TURCK

Your Global Automation Partner

# TS720...
# Processing and Display Unit

Instructions for Use

# Contents

# 1 About these instructions

These instructions describe the setup, functions and use of the product and help you to operate the product according to its intended purpose. Read these instructions carefully before using the product. This will prevent the risk of personal injury and damage to property. Keep these instructions safe during the service life of the product. If the product is passed on, pass on these instructions as well.

## 1.1 Target groups

These instructions are aimed at qualified personal and must be carefully read by anyone mounting, commissioning, operating, maintaining, dismantling or disposing of the device.

## 1.2 Explanation of symbols

The following symbols are used in these instructions:

| | |
|---|---|
|  | **DANGER**<br>DANGER indicates a hazardous situation with a high level of risk, which, if not avoided, will result in death or serious injury. |
|  | **WARNING**<br>WARNING indicates a hazardous situation with a medium level of risk, which, if not avoided, will result in death or serious injury. |
|  | **CAUTION**<br>CAUTION indicates a hazardous situation with a medium level of risk, which, if not avoided, will result in moderate or minor injury. |
|  | **NOTICE**<br>CAUTION indicates a situation which, if not avoided, may cause damage to property. |
|  | **NOTE**<br>NOTE indicates tips, recommendations and important information about special action steps and issues. The notes simplify your work and help you to avoid additional work. |
| ▶ | **MANDATORY ACTION**<br>This symbol denotes actions that the user must carry out. |
| ⇨ | **RESULT OF ACTION**<br>This symbol denotes the relevant results of an action. |

## 1.3 Other documents

Besides this document, the following material can be found on the Internet at www.turck.com:

- Data sheet
- Declarations of conformity
- Quick Start Guide
- Commissioning manual IO-Link devices

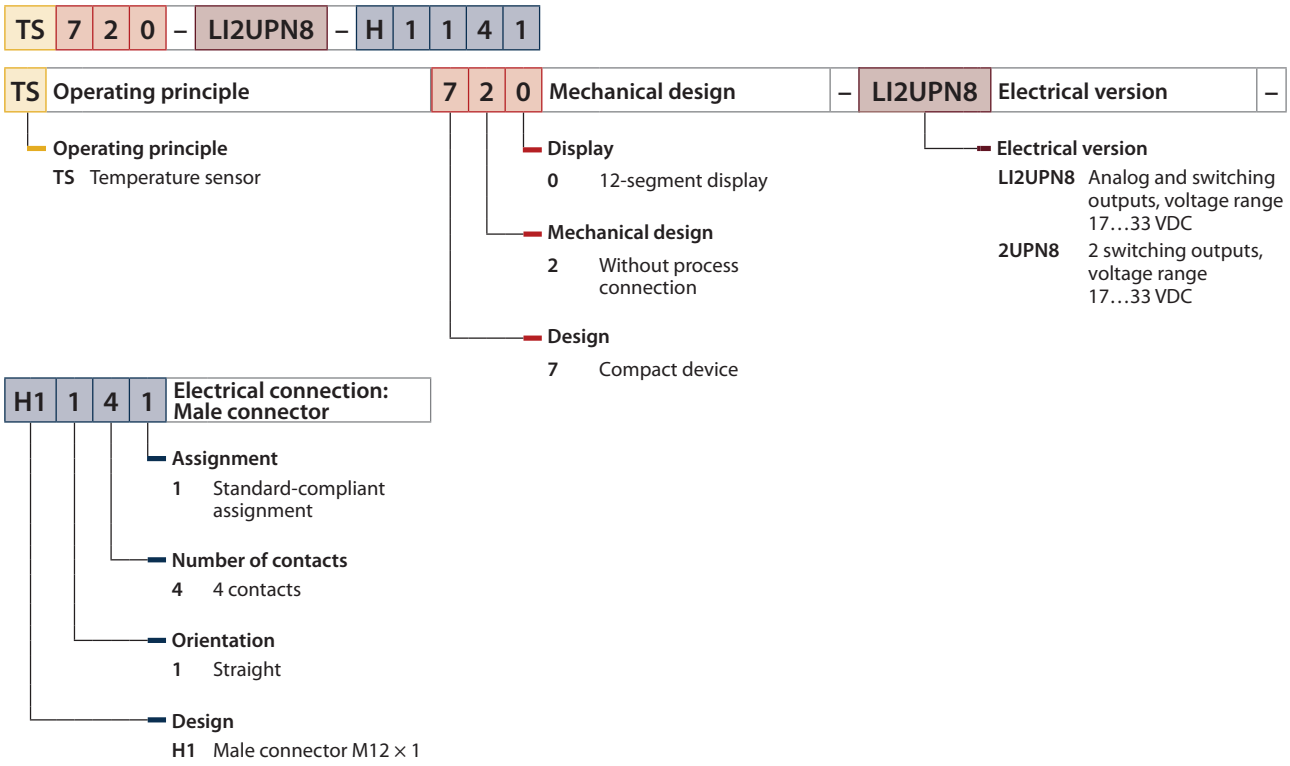
## 1.4 Feedback about these instructions

We make every effort to ensure that these instructions are as informative and as clear as possible. If you have any suggestions for improving the design or if some information is missing in the document, please send your suggestions to techdoc@turck.com.

# 2 Notes on the product

## 2.1 Product identification

These instructions apply to the following temperature processing and display units:



### Devices with Smart Sensor Profile 4.1.1

The instructions for use apply to devices from Production date 2310 (date format YYWW) with Smart Sensor Profile 4.1.1. You can find the production date on the back of the housing.

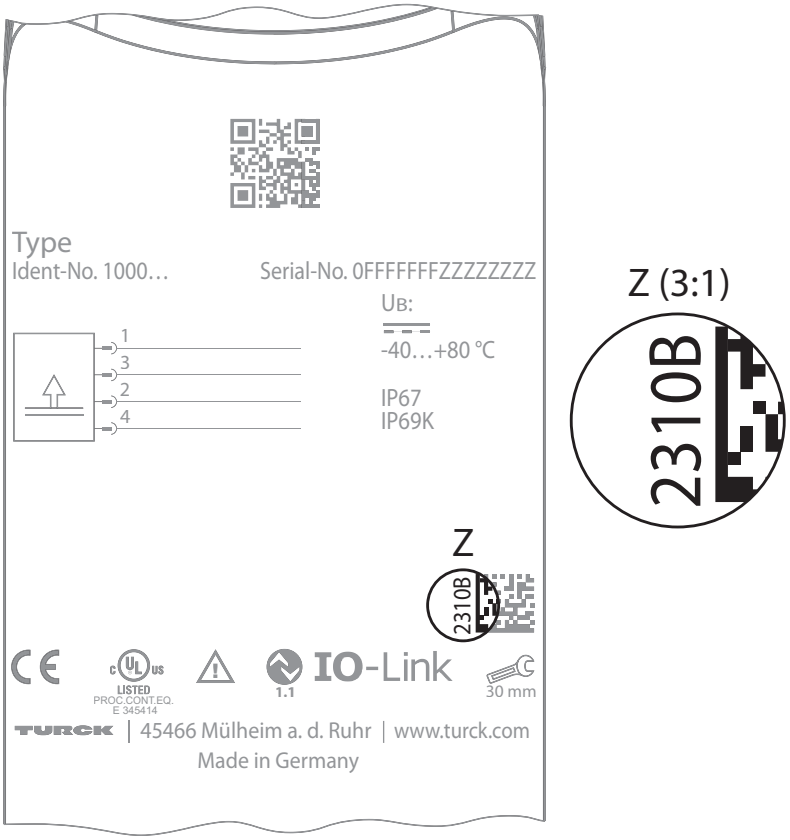



Fig. 1: Production date on the back of the housing

## 2.2 Scope of delivery

The delivery consists of the following:

- Temperature processing and display unit
- Quick Start Guide

## 2.3 Turck service

Turck supports you in your projects – from the initial analysis right through to the commissioning of your application. The Turck product database at **www.turck.com** offers you several software tools for programming, configuring or commissioning, as well as data sheets and CAD files in many export formats.

The contact data for Turck branches is provided at [▷ 51].

# 3 For your safety

The product is designed according to state of the art technology. Residual hazards, however, still exist. Observe the following safety instructions and warnings in order to prevent danger to persons and property. Turck accepts no liability for damage caused by failure to observe these safety instructions.

## 3.1 Intended use

The compact processing and display units of the TS720… product series are designed for measuring temperatures in machines and plants. This requires the connection of a temperature probe to the devices. The temperature processing and display units support the connection of resistance thermometers (RTD) and thermocouples (TC).

The device must only be used as described in these instructions. Any other use is not in accordance with the intended use. Turck accepts no liability for any resulting damage.

## 3.2 Obvious misuse

- The devices are not safety components and must not be used for personal or property protection.

## 3.3 General safety instructions

- The device meets the EMC requirements for the industrial areas. When used in residential areas, take measures to prevent radio frequency interference.
- The device must only be fitted, installed, operated, parameterized and maintained by trained and qualified personnel.
- Only use the device in compliance with the applicable national and international regulations, standards and laws.
- Only operate the device within the limits stated in the technical specifications.

# 4 Product Description

**NOTE**
These instructions apply to temperature and processing units of the TS720… product series from production date 2310 (date format YYWW) with Smart Sensor Profile 4.1.1. The date of production can be found on the rear of the housing. Devices prior to a production date 2310 are not compatible with the Smart Sensor Profile. The 100020587 instructions for use apply to old devices.

The temperature processing and display units of the TS+ product series are contained in a metal housing and provided with a G1/2″ process connection. The sensor head can also be rotated by 340° after installation. The devices have a metal M12 connector (male) for connecting the sensor cable. Another M12 connector (female) is provided for connecting resistance thermometers (RTD) and thermocouples (TC).

Devices with the following output functions are available:

- TS…LI2UPN…: 2 switching outputs (PNP/NPN/Auto) according to Smart Sensor Profile 4.1.1 or 1 switching output (PNP/NPN/Auto) according to Smart Sensor Profile 4.1.1 and 1 analog output (I/U/Auto)
- TS…2UPN…: 2 switching outputs (PNP/NPN/Auto) according to Smart Sensor Profile 4.1.1

## 4.1 Device overview

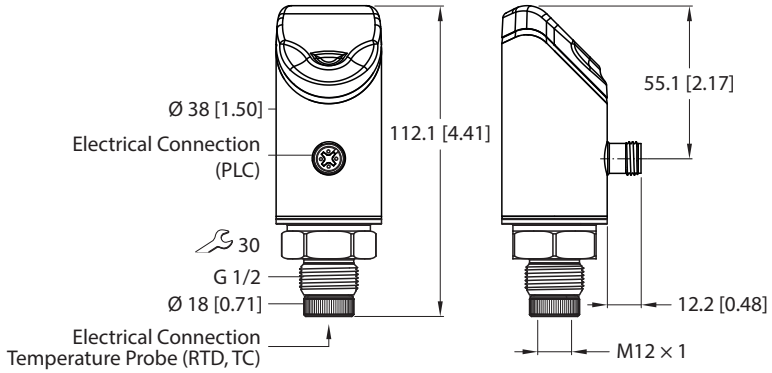



Fig. 2: Dimensions in mm [inch]

## 4.2 Properties and features

- Processing unit for connecting resistance thermometers (RTD) and thermocouples (TC)
- Automatic probe detection
- 4-digit, 2-color, 12-segment display, rotatable by 180°
- Housing upper section rotatable by 340°
- Legacy Mode: various IO-Link mapping profiles selectable

## 4.3 Operating and display functions

The front of the device is provided with three touchpads [ENTER], [MODE] and [SET], a 4-digit 12-segment multicolor display and status LEDs. This enables the user to set all essential functions and properties directly on the device and read the actual process values and set switching points.

## 4.4 Operating principle

Standard Pt100 and Pt1000 resistance thermometers (RTD) as well as thermocouples (TC) can be connected to the temperature display and processing unit. The temperature value measured on the attached probe is passed on to the higher-level I/O. The device display shows the temperature value in the unit selected by the user.

## 4.5 Functions and operating modes

| Type | Output |
|---|---|
| TS…LI2UPN… | 2 switching outputs (PNP/NPN/Auto) according to Smart Sensor Profile 4.1.1 or 1 switching output (PNP/NPN/Auto) according to Smart Sensor Profile 4.1.1 and 1 analog output (I/U/Auto) |
| TS…2UPN… | 2 switching outputs (PNP/NPN/Auto) according to Smart Sensor Profile 4.1.1 |

The sensors can be operated in normal operation (factory settings) or in Legacy Mode. In normal operation, a single point mode (SPM), two point mode (TPM) or window mode (WIn) can be set for the switching outputs. In single point mode, a limit value is set at which the selected switching output changes its switching state. In two point mode, a lower and an upper limit are set at which the selected switching output changes its switching state as the temperature rises or falls. In window mode, a lower and an upper window limit are set. Outside the window, the selected switching output changes its switching state. In Legacy Mode, a window function or a hysteresis function can be defined for the switching outputs. The output range of the analog output is freely scalable to the measuring range. The measured temperature can be displayed in °C, °F or K, or the resistance can be displayed in Ω if a resistance thermometer is connected. The device parameters can be set via IO-Link and with the touchpads.

The following temperature probes can be connected to the device:

- Resistance thermometers (RTD)
  - Pt100 (2-, 3-, 4-wire)
  - Pt1000 (2-, 3-, 4-wire)
- Thermocouples (TC)
  - Type K, B, E, J, N, R, S and T

### 4.5.1 Setting options

The devices have three setting options:

- Setting via IO-Link
- Setting via touchpads
- Setting via FDT/DTM

### 4.5.2 Normal operation — run mode

The device detects the temperature on the probe and shows the required switching or analog behavior according to the factory-set or customer-specific parameters. The display indicates the process temperature present, the selected unit and the status of the switching outputs.

### 4.5.3 Programming mode

When the sensor is unlocked, the display will go into programming mode after the user presses the [MODE] touch pad. In programming mode, all parameters and their corresponding values can be read out and changed. The values for a parameter are displayed by briefly pressing the [ENTER] touch pad. The [MODE] and [SET] touch pads are used to navigate within programming mode. For more information, refer to the chapter “Setting and parameterization.”

### 4.5.4 Legacy Mode

Devices prior to production date 2310 without Smart Sensor Profile operate with their own menu guidance, which is divided into a main menu, an extended functions menu and VDMA menus.

In Legacy Mode, devices after production date 2310 with Smart Sensor Profile can be operated using the old menu guidance.

### 4.5.5 Output functions

The output functions in normal operation (factory setting) include a single point mode (SPM), a two point mode (TPM) or a window mode. In Legacy Mode, a window function or hysteresis function can be selected.

### 4.5.6 Output functions — switching output

The switching logic can be inverted via IO-Link or via the touchpad (parameter LOGI). The following examples apply to the **HIGH** (0 → 1) switching logic.

#### Single point mode

In single point mode, the switching behavior is defined via a SP1 limit value and a hysteresis. The output changes its switching state at limit value SP1.

The hysteresis can be set via IO-Link or via the touchpad (parameter HYST) and must be within the detection range.

If the process value increases, the switching output is inactive as long as the process value is between the start of the detection range and the SP1 limit value. If the process value increases above the SP1 limit value, the switching output becomes active.

If the process value decreases, the switching output is active as long as the process value is between the end of the detection range and the SP1 limit minus the set hysteresis (SP1-Hyst). If the process value decreases below the limit value (SP1-Hyst), the switching output becomes inactive.

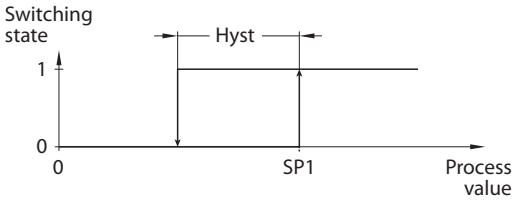



Fig. 3: Single point mode

## Two point mode

In two point mode, the switching behavior is defined via a switch-on point SP1 and a switch-off point SP2. This mode can also be used as a freely adjustable hysteresis.

If the process value increases, the switching output is inactive as long as the process value is between the start of the detection range and the switch-on point SP1. If the process value rises above the switch-on point SP1, the switching output becomes active.

If the process value decreases, the switching output is active as long as the process value is between the end of the detection range and the SP2 switch-off point. If the process value decreases below the switch-off point SP2, the switching output becomes inactive.

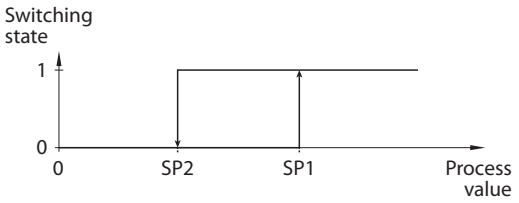



Fig. 4: Two point mode

## Window mode

In window mode, an upper and lower window limit are set for the switching output. A hysteresis can be set for the window limits SP1 and SP2. The switching window must be within the detection range.

The hysteresis can be set via IO-Link or via the touchpad (parameter HYST) and must be within the detection range.

If the process value increases, the switching output is inactive as long as the process value is between the start of the detection range and the window limit SP2. The switching output remains active until the process value increases above the window limit SP1 plus the hysteresis (SP1+Hyst). If the process value increases above (SP1+Hyst), the switching output becomes inactive again.

If the process value decreases, the switching output is inactive as long as the process value is between the end of the detection range and the window limit SP1. The switching output remains active until the process value decreases below the window limit SP2 minus the hysteresis (SP2-Hyst). If the process value decreases below (SP2- Hyst), the switching output becomes inactive again.

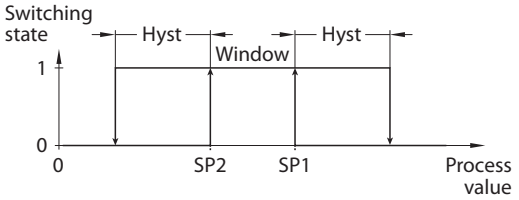



Fig. 5: Window mode

### 4.5.7 Output functions — switching output in Legacy Mode

A window function and a hysteresis function can be set for the switching outputs.

#### Window function

The window function is used to set a switching range in which the switching output takes on a defined switching state. The switching range is defined by means of an upper (FH) and lower limit (FL). The minimum distance between the switching points is 0.2 K. The release point is automatically adjusted if the switching point is changed.

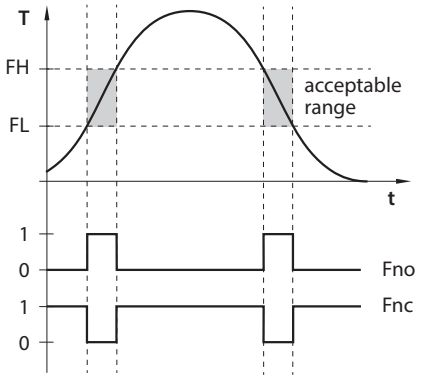



Fig. 6: Behavior of the switching output – Window function

#### Hysteresis function

The hysteresis function is used to set a stable switching state around a setpoint that is independent of system-related temperature fluctuations. The switching range is defined by means of a switching point (SP) and a release point (rP). The minimum hysteresis is 0.2 K. The release point is automatically adjusted if the switching point is changed.

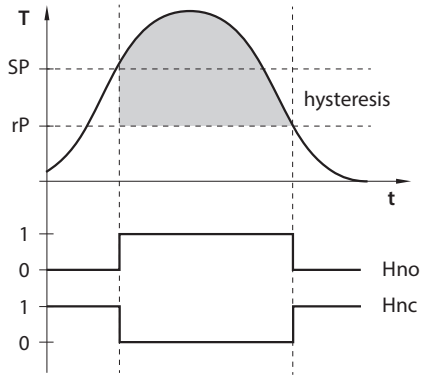



Fig. 7: Behavior of the switching output (hysteresis function)

### 4.5.8 Output functions — analog output

The analog output of the TS…LI2UPN8 sensors can be set as either a current or voltage output. The measuring range is freely definable.

The minimum distance between the start and end point is 0.2 K.

#### Current output

In the defined measuring range, the device supplies an analog current signal between ASP (analog start point) and AEP (analog end point). The following output configurations can be set:

- 4…20 mA (factory setting)
- 0…20 mA
- 20…4 mA
- 20…0 mA

#### Voltage output

In the defined measuring range, the device supplies an analog voltage signal between ASP (analog start point) and AEP (analog end point). The following output configurations can be set:

- 0…10 V
- 0…5 V
- 1…6 V
- 0.5…4.5 V
- 4.5…0.5 V (not in Legacy Mode)
- 10…0 V
- 5…0 V
- 6…1 V

#### Output behavior of the analog outputs

The following figures illustrate the behavior of the analog outputs:

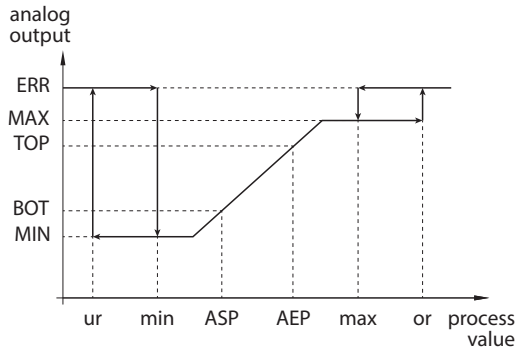



Fig. 8: Rising output characteristic

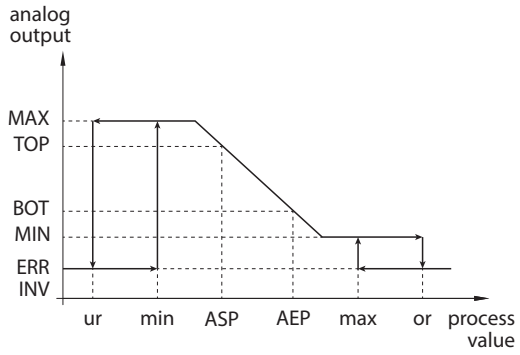



Fig. 9: Falling output characteristic, MIN ≠ 0

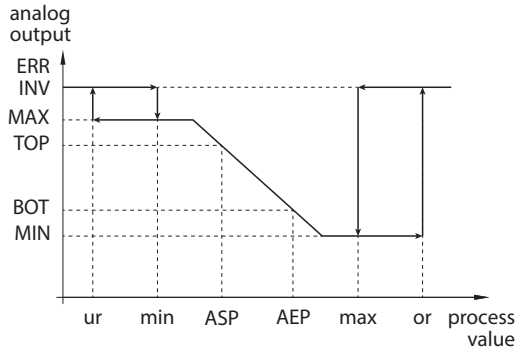



Fig. 10: Falling output characteristic, MIN = 0

| Output configuration | | BOT | TOP | ERR INV | MIN | MAX | ERR |
|---|---|---|---|---|---|---|---|
| 4…20 mA | 20…4 mA | 4 mA | 20 mA | 3.5 mA | 3.8 mA | 20.5 mA | 21.1 mA |
| 0…20 mA | 20…0 mA | 0 mA | 20 mA | 21.1 mA | 0 mA | 20.5 mA | 21.1 mA |
| 0…10 V | 10…0 V | 0 V | 10 V | 11 V | 0 V | 10.5 V | 11 V |
| 0…5 V | 5…0 V | 0 V | 5 V | 6 V | 0 V | 5.5 V | 6 V |
| 1…6 V | 6…1 V | 1 V | 6 V | 0 V | 0.5 V | 6.5 V | 7 V |
| 0.5…4.5 V | 4.5…0.5 V | 0.5 V | 4.5 V | 5.5 V | 0 V | 5 V | 5.5 V |

| Abbreviation | Description |
|---|---|
| ERR | Fault value |
| MAX | Upper value of the analog output |
| MIN | Lower value of the analog output |
| ASP | Analog start point |
| AEP | Analog end point |
| TOP | Value of the output when the AEP or ASP is reached |
| BOT | Value of the output when the ASP or AEP is reached |
| ur | Underrun/underrange |
| or | Overrun/overrange |
| max | Maximum process value |
| min. | Minimum process value |

### 4.5.9 IO-Link mode

In order to operate in IO-Link mode, the device must be connected to an IO-Link master. When the port is configured in IO-Link mode, bidirectional IO-Link communication takes place between the IO-Link master and the device. To make this possible, the device is integrated via an IO-Link master at the control level. First the communication parameters are exchanged, and then the cyclic data exchange of process data (objects) starts.

### 4.5.10 SIO mode (standard I/O mode)

In standard I/O mode no IO-Link communication takes place between the device and the master. The device only transfers the switching state of its binary outputs and can also be run via a fieldbus device or controller with digital PNP or NPN inputs. An IO-Link master is not required for operation.

The device parameters can be set via IO-Link and then operated at the digital inputs with the appropriate settings in SIO mode. Not all functions and properties of the device can be used in SIO mode.

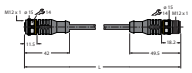
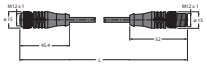
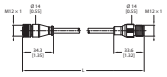
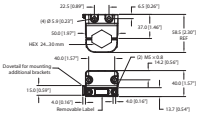
### 4.5.11 Auto detect function

The device uses the auto detect function to detect whether a resistance thermometer or a thermocouple is connected. The type of thermocouple is determined by the user. When connected to an I/O module, the device detects the pre-defined switching output behavior (PNP/NPN) or the analog output characteristic. The auto detect function is activated by default.

## 4.6 Technical accessories

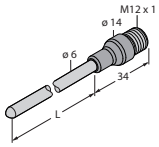
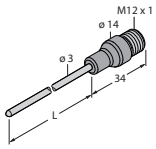
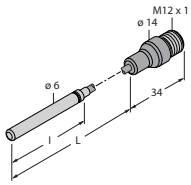
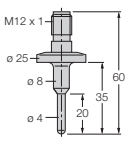
### 4.6.1 Connectivity accessories

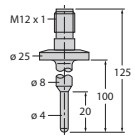
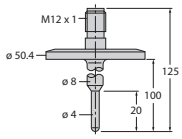
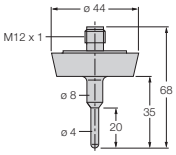
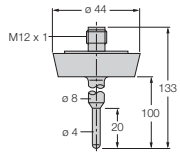
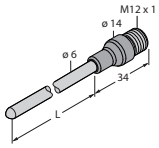
In addition to the above connection cables, Turck also offers other cable types for specific applications with the correct terminals for the device. More information on this is available from the Turck product database at **www.turck.de/products** in the Connectivity area.

| Dimension drawing | Type | ID | Description |
|---|---|---|---|
|  | RKC4.4T-2-RSC4.4T/TEL | 6625208 | Extension cable, M12 female to male, straight, 4-pin, cable length: 2 m, jacket material: PVC, black; cULus approval |
| | RKC4.4T-2-RSC4.4T/TXL | 6625608 | Extension cable, M12 female, straight, 4-pin to M12 male, straight, 4-pin; cable length: 2 m, jacket material: PUR, black; cULus approval |
|  | HT-WAK4-2-HT-WAS4/S2430 | 8038668 | High-temperature-resistant extension cable, M12 female, straight, 4-pin to M12 male, straight, 4-pin; cable length: 2 m, jacket material: PTFE, white |
|  | RKH4.4-2-RSH4.4/TFG | 6933472 | Food and Beverage extension cable, M12 female, straight, 4-pin to M12 male, straight, 4-pin; cable length: 2 m, jacket material: TPE, gray; approval: Ecolab, FDA |
|  | RK4.217T-…-RS4.217T/TS7198 | 100033104 | Type K thermocouple cable, extension cable, M12 coupling, straight, 2-pole; cable length: 2 m, jacket material: TPE, green |
| | | 100033105 | Type K thermocouple cable, extension cable, M12 coupling, straight, 2-pole; cable length: 5 m, jacket material: TPE, green |
| | | 100033107 | Type K thermocouple cable, extension cable, M12 coupling, straight, 2-pole; cable length: 7 m, jacket material: TPE, green |
|  | FAM-30-PA66 | 100018384 | Mounting of display sensors on walls and surfaces, variable wrench size 24…30 mm, removable labeling plates 20 × 9 mm |

## 4.6.2 Temperature probe

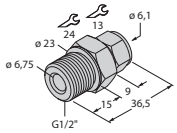
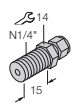
The temperature probes are connected to the temperature processing and display units via M12 connectors. A selection of the available temperature probes is shown. For more versions, visit **https://www.turck.de/en/productgroup/** and view the selection of temperature sensors and accessories.

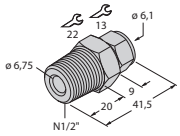
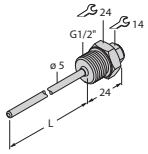
| Dimension drawing | Type | ID | Description |
|---|---|---|---|
|  | TP-206A-CF-H1141-L100 | 9910475 | Temperature probe for liquid and gaseous media, Pt100, class A; measuring range -50…500 °C; dimensions Ø 6 × 100 mm |
| | TP-206A-CF-H1141-L150 | 9910476 | Temperature probe for liquid and gaseous media, Pt100, class A; measuring range -50…500 °C; dimensions Ø 6 × 150 mm |
| | TP-206A-CF-H1141-L200 | 9910477 | Temperature probe for liquid and gaseous media, Pt100, class A; measuring range -50…500 °C; dimensions Ø 6 × 200 mm |
| | TP-206A-CF-H1141-L300 | 9910478 | Temperature probe for liquid and gaseous media, Pt100, class A; measuring range -50…500 °C; dimensions Ø 6 × 300 mm |
|  | TP-203A-CF-H1141-L100 | 9910402 | Temperature probe for liquid and gaseous media, Pt100, class A; measuring range -50…500 °C; dimensions Ø 3 × 100 mm |
| | TP-203A-CF-H1141-L150 | 9910403 | Temperature probe for liquid and gaseous media, Pt100, class A; measuring range -50…500 °C; dimensions Ø 3 × 150 mm |
| | TP-203A-CF-H1141-L200 | 9910482 | Temperature probe for liquid and gaseous media, Pt100, class A; measuring range -50…500 °C; dimensions Ø 3 × 200 mm |
| | TP-203A-CF-H1141-L300 | 9910474 | Temperature probe for liquid and gaseous media, Pt100, class A; measuring range -50…500 °C; dimensions Ø 3 × 300 mm |
|  | TP-306A-CF-H1141-L1000 | 9910479 | Temperature probe for liquid and gaseous media, Pt100, class A; measuring range -50…105 °C; dimensions Ø 6 × 50 mm; with connection cable, length 1000 mm |
| | TP-306A-CF-H1141-L2000 | 9910480 | Temperature probe for liquid and gaseous media, Pt100, class A; measuring range -50…105 °C; dimensions Ø 6 × 50 mm; with connection cable, length 2000 mm |
| | TP-306A-CF-H1141-L5000 | 9910481 | Temperature probe for liquid and gaseous media, Pt100, class A; measuring range -50…105 °C; dimensions Ø 6 × 50 mm; with connection cable, length 5000 mm |
|  | TP-504A-TRI3/4-H1141-L035 | 9910429 | Temperature probe for liquid and gaseous media, Pt100, class A; measuring range -50…125 °C; installation length 35 mm; process connection Tri-Clamp 3/4″ |

| Dimension drawing | Type | ID | Description |
|---|---|---|---|
|  | TP-504A-TRI3/4-H1141-L100 | 9910430 | Temperature probe for liquid and gaseous media, Pt100, class A; measuring range -50… 125 °C; installation length 100 mm; process connection Tri-Clamp 3/4″ |
|  | TP-504A-TRI1.5-H1141-L100 | 9910860 | Temperature probe for liquid and gaseous media, Pt100, class A; measuring range -50… 125 °C; installation length 100 mm; process connection Tri-Clamp 1 1/2″ |
|  | TP-504A-DN25K-H1141-L035 | 9910431 | Temperature probe for liquid and gaseous media, Pt100, class A; measuring range -50…125 °C; installation length 35 mm; process connection DN25 according to DIN 11851 |
|  | TP-504A-DN25K-H1141-L100 | 9910432 | Temperature probe for liquid and gaseous media, Pt100, class A; measuring range -50…125 °C; installation length 100 mm; process connection DN25 according to DIN 11851 |
|  | TP-206KK1-CF-H1141-L100 | 100017085 | Temperature probe for liquid and gaseous media, type K, class 1 thermocouple; measuring range -40…1100 °C; dimensions Ø 6 × 100 mm |
| | TP-206KK1-CF-H1141-L150 | 100017084 | Temperature probe for liquid and gaseous media, type K, class 1 thermocouple; measuring range -40…1100 °C; dimensions Ø 6 × 150 mm |
| | TP-206KK1-CF-H1141-L200 | 100017083 | Temperature probe for liquid and gaseous media, type K, class 1 thermocouple; measuring range -40…1100 °C; dimensions Ø 6 × 200 mm |
| | TP-206KK1-CF-H1141-L500 | 100017082 | Temperature probe for liquid and gaseous media, type K, class 1 thermocouple; measuring range -40…1100 °C; dimensions Ø 6 × 500 mm |

### 4.6.3 Compression fittings and thermowells

The temperature probe is introduced into the process by means of compression fittings or thermowells. A selection of the available compression fittings and thermowells is shown. For more versions, visit **https://www.turck.de/en/productgroup/** and view the selection of temperature sensors and accessories.

| Dimension drawing | Type | ID | Description |
|---|---|---|---|
|  | CF-M-3-G1/8-A4 | 9910405 | Compression fitting for direct mounting of temperature probes; probe diameter 3 mm; process connection G1/8″ male thread |
|  | CF-M-3-N1/8-A4 | 9910406 | Compression fitting for direct mounting of temperature probes; probe diameter 3 mm; process connection 1/8″ NPT male thread |
|  | CF-M-3-N1/4-A4 | 9910408 | Compression fitting for direct mounting of temperature probes; probe diameter 3 mm; process connection 1/4″ NPT male thread |
|  | CF-M-3-G1/4-A4 | 9910407 | Compression fitting for direct mounting of temperature probes; probe diameter 3 mm; process connection G1/4″ male thread |
| | CF-M-6-G1/4-A4 | 9910483 | Compression fitting for direct mounting of temperature probes; probe diameter 6 mm; process connection G1/4″ male thread |
|  | CF-M-6-G1/2-A4 | 9910530 | Compression fitting for direct mounting of temperature probes; probe diameter 6 mm; process connection G1/2″ male thread |
|  | CF-M-6-N1/4-A4 | 9910484 | Compression fitting for direct mounting of temperature probes; probe diameter 6 mm; process connection 1/4″ NPT male thread |

| Dimension drawing | Type | ID | Description |
|---|---|---|---|
|  | CF-M-6-N1/2-A4 | 9910529 | Compression fitting for direct mounting of temperature probes; probe diameter 6 mm; process connection 1/2″ NPT male thread |
|  | THW-3-G1/2-A4-L050 | 9910443 | Thermowell for mounting temperature probes; probe diameter 3 mm; process connection G1/2″ external thread; immersion depth 50 mm |
| | THW-3-G1/2-A4-L100 | 9910444 | Thermowell for mounting temperature probes; probe diameter 3 mm; process connection G1/2″ male thread; insertion depth 100 mm |
| | THW-3-G1/2-A4-L200 | 9910487 | Thermowell for mounting temperature probes; probe diameter 3 mm; process connection G1/2″ external thread; immersion depth 200 mm |
| | THW-3-G1/2-A4-L250 | 9910446 | Thermowell for mounting temperature probes; probe diameter 3 mm; process connection G1/2″ external thread; immersion depth 250 mm |

# 5 Installing

The temperature processing and display unit features a G1/2″ thread (AF30) for mounting with an application-specific mounting bracket. Alternatively, the device can be mounted with the FAM-30-PA66 (ID 100018384) mounting bracket. The display of the unit can be rotated by 180° (see figure and parameter DiSr).

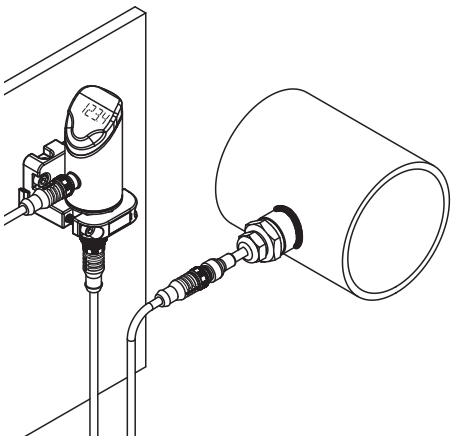


Fig. 11: Installing TS720…

- ▶ Mount the temperature processing and display unit on any part of the plant. Observe the technical specifications for mounting (e.g. ambient temperature).
- ▶ Optional: Rotate the sensor head within the 340° range to align the connection to the I/O level as well as to ensure optimum operability and readability.

# 6 Connection

**NOTE**

For USA/Canada: The devices must be supplied with limited energy in accordance with UL 61010-1 3rd Edition, section 9.4 or LPS in accordance with UL 60950-1 or Class 2 in accordance with UL 1310 or UL 1585. Connect the sensor to a separated extra-low voltage (SELV) power supply.

The connection cables between the temperature probe and the compact processing and display unit must have a rated operating temperature of at least 75 °C and a rated voltage of at least 300 V RMS.

Standard 2-, 3- and 4-wire Pt100 and Pt1000 resistance thermometers (RTD) as well as thermocouples (TC) of types K, B, E, J, N, R, S and T can be connected to the temperature processing and display unit.

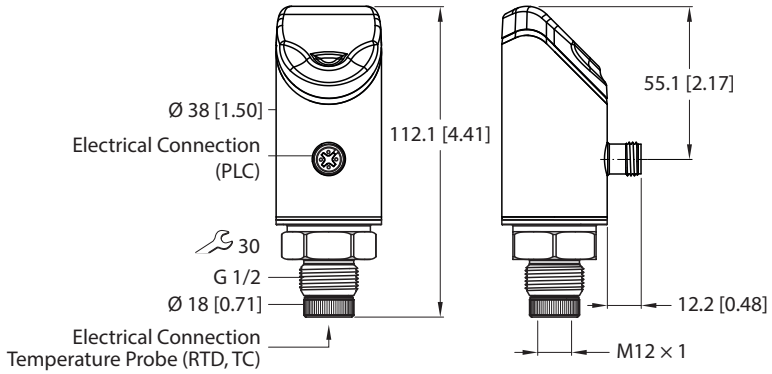



Fig. 12: Electrical connections for controller and temperature probe

- Connect the temperature probe to the temperature processing and display unit in accordance with the relevant specifications (see “Electrical connection for temperature probes (RTD, TC)”). Observe here the technical specifications and the installation instructions of the temperature probe.
- Connect the device to the controller or an I/O module as shown in the wiring diagram (see "Electrical connection (PLC)").

## 6.1 Wiring diagrams

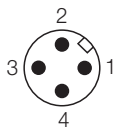



Fig. 13: Pin assignment TS…LI2UPN…

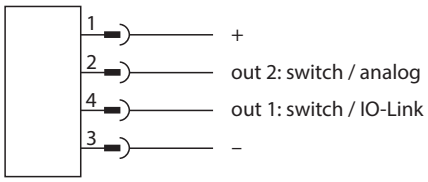



Fig. 14: Wiring diagram TS…2LIUPN…

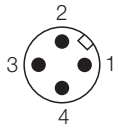



Fig. 15: Pin assignment TS…2UPN…

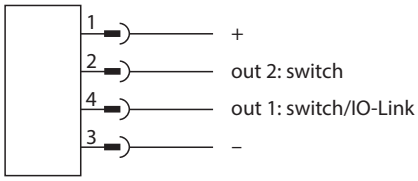



Fig. 16: Wiring diagram TS…2UPN…

## 6.2 Wiring diagrams — Temperature probes

### Resistance thermometer (RTD) — 2-wire

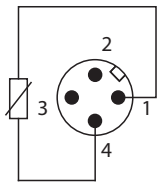



Fig. 17: RTD, 2-wire

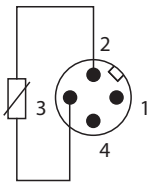



Fig. 18: RTD, 2-wire

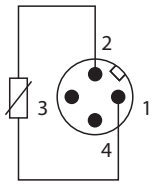



Fig. 19: RTD, 2-wire

### Resistance thermometer (RTD) — 3-wire

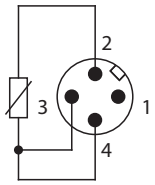



Fig. 20: RTD, 3-wire

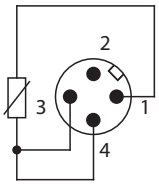



Fig. 21: RTD, 3-wire

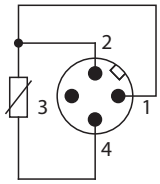



Fig. 22: RTD, 3-wire

### Resistance thermometer (RTD) — 4-wire

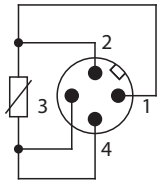



Fig. 23: RTD, 4-wire

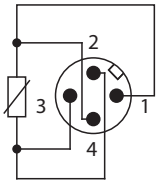



Fig. 24: RTD, 4-wire

### Thermocouples (TC)

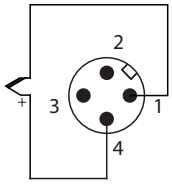



Fig. 25: Thermocouple between Pin 1 and Pin 4

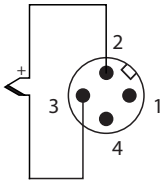



Fig. 26: Thermocouple between Pin 2 and Pin 3

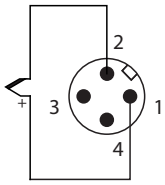



Fig. 27: Thermocouple between Pin 1 and Pin 2

## 6.3 Connection instructions for thermocouples

▶ Observe the following instructions when connecting thermocouples:

- Use thermocouples and cables in accordance with IEC 60584.
- Turck recommends the use of compensated connectors and connection cables. If thermocouples are connected with incorrect balancing lines or copper lines, the device may output an implausible reading.
- Use shielded cables for connection and connect the shield to one side.
- Automatic detection (factory setting) is designed for thermocouples with a 4-pin M12 connector. When using thermocouples with a 4-pin M12 connection and corresponding extension or balancing cable, Turck recommends using automatic detection of the probe configuration. The thermocouple type must also be selected.
- A Pt1000 resistor is used as an internal reference point. It is not possible to use an external reference point.

## 6.4 Connection instructions for resistance thermometers

▶ Observe the following instructions when connecting resistance thermometers:

- Keep the cable length as short as possible for a 2-wire circuit.
- Do not change the circuit types by adding additional bridges to the connector.

# 7 Commissioning

The device is operational automatically once the power supply is switched on.

The device uses the auto detect function to detect whether a resistance thermometer or a thermocouple is connected. The type of thermocouple is determined by the user. When connected to an I/O module, the device detects the pre-defined switching output behavior (PNP/NPN) or the analog output characteristic. The auto detect function is activated by default.

## Replacing the devices

If replacing an old device (Production date 2310 (date format YYWW)) with a new device, proceed as follows:

- Set the Compatible Device mode in the IO-Link master so that the device changes to Legacy Mode.
- Alternatively, set to Legacy Mode in the Extended Functions menu.

# 8 Operation

**WARNING**
The enclosure can heat to over 75 °C (167 °F).
**Risk of burns from hot enclosure surfaces!**
- ▶ Prevent the enclosure from coming into contact with flammable substances.
- ▶ Prevent the enclosure from being touched unintentionally.

## 8.1 LEDs — operation

| LED | Display | Meaning |
|---|---|---|
| PWR | green | Device is operational |
| | Green flashing | IO-Link communication |
| FLT | red | Error |
| °C | green | Temperature in °C |
| °F | green | Temperature in °F |
| K | green | Temperature in K |
| Ω | green | Resistance in Ω (resistance thermometers only) |
| LOC | yellow | Device locked |
| | Yellow flashing | "Lock/unlock" process active |
| | off | Device unlocked |
| I and II (switching point LEDs) | yellow | switching output<br>■ NO: Switching point exceeded/within window (active output)<br>■ NC: Switching point undershot/outside window (active output) |
| | off | switching output<br>■ NO: Switching point undershot/outside window (inactive output)<br>■ NC: Switching point exceeded/within window (inactive output) |

## 8.2 Display indications

| Display | Meaning |
|---|---|
| - - - - | Sensor failure |
| HW | Internal hardware error |
| PArF | Faulty factory parameters |
| SC 1 | Short circuit at output 1 |
| SC 2 | Short circuit at output 2 |
| SC12 | Short circuit at both outputs |
| WB 2 | Wire break at current output 2 |
| Prob | Probe not present, incorrectly connected or faulty |
| VOLT | Operating voltage outside the permissible range |
| LOAD | Burden at the analog output outside of the permissible range |
| Oor+ | Value outside of the measuring range, temperature > 5 % of full scale above the measuring range |
| Oor- | Value outside of the measuring range, temperature > 5 % of full scale below the measuring range |
| Oor | No measurement data available |
| PArA | Incorrect user parameterization |
| TEMP | Device temperature outside the permissible range |
| Err | Unspecified error |

# 9 Setting and Parameterization

The device can be assigned parameters as follows:

- Setting via touchpads
- Setting via IO-Link
- Setting via FDT/DTM

## 9.1 Settable functions and properties

The three front touchpads [ENTER], [MODE] and [SET] enable the user to set all the essential functions and properties directly on the device via the menu guidance. It is also possible to configure the device via the IO-Link interface (see IODDfinder).

### Setting options — via touchpads and IO-Link interface

The following functions and properties can be set and used both in standard I/O mode as well as in IO-Link mode:

- Locking/unlocking the device
- Switching behavior in Smart Sensor Profile:
  - Window mode
  - Single point mode
  - Two point mode
- Switching behavior in Legacy Mode:
  - Window function
  - Hysteresis function
- Analog range
- Probe configuration
- Thermocouple type
- OUT1 output configuration for SIO mode: PNP/NPN, auto detection on/off
- OUT2 output configuration for SIO mode: PNP/NPN, auto detection on/off
- Advanced settings: Reset to factory settings.
- Advanced settings: Minimum and maximum value memory
- Advanced settings: Offset adjustment
- Advanced settings: Display color and behavior

### Other setting options — only via touchpads

- Advanced settings: Reset to presettings.
- Advanced settings: Set password.

### Other setting options — only via IO-Link

Additional functions and properties can also be set via the IO-Link interface.

- Set display units for IO-Link mode
- Fully lock user interface (display and touchpads locked)
- Lock local parameters (user interface parameters — parameters are displayed but cannot be changed)

## 9.2 Setting parameter values via touchpads

### Turck standard menu

- Unlock the device when [MODE] or [SET] is touched, a red running light appears and the LOC LED is lit.
- Touch [MODE] or [SET] until the required parameter is displayed.
- Touch [ENTER] to select a parameter.
- Changing the displayed value: Touch [SET] for 3 s until the display is no longer flashing. Or: Touch [MODE] to return to the parameter selection.
- Increase or decrease the value gradually via [MODE] or [SET]. Certain values can be continuously changed by holding down [MODE] or [SET].
- Touch [ENTER] to save the modified value. The saved value flashes twice.

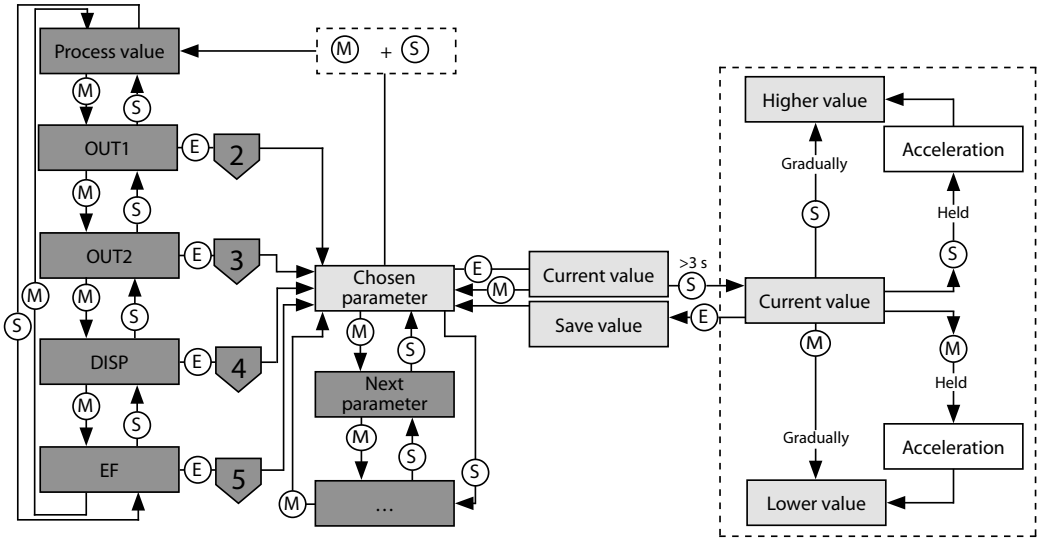



Fig. 28: Setting parameter values

## 9.3 Unlocking the device

- Touch [ENTER] for 3 s until all green bars are flashing on the display.
- Swipe [MODE], [ENTER], [SET] in succession: Two red flashing bars appear when each touchpad is touched. Once the two red bars have turned green, move onto the next touchpad without removing your finger from the touchscreen.
- Release the touchpads when six green bars are flashing on the display.
- ⇨ LOC LED goes off.
- ⇨ uLoc appears in the display and then disappears.

## 9.4 Locking the device

- Touch [MODE] and [SET] simultaneously for 3 s.
- ⇨ When the LOC LED flashes, Loc will appear on the display and then go out.
- ⇨ LOC LED is yellow.

The sensor is automatically locked if the touchpads of the device are not actuated for 1 min.

## 9.5 Protecting the sensor with a password

- Select PASS in the EF menu.
- Change values via [SET].
- Use [MODE] to navigate between the four digits of the password.
- Use [ENTER] to store the new password.

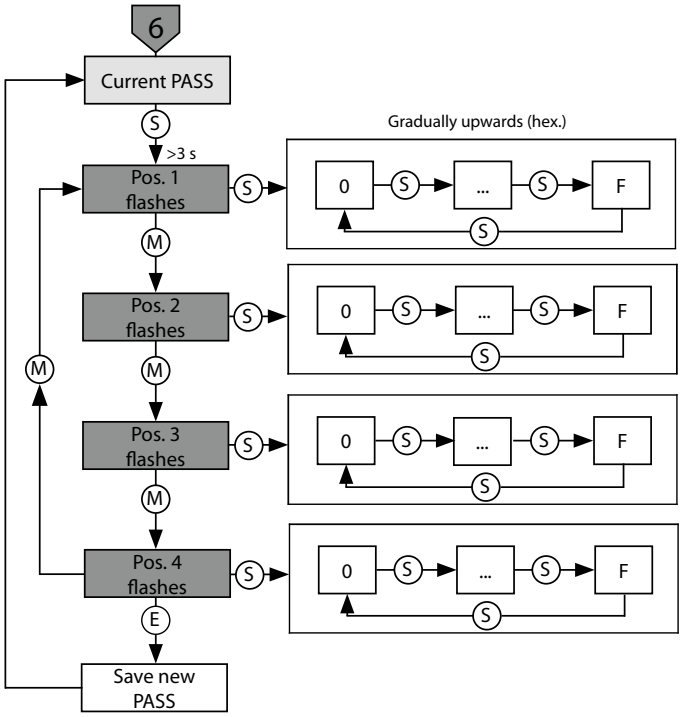



Fig. 29: Password setting

## 9.6 Setting via touchpads — standard menu guidance

Use the [MODE] or [SET] touchpads to navigate through the main menu, as well as the OUT1 and OUT2 submenus, the EF extended functions menu and the DISP display menu. Press [ENTER] to select the respective submenu. Touching [MODE] and [SET] at the same time will cancel the parameter assignment. The device returns to the standard display.

In the EF menu, you can select Legacy Mode with its own menu guidance.

### Standard menu guidance — main menu

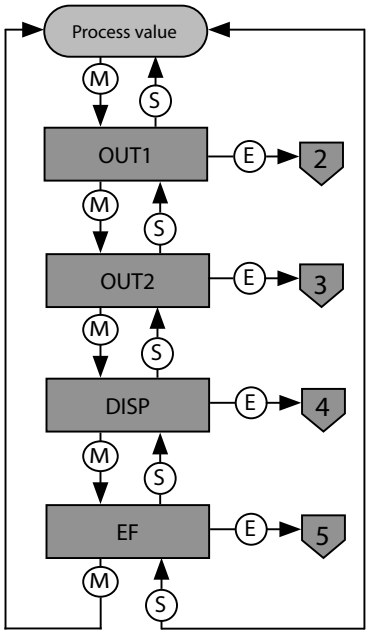



Fig. 30: Main menu

## Outputs submenu (OUT…)

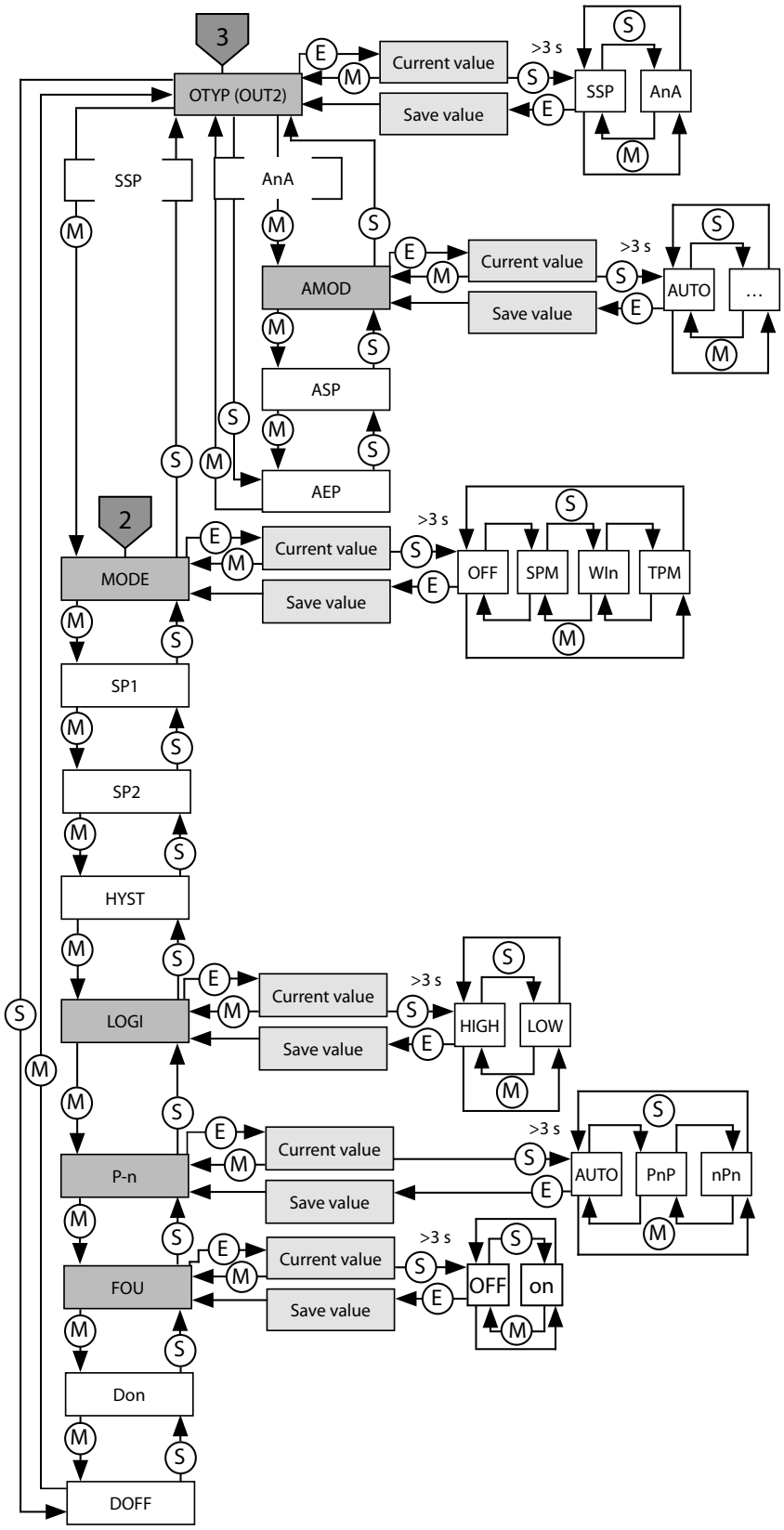



Fig. 31: Outputs submenu (OUT…)

## Display submenu (DISP)

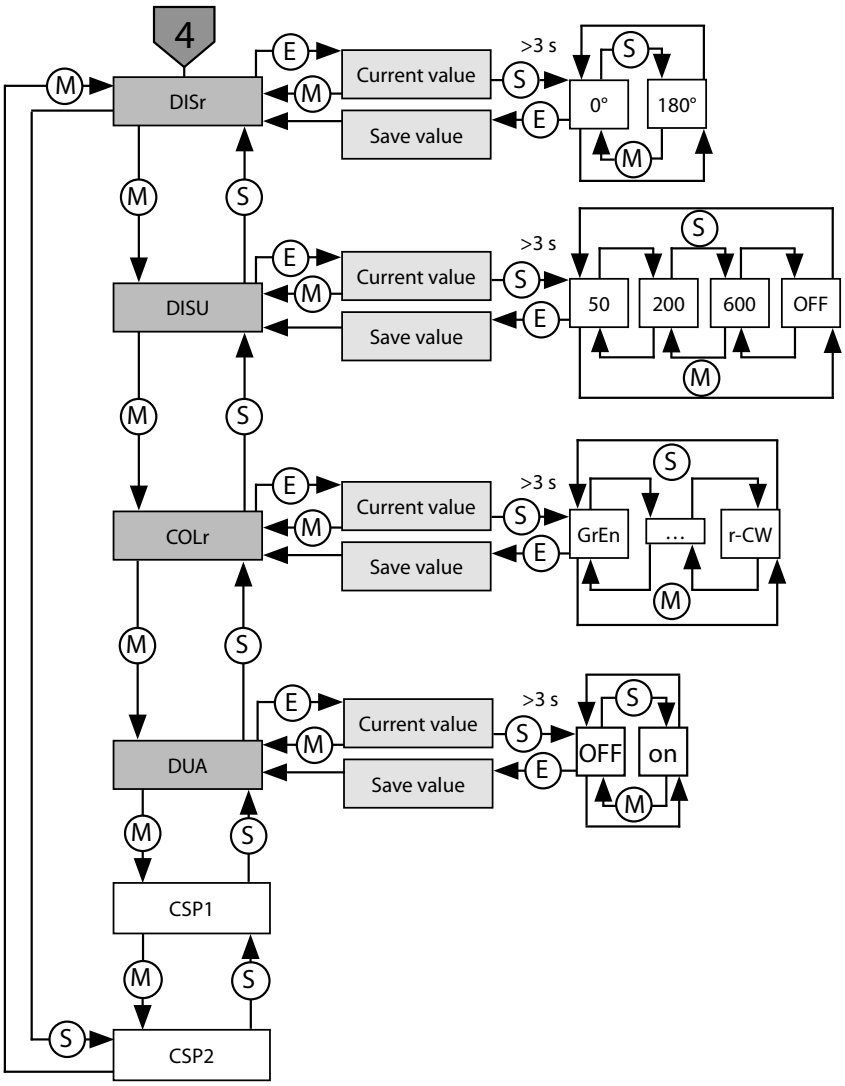



Fig. 32: Display submenu (DISP)

## Extended functions submenu (EF)

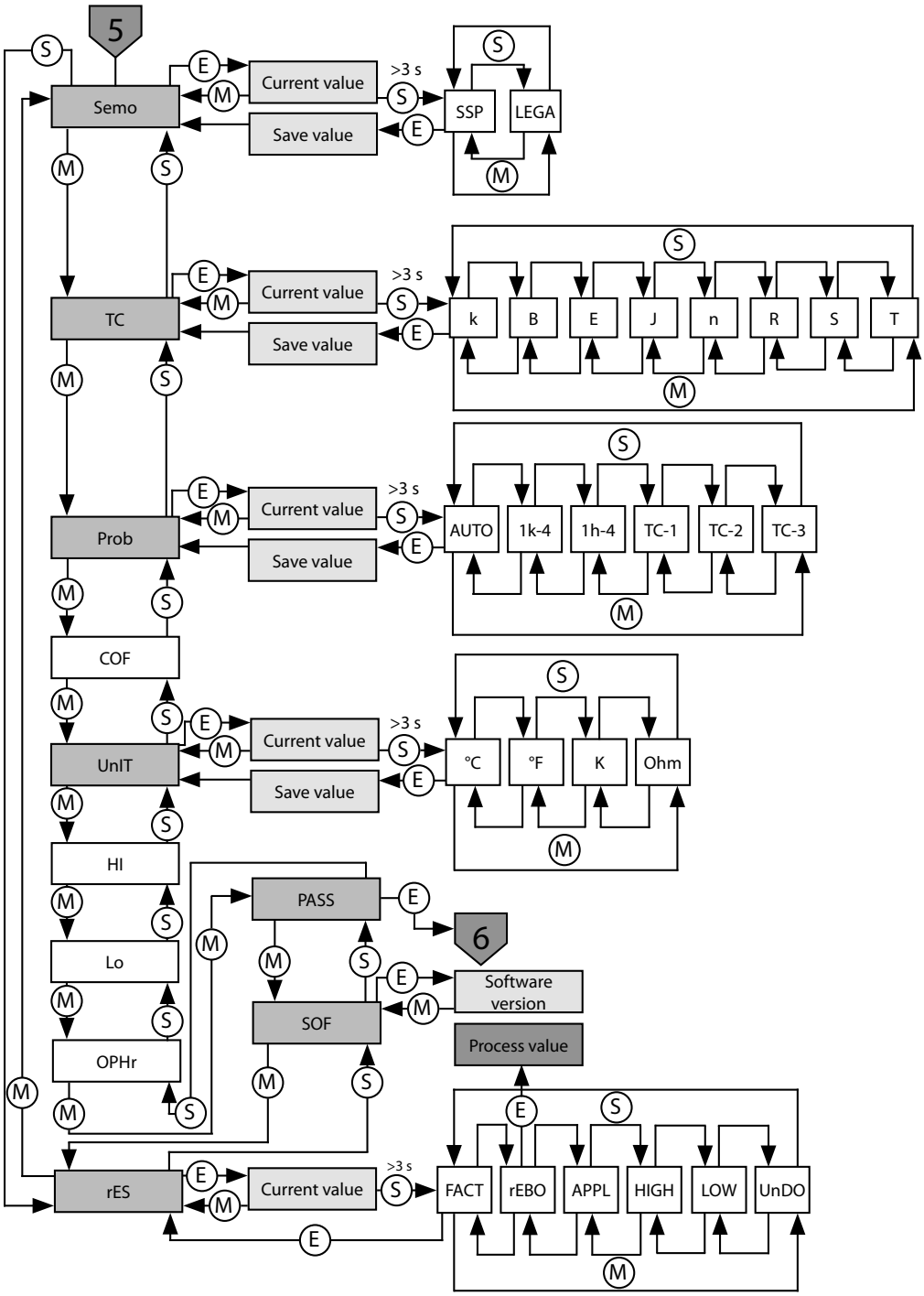



Fig. 33: Extended functions submenu (EF)

### 9.6.1 Parameters in the main menu

Default values are shown in **bold**.

| | Explanation | Function |
|---|---|---|
| **OUT1** | Output 1 submenu | Setting options for switching output 1 |
| **OUT2** | Output 2 submenu | Setting options for switching output 2 or analog output |
| **DISP** | Display submenu | Refer to the "Parameters in the DISP submenu" table for additional setting options |
| **EF** | Extended Functions submenu | For additional setting options see the “Parameters in the EF submenu” table |

### 9.6.2 Parameters in the OUT… (outputs) submenu

| | Explanation | Options | Function |
|---|---|---|---|
| **OTYP** | Output Type (OUT2) | SSP | Switching output Smart Sensor Profile |
| | | **AnA** | Analog output |
| **MODE** | | OFF | |
| | | SPM | Single point mode |
| | | WIn | Window mode |
| | | **TPM** | Two point mode |
| **SP1** | Switching point 1 | | SPM: Limit value at which the switching output changes its switching state<br>TPM: Upper limit value at which the switching output changes its switching state as the temperature rises<br>WIn: Upper window limit at which the switching output changes its switching state<br>**Default: 800 (80.0 °C)** |
| **SP2** | Switching point 2 | | SPM: Not available<br>TPM: Lower limit value at which the switching output changes its switching state as the temperature falls<br>WIn: Lower window limit at which the switching output changes its switching state<br>**Default: 700 (70.0 °C)** |
| **HYST** | Hysteresis | | The minimum hysteresis is 0.1 K.<br>The maximum hysteresis comprises the complete value range of the sensor. For thermocouples, the maximum hysteresis comprises the value range of the connected temperature probe.<br>**Default: 0.1 K** |
| **LOGI** | Invert switching logic | **HIGH** | 0 → 1 |
| | | LOW | 1 → 0 |
| **P-n** | Behavior of the switching output | **AUTO** | Auto detection (NPN/PNP) |
| | | PnP | N switching |
| | | nPn | P switching |
| **Don** | Switch-on delay | | 0…60 s in increments of 0.1 s (0 = delay time not activated)<br>**Default: 0.0 s** |
| **DOFF** | Switch-off delay | | 0…60 s in increments of 0.1 s (0 = delay time not activated)<br>**Default: 0.0 s** |

| | Explanation | Options | Function |
|---|---|---|---|
| **FOU** | Behavior in the event of a fault (e.g. wire break or short circuit) | on | Switching output: The output is activated in the event of a fault<br>Analog output: Fault value of the set function at output 2 (OUT2) |
| | | **OFF** | Switching output: The output is deactivated in the event of a fault.<br>Analog output: Fault value of the set function at output 2 (OUT2) |
| **AMOD** | Analog output (only available for OUT2) | **AUTO** | Automatic detection (4…20 mA/0…10 V) |
| | | 4–20 | 4…20 mA |
| | | 0–20 | 0…20 mA |
| | | 20–4 | 20…4 mA |
| | | 20–0 | 20…0 mA |
| | | 0–10 | 0…10 V |
| | | 0–5 | 0…5 V |
| | | 1–6 | 1…6 V |
| | | 10–0 | 10…0 V |
| | | 5–0 | 5…0 V |
| | | 6–1 | 6…1 V |
| | | 0545 | 0.5…4.5 V |
| | | 4505 | 4.5…0.5 V |
| **ASP** | Start point of the analog signal | | Temperature value at which the analog output signal has its start point<br>**Default: -49.8 °C** |
| **AEP** | End point of the analog signal | | Temperature value at which the analog output signal has its end point<br>**Default: 50.0 °C** |

### 9.6.3 Parameters in the DISP (display) submenu

| | Explanation | Options | Function |
|---|---|---|---|
| **DISr** | Display orientation | **0°** | Display rotated by 0° |
| | | 180° | Display rotated by 180° |
| **DISU** | Display update | 50 | 50-ms update time |
| | | **200** | 200-ms update time |
| | | 600 | 600-ms update time |
| | | OFF | Display update deactivated |
| **COLr** | Display color | **GrEn** | Always green |
| | | rED | Always red |
| | | G1oU | Green if OUT1 is switched, otherwise red |
| | | r1oU | Red if OUT1 is switched, otherwise green |
| | | G2ou | Green if OUT2 is switched, otherwise red |
| | | r2ou | Red if OUT2 is switched, otherwise green |
| | | G-CW | Green if the process value is between the virtual switching points CSP1 and CSP2 |
| | | r-CW | Red if the process value is between the virtual switching points CSP1 and CSP2 |

| | Explanation | Options | Function |
|---|---|---|---|
| **DUA** | Display | **OFF** | Display of process value |
| | | on | Alternating display of process value and unit |
| **CSP1** | Virtual upper switching point | | Virtual upper switching point at which the display changes color (if display color G-CW or r-CW is selected)<br>**Default: 80.0** |
| **CSP2** | Virtual lower switching point | | Virtual lower switching point at which the display changes color (if display color G-CW or r-CW is selected)<br>**Default: 70.0** |

### 9.6.4 Parameters in the EF submenu (Extended Functions)

| | Explanation | Options | Function |
|---|---|---|---|
| **Semo** | Set mode | SSP | Smart Sensor Profile |
| | | LEGA | Legacy Mode |
| **TC** | Thermocouple type | K | -200 °C…+1300 °C |
| | | b | +250 °C…+1820 °C |
| | | E | -200 °C…+1000 °C |
| | | J | -210 °C…+1200 °C |
| | | n | -200 °C…+1300 °C |
| | | R | -50 °C…+1500 °C |
| | | S | -50 °C…+1500 °C |
| | | T | -200 °C…+400 °C |
| **Prob** | Probe configuration | AUTO | Automatic detection of the temperature probe |
| | | 1k-4 | Pt1000 sensor, 4-wire version (connected to Pin1\|\|Pin2 and Pin3\|\|Pin4) |
| | | 1h-4 | Pt100 sensor, 4-wire version (connected to Pin1\|\|Pin2 and Pin3\|\|Pin4) |
| | | TC-1 | Thermocouple between Pin 1 and Pin 4 |
| | | TC-2 | Thermocouple between Pin 2 and Pin 3 |
| | | TC-3 | Reserved |
| **COF** | Offset adjustment | | Severe temperature changes in the environment of the sensor can cause the shifting of the zero point. As a result, the measured value zero is not displayed at 0 °C . This drift can be corrected with the offset value.<br>Setting range: -55…+55 °C in increments of 0.1 K.<br>**Default: 0.0 °C** |
| **UnIT** | Display unit | °C | °C |
| | | °F | °F |
| | | K | K |
| | | OHM | Ohm |
| **HI** | Maximum value memory | | The highest process temperature is stored and displayed. |
| **Lo** | Minimum value memory | | The lowest process temperature is stored and displayed. |
| **OPHr** | Operating hours counter | | Display of operating hours in years (y), days (d) and hours (h) |
| **PASS** | Password protection | | Define password and activate password protection |
| | | **0000** | No password |
| **SOF** | Software version | | Display the firmware version |

| | Explanation | Options | Function |
|---|---|---|---|
| **rES** | Reset | FACT | Reset the parameters to factory settings |
| | | rEBO | Restart the device (warm start) |
| | | APPL | Reset application-specific data |
| | | HIGH | Reset the maximum value memory: The highest process temperature is deleted. |
| | | LOW | Reset the minimum value memory: The lowest process temperature is deleted. |
| | | UnDO | Reset the parameters to the previous settings (last device start) |

## 9.7 Setting via touchpads — Legacy Mode

Use the [MODE] or [SET] touchpads to navigate through the main menu, the EF extended functions menu or the VDMA menus. Press [ENTER] to select the respective submenu. Touching [MODE] and [SET] at the same time will cancel the parameter assignment. The device returns to the standard display.

In the EF menu, you can select the VDMA menu with its own menu guidance.

### Legacy Mode — main menu

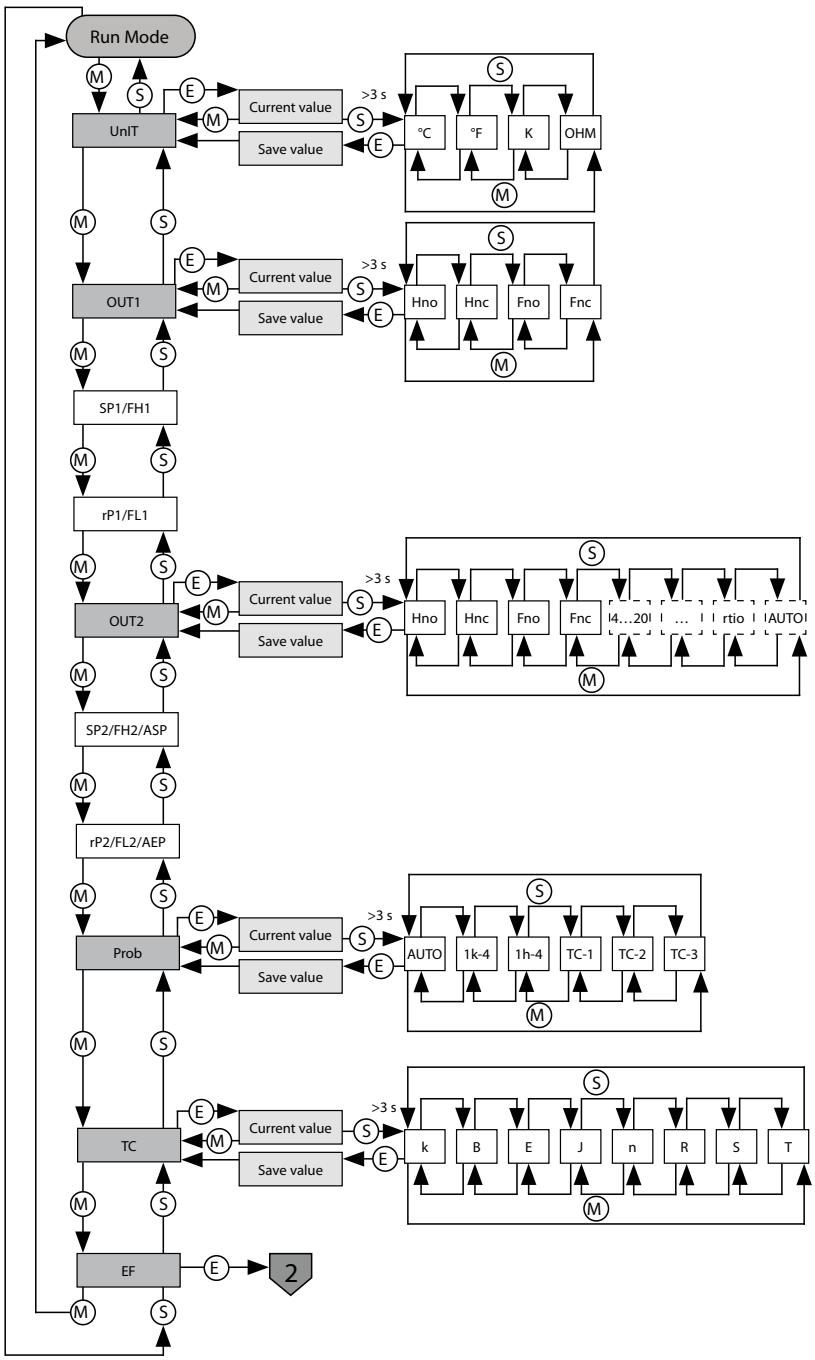



Fig. 34: Main menu TS720 in Legacy Mode

## Legacy Mode — extended functions (EF) submenu

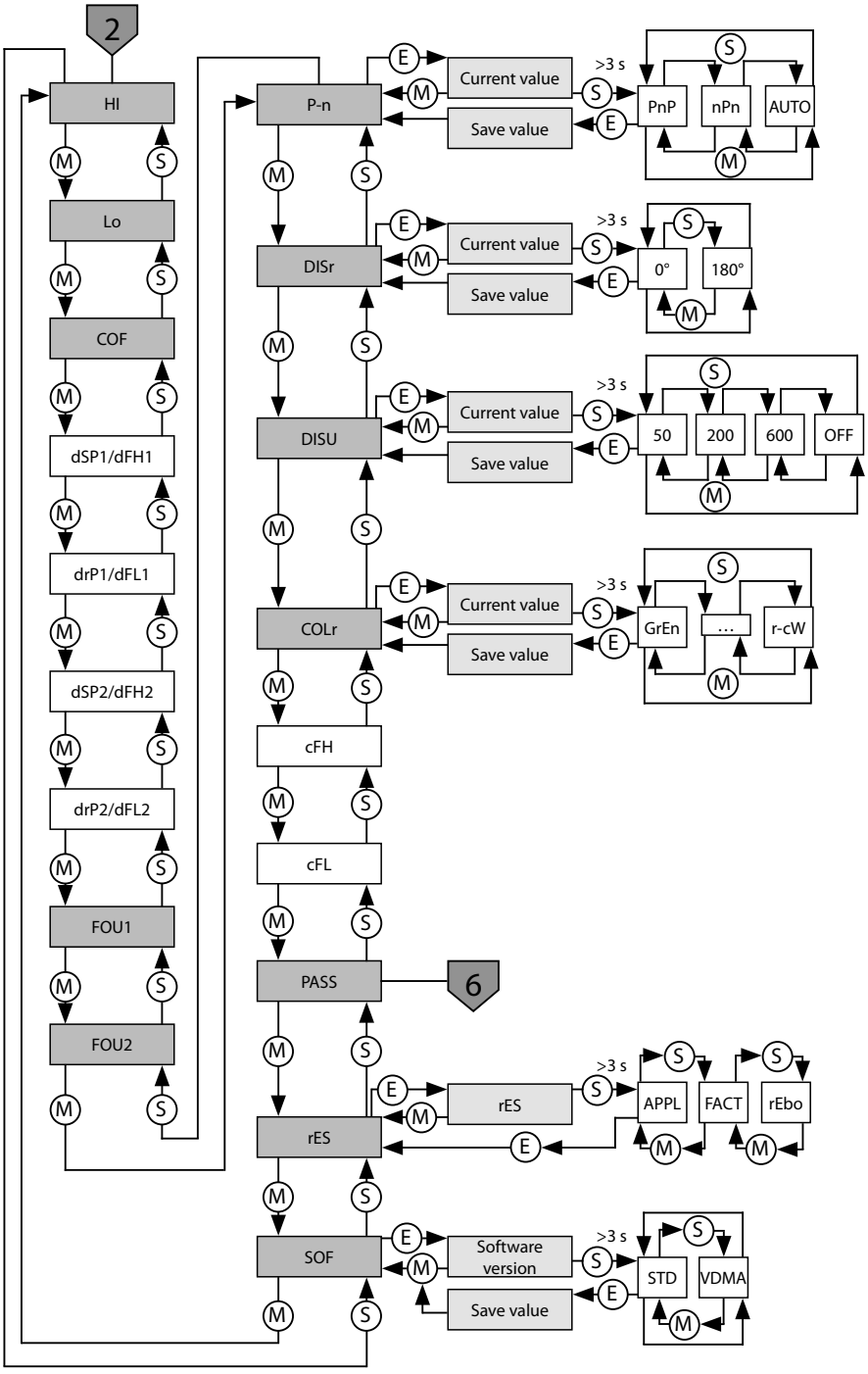



Fig. 35: Extended functions (EF) submenu in Legacy Mode

VDMA menu — main menu

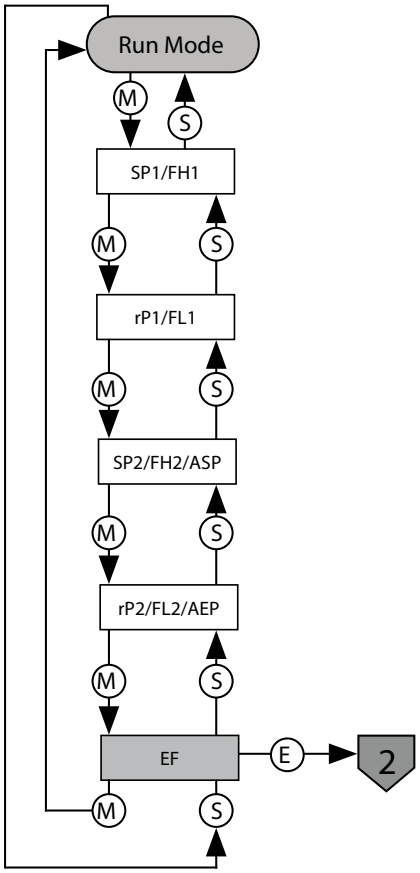



Fig. 36: Main menu in the VDMA menu guidance

## VDMA menu — extended functions (EF)

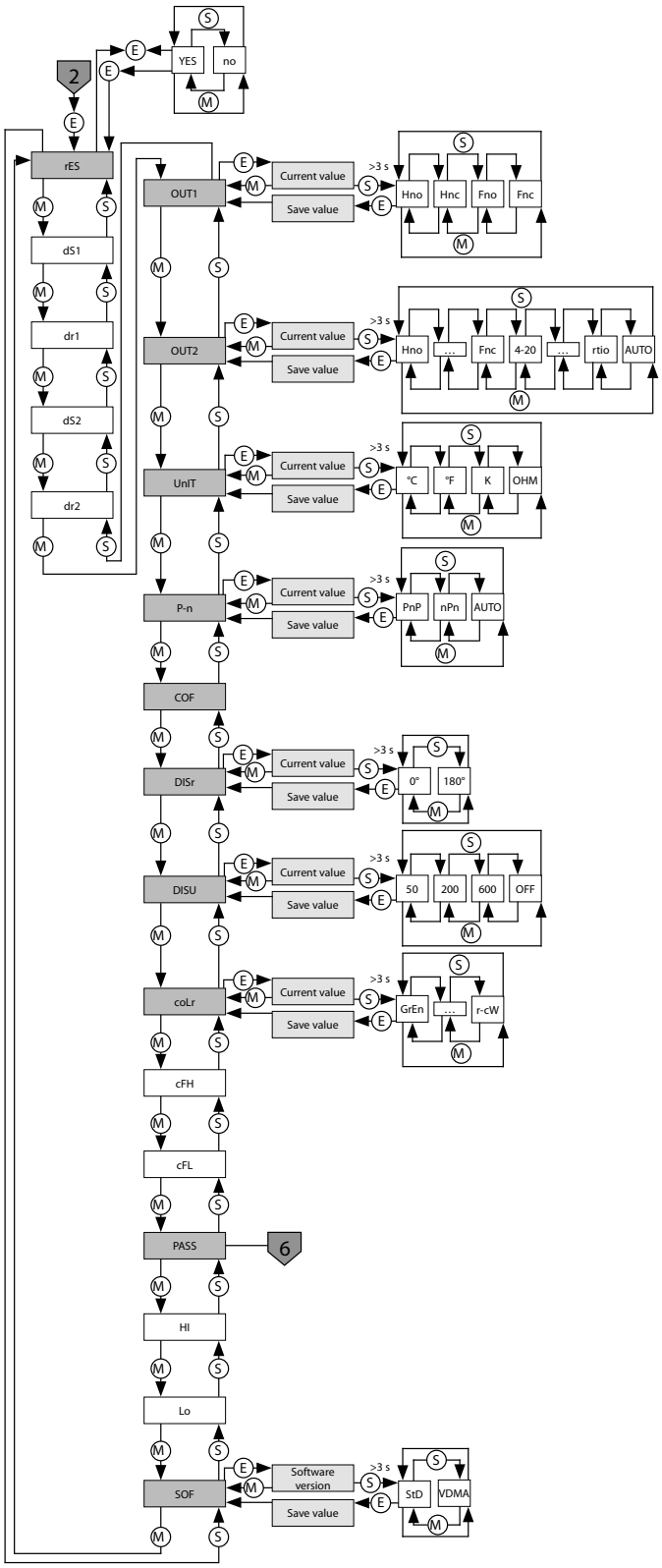



Fig. 37: Extended functions (EF) submenu in the VDMA menu guidance

### 9.7.1 Legacy Mode — parameters in the main menu

| | Explanation | Options | Function |
|---|---|---|---|
| **UnIT** | Display unit | **°C** | °C |
| | | °F | °F |
| | | K | K |
| | | OHM | Ohm |
| **OUT1** | Function of output 1 | **Hno** | Hysteresis function (NO = NO contact) |
| | | Hnc | Hysteresis function (NC = NC contact) |
| | | Fno | Window function (NO = NO contact) |
| | | Fnc | Window function (NC = NC contact) |
| **SP1** | Switching point 1 for hysteresis function<br>OUT1: Hno/Hnc | | Upper limit value at which output 1 changes its switching state as the temperature rises<br>**Default: 80.0 °C** |
| **rP1** | Release point 1 for hysteresis function<br>OUT1: Hno/Hnc | | Lower limit value at which output 1 changes its switching state as the temperature falls<br>**Default: 70.0 °C** |
| **FH1** | Upper switching point for window function<br>OUT1: Fno/Fnc | | Upper switching point at which output 1 changes its switching state<br>**Default: 80.0 °C** |
| **FL1** | Lower switching point for window function<br>OUT1: Fno/Fnc | | Lower switching point at which output 1 changes its switching state<br>**Default: 70.0 °C** |
| **OUT2** | Function of output 2 | **Hno** | Hysteresis function (NO = NO contact) |
| | | Hnc | Hysteresis function (NC = NC contact) |
| | | Fno | Window function (NO = NO contact) |
| | | Fnc | Window function (NC = NC contact) |
| | Analog output | **AUTO** | Automatic detection (4…20 mA/0…10 V) |
| | | 4-20 | 4…20 mA |
| | | 0-20 | 0…20 mA |
| | | 20-4 | 20…4 mA |
| | | 20-0 | 20…0 mA |
| | | 0-10 | 0…10 V |
| | | 0-5 | 0…5 V |
| | | 1-6 | 1…6 V |
| | | 10-0 | 10…0 V |
| | | 5-0 | 5…0 V |
| | | 6-1 | 6…1 V |
| | | rtio | 0.5…4.5 V |
| **SP2** | Switching point 2<br>OUT2: Hno/Hnc | | Upper limit value at which output 2 changes its switching state as the temperature rises<br>**Default: 80.0 °C** |
| **rP2** | Release point 2<br>OUT2: Hno/Hnc | | Lower limit value at which output 2 changes its switching state as the temperature falls<br>**Default: 70.0 °C** |

| | Explanation | Options | Function |
|---|---|---|---|
| **FH2** | Upper switching point for window function<br>OUT2: Fno/Fnc | | Upper switching point at which output 2 changes its switching state<br>**Default: 80.0 °C** |
| **FL2** | Lower switching point for window function<br>OUT2: Fno/Fnc | | Lower switching point at which output 2 changes its switching state<br>**Default: 70.0 °C** |
| **ASP** | Start point of the analog signal<br>OUT2: Auto/analog values/rtio | | Temperature value at which the analog output signal has its start point<br>**Default: -49.8 °C** |
| **AEP** | End point of the analog signal<br>OUT2: Auto/analog values/rtio | | Temperature value at which the analog output signal has its end point<br>**Default: 50.0 °C** |
| **Prob** | Probe configuration | **AUTO** | Automatic detection of the temperature probe |
| | | 1k-4 | Pt1000 sensor, 4-wire version<br>(connected to Pin 1‖Pin 2 and Pin 3‖Pin 4) |
| | | 1h-4 | Pt100 sensor, 4-wire version<br>(connected to Pin 1‖Pin 2 and Pin 3‖Pin 4) |
| | | tc-1 | Thermocouple between Pin 1 and Pin 4 |
| | | tc-2 | Thermocouple between Pin 2 and Pin 3 |
| | | tc-3 | Reserved |
| **TC** | Thermocouple type | **k** | -200…+1300 °C |
| | | B | 250…1820 °C |
| | | E | -200…+1000 °C |
| | | J | -210…+1200 °C |
| | | n | -200…+1300 °C |
| | | R | -50…+1500 °C |
| | | S | -50…+1500 °C |
| | | T | -200…+400 °C |
| **EF** | Submenu for additional setting options | | See table "Legacy Mode: Parameters in the EF (extended functions) submenu" |

### 9.7.2 Legacy Mode — parameters in the EF (extended functions) submenu

| | Explanation | Options | Function |
|---|---|---|---|
| **HI** | Maximum value memory | | The highest process temperature is stored and can be displayed or deleted (press and hold [SET]). |
| **Lo** | Minimum value memory | | The lowest process temperature is stored and can be displayed or deleted (press and hold [SET]). |
| **CoF** | Offset adjustment | | Severe temperature changes in the environment of the sensor can cause the shifting of the zero point. As a result, the measured value zero is not displayed at 0 °C . This drift can be corrected with the offset value.<br>Setting range: -55…+55 °C in increments of 0.1 K.<br>**Default: 0.0 °C** |

| | Explanation | Options | Function |
|---|---|---|---|
| **dSP1** | Switching delay of SP1 | | 0…60 s in increments of 0.1 s<br>(0 = delay time not active)<br>**Default: 0.0 s** |
| **drP1** | Switching delay of rP1 | | 0…60 s in increments of 0.1 s<br>(0 = delay time not active)<br>**Default: 0.0 s** |
| **dFH1** | Switching delay of FH1 | | 0…60 s in increments of 0.1 s<br>(0 = delay time not active),<br>only available with window mode Fno or Fnc<br>**Default: 0.0 s** |
| **dFL1** | Switching delay of FL1 | | 0…60 s in increments of 0.1 s<br>(0 = delay time not active),<br>only available with window mode Fno or Fnc<br>**Default: 0.0 s** |
| **dSP2** | Switching delay of SP2 | | 0…60 s in increments of 0.1 s<br>(0 = delay time not active).<br>**Default: 0.0 s** |
| **drP2** | Switching delay of rP2 | | 0…60 s in increments of 0.1 s<br>(0 = delay time not active).<br>**Default: 0.0 s** |
| **dFH2** | Switching delay of FH2 | | 0…60 s in increments of 0.1 s<br>(0 = delay time not active),<br>only available with window mode Fno or Fnc<br>**Default: 0.0 s** |
| **dFL2** | Switching delay of FL2 | | 0…60 s in increments of 0.1 s<br>(0 = delay time not active),<br>only available with window mode Fno or Fnc<br>**Default: 0.0 s** |
| **FOU1** | Behavior of output 1 in the event of an error (not a short circuit) | ON | Switching output: The output is activated in the event of a fault |
| | | **OFF** | Switching output: The output is deactivated in the event of a fault. |
| **FOU2** | Behavior of output 2 in the event of an error (not a wire break or short circuit) | ON | Switching output: The output is activated in the event of a fault<br>Analog output: Fault value of the set function at output 2 (OUT2) |
| | | **OFF** | Switching output: The output is deactivated in the event of a fault.<br>Analog output: Fault value of the set function at output 2 (OUT2) |
| **P-n** | Behavior of the switching output | **AUTO** | Auto detection (NPN/PNP) |
| | | nPn | N switching |
| | | PnP | P switching |
| **DISr** | Display orientation | **0°** | Display rotated by 0° |
| | | 180° | Display rotated by 180° |

| | Explanation | Options | Function |
|---|---|---|---|
| **DISU** | Measured value display | 50 | 50-ms update time |
| | | **200** | 200-ms update time |
| | | 600 | 600-ms update time |
| | | OFF | The display does not show any values during operation. The status LEDs remain active. The value on the display appears when you touch the touch pads. |
| **COLr** | Display color | **GrEn** | Always green |
| | | rEd | Always red |
| | | G1oU | Green if ou1 is switched, otherwise red |
| | | r1oU | Red if ou1 is switched, otherwise green |
| | | G2oU | Green if ou2 is switched, otherwise red |
| | | r2oU | Red if ou2 is switched, otherwise green |
| | | G-CW | Green if the measured value is between the virtual switching points cFL and cFH |
| | | r-CW | Red if the measured value is between the virtual switching points cFL and cFH |
| **cFH** | Virtual upper switching point | | Upper switching point at which the display changes color (if display color G-CW or r-CW is selected)<br>**Default: 80.0 °C** |
| **cFL** | Virtual lower switching point | | Lower switching point at which the display changes color (if display color G-CW or r-CW is selected)<br>**Default: 70.0 °C** |
| **PASS** | Password protection | | Define password and activate password protection |
| | | **0000** | No password |
| **rES** | Reset | FACT | Reset the parameters to factory settings |
| | | UnDO | Reset the parameters to the previous settings (last device start) |
| | | rEBO | Restart the device (warm start) |
| **SOF** | menu navigation | **STD** | Standard menu guidance in Legacy Mode |
| | | VDMA | VDMA menu navigation |

## 9.8 Setting via IO-Link

The device can be parameterized within the technical specifications (see data sheet) via the IO-Link communication interface – both offline, e.g. with the configuration tool as well as also online via the controller. An overview of the different functions and properties that can be set and used for IO-Link or SIO mode can be found in the chapter “Setting and parameterization” and via the IODDfinder. Detailed instructions on the parameterization of devices via the IO-Link interface are provided in the IO-Link commissioning manual.

All parameters can be changed in IO-Link mode via the controller, both during commissioning and during operation. In SIO mode, the device operates in accordance with the most recent setting configured in IO-Link mode.

# 10 Troubleshooting

If the device does not function as expected, first check whether ambient interference is present. If there is no ambient interference present, check the connections of the device for faults.

If there are no faults, there is a device malfunction. In this case, decommission the device and replace it with a new device of the same type.

# 11 Maintenance

The device is maintenance-free. Clean with a damp cloth if required.

# 12 Repair

The device is not intended for repair by the user. The device must be decommissioned if it is faulty. Observe our return acceptance conditions when returning the device to Turck.

## 12.1 Returning devices

If a device has to be returned, bear in mind that only devices with a decontamination declaration will be accepted. This is available for download at
**https://www.turck.de/en/return-service-6079.php**
and must be completely filled in, and affixed securely and weather-proof to the outside of the packaging.

# 13 Disposal

The devices must be disposed of properly and do not belong in the domestic waste.

# 14 Technical data

| Technical data | TS720-2UPN8-H1141 | TS720-LI2UPN8-H1141 |
|---|---|---|
| ID | 100003633 | 100003640 |
| **Temperature range** | | |
| Temperature display range | -210…+1820 °C<br>-346…+3308 °F | |
| Measuring element | For connection to probes of the TP product series | |
| Response time | 100 ms | |
| **Electrical data** | | |
| Operating voltage | 17…33 VDC | |
| Current consumption | ≤ 200 mA | |
| Voltage drop at $I_e$ | ≤ 2 V | |
| Protective measure | SELV, PELV according to DIN EN 61140 | |
| Short-circuit/reverse polarity protection | Yes/yes | |
| Protection class | III | |
| **Outputs** | | |
| Output 1 | Switching output or IO-Link mode | |
| Output 2 | switching output | Analog or switching output |
| **switching output** | | |
| Communication protocol | IO-Link | |
| Output function | NC/NO programmable, PNP/NPN | |
| Switching point accuracy | ± 0.2 K | |
| Rated operating current | 0.25 A | |
| Switching point distance | ≥ 0.2 K | |
| Switch point: | Sensor dependent:<br>(min. measuring range + 0.2 K) … (max. measuring range) | |
| Release point(s) | Sensor dependent:<br>(min. measuring range) … (max. measuring range - 0.2 K) | |
| Switching cycles | ≥ 100 million | |
| Repetition accuracy | 0.1 K | |
| **Analog output** | | |
| Current output | – | 0…20 mA/4…20 mA, each invertible |
| Load resistance, current output | – | ≤ 0.5 kΩ |
| Voltage output | – | Smart Sensor Profile: 0…5/10 VDC, 1…6 VDC, 0.5…4.5 V, each invertible<br>Legacy Mode: 0…5/10 VDC, 1…6 VDC, each invertible, 0.5…4.5 VDC |
| Voltage output load resistance | – | ≥ 8 kΩ |
| Accuracy (Lin. + Hys. + Rep.) | – | ± 0.3 K (or 0.1 % of scale at > 200 °C) |
| Repetition accuracy | – | 0.1 K |
| **IO-Link** | | |
| IO-Link specification | V1.1 | |
| Physical transmission layer | Corresponds to 3-wire technology (PHY2) | |

| Technical data | TS720-2UPN8-H1141 | TS720-LI2UPN8-H1141 |
|---|---|---|
| Frame type | 2.2 | |
| Transmission rate | COM 2 (38.4 kBaud) | |
| Parameterization | FDT/DTM/selection of various mapping profiles | |
| Accuracy | ± 0.1 K | |
| Included in the SIDI GSDML | yes | |
| **Programming** | | |
| Programming options | Automatic switching logic recognition, switching/release point; hysteresis/window mode; NO/NC; unit; IO-Link mapping profile; Smart Sensor Profile: Single point mode, two point mode, window mode | |
| Programming options for analog output | | 0/4…20 mA, 0…5/10 VDC, 1…6 VDC, 0,5…4.5 VDC |
| **Mechanical data** | | |
| Housing material | Stainless steel/plastic, 1.4404 (AISI 316L)/Grilamid TR90 UV | |
| Electrical connection | M12 × 1 connector | |
| Protection class | IP67, IP69K (not UL approved) | |
| Electromagnetic compatibility (EMC) | EN 61326-2-3: 2013 minimum operating quality: +3.0 K under worst possible conditions | |
| **Ambient conditions** | | |
| Ambient temperature | -40…+80 °C | |
| Storage temperature | -40…+85 °C | |
| Shock resistance | 50 g (11 ms) , DIN EN 60068-2-27 | |
| Vibration resistance | 20 g (10…3000 Hz), DIN EN 60068-2-6 | |
| Application range (UL) | Indoor application | |
| **Tests/approvals** | | |
| Approvals | UL | |
| UL approval number | E516036 | |
| **Reference conditions acc. to IEC 61298-1** | | |
| Temperature | 15…25 °C | |
| Atmospheric pressure | 860…1060 hPa abs. | |
| Air humidity | 10…95 % rel. | |
| Auxiliary power | 24 VDC | |
| **Display** | 4-digit 2-color (green/red) 12-segment display, rotatable by 180° | |
| Switching state indication | 2 × LEDs, yellow | |
| Unit display | 4 × green LED (°C, °F, K, ohm) | |

# 15 Turck branches — contact data

| | |
|---|---|
| **Germany** | Hans Turck GmbH & Co. KG<br>Witzlebenstraße 7, 45472 Mülheim an der Ruhr<br>www.turck.de |
| **Australia** | Turck Australia Pty Ltd<br>Building 4, 19-25 Duerdin Street, Notting Hill, 3168 Victoria<br>www.turck.com.au |
| **Austria** | Turck GmbH<br>Graumanngasse 7/A5-1, A-1150 Vienna<br>www.turck.at |
| **Belgium** | TURCK MULTIPROX<br>Lion d'Orweg 12, B-9300 Aalst<br>www.multiprox.be |
| **Brazil** | Turck do Brasil Automação Ltda.<br>Rua Anjo Custódio Nr. 42, Jardim Anália Franco, CEP 03358-040 São Paulo<br>www.turck.com.br |
| **Canada** | Turck Canada Inc.<br>140 Duffield Drive, CDN-Markham, Ontario L6G 1B5<br>www.turck.ca |
| **China** | Turck (Tianjin) Sensor Co. Ltd.<br>18,4th Xinghuazhi Road, Xiqing Economic Development Area, 300381 Tianjin<br>www.turck.com.cn |
| **Czech Republic** | TURCK s.r.o.<br>Na Brne 2065, CZ-500 06 Hradec Králové<br>www.turck.cz |
| **France** | TURCK BANNER S.A.S.<br>11 rue de Courtalin Bat C, Magny Le Hongre, F-77703 MARNE LA VALLEE Cedex 4<br>www.turckbanner.fr |
| **Hungary** | TURCK Hungary kft.<br>Árpád fejedelem útja 26-28., Óbuda Gate, 2. em., H-1023 Budapest<br>www.turck.hu |
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