OCTOGON

# MANUAL

# TSMA

## MODULAR TEMPERATURE SENSOR HART WITH SPRING

Operating manual



| Document | Version | Date | Applies to |
|---|---|---|---|
| Operating manual | V00x | 10/2026 | TSMA, Pt100 / Pt1000 / type K, 4 ... 20 mA HART |

**This English version is a translation of the German version (TSMA Manual V00x DE) by octogon. The German version is authoritative.**

This operating manual describes transport, safety, mounting, connection, operation, fault recovery and maintenance of the TSMA spring-loaded temperature sensor.

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# 1 General

## 1.1 For your information

– These operating instructions contain important information on handling the TSMA. Working safely requires that all safety instructions and work instructions are observed.

– Skilled personnel must have carefully read and understood these operating instructions prior to mounting and start-up of the temperature sensor.

– These operating instructions are part of the product. Keep them in a place near the place of use that is accessible to all users at any time.

– Observe the local regulations and safety regulations applicable to the range of use of the temperature sensor.

– If the serial number on the product label becomes illegible (e. g. through mechanical damage), traceability can no longer be ensured.

– The temperature sensors described in these operating instructions are designed and manufactured using state-of-the-art technology. Every component undergoes strict quality and environmental criteria during manufacture.

– The manufacturer's liability is void in the case of any damage caused by using the product contrary to its intended use, non-compliance with these operating instructions, assignment of insufficiently qualified skilled personnel or unauthorised modifications to the resistance thermometer.

## 1.2 Signs, abbreviations

| Sign | Meaning |
|---|---|
| Warning | Non-compliance can cause injuries to persons and/or the destruction of the device. There can be danger to life. |
| Attention | Non-compliance can cause faulty device operation or lead to property damage. |
| Information | Non-compliance can influence device operation or cause unintentional device reactions. |
| Danger – electrical power | If the safety instructions are not complied with, there is a risk of serious or fatal injury caused by electrical power. |
| Warning – hot surface | A dangerous situation may occur which can result in burns from hot surfaces or liquids if it is not avoided. |
| U+ | Positive supply connection |
| U– | Negative supply connection |

## 1.3 Device

| Feature | Version |
|---|---|
| Design | modular temperature sensor with spring-loaded tip |
| Sensor | 1x / 2x Pt100, 1x / 2x Pt1000, 1x thermocouple type K with crossed tape |
| Output | 4 ... 20 mA with HART, 2-wire current loop, or without transmitter (sensor connections directly on the plug) |
| Manufacturer type | MKTS-SP |

# 2 Transport, packaging, storage

## 2.1 Transport

Check the device for any damage that may have been caused during transport. Report obvious damage immediately.

## 2.2 Packaging

Do not remove the packaging until just before mounting. Keep the packaging, as it provides optimum protection during transport (e. g. change of installation site, return).

## 2.3 Storage

For longer storage avoid the following influences:

- Direct sunlight or proximity to hot objects
- Mechanical vibration, mechanical shock (putting it down hard)
- Soot, vapour, dust and corrosive gases

If possible, store the device in its original packaging or in an equivalent packaging.

# 3 Safety instructions

**Warning** Before mounting, start-up and operation, select the correct temperature sensor in terms of measuring range, design, suitable wetted material (corrosion) and specific measuring conditions.

**Information** More important safety instructions can be found in the individual chapters.

## 3.1 Intended product use

The temperature sensor TSMA is used for the measurement of temperatures from −50 … +150 °C on surfaces.

The sensor has been designed and built solely for the intended use described here and may only be used accordingly.

The technical specifications contained in these operating instructions must be observed. Improper handling or operation of the device outside of its technical specifications requires the device to be taken out of service immediately and an inspection by the manufacturer.

When the device is transported from a cold into a warm environment, the formation of condensation may result in the device malfunctioning. Before putting it back into operation, wait for the device temperature and the room temperature to equalise.

Claims of any type based on use contrary to the intended use are excluded.

## 3.2 Personnel qualification

**Warning** **Risk of injury if qualification is insufficient**

Improper handling can result in considerable injury and damage to equipment.

- The activities described in these operating instructions may only be carried out by skilled personnel who have the qualifications described below.
- Keep unqualified personnel away from hazardous areas.

For mounting and start-up of the temperature sensor, the personnel must be familiar with the relevant national regulations and standards and have the corresponding qualification. They must have knowledge of measurement and control technology, be acquainted with electric circuits, be capable of carrying out the work described and independently recognise potential hazards. Depending on the operating conditions, other knowledge may also be required, e. g. of aggressive media.

## 3.3 Special hazards

**Warning** Observe the national regulations (e. g. standards) and, for special applications, the applicable standards and directives (e. g. for hazardous media such as acetylene, flammable or toxic substances, and for refrigeration plants and compressors).

**If the appropriate regulations are not observed, serious injuries and damage to property can occur!**

**Warning** A protection from electrostatic discharge (ESD) is required.

The proper use of grounded work surfaces and personal wrist straps is required when working with exposed circuitry (printed circuit boards), in order to prevent static discharge from damaging sensitive electronic components.

**Warning** Residual media in dismounted devices can result in a risk to persons, the environment and equipment. Please take sufficient precautionary measures.

Do not use this device in safety or emergency stop devices. Incorrect use of the device can result in injury.

Should a failure occur, aggressive media with extreme temperature and under high pressure or vacuum may be present at the device.

**Danger – electrical power** There is a danger of death caused by electric current. Upon contact with live parts, there is a direct danger of death.

Electrical devices may only be installed and mounted by skilled electrical personnel.

Operation using a defective power supply unit (e. g. short circuit from the mains voltage to the output voltage) can result in life-threatening voltages at the device.

# 4 Start-up, operation

## 4.1 Function

The TSMA is installed in the process with a knurled screw. A change in resistance of the sensor element in the tip of the protecting tube is transformed into an electrical standard signal by the measuring amplifier. This signal changes proportionally to the temperature and can be processed further.

## 4.2 Before mounting

**Information**

- Check whether a completely assembled temperature sensor has been supplied.
- Inspect the temperature sensor for possible damage during transport. If there is any such damage, inform the transport company and the supplier immediately.
- Keep the packaging, as it offers optimum protection during transport.
- Make sure that the process connection thread and the connection contacts are not damaged.

## 4.3 Product label (example)

| Field | Meaning | Field | Meaning |
|---|---|---|---|
| MK | product code | Art.Nr. | part number |
| SN | serial number | Output | loop signal (or passive) |
| Sensor | kind of sensor | Range | adjusted range |
| Supply | voltage range and connection | | |

## 4.4 Mounting of the process connection

Tool: screwdriver

The temperature sensors are designed for installation in the process. The spring tip must be in contact with the measuring surface.

**Attention** Note: Installation in pipes, vessels and similar environments that may be under pressure is not recommended.

When mounting, make sure that the connections at the sensor and the measuring point are clean and undamaged.

Screw in the sensor carefully with the knurled screw. Do not use excessive force when tightening, in order to avoid damage to the thread.

When screwing in, make sure that the threads are not jammed.

## 4.5 Electrical connection

**Attention** Ground the housing via the process connection.

The specified IP protection class only applies while the mating connector with the corresponding protection class is plugged in.

Select the cable diameter to fit the cable entry of the connector. Make sure that the cable gland of the mounted connector is seated correctly and is not damaged, in order to ensure the protection class.

With cable outlets, make sure that no moisture enters at the end of the cable.

The cables must be laid in such a way that no forces or torque act on the device.

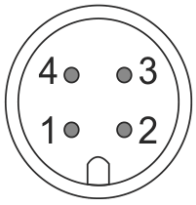
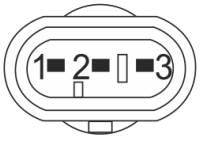
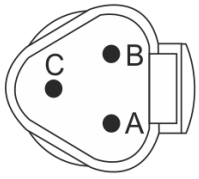
## 4.6 Pin assignment

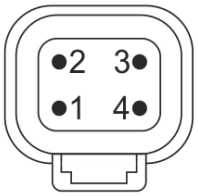
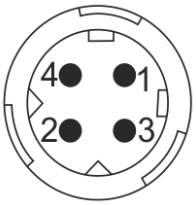
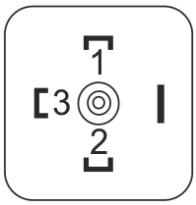
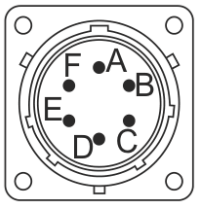
| Connection | 2-wire | 3-wire | 4-wire | Transmitter U+ U– |
|---|---|---|---|---|
| **Connection of 1 sensor** | | | | |
| M12, 4-pole | 3 2 | 4 3 2 | 4 3 2 1 | 1 3 |
| M12, 5-pole | 3 2 | 4 3 2 | 4 3 2 1 | 1 3 |
| M12, 8-pole | 3 2 | 4 3 2 | 4 3 2 1 | 1 3 |
| Super Seal, 3-pole | 3 2 | 1 3 2 | – | 1 3 |
| Deutsch DT04, 3-pole | C B | A C B | – | A B |
| Deutsch DT04, 4-pole | 3 2 | 4 3 2 | 4 3 2 1 | 1 3 |
| Bayonet, 4-pole | 3 2 | 4 3 2 | 4 3 2 1 | 1 3 |
| Valve, 4-pole | 3 2 | earth 3 2 | earth 3 2 1 | 1 2 |
| MIL, 6-pole | B C | A B C | A B C D | A C |
| Cable, n-pole | bn gn | ye bn gn | ye bn gn wh | ye wh |
| Cable, n-pole (DIN 60751) | rd wh | rd rd wh | rd rd wh wh | – |
| **Connection of 2 sensors** | | | | |
| M12, 4-pole – Sensor 1 | 4 3 | – | – | – |
| M12, 4-pole – Sensor 2 | 2 1 | – | – | – |
| M12, 5-pole – Sensor 1 | 4 3 | – | – | – |
| M12, 5-pole – Sensor 2 | 2 1 | – | – | – |
| M12, 8-pole – Sensor 1 | 3 2 | 4 3 2 | 4 3 2 1 | – |
| M12, 8-pole – Sensor 2 | 7 6 | 8 7 6 | 8 7 6 5 | – |
| Deutsch DT04, 4-pole – Sensor 1 | 4 3 | – | – | – |
| Deutsch DT04, 4-pole – Sensor 2 | 2 1 | – | – | – |
| Bayonet, 4-pole – Sensor 1 | 4 3 | – | – | – |
| Bayonet, 4-pole – Sensor 2 | 2 1 | – | – | – |
| Valve, 4-pole – Sensor 1 | earth 3 | – | – | – |
| Valve, 4-pole – Sensor 2 | 2 1 | – | – | – |
| MIL, 6-pole – Sensor 1 | E D | F E D | – | – |
| MIL, 6-pole – Sensor 2 | B A | C B A | – | – |
| Cable, n-pole (DIN 60751) – Sensor 1 | rd wh | rd rd wh | rd rd wh wh | – |
| Cable, n-pole (DIN 60751) – Sensor 2* | bk ye | bk bk ye | bk bk ye ye | – |

Sensor 2*: gr (grey) is also possible as an alternative to bk (black).

### Connection plugs

View: plug pins of the male connector (on the device)

| M12, 4-pole | M12, 5-pole | M12, 8-pole | Super Seal, 3-pole | Deutsch DT04, 3-pole |
|---|---|---|---|---|
|  |  |  |  |  |

| Deutsch DT04, 4-pole | Bayonet DIN, 4-pole | Valve, 4-pole | MIL, 6-pole | Cable, 4-, 6-pole |
|---|---|---|---|---|
|  |  |  |  | LIYCY, 4 or 6 × 0.25 mm², grey |

## 4.7 Connection example

Two-wire connection via the current loop 4 ... 20 mA HART:

| TSMA | Connection |
|---|---|
| 1 (+) | to + of the supply |
| 3 (–) | to + of the evaluation unit (e. g. PLC) |
| | – of the supply to – of the evaluation unit |

## 4.8 Functional test

**Information** The output signal must be proportional to the temperature. If it is not, this may indicate a defect of the temperature sensor. In this case, refer to Fault recovery (section 5).

**Warning**

- Open process connections only when the system is unpressurised.
- Observe the operating parameters in the technical data (section 7).
- The surfaces of the device components can become hot during operation. Please take the necessary precautionary measures before touching the device or its components.

## 4.9 Fault detection / fault current

The device detects sensor break and short circuit (sensor element <> measuring amplifier) as well as temperatures outside of the measuring range and indicates this with a fault current in the current loop.

The current output is proportional to the temperature from 3.8 to 20.5 mA. If the measured temperature would result in a current below 3.8 mA, the device outputs a fault current of 3.6 mA (also for a sensor short circuit). If the current would exceed 20.5 mA, a fault current of 21 mA is output (also for a sensor break).

# 5 Fault recovery

**Warning**

- Open connections only when the system is unpressurised.
- Take precautionary measures for residual media in dismounted temperature sensors. Residual media can result in a risk to persons, the environment and equipment.
- If faults cannot be rectified, take the temperature sensor out of service and secure it against accidental start-up.

| Failure | Possible cause | Procedure |
|---|---|---|
| No output signal | Cable break | Check continuity |
| | Mechanical load too high or overtemperature | Replace the sensor with a suitable design |
| No/false output signal | Wiring error | Observe the pin assignment (see product label / operating instructions) |
| Erroneous measured values | Sensor drift caused by overtemperature | Replace the sensor with a suitable design |
| | Sensor drift caused by chemical attack | Replace the sensor with a suitable design |
| Erroneous measured values (too low) | Entry of moisture into cable or plug | Replace the sensor with a suitable design |
| Erroneous measured values and response time too long | Wrong mounting geometry, e. g. mounting depth too low or heat dissipation too high | The temperature-sensitive area of the sensor must be inside the medium, surface measurements must be insulated |
| | Deposits on the sensor | Remove deposits |
| Measurement signal “comes and goes” | Cable break in the connecting cable / loose contact caused by mechanical overload | Replace the sensor with a suitable design, e. g. use a thicker cable |
| Corrosion | Composition of the medium not as expected / changed / wrong material of protecting tube | Analyse the medium and select a more suitable material |
| Signal fluctuating/inaccurate | EMC interference sources in the vicinity, e. g. frequency inverters | Shield the sensor, cable shielding, remove the interference source, increase the distance to the interference source |
| | Earth loops | Elimination of potentials, use supply isolators / galvanically isolated measuring amplifiers |

Note: Unjustified complaints may result in costs for you.

# 6 Maintenance, dismounting, return, cleaning, disposal

## 6.1 Maintenance

The TSMA temperature sensors require no maintenance and contain no components which could be replaced or repaired.

## 6.2 Dismounting

**Warning** Residual media in dismounted devices can result in a risk to persons, the environment and equipment. Take sufficient precautionary measures.

**Warning – hot surface** There is a risk of burns. Let the sensor cool down sufficiently before dismounting. During dismounting there is a risk of dangerously hot media escaping.

Only dismount the resistance thermometer when the system is unpressurised.

## 6.3 Return

**Warning** Before shipping a device, observe chapter 6.4.

To return the device, use the original packaging or a comparable one.

To protect against damage, e. g. antistatic film, insulating material or a marking as a sensitive measuring instrument can be used.

## 6.4 Cleaning

**Attention**

- Before cleaning the sensor, disconnect the electrical connection.
- Clean the device with a moist cloth.
- Do not bring the electrical connection into contact with moisture.
- Rinse or clean a dismounted device before returning it, in order to protect persons and the environment from exposure to adhering residual media.
- Residual media in dismounted devices can result in a risk to persons, the environment and equipment. Take sufficient precautionary measures.

## 6.5 Disposal

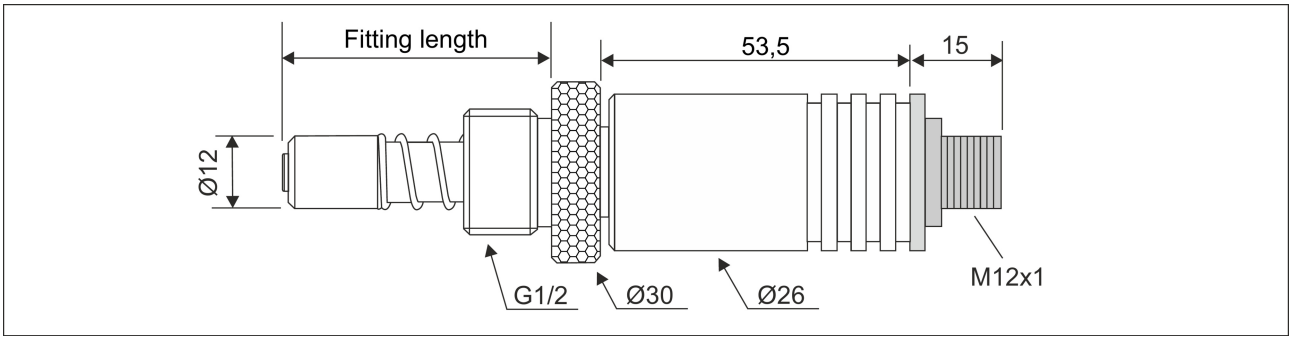
**Information** Dispose of device components and packaging materials in an environmentally sound manner in accordance with the national waste treatment and disposal regulations.

# 7 Technical data

| Item | Value |
|---|---|
| **Input** | |
| Sensor | 1x Pt100 / 1x Pt1000 / 2x Pt100 / 2x Pt1000 / 1x thermocouple type K with crossed tape |
| Connection | 2-wire / 3-wire / 4-wire |
| Accuracy | Class A / Class B / Class AA |
| Maximum range | –50 … +150 °C |
| Minimum span | 50 °C |
| **Output** | |
| Transmitter HART: current | 4 … 20 mA with superimposed communication signal |
| Transmitter HART: connection | 2-wire current loop |
| Current range | 3.8 … 20.5 mA |
| Signal on error | 3.6 mA (sensor short circuit, underflow); 21 mA (sensor break, sensor open circuit, overflow) |
| Sensor element | connections of the temperature sensor directly on the plug, cable lead out |
| **Measuring amplifier (transmitter HART)** | |
| Combined error | 0.3 % of range |
| Resolution | 16 bit |
| Filter setting | 0 … 99 s |
| Transmission behaviour | linear with temperature |
| Switch-on delay | < 5 s |
| Measuring rate | 10 measurements/s |
| Configuration | via software (HART communication) |
| Response time | 20 ms |
| **Supply (transmitter HART)** | |
| Current loop | 12 … 40 VDC |
| Load | R = (UB – 12 V) / 21 mA |
| Reverse polarity protection | available (no function, no damage) |
| **Environmental conditions** | |
| Operating temperature with transmitter | –20 … +80 °C |
| Operating temperature without transmitter | –20 … +100 °C |
| Storage temperature | –40 … +85 °C |
| Medium temperature | –50 … +150 °C |
| System pressure | not possible, the process connection has no sealing effect |
| Condensation | uncritical |
| **Mechanics** | |
| Dimensions | see section 8 |
| Fitting length | 45 mm / 65 mm / customer-specific |
| Spring travel | 14 mm, ±1 mm |
| Process connection | 3/8″ / 1/2″ / 3/4″ |
| Electr. connection | see section 4.5 Electrical connection |
| Sensor tube | Ø 6 mm |
| Material sensor tube | stainless steel 1.4571 |
| Material process connection | knurled screw stainless steel 1.4541 |
| Material body | stainless steel 1.4571 |
| Material compression spring | spring steel 1.4310 |
| Material insulating body | PTFE white |
| Material electr. connection insert | PBT GF30; option: stainless steel 1.4571 |
| Weight | approx. 200 g (1/2″, 45 mm, M12) |
| Fitting position | any |
| **Device protection** | |
| Protection class | at least IP65 (electronics), IP68 (sensor) |
| Housing | completely potted inside |

| Item | Value |
|---|---|
| **Configurable parameters HART** | |
| Measuring amplifier | lower range limit (LRL) / upper range limit (URL) / filter function / lower range value (LRV) / upper range value (URV) / output current trim / output current simulation / HART address / linear output signal / 2-point calibration |

# 8 Dimensions




Dimensions in mm.