °C | Spring clip on holder | **6** |
| **Weathering and climate chamber** | | | | | |
| **WSS** | Black standard thermometer (BST) | Pt100 | 0...+200 °C | Cable | **7** |
| **Sheathed sensors with cable** | | | | | |
| **WML · WML-EX** | Sheathed resistance thermometer with cable | Pt100 / Pt1000 | –200...+600 °C (Pt) | Cable, LEMO, M12 | **8** |
| **TML · TML-EX** | Sheathed thermocouple with cable | TE K, N, J, S | depending on type up to +1,300 °C | Cable, Connector | **8** |
| **Sheathed sensors for your own assembly** | | | | | |
| **WMT · TMT** | Sheathed sensor with bare ends | Pt100 / TC K, N, J | Pt +600 / TC +1,150 °C | bare ends | **9** |
| **WST · TMS** | Sheathed sensor with connector | Pt100 / TC K, N, J | Pt +600 / TC +1,150 °C | LEMO, M12, thermocouple connector | **9** |
| **Screw-in sensors** | | | | | |
| **WF · TF** | Screw-in sensor with cable | Pt100 / Pt1000 · TC K, N, J | Pt +400, TC +600 °C | Strands, cable, M12, thermocouple connector | **10** |

### PT100 OR THERMOCOUPLE?

Up to +600 °C the Pt100 is more accurate and more stable in the long term. The thermocouple is faster, mechanically more robust and goes considerably higher – above +600 °C it is the only choice anyway.

### EVERYTHING ALSO AS CUSTOM DESIGN

Different lengths, threads, cables or connectors are the norm, not the exception. A sample, drawing or sketch is sufficient.

### EX VERSION

WML, TML, WMT and WST are available ATEX and IECEx certified for zones 0, 1 and 2 as well as 20, 21 and 22.

## We also supply

### CABLES AND CONNECTORS

Compensating and thermocouple cables, LEMO, M12, standard and miniature thermocouple connectors, sockets, colour code to IEC or ANSI.

### PROCESS CONNECTION

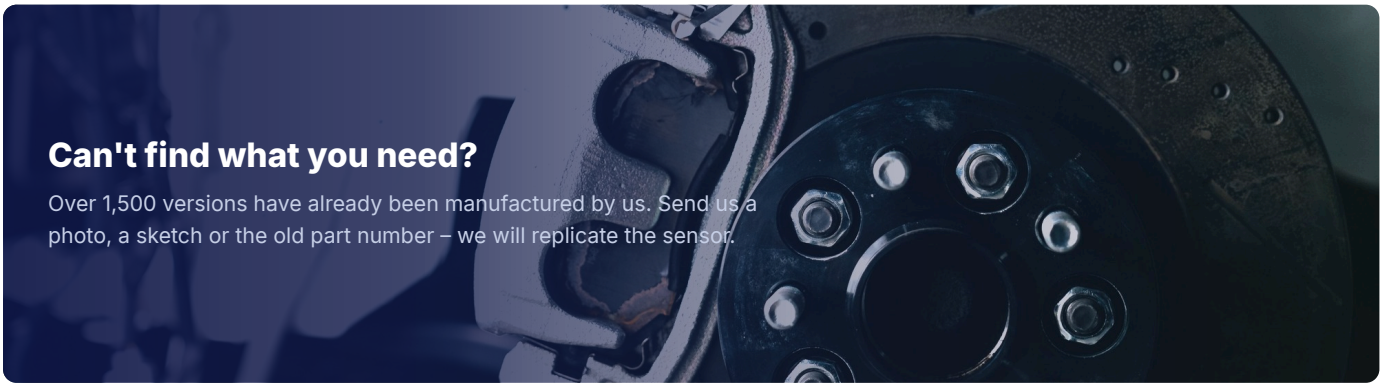
Compression fittings G 1/4" to G 1/2", NPT and metric, ferrule stainless steel or PTFE, weld sockets and sealing rings.

### CALIBRATION

Factory and DAkkS calibration with freely selectable test points, calibration certificate with measurement uncertainty, serial number per sensor.

### TRANSMITTERS

Head and DIN-rail transmitters 4–20 mA or HART, on request matched and calibrated together with the sensor.



## Can't find what you need?

Over 1,500 versions have already been manufactured by us. Send us a photo, a sketch or the old part number – we will replicate the sensor.

# Rubbing and insertion sensors

Sensors that measure directly at the brake and in the component – in rubbing contact, driven in or chiselled in.

## TAM-1

### Rubbing thermocouple for brake systems

**Brake test bench – temperature at disc and pad in rubbing contact**

| | |
|---|---|
| Sensor | TC type K |
| Measuring range | Brake disc |
| Design | Ø 7.9 mm |
| Termination | Cable, miniature connector |

- Measuring junction spring-loaded, electrically connected
- Sensor Ø 7.9 mm, length 15 or 26 mm
- Accessory: guide sleeve with spring and lock nut

Ordering example **TAM-1-2-1-3-2-1-5**

## TAM-2

### Insertion, hammer-in and chisel-in sensors

**Component and surface measurement – driven in, inserted or chiselled in**

| | |
|---|---|
| Sensor | TC type K |
| Measuring range | up to +1,000 °C |
| Design | Ø 2 / 3 mm |
| Termination | Cable, miniature connector |

- Tip stainless steel or brass
- Ø 2 / 3 mm, length 2 / 3 / 5 mm
- Tip up to 1,000 °C, cable up to 600 °C

Ordering example **TAM-2-1-1-2-2-2-2-1-5**

### Accessories and practice

For the TAM-1 we supply the guide sleeve with spring and lock nut: it is mounted permanently on the test bench, the spring holds the measuring junction against the disc with constant pressure, the lock nut secures the insertion depth once set. The sensor thus becomes a wear part that can be replaced without setting up the measuring point again. We supply sets with identical sensor and cable length, on request with serial number and calibration certificate over the actual working range.

# Brake fluid and brake disc

In the hydraulic circuit and on the rotating component.

## TAM-3

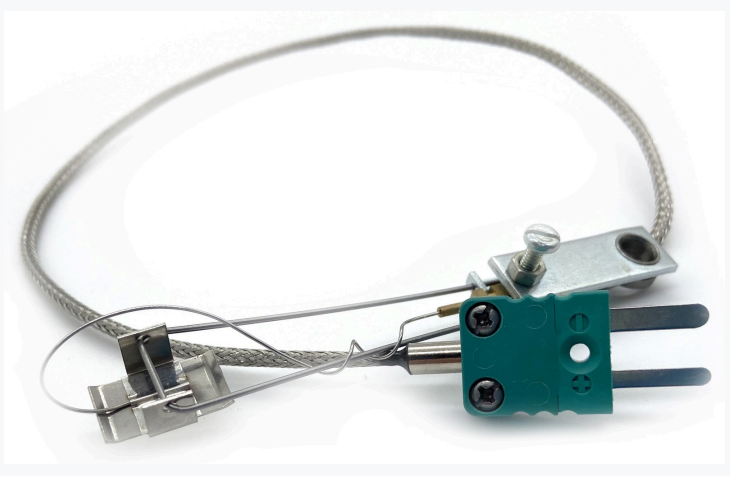
### Brake fluid sheathed thermocouple

**Brake fluid in the calliper, up to 320 bar**

| | |
|---|---|
| Sensor | TC type K / N |
| Measuring range | up to +300 °C |
| Design | Ø 2 mm, 320 bar |
| Termination | Threads M6–M10, 3/8" |

- Sheathed thermocouple Ø 2.0 mm, electrically isolated
- 90° sealing cone, pressure up to 320 bar
- Thermocouple lead 2 × 0.22 mm², silicone-rubber insulated

Ordering example **TAM-3-K-10-1-2-1-1**



## TAM-4

### Brake disc thermocouple with spring clip

**Brake disc in road testing, spring clip with adjustable contact pressure**

| | |
|---|---|
| Sensor | TE K, J, T |
| Measuring range | up to +800 °C |
| Design | Measuring tip Ø 0.5 mm |
| Termination | Spring clip on holder |

- Sheathed measuring tip Ø 0.5 mm – very short response time
- Contact pressure adjustable via screw and lock nut
- Stainless-steel holder with Ø 5 mm mounting hole

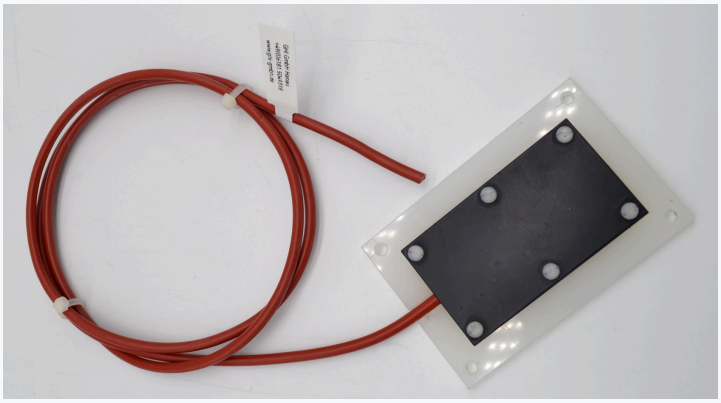
Ordering example **TAM-4-K-G-1-1-1-2-1-4**

**Adaptation is the norm**

You specify thread, tip shape, cable material and connector type. For TAM-2 we make the tip of stainless steel or brass, for TAM-3 any common brake calliper fitting – a sample or drawing is sufficient.

# Weathering and climate chamber

Black standard temperature to ISO 4892-1 – the quantity that makes weathering tests comparable.



## WSS

### Black standard thermometer (BST)

**Weathering and climate chamber – black standard temperature to ISO 4892-1**

| | |
|---|---|
| Sensor | Pt100 |
| Measuring range | 0...+200 °C |
| Design | Plate 70 × 40 |
| Termination | Cable |

- Absorber plate 70 × 40 × 1 mm, replaceable
- PTFE carrier block with air gap
- 1 × or 2 × Pt100, 2-/3-/4-wire, class A

Ordering example **WSS-P1-4-3-1-3-1-1**

## Using the black standard correctly

#### WHAT THE BLACK STANDARD TEMPERATURE IS

Not the air temperature in the chamber, but the temperature that a black, thermally insulated surface reaches under irradiation. It is the reference value that makes weathering tests comparable in the first place.

#### CONSTRUCTION

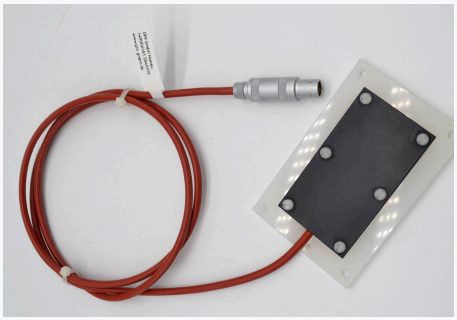
Absorber plate of stainless steel, black-coated, 70 × 40 × 1 mm, on a PTFE carrier block with defined air gap. Overall height 9 mm, four Ø 6 mm mounting holes. The plate is replaceable – the measuring element stays.

#### MEASURING ELEMENT AND CERTIFICATION

1 × or 2 × Pt100 class A, 2-, 3- or 4-wire, FEP cable with copper braid. On request with calibration certificate over the chamber's working range and serial number per sensor.

For the air temperature next to the test specimen we recommend a small-diameter sheathed sensor WML or TML – it follows temperature changes considerably faster than the absorber plate.

View of the PTFE carrier block: the Pt100 sits directly beneath the absorber plate



Version with LEMO connector – plate and cable stay in the chamber, the sensor is pluggable

# Sheathed sensors with cable

The workhorses on the test bench: thin, bendable, fast – as Pt100 and as thermocouple up to +1,300 °C.

## WML · WML-EX

Successor to the Schramm series **W90** – identical installation dimensions

### Sheathed resistance thermometer with cable

**Media, air and component temperature with process connection**

| | |
|---|---|
| Sensor | Pt100 / Pt1000 |
| Measuring range | –200…+600 °C (Pt) |
| Design | Ø 1–6 mm |
| Termination | Cable, LEMO, M12 |
| Ex | i |

- Bendable sheath, Ø 1.0 – 6.0 mm
- Cable silicone, PTFE or glass fibre
- Termination stranded leads, LEMO or M12

Ordering example **`WML-1-P1-4-A-1-2-2-2-1-K-1-3-K`**

## TML · TML-EX

Successor to the Schramm series **T90** – identical installation dimensions

### Sheathed thermocouple with cable

**Exhaust gas, engine bay and hot components up to +1,300 °C**

| | |
|---|---|
| Sensor | TE K, N, J, S |
| Measuring range | depending on type up to +1,300 °C |
| Design | Ø 0.5–6 mm |
| Termination | Cable, Connector |
| Ex | i |

- Ø 0.5 – 6.0 mm, tightly bendable
- Measuring junction insulated or grounded
- Cable silicone, PTFE or glass fibre

Ordering example **`TML-3-K1-I-1-5-4-3-3-K-K-1-6-K`**

**Ex version available**

WML and TML are available ATEX and IECEx certified (EPS 25 ATEX 1 060 X, IECEx EPS 25.0012X) for zones 0, 1 and 2 as well as 20, 21 and 22 – relevant for hydrogen, battery and fuel test benches.

# Sheathed sensors for your own assembly

When you build the measuring chain yourself or change quickly between tests.

## WMT · TMT

### Sheathed sensor with bare ends

**freely assembled for your own measuring chains and connectors**

| | |
|---|---|
| Sensor | Pt100 / TC K, N, J |
| Measuring range | Pt +600 / TC +1,150 °C |
| Design | Ø 0.5–8 mm |
| Termination | bare ends |

- Ø 0.5 – 8.0 mm, tightly bendable
- Pt100 / Pt1000 or type K, N, J, S
- bare ends 10 / 20 / 30 mm

Ordering example **TMT-K1-G-1-3-2-2-C(500)-K-5-K**

## WST · TMS

### Sheathed sensor with connector

**pluggable measuring chain, quick sensor change between tests**

| | |
|---|---|
| Sensor | Pt100 / TC K, N, J |
| Measuring range | Pt +600 / TC +1,150 °C |
| Design | Ø 0.5–6 mm |
| Termination | LEMO, M12, thermocouple connector |

- Ø 0.5 – 6.0 mm, tightly bendable
- LEMO, M12 or thermocouple connector
- Plug or socket, colour-coded to IEC

Ordering example **WST-M-P1-4-A-5-1-3-1-1-3-K**

**Connectors to suit your measuring chain**

LEMO, M12, standard and miniature thermocouple connectors, socket or plug, colour code to IEC 60584-3 or ANSI. Tell us what is on your measuring amplifier and the sensor arrives assembled to match.

# Screw-in sensors

Sealed screw-in from M5 to G 1/2" – as resistance thermometer and as thermocouple, same mechanics.

## WF · TF

### Screw-in sensor with cable

**Oil, hydraulics, coolant, tools and assemblies – sealed screw-in**

| | |
|---|---|
| Sensor | Pt100 / Pt1000 · TC K, N, J |
| Measuring range | Pt +400, TC +600 °C |
| Design | M5 to G 1/2", Ø 2.5–8 mm |
| Termination | Strands, cable, M12, thermocouple connector |

- Threads M5 to G 1/2", metric, Whitworth and NPT
- WF: Pt100 / Pt1000 · TF: type K, N, J
- Sensor tube Ø 2.5 – 8 mm, wear-resistant tip on request

Ordering example **`WF-P1-3-A-2-3-C(50)-1-2-3-J-1-1-1-2-9`**

## Thread from smallest to largest – metric, Whitworth and NPT

| M5 | M6 | M8 · M8 × 1 | G 1/8" | M10 × 1 | M12 × 1.5 | G 1/4" | 1/4" NPT | M14 × 1.5 | G 3/8" | G 1/2" |
|---|---|---|---|---|---|---|---|---|---|---|
| Ø 5.0 mm | Ø 6.0 mm | Ø 8.0 mm | Ø 9.7 mm | Ø 10.0 mm | Ø 12.0 mm | Ø 13.2 mm | Ø 13.7 mm | Ø 14.0 mm | Ø 16.7 mm | Ø 21.0 mm |

Hexagon 8 to 27 mm A/F · sensor tube Ø 2.5 / 3.0 / 4.0 / 4.5 / 5.0 / 6.0 / 8.0 mm · insertion length freely selectable · other threads on request.

Same design, free insertion length – made in sets for test series

Fine thread M5 to M8 for confined spaces, sensor tube from Ø 2.5 mm

**Reproducible measurement**

Same thread, same insertion length: on the test bench, repeatable installation is often more important than the last tenth of a degree. We supply matching weld sockets and sealing rings.

# Calibration, certification and custom design

On the test bench it is not only the sensor that counts, but also the proof that it measures what it indicates – and that the next one measures just like the last.

### FACTORY CALIBRATION IN OUR OWN LABORATORY

Comparison calibration against traceable standards, test points as you specify. Calibration certificate with measured value, deviation and measurement uncertainty. Typical uncertainty ± 0.3 K. For test series we place the test points in the later working range – not at 0 and 100 °C when measuring at 250 °C.

### DAKKS CALIBRATION

Via an accredited laboratory, from ± 0.03 K. For reference sensors, acceptance measurements and wherever traceability must be demonstrated. We handle it for you – you receive sensor and certificate together.

### DOCUMENTATION

Test report 2.2 and inspection certificate 3.1 to EN 10204, declaration of conformity, ATEX and IECEx certificates. Serial number per sensor on request – so every channel can be clearly assigned later.

## What certification you can get

| Certification | by | Uncertainty | For what |
|---|---|---|---|
| **Factory calibration** | GHI calibration laboratory | typ. ± 0.3 K | Calibration certificate with freely selectable test points |
| **DAkkS calibration** | accredited laboratory | from ± 0.03 K | Reference and acceptance measurements |
| **Test report 2.2** | GHI | – | Confirmation of the ordered version |
| **Inspection certificate 3.1** | GHI, per batch | – | Material and design to EN 10204 |
| **Test equipment monitoring** | to CQI-9 | – | periodic testing of your sensors |

## What else we do

- **Custom design from 1 piece** – Different length, different thread, different cable, different connector – to sample, drawing or sketch. Quotation within one working day.
- **Replicas and replacements** – Also of third-party and legacy makes. A photo, the old part number or the defective sensor is sufficient.
- **Sets of identical design** – Same sensor and cable length across all channels so that the measurements remain comparable.
- **Made in Hanau** – Assembly, laser welding, calibration laboratory and testing under one roof.

### A tip from practice

Have sensors in continuous operation recalibrated at fixed intervals. Thermocouples drift through ageing of the legs, Pt100s through mechanical stress. Doing this once a year reveals a deviation before the test series – not after.

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# Tell us what you want to measure.

Most test bench sensors are special versions – different length, different thread, different cable. That is exactly what we are built for.

**1**

### Describe the application

Medium, temperature, installation location, connection – a photo or sketch is all it takes.

**2**

### Quotation within one working day

with dimension drawing if it is a special version.

**3**

### Sample or series

from quantity 1, on request with calibration certificate and serial number.

## CONTACT


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## MORE PRODUCTS

This brochure is an extract for automotive and test bench applications. The GHI product catalogue Temperature Sensors contains all series with complete order codes: protective-tube thermometers to DIN 43772, high-temperature thermocouples, multipoint, melt, bearing and surface sensors as well as protective tubes and fittings.

Request the full catalogue
**info@ghi-gmbh.de**


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