TURCK

Your Global Automation Partner

FS121-2UPN8-H1141 Flow 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** DANGER indicates a hazardous situation with a high level of risk, which, if not avoided, will result in death or serious injury.
	**WARNING** WARNING indicates a hazardous situation with a medium level of risk, which, if not avoided, will result in death or serious injury.
	**CAUTION** CAUTION indicates a hazardous situation with a medium level of risk, which, if not avoided, will result in moderate or minor injury.
	**NOTICE** CAUTION indicates a situation which, if not avoided, may cause damage to property.
	**NOTE** 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** This symbol denotes actions that the user must carry out.
⇨	**RESULT OF ACTION** 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

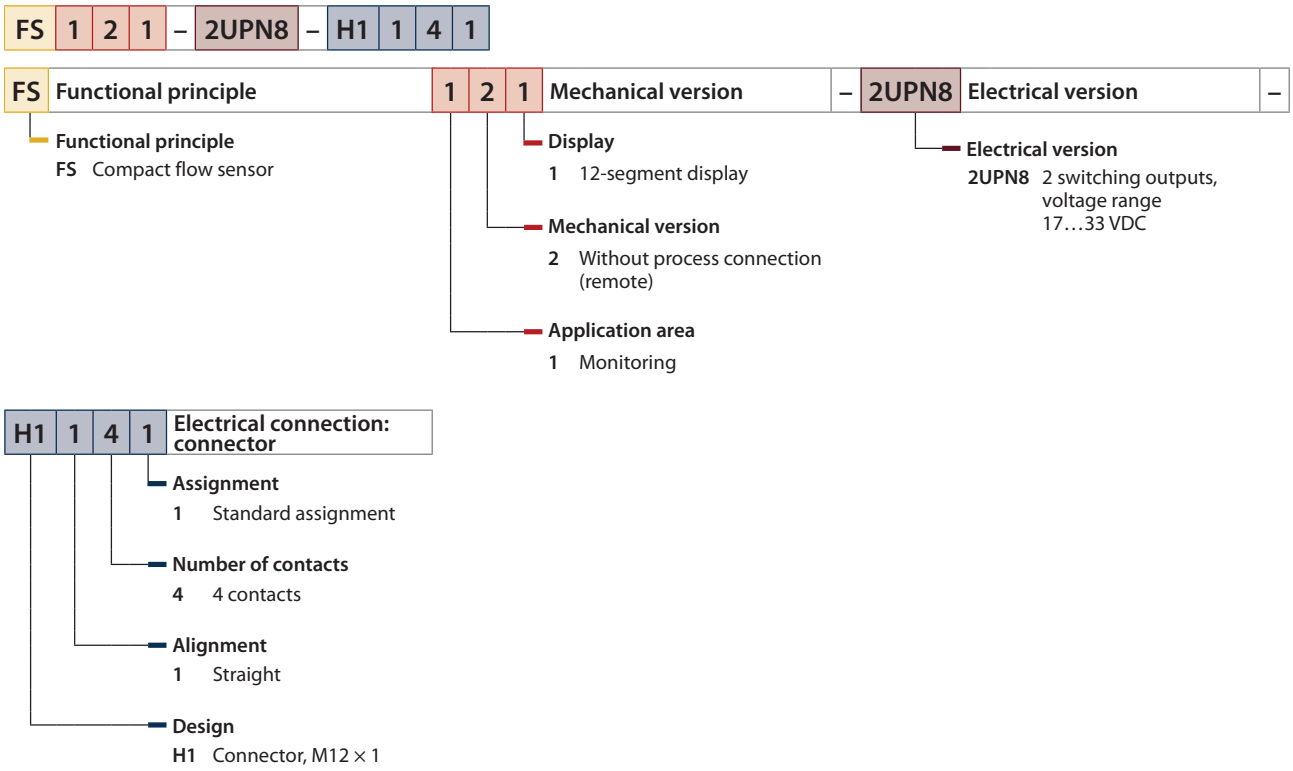
1.4 Feedback about these instructions

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 flow processing and display units:



2.2 Scope of delivery

The delivery consists of the following:

- Flow 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 [▷ 35].

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 flow processing and display units of the FS121… product series are used to monitor the flow rate of liquid and gaseous media. This requires the connection of a flow sensor to the devices. The devices support the following flow sensors:

Type	Description	Medium	Mounting condition
FP100…	Media temperature -25…+85 °C	Liquids	Immersion sensor
FCS…NA-…	Media temperature -20…+80 °C	Liquids	Immersion sensor
FCS…NA-…D100… FCS…NA-…D014… FCS…NA-…D003…	High-temperature sensor, media temperature +10…+120 °C	Liquids	Immersion sensor
FCS…NA-…/A	Media temperature -20…+80 °C	Gases	Immersion sensor
FCI-…A4-NA-…	Media temperature -20…+80 °C	Liquids	Inline sensor, metal version
FCI-…A4P-NA-…	Media temperature 0…+80 °C	Liquids	Inline sensor, plastic version

Typical applications include monitoring cooling circuits (e.g. in welding applications) and protecting pumps from running dry. The devices operate using the calorimetric principle; this means that, in addition to measuring the media temperature, the devices are able to indicate whether adjustable limit values are exceeded or undershot.

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 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.
- The device meets the EMC requirements for the industrial areas. When used in residential areas, take measures to prevent radio frequency interference.

4 Product description

The flow processing and display units of the FS+ 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 flow sensors (FP100…, FCI…NA or FCS…NA).

The devices have two switching outputs (PNP/NPN/Auto) according to Smart Sensor Profile 4.1.2.

4.1 Device overview

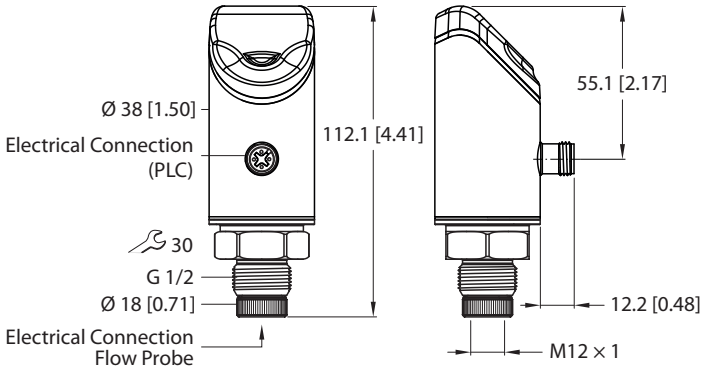


Fig. 1: Dimensions

4.2 Properties and characteristics

- Flow monitoring of liquid and gaseous media
- Sensor housing material 1.4404 (316L)
- Protection classes IP66, IP67, IP69K
- 4-digit, 2-color, 12-segment display, rotatable by 180°
- Housing upper section rotatable by 340°
- 2 switching outputs, various IO-Link mapping profiles can be selected, Quick-Teach, MAX/MIN-Teach
- DeltaFlow function: The memory function for teach-in values is only released after the warm-up phase with constant flow

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

The Connected flow sensors works calorimetrically. The function is based on the thermodynamic principle. When the medium is flowing, thermal energy is dissipated at the sensor. The resulting temperature on the probe is measured and compared to the media temperature. The flow status can be derived directly from the determined temperature difference: The greater the energy dissipation, the higher the flow speed or flow rate.

4.5 Functions and operating modes

The devices show the recorded flow and temperature values on the front via status LEDs and a four-digit display. In Quick-Teach mode, the display shows the flow value as a deviation (±) from a teachable switching point. In MAX/MIN mode, the display shows the flow value—relative to a teachable flow range—as a percentage. The temperature values can be displayed in °C or °F.

The two switching outputs of the FS121-2UPN8… sensors can be used either as NO contacts or as NC contacts. Through the auto detection function, the sensor automatically detects and activates the relevant type of output (PNP/NPN).

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 process value 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.

4.5.1 Flow monitoring

The flow speed is detected by a calorimetric sensor in the flow channel and evaluated by the integrated processing unit. The current flow value is shown on the display and—when connected to an IO-Link master—is output via a communication signal.

The switching output Out 1 (Flow) changes its switching state when the set switching point is reached for the flow rate. The switching state depends on the switching logic as well as on single point mode, two point mode and window mode.

4.5.2 Temperature monitoring

The calorimetric measurement method used by the sensors not only monitors the flow rate, but also measures the approximate temperature of the media. Both process variables are recorded and evaluated independently of each other. The current temperature is shown on the display and—when connected to an IO-Link master—is output via a communication signal. After the display is unlocked, press the [SET] touchpad once or use the [MODE] touchpad to navigate through the main menu to display the current temperature.

The switching output OUT2 (TEMP) is used for temperature monitoring. The devices change their switching state when the set switching point is reached for the temperature. The switching state depends on the switching logic as well as on single point mode, two point mode and window mode.

4.5.3 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 for temperature values.

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.

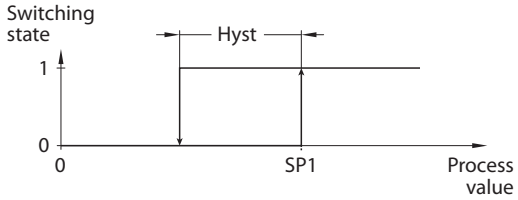


Fig. 2: Single point mode

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.

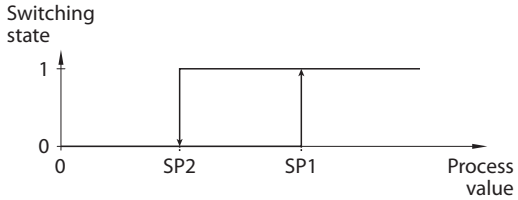


Fig. 3: Two point mode

Window mode

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

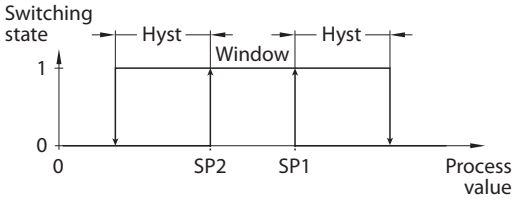


Fig. 4: Window mode

4.5.4 DeltaFlow monitoring

The DeltaFlow monitor compares the flow speed within a predefined time period. The user has no influence on this function.

In teach-in mode, the memory function for teach-in values is only enabled when the system is in a stable condition, i.e. the changes in flow speed are sufficiently small. DeltaFlow monitoring prevents values from being stored when the physical system (comprising the sensor and medium) is still in the temperature compensation phase, in which incorrect results can arise. In operating mode, the DeltaFlow function monitors the warm-up process of the sensor after the operating voltage is switched on.

The following schematic diagram illustrates the functional sequence:

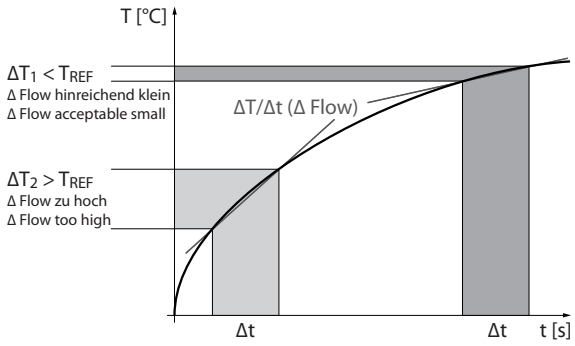


Fig. 5: DeltaFlow monitoring — schematic diagram

4.5.5 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.

4.5.6 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.

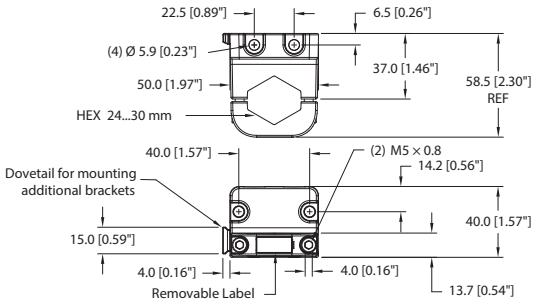
The device parameters can be set via IO-Link and then operated at the digital inputs with the appropriate settings in SIO mode. Not all functions and properties of the device can be used in SIO mode.

4.5.7 Auto detect function

The auto detect function enables the device to automatically detect the pre-defined switching output behavior (PNP/NPN)when connected to an I/O module. The auto detect function is activated by default.

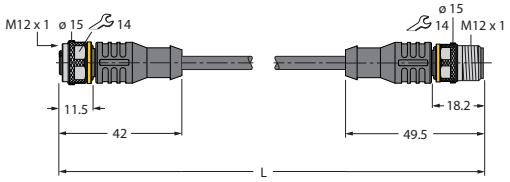
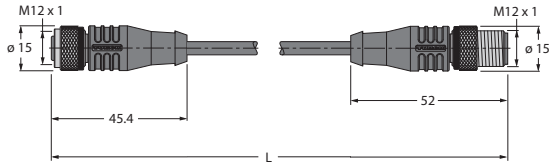
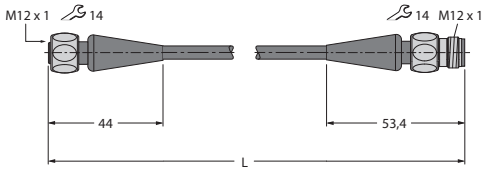
4.6 Technical accessories

4.6.1 Mounting accessories

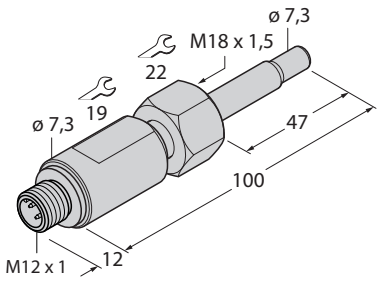
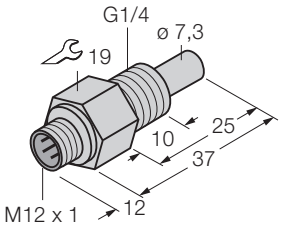
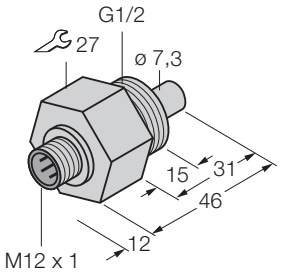
Dimension drawing	Type	ID	Description
	FAM-30-PA66	100018384	Mounting bracket; variable wrench size 24…30 mm; removable labeling plate 20 × 9 mm

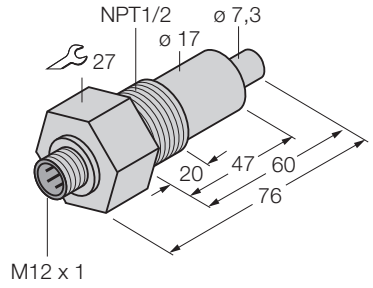
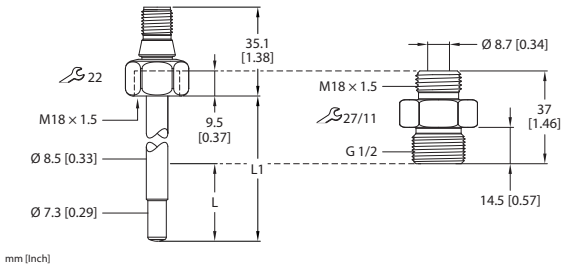
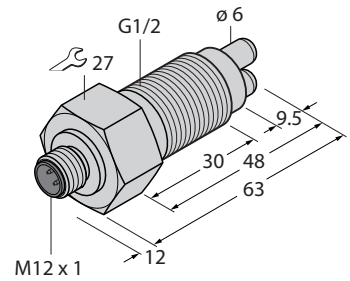
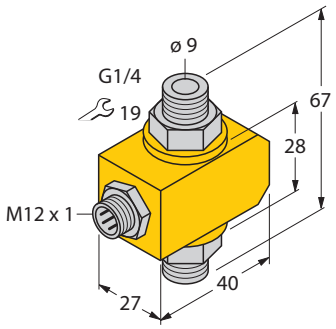
4.6.2 Connectivity accessories

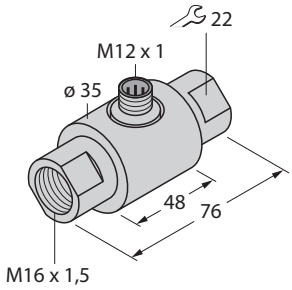
In addition to the above connection cables, Turck also offers other cable types for specific applications with the correct terminals for the device. More information on this is available from the Turck product database at www.turck.de/products in the Connectivity area.

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

4.6.3 Flow sensors

Dimension drawing	Type	ID	Description
	FCST-A4-NA-H1141	6870266	Flow sensor for liquids, immersion sensor without integrated signal processor
	FCS-G1/4A2-NA-H1141	6870301	Flow sensor for liquids, immersion sensor without integrated signal processor
	FCS-G1/2A4-NA-H1141	6870303	Flow sensor for liquids, immersion sensor without integrated signal processor

Dimension drawing	Type	ID	Description
	FCS-N1/2A4-NA-H1141-L060	6871310	Flow sensor for liquids, immersion sensor without integrated signal processor
	FP100-300L-30-NA-H1141	100001044	Flow sensor for liquids, immersion sensor without integrated signal processor
	FCS-GL1/2A2-NA-H1141/A	6870404	Flow sensor for liquids, immersion sensor without integrated signal processor
	FCI-D10A4P-NA-H1141	6870629	Flow sensor for liquids, inline sensor without integrated signal processor

Dimension drawing	Type	ID	Description
	FCI-D09A4-NA-H1141/M16	6870631	Flow sensor for liquids, inline sensor without integrated signal processor

5 Installing

The flow 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).

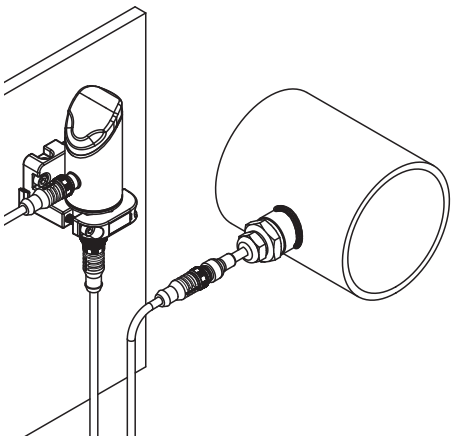


Fig. 6: Installing FS121…

- Mount the flow processing and display unit on any part of the system. 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.
- If the connected sensor is replaced: Teach in new teach values.

6 Connection

The following flow sensors can be connected to the flow processing and display unit:

Type	Description	Medium	Mounting condition
FP100…	Media temperature -25…+85 °C	Liquids	Immersion sensor
FCS…NA-…	Media temperature -20…+80 °C	Liquids	Immersion sensor
FCS…NA-…D100… FCS…NA-…D014… FCS…NA-…D003…	High-temperature sensor, media temperature +10…+120 °C	Liquids	Immersion sensor
FCS…NA-…/A	Media temperature -20…+80 °C	Gases	Immersion sensor
FCI-…A4-NA-…	Media temperature -20…+80 °C	Liquids	Inline sensor, metal version
FCI-…A4P-NA-…	Media temperature 0…+80 °C	Liquids	Inline sensor, plastic version

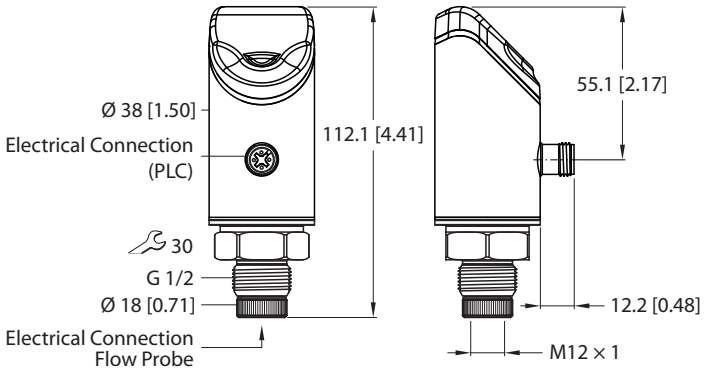


Fig. 7: Electrical connections for controller and flow sensors

- Connect the flow sensor to the flow processing and display unit in accordance with the relevant specifications (see "Electrical connection flow sensor"). When doing so, observe the technical specifications and the installation instructions for the flow sensor.
- Connect the device to the controller or an I/O module as shown in the wiring diagram (see "Electrical connection (PLC)").

6.1 Wiring diagram

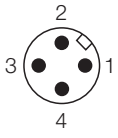


Fig. 8: Pin assignment

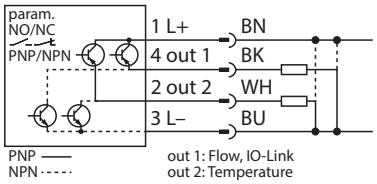


Fig. 9: FS…-2UPN8-H1141 wiring diagram

7 Commissioning

The device is operational automatically once the power supply is switched on and the warm-up phase is complete. During the warm-up process, -- -- -- -- is shown on the display. The number of dashes decreases from left to right until the device is ready. The process value is then displayed.

The device is set by default as follows:

- FP100… flow sensors
- Cable length of the connected sensors: 2 m
- Operating mode: MAX/MIN mode

▶ If a sensor other than an FP100… flow sensor is connected: Select the correct flow sensor (see parameter **ProB**).

▶ Specify the cable length of the connected flow sensor (see fig. 6 and parameter CLEn).

▶ Perform MAX/MIN-Teach or Quick-Teach to adapt the sensor to application-specific conditions.

8 Operation

WARNING
The housing can heat up to over 75 °C (167 °F) in the area of the probe
Risk of burning due to hot housing surfaces!
- ▶ Protect the housing from contact with flammable material.
- ▶ Protect the housing from accidental contact.

If the device is restarted (e.g. after a power failure during operation), the sensor will require another a warm-up phase before any values can be recorded again. During the warm-up process, -- -- -- -- is shown on the display.

8.1 LEDs — operation

The LEDs indicate readiness for operation, the status of the outputs and pending diagnostic messages. An additional LED indicates that the device has been locked.

LED	Indication	Meaning
PWR	Green	Device is operational
	Green flashing	IO-Link communication active
FLT	Red	Error, see "LEDs — diagnostic messages"
LOC	Yellow	Device locked
	Yellow flashing	"Lock/unlock" process active
	Off	Device unlocked
I (FLOW) and II (TEMP)	Yellow	Switching output ■ NO: Switching point exceeded/within window (active output) ■ NC: Switching point undershot/outside window (active output)
	Off	Switching output ■ NO: Switching point undershot/outside window (inactive output) ■ NC: Switching point exceeded/within window (inactive output)
%	Green	Flow in %
°C	Green	Temperature in °C
°F	Green	Temperature in °F

8.2 Displays

Display	Meaning
- - - -	Sensor failure
HW	Internal hardware fault
PArF	Incorrect factory parameterization
SC 1	Short circuit at output 1
SC 2	Short circuit at output 2
SC12	Short circuit at both outputs
WB 2	Wire break
Prob	No sensor present, sensor incorrectly connected or sensor faulty

Display	Meaning
VOLT	Operating voltage outside the permissible range
LOAD	Load at the analog output outside the permissible range
Oor+	Flow value and/or media temperature above the detection range
Oor-	Flow value and/or media temperature below the detection range
Oor	No measurement data available
PArA	Incorrect user parameterization
TEMP	Device temperature outside the permissible range
Err	Unspecified error
UnIT	Value cannot be displayed in the selected unit
Orun	Value > 105 % of the set flow range in MAX/MIN-Teach, value > +55 % of the set switching point in Quick-Teach, media temperature greater than the max. working temperature of the respective sensor
Urun	Value < -5 % of the set flow range in MAX/MIN-Teach, value < -55 % of the set switching point in Quick-Teach, media temperature less than the min. working temperature of the respective sensor

9 Setting and parameterization

The device can be assigned parameters as follows:

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

9.1 Settable functions and features

The three front touchpads (ENTER, MODE, 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

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

- Lock/unlock touchpads
- FS…2UPN8 — Flow switching point: MAX/MIN-Teach; Temp switching point
- Advanced settings: Reset to the previous settings (pre-settings) or factory settings
- FS…2UPN8 advanced settings: Flow/Temp output: NO/NC changeover
- Advanced settings: Switching behavior of the outputs, display settings
- OUT1/OUT2 output configuration for SIO mode: PNP/NPN, auto detection on/off
- Display units: metric, imperial
- Select the connected flow sensor
- Set the cable length of the connected flow sensor

Other setting options — only via touchpads

- Advanced settings: password setting
- Flow switching point: Quick-Teach

Other setting options — only via IO-Link

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

- Lock data storage on IO-Link master
- Fully lock user interface (display and touchpads locked)
- Lock parameters (parameters are displayed but cannot be changed)

Factory settings

- Sensor type: FP100… (P1)
- MAX/MIN values for teach functions: Re-teach the application after commissioning
- Auto detection function switched on
- FS…2UPN8 — switching point SP1: flow (OUT1) 70 % or temperature (OUT2) 60 °C
- FS…2UPN8 — switching point SP2: flow (OUT1) 69 % or temperature (OUT2) 59.5 °C
- FS…2UPN8 — OUT1/OUT2 output function: NO contact

Auto detection function

The auto detect function enables the device to automatically detect the pre-defined switching output behavior (PNP/NPN)when connected to an I/O module. The auto detect function is activated by default.

9.2 Setting via touchpads

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.

Standard menu guidance — main menu

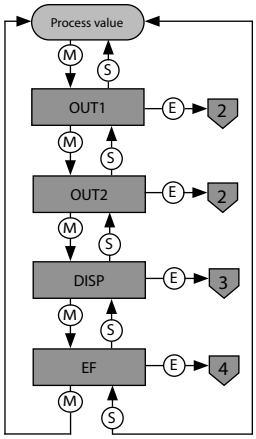


Fig. 10: Main menu

OUT… submenu

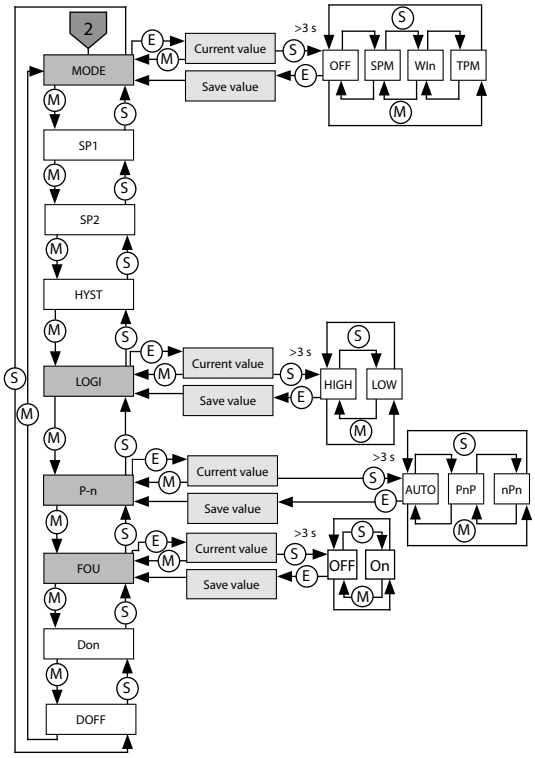


Fig. 11: OUT… submenu (FS…2UPN8)

Display submenu (DISP)

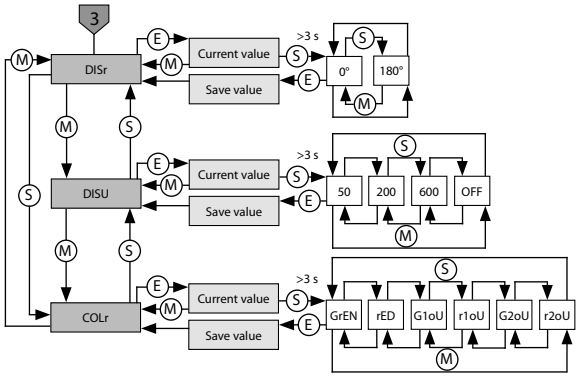


Fig. 12: Display submenu

Extended functions submenu (EF)

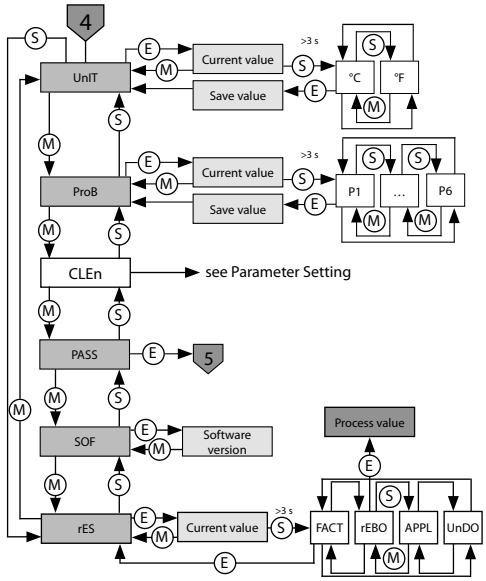


Fig. 13: Extended functions submenu (EF)

9.2.1 Setting parameter values via the touchpads

- ▶ 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.

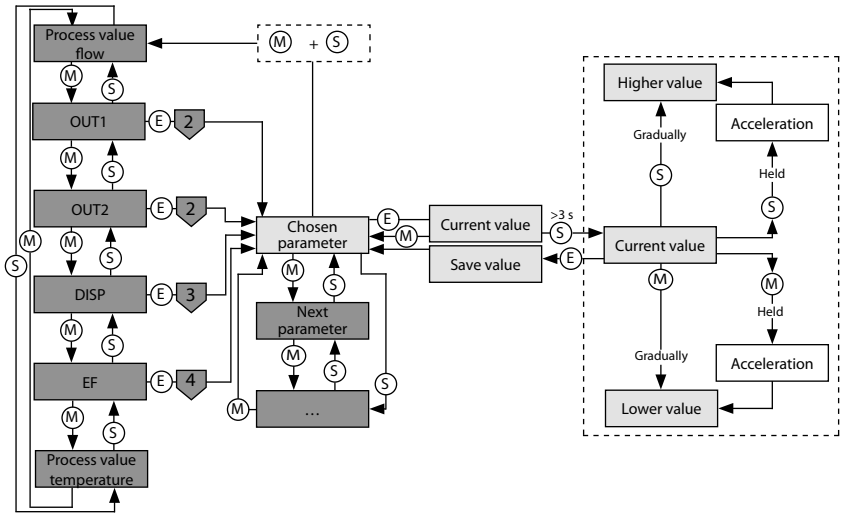


Fig. 14: Selecting parameters

9.2.2 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.

9.2.3 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.

9.2.4 Protecting the sensor with a password

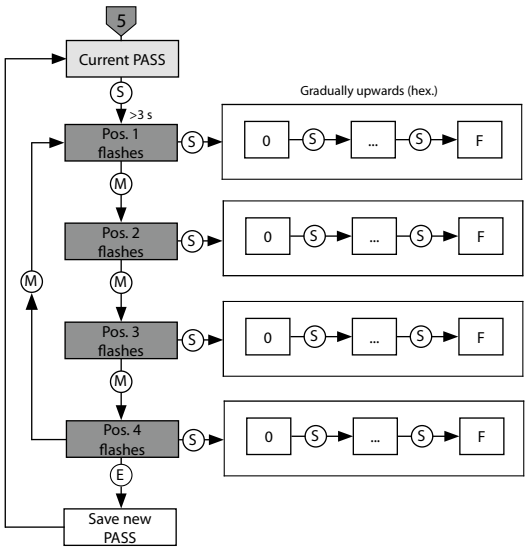


Fig. 15: Password setting

9.2.5 Parameters in the main menu

Default values are shown in **bold**.

	Explanation	Function
OUT1	Output 1 submenu	Setting options for switching output 1 for flow speed
OUT2	Output 2 submenu	Setting options for switching output 2 for temperature
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

9.2.6 Parameters in the OUT… (FS…2UPN8) submenu

	Explanation	Options	Function
MODE		OFF	
		SPM	Single point mode
		WIn	Window mode (window function)
		TPM	Two point mode
SP1	Switching point 1		SPM: Limit value at which the switching output changes its switching state TPM: Upper limit value at which the switching output changes its switching state as the flow speed or temperature rises WIn: Upper window limit at which the switching output changes its switching state **Default: 70 % or 60.0 °C**
SP2	Switching point 2		SPM: Not available TPM: Lower limit value at which the switching output changes its switching state as the flow speed or temperature falls WIn: Lower window limit at which the switching output changes its switching state **Default: 69 % or 59.5 °C**
HYST	Hysteresis OUT2		The minimum hysteresis is 0.1 K. 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.
LOGI	Invert switching logic	**HIGH**	0 → 1
		LOW	1 → 0
P-n	Behavior of the switching output	**AUTO**	Automatic detection (NPN/PNP)
		PnP	N switching
		nPn	P switching
FOU	Behavior in the event of a fault (e.g. wire break or short circuit)	on	Switching output FS…2UPN8: The output is activated in the event of an error. Analog output FS…2LI: Error value of the set function at output 2 (OUT2).
		OFF	Switching output FS…2UPN8: The output is deactivated in the event of a fault. Analog output FS…2LI: Error value of the set function at output 2 (OUT2).
Don	Switch-on delay		0…60 s in increments of 0.1 s (0 = delay time not activated) **Default: 0.0 s**
DOFF	Switch-off delay		0…60 s in increments of 0.1 s (0 = delay time not activated) **Default: 0.0 s**

9.2.7 Parameters in the DISP submenu (Display)

	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**	Green
		rED	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

9.2.8 Parameters in the EF submenu (Extended Functions)

	Explanation	Options	Function
UnIT	Display unit	°C	°C
		°F	°F
ProB	Flow sensor	**P1**	FP100…
		P2	FCS…NA-…
		P3	FCS…NA-…D100… FCS…NA-…D014… FCS…NA-…D003…
		P4	FCS…NA-…/A
		P5	FCI-…A4-NA-…
		P6	FCI-…A4P-NA-…
CLEn	Cable length of the flow sensor		0…30 m in increments of 1 m. Round up or down for lengths between increments.
PASS	Password		Define password and activate password protection
		0000	No password
SOF	Software version		Display the firmware version
rES	Reset	FACT	Reset the parameters to the factory settings
		rEBO	Restart the device (warm start)
		APPL	Reset the application-specific data
		UnDO	Reset the parameters to previous settings (last device start)

9.2.9 Quick-Teach

- ▶ Bring the flow speed in the application to the target flow rate to be monitored.
- ▶ Press [ENTER] once.
- ⇨ DeltaFlow active: If the display (+ 0) flashes red, the system is not yet in a stable condition. If the display (+ 0) flashes green, the system is in a stable condition.
- ▶ Press [ENTER] for 3 s until the display (+ 0) lights up green.
- ▶ Optional: Modify the switching point in ±1 % increments (max. 9 %).
- ▶ Press [SET] to incrementally increase the switching point by 1 % of the reference flow rate.
- ▶ Press [MODE] to incrementally decrease the switching point by 1 % of the reference flow rate.
- ▶ Store the switching point: Press [ENTER].
- ⇨ The display flashes green briefly and changes to + 0.
- ⇨ The display shows the percentage deviation of the flow rate in relation to the set switching point.
- ⇨ The display shows if the value deviates by -50 % (Urun) or +50 % (Orun) of the set switching point.

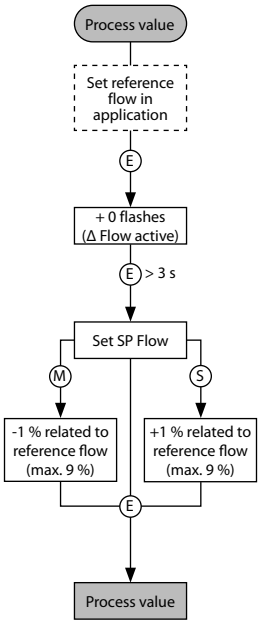


Fig. 16: FS101 Quick-Teach

9.2.10 MAX/MIN teach-in

Set the upper limit of the indicated range:

- ▶ Bring the flow speed in the application to the upper limit value.
- ▶ Press and hold [ENTER].
- ⇨ DeltaFlow active: If the display IEP flashes red, the system is not yet in a stable condition. If the display IEP flashes green, the system is in a stable condition.
- ▶ Press [SET] for 3 s until IEP briefly lights up green and the value 9 flashes green.
- ⇨ The upper limit value for the flow speed is set.

Set the lower limit of the indicated range:

- ▶ Bring the flow speed in the application to the lower limit value.
- ▶ Keep reducing the flow speed while a numerical value (9…1) flashes green on the display.
- ▶ As soon as ISP appears on the display, the lower limit can be freely selected.
- ⇨ DeltaFlow active: If the display ISP flashes red, the system is not yet in a stable condition. If the display ISP flashes green, the system is in a stable condition.
- ▶ Press [SET] for 3 s until ISP lights up green on the display.
- ⇨ The display changes to 0. The lower limit value for the flow speed is set.
- ⇨ The display shows if the value drops below 0 % (Urun) or rises above 100 % (Orun) of the set flow range.

The switching points for single point mode, window mode and two point mode can be set for the MAX/MIN-Teach. By default, the switching point in single point mode is at a flow speed of 70 %.

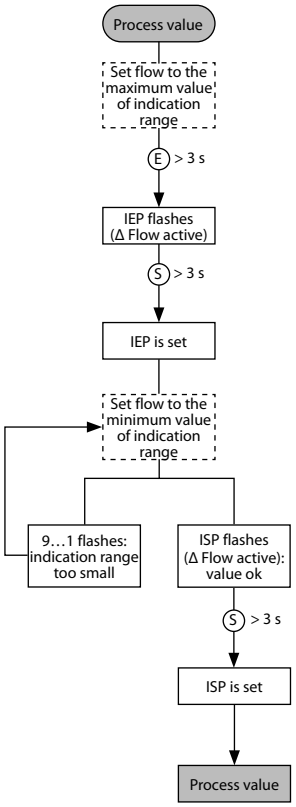


Fig. 17: MAX/MIN-Teach

9.3 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	
Flow monitoring	
Switching point accuracy	Typically < 5 % (depending on the flow sensor connected and the measuring range)
Reproducibility	Typically < 3 % (depending on the flow sensor connected and the measuring range)
Response time	Depending on the flow sensor connected
Hysteresis	5…20 %, depending on the detection range
Temperature monitoring	
Switching point accuracy	Typically ± 2 K (depending on the flow sensor connected)
Reproducibility	Typically ≤ 0.5 K (depending on the flow sensor connected)
Resolution	0.1 K
Electrical data	
Operating voltage	17…33 VDC
Protective measure	SELV, PELV according to DIN EN 61140
Short-circuit/reverse polarity protection	Yes, cyclic/yes (power supply)
Power consumption	≤ 3 W
Voltage drop	≤ 2 VDC
Continuous current carrying capacity of the DC switching output	250 mA
Overload protection	Yes
Protection class	III
Startup delay	30 s
Outputs	
Output 1	Flow: Switching output or IO-Link
Output 2	Temperature: switching output
Communication protocol	IO-Link
Output function	NC/NO programmable, PNP/NPN
IO-Link	
IO-Link specification	V 1.1
IO-Link port type	Class A
Transmission rate	COM 2 (38.4 kBaud)
Process data width	64 bits: 2 × 32 bits, of which 2 × 6 bits are not used
Measured value information	48 bits: 2 × (16-bit process values + 8-bit scale)
Switching point information	4 bits: 2 × 2 switching points
Frame type	2.2
Minimum cycle time	6 ms
Function pin 4	IO-Link
Function pin 2	DI
Maximum cable length	20 m

Technical data	
Profile support	Smart Sensor Profile (SSP 4.1.2)
Programming	
Programming options	Switching behavior (PNP/NPN/Auto); switching logic (high/low); switching point set via touchpads: single point, two point, window mode; display: color: red/green including color change when switching, display orientation 0°/180°, update time, temperature unit, password protection
Mechanical data	
Housing material	Stainless steel/plastic, 1.4404 (AISI 316L)/ Grilamid TR90 UV
Electrical connection	M12 × 1 connector
Protection class	IP66/IP67/IP69K (not UL approved)
Electromagnetic compatibility	DIN EN 61326-2-3: 2007
Ambient conditions	
Ambient temperature	-40…+80 °C (UL: -25…+80 °C)
Storage temperature	-40…+80 °C
Shock resistance	50 g (11 ms), DIN EN 60068-2-27
Vibration resistance	20 g, DIN EN 60068-2-6
Tests/approvals	
Approvals	cULus
UL approval number	E516036
Displays/controls	
Display	4-digit 12-segment display, rotatable by 180°, red or green
Switching state indication	2 × LEDs, yellow
MTTF	120 years acc. to SN 29500 (Ed. 99) 40 °C

15 Turck branches — contact data

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Australia	Turck Australia Pty Ltd Building 4, 19-25 Duerdin Street, Notting Hill, 3168 Victoria **www.turck.com.au**
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