TURCK

Your Global Automation Partner

FS101…2UPN8 | …2LI Compact Flow Sensors

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 (current version)
- Quick Start Guide
- Commissioning manual IO-Link devices

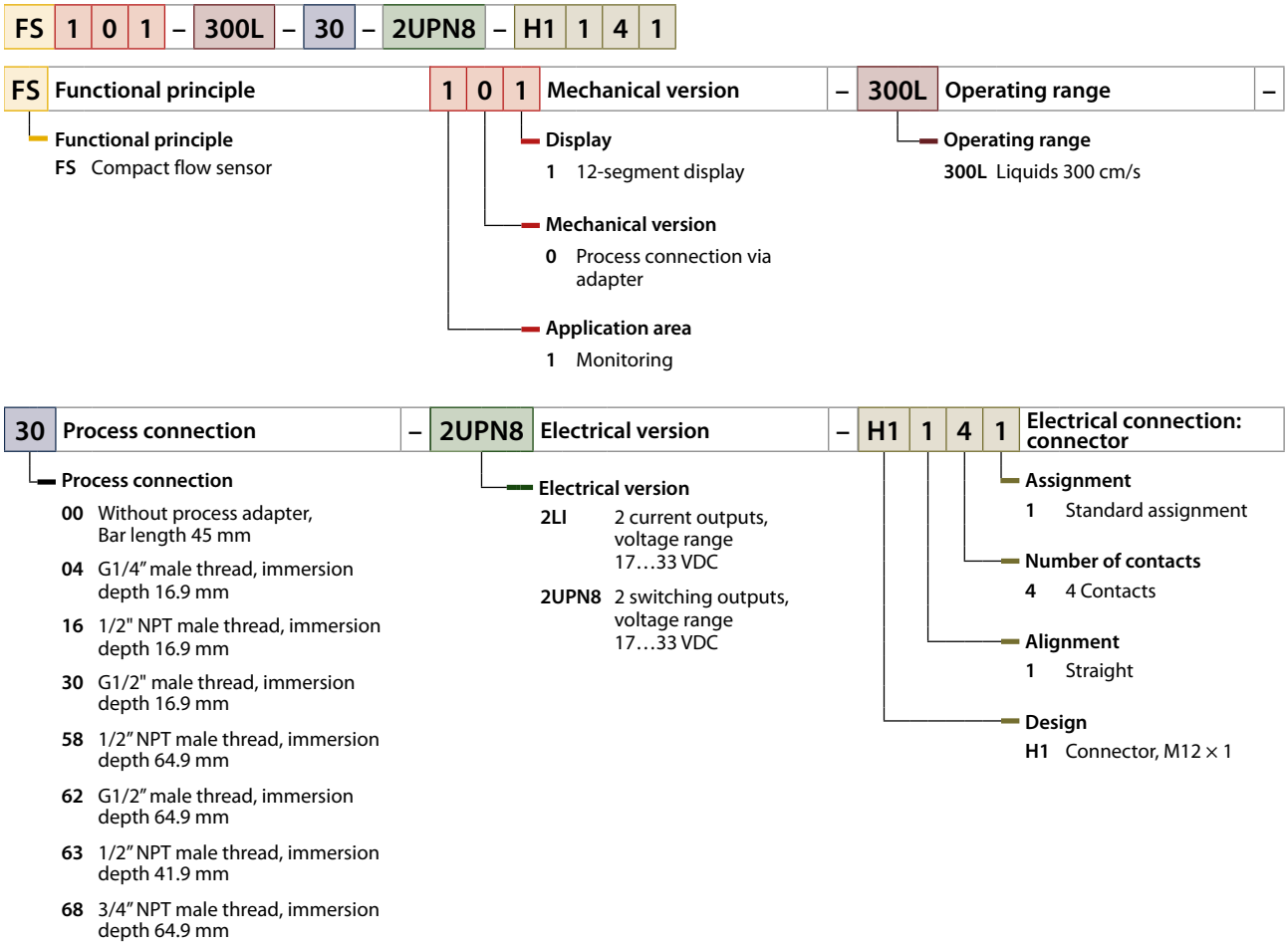
1.4 Feedback about these instructions

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 sensors:



2.2 Scope of delivery

The delivery consists of the following:

- Compact flow sensor
- Thread adapter for process connection (not with FS10…-00-…)
- Two seals (not on devices with NPT threads)
- 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 [▷ 39].

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 flow sensors are used to monitor the flow speed of liquid media. 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 compact flow sensors of the FS+ product series are housed in a metal housing with protection class IP67 and IP69K and are available in various immersion lengths. The devices are available without a process connection or with an NPT or G process connection. The sensor head can also be rotated by 340° after installation. The display can be rotated 180°. The devices have a metal M12 connector (male) for connecting the sensor cable.

- FS…2LI…: 2 current outputs
- FS…2UPN8…: Two switching outputs (PNP/NPN/Auto)

4.1 Device overview

The overview shows example dimension drawings of the compact flow sensors.

Plug-in devices

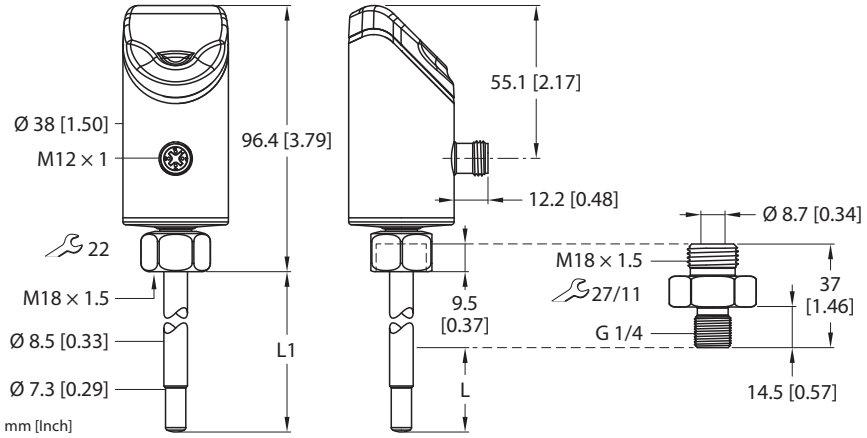


Fig. 1: Dimensions — sensor with G1/4″ screw-in adapter

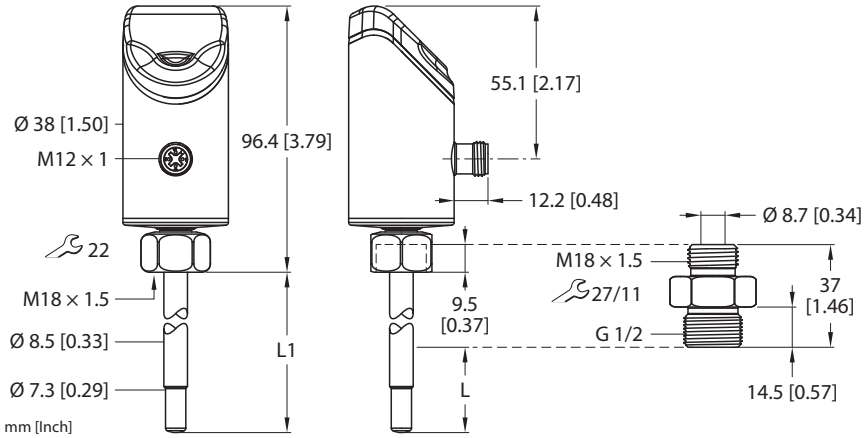


Fig. 2: Dimensions — sensor with G1/2″ screw-in adapter

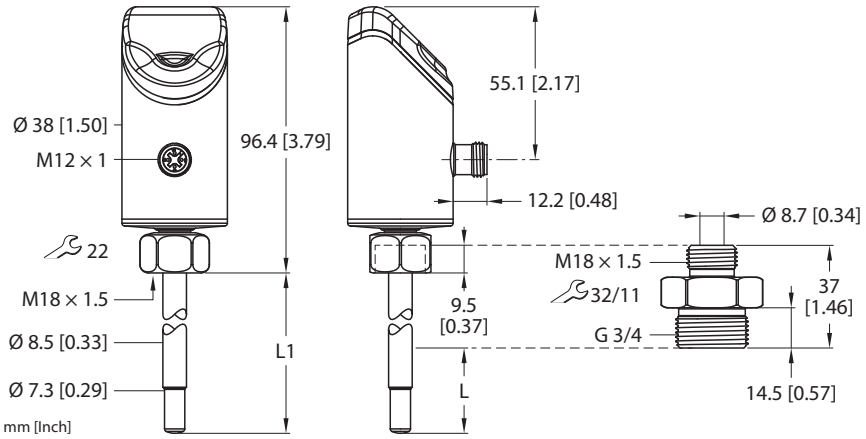


Fig. 3: Dimensions — sensor with G3/4″ screw-in adapter

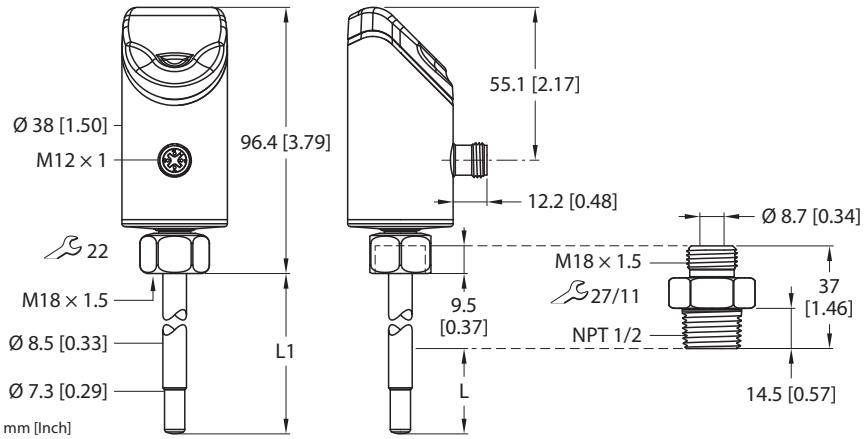


Fig. 4: Dimensions — sensor with NPT 1/2″ screw-in adapter

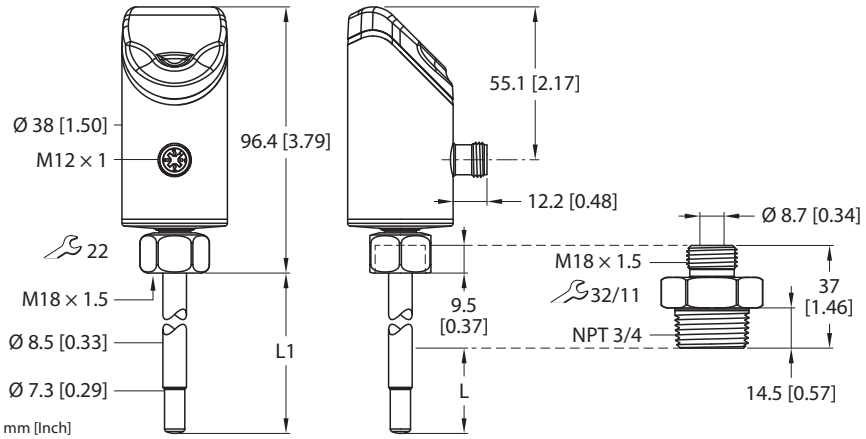


Fig. 5: Dimensions — sensor with NPT 3/4″ screw-in adapter

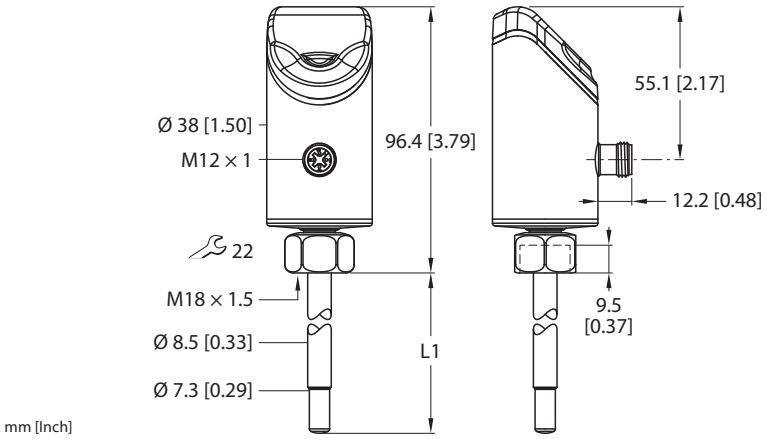


Fig. 6: Dimensions — sensor without screw-in adapter

4.2 Properties and characteristics

- Flow monitoring for liquid media
- Sensor housing material 1.4404 (316L)
- Material in contact with medium 1.4571 (316Ti)
- Protection class IP66, IP67, IP69K
- 4-digit, 2-color, 12-segment display, rotatable by 180°
- Housing upper section rotatable by 340°
- FS…2UPN8: 2 switching outputs, various IO-Link mapping profiles can be selected, Quick-Teach, MAX/MIN-Teach
- FS…2LI: 2 current outputs 4…20 mA, 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 Flow sensors works calorimetrically. The function is based on the thermo-dynamic 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 FS101…2UPN… 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.

With the FS101…2LI… sensors, the output range of the current outputs can be freely scaled to the measuring range.

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 speed, 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 (FS…2UPN8)—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 (FS…2UPN8) 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.

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.

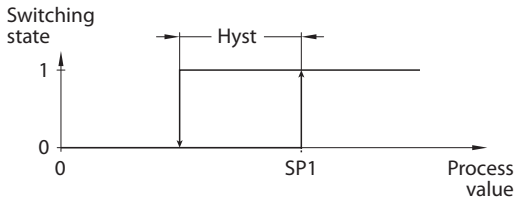


Fig. 7: Single point mode

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.

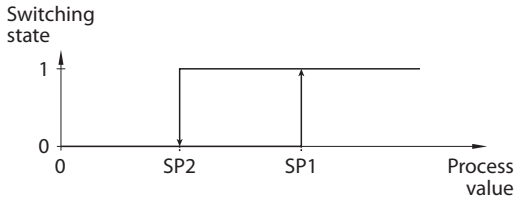


Fig. 8: Two point mode

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.

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.

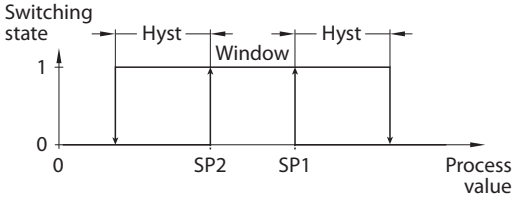


Fig. 9: Window mode

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:

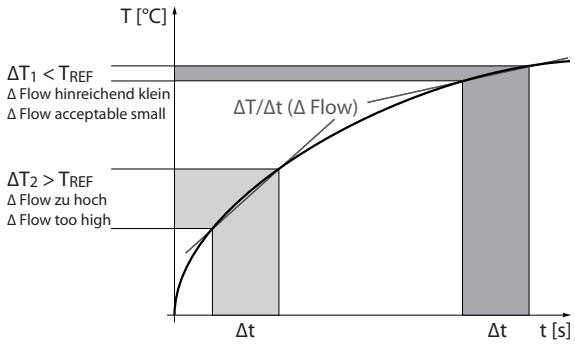


Fig. 10: DeltaFlow monitoring — schematic diagram

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.

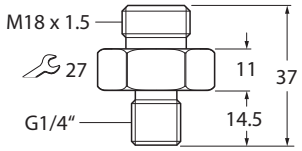
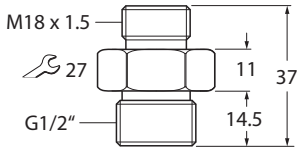
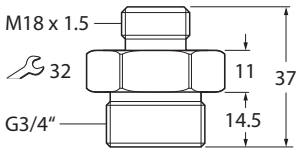
The device parameters can be set via IO-Link and then operated at the digital inputs with the appropriate settings in SIO mode. Not all functions and properties of the device can be used in SIO mode.

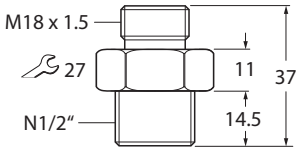
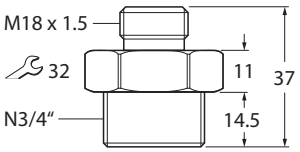
4.5.7 Auto detect function

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

The screw-in adapters are available for different threads. This allows the device to be flexibly adapted to different process connections. Additional adapters can be ordered separately as accessories.

Dimension drawing	Type	ID	Description
	FAA-04-1.4571	100001989	Screw-in adapter for immersion sensors from the FS…, FP… product series; material: stainless steel 1.4571 (316Ti); process connection: G1/4"
	FAA-80-1.4571	100001988	Screw-in adapter for immersion sensors from the FS…, FP… product series; material: stainless steel 1.4571 (316Ti); process connection: G1/2"
	FAA-81-1.4571	100001991	Screw-in adapter for immersion sensors from the FS…, FP… product series; material: stainless steel 1.4571 (316Ti); process connection: G3/4"

Dimension drawing	Type	ID	Description
	FAA-A1-1.4571	100001987	Screw-in adapter for immersion sensors from the FS…, FP… product series; material: stainless steel 1.4571 (316Ti); process connection: N1/2"
	FAA-34-1.4571	100001990	Screw-in adapter for immersion sensors from the FS…, FP… product series; material: stainless steel 1.4571 (316Ti); process connection: N3/4"

5 Installing

5.1 General installation instructions

- For optimal monitoring, mount the sensor such that the probe rod is fully immersed in the medium.
- If the medium flows in a horizontal direction and may contain deposits or trapped gas (e.g. air bubbles): Mount the sensor e.g. laterally.

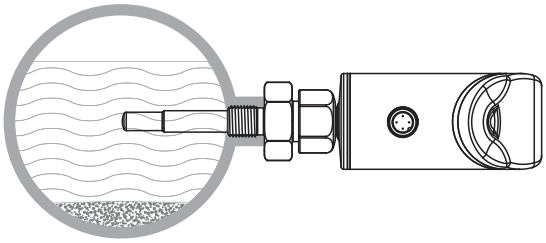


Fig. 11: Lateral mounting

- If the medium flows in a horizontal direction and the flow channel is not completely filled with the medium: Mount the sensor e.g. below the flow.

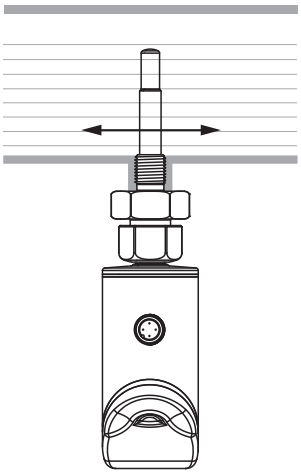


Fig. 12: Mounting below the flow

- If the medium flows in a vertical direction: Mount the sensor only in risers.
- A minimum distance from potential interference variables (pumps, valves, flow rectifiers, pipe bends, changes in the cross section) must be maintained.

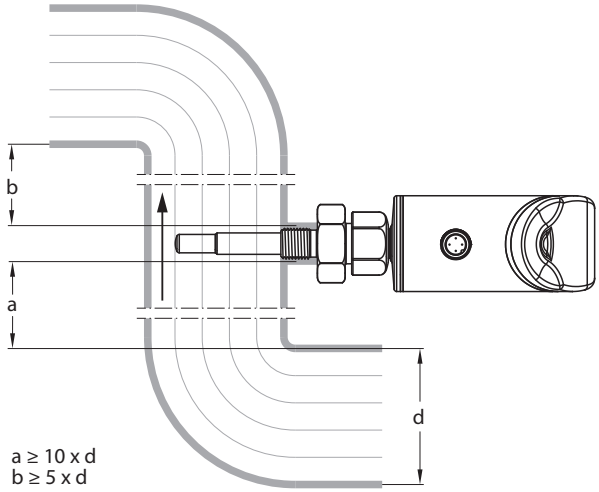


Fig. 13: Minimum distances to interference variables

- Prevent the tip of the probe rod coming into contact with the opposite side of the flow channel inner wall.

5.2 Special installation instructions

- Only mount Turck sensors from the FS product series using screw-in adapters from the FAA-… product series.
- For devices with a G…" process connection: Position one of the two seals (included in the delivery) between the screw-in adapter and the process connection (e.g. union).
- Screw the screw-in adapter onto the process connection (maximum torque of 100 Nm).
- Guide the probe rod through the screw-in adapter and hand-tighten the sensor (M18 × 1.5 coupling nut) with the screw-in adapter.
- For a standard flow range (3…300 cm/s): The probe rod can be installed in the medium independent of the flow direction (range of 360°).
- For an extended flow range (1…300 cm/s): Mount the probe rod directed so that the medium flows toward the prick punch mark, tolerance range of ±45°.

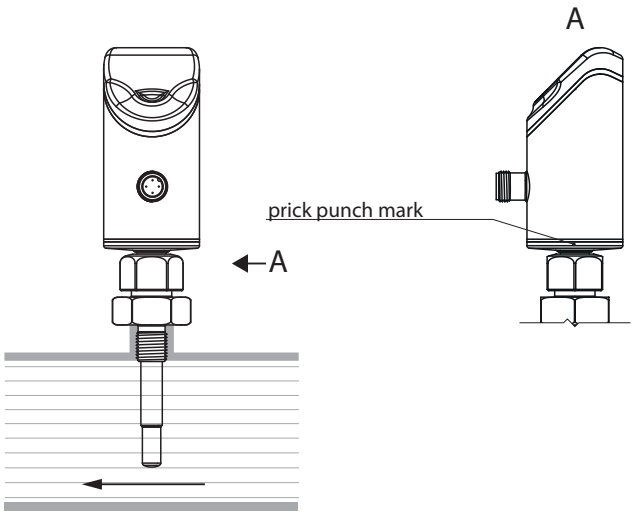


Fig. 14: Mounting the probe rod directed correctly

- Screw an M18 × 1.5 coupling nut onto the screw-in adapter (maximum torque of 40 Nm).
- Optional: For optimum operation and readability, adjust the sensor head within a range of 340°.
- For devices with a G…" process connection: After removing and reinstalling the screw-in adapter, use a new seal (replacement seal included in the delivery).
- Teach in the teach-in values again if the sensor has been removed and reinstalled or the process connection has been disconnected.

6 Connecting

- Connect the female connector of the connection cable to the male connector of the sensor.
- Connect the connection cable to the power source as shown in the wiring diagram.

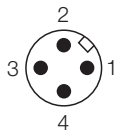


Fig. 15: Pin assignment

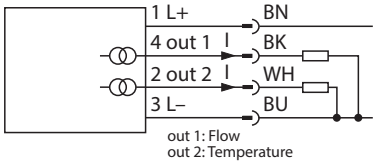


Fig. 16: FS…-2LI-H1141 wiring diagram

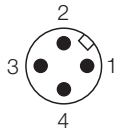


Fig. 17: Pin assignment

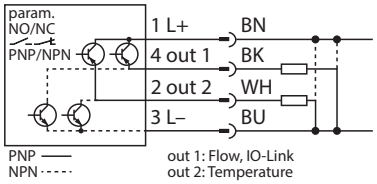


Fig. 18: FS…-2UPN8-H1141 wiring diagram

7 Commissioning

The device is operational automatically once the power supply is switched on. During the heating-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 sensor operates in MAX/MIN mode by default.

- ▶ 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.

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
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 > 100 % of the set flow range in MAX/MIN-Teach, value > 50 % of the set switching point in Quick-Teach, media temperature > +85 °C
Urun	Value < 0 % of the set flow range in MAX/MIN-Teach, value < 50 % of the set switching point in Quick-Teach, media temperature < -25 °C

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:

- Locking/unlocking 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

Other setting options — only via touchpads

- Advanced settings: password setting
- FS…2LI — indicated range: MAX/MIN-Teach
- FS…2UPN8 — 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

- MAX/MIN values for teach functions: Re-teach the application after commissioning
- Auto detection function switched on
- FS…2UPN8 — switching point 1: flow 70 % or temperature 60 °C
- FS…2UPN8 — switching point 2: flow 69 % or temperature 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

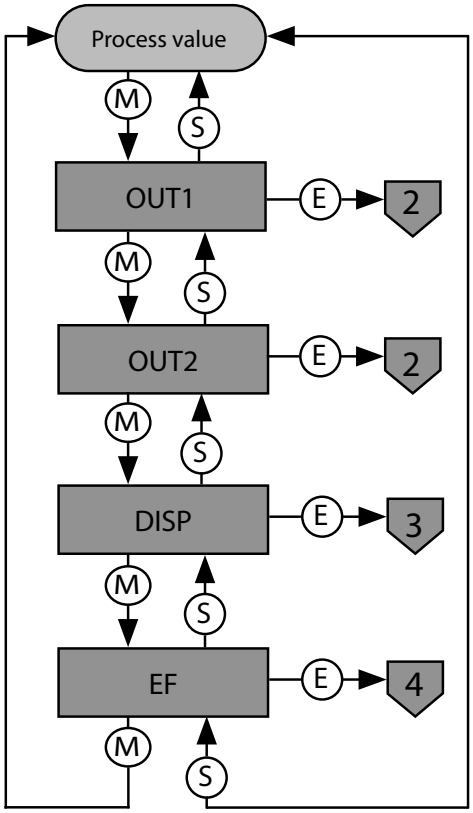


Fig. 19: Main menu

OUT… submenu (FS…2UPN8)

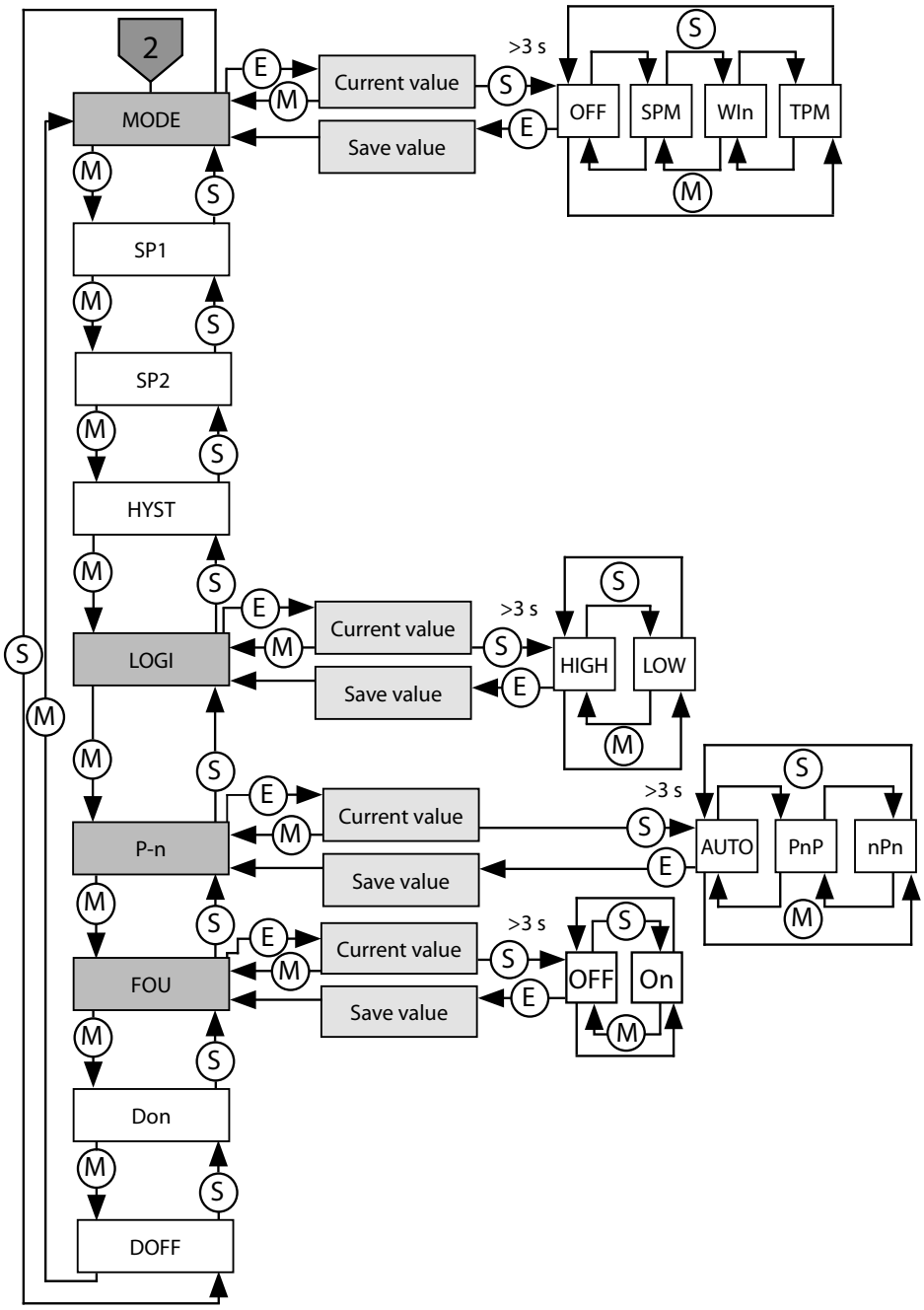


Fig. 20: OUT… submenu (FS…2UPN8)

OUT… submenu (FS…2LI)

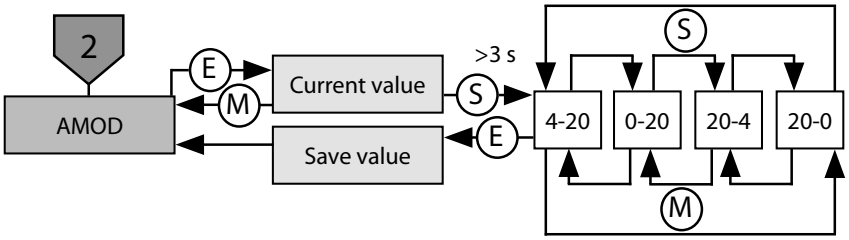


Fig. 21: OUT… submenu (FS…2LI)

Display submenu (DISP)

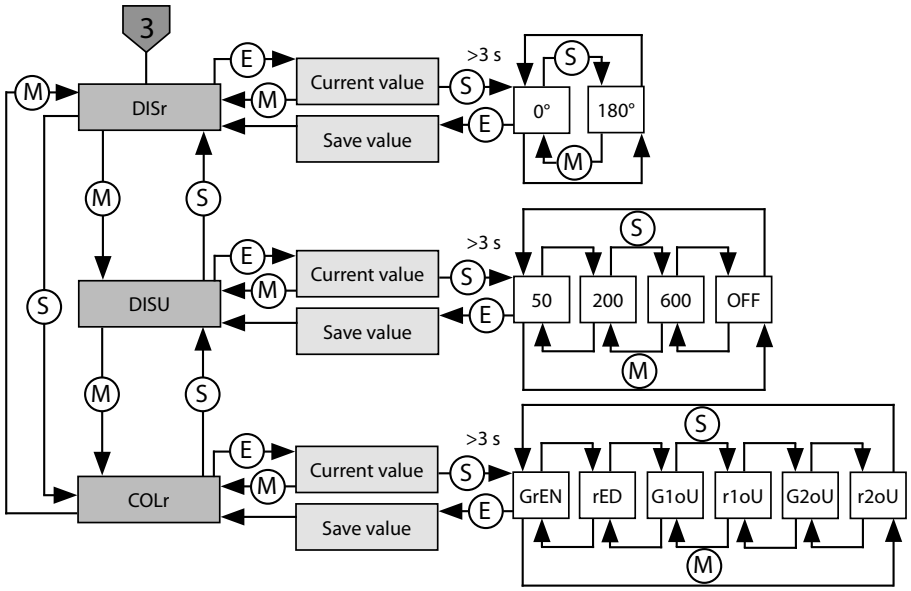


Fig. 22: Display submenu

Extended functions submenu (EF)

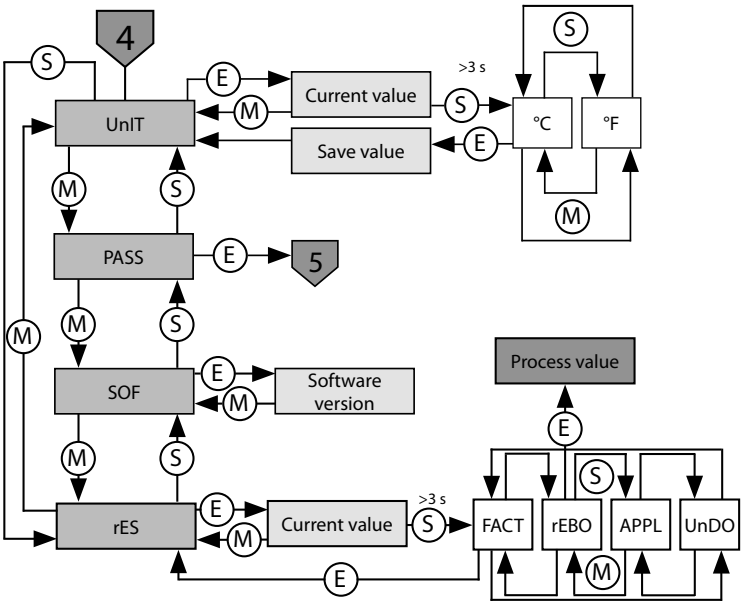


Fig. 23: Extended functions submenu (EF)

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.

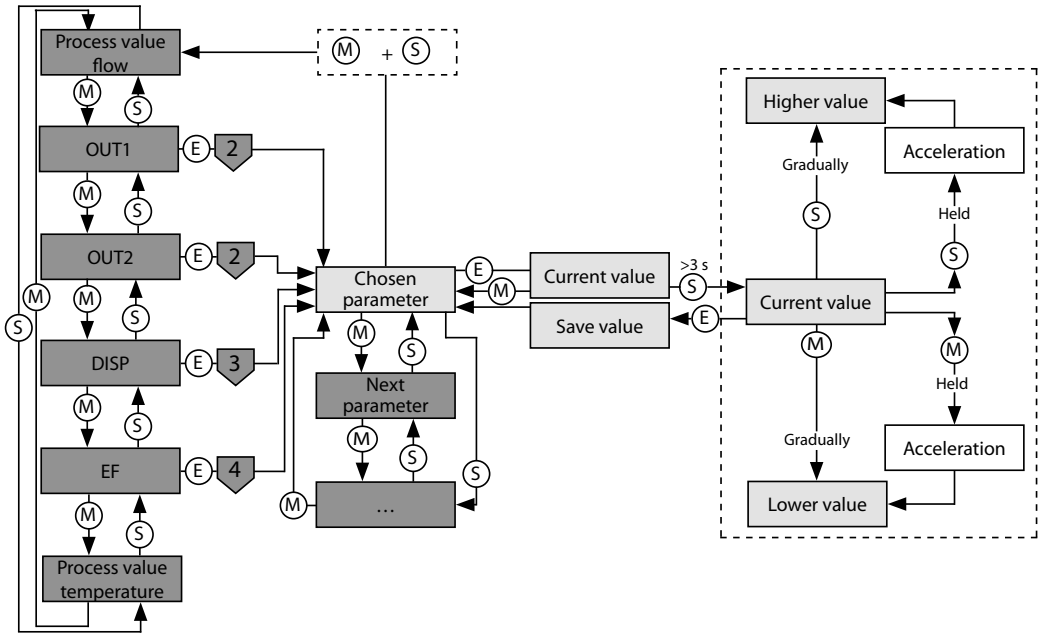


Fig. 24: Selecting parameters

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

- 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.

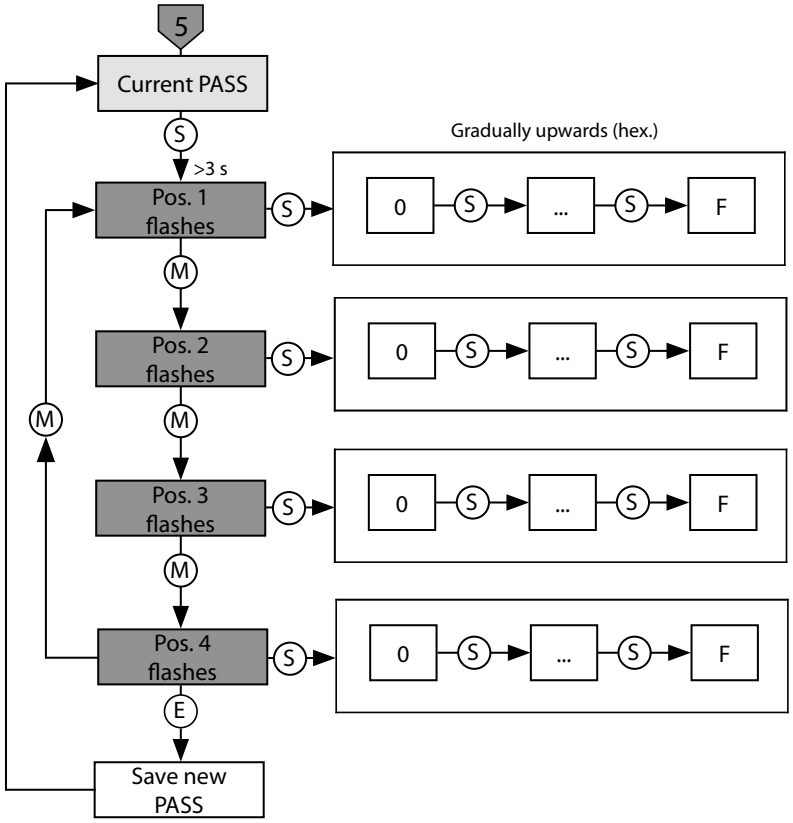


Fig. 25: Password setting

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 OUT… (FS…2LI) submenu

	Explanation	Options	Function
AMOD	Analog output	4–20	4…20 mA
		0–20	0…20 mA
		20–4	20…4 mA
		20–0	20…0 mA

9.2.8 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

9.2.9 Parameters in the EF submenu (Extended Functions)

	Explanation	Options	Function
UnIT	Display unit	**°C**	°C
		°F	°F
PASS	Password		Define password and activate password protection
		0000	No password
SOF	Software version		Display of the firmware version
rES	Reset	FACT	Reset the parameters to the factory settings
		rEBO	Device restart (warm start)
		APPL	Reset the application-specific data
		UnDO	Reset the parameters to previous settings (last device start)

9.2.10 Quick-Teach

With the Quick-Teach function, the current flow speed can be directly taught in as the switching point FLOW for devices with a switching output; setting a separate MAX/MIN indicated range is not required.

- ▶ 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.

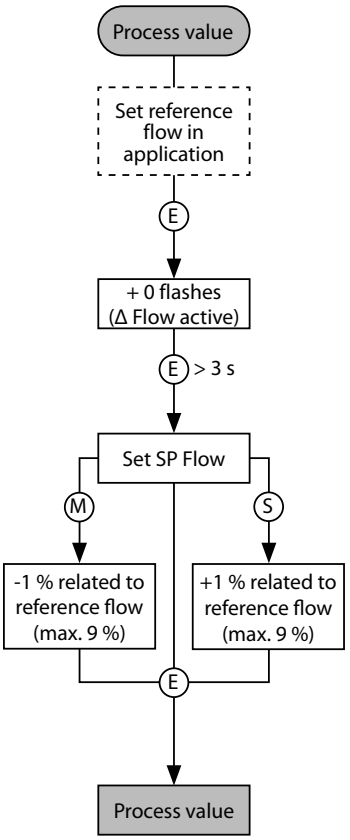


Fig. 26: FS101 Quick-Teach

9.2.11 MAX/MIN teach-in

With the MAX/MIN teach-in function, the FLOW switching point is taught in as a percentage value within an adjustable MAX/MIN indicated range for devices with a switching output.

Depending on the type of output, the devices have different displays:

FS…2UPN8	FS…2LI
IEP	AEP
ISP	ASP

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/AEP flashes red, the system is not yet in a stable condition. If the display IEP/AEP flashes green, the system is in a stable condition.
- ▶ Press [SET] for 3 s until IEP/AEP 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/ASP appears on the display, the lower limit can be freely selected.
- ⇨ DeltaFlow active: If the display ISP/ASP flashes red, the system is not yet in a stable condition. If the display ISP/ASP flashes green, the system is in a stable condition.
- ▶ Press [SET] for 3 s until ISP/ASP 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 %.

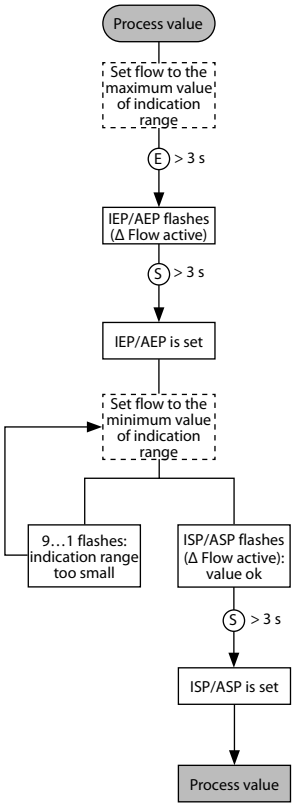


Fig. 27: MAX/MIN-Teach

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	FS101…2LI…	FS101…2UPN8…
Application area		
Mounting conditions	Immersion sensor	
Application area	FS101: liquid media	
Ambient temperature	-40…+80 °C (UL -25…+80 °C)	
Temperature of medium	-25…+85 °C	
Storage temperature	-40…+80 °C	
Pressure resistance	300 bar	
Flow monitoring		
Response time T09	6 s	
Response time T05	3 s	
Standard flow range	3…300 cm/s	
	Any axial alignment of the sensor rod in the medium	
Extended flow range	1…300 cm/s	
	Directed inflow to punch mark ±20°	
Switching point accuracy	1…30 cm/s; for water 3…300 cm/s	
Reproducibility	1…5 cm/s; for water 3…100 cm/s; 10…80 °C	
Temperature drift	0.5 cm/s x 1/K	
Temperature gradient	≤ 300 K/min	
Hysteresis	3…25 % of the switching point	
Temperature monitoring		
Measuring range	-25…+85 °C	
Switching point accuracy	2 K; for water >3 cm/s; 20…70 °C	
Reproducibility	≤ 0.5 K	
Resolution	0.1 K	
Response time T09	12 s	
Response time T05	3 s	
Electrical data		
Operating voltage	17…33 VDC	
Short-circuit/reverse polarity protection	Yes	
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	
Start-up delay	30 s	

Technical data	FS101…2LI…	FS101…2UPN8…
Outputs		
Output function	Analog output: 4…20 mA, corresponds to -40…+180 °C	Switching output: NC/NO programmable, PNP/NPN
Output 1	Flow: Current output	Flow: Switching output/IO-Link
Output 2	Temperature: Current output	Temperature: Switching output
Load resistance, current output	≤ 0.5 kΩ	
IO-Link		
IO-Link specification		V 1.1
IO-Link port type		Class A
Physical transmission layer		COM 2 (38.4 kBaud)
Frame type		2_V
Included in the SIDI GSDML		Yes
Programming		
Programming options		Automatic switching logic recognition, easy switchpoint adjustment via touchpads
Mechanical data		
Housing material	Stainless steel, 1.4404 (316L)	
Adapter material	Stainless steel, 1.4571 (316Ti)	
Material (in direct contact with media)	Stainless steel, 1.4571 (AISI 316Ti), FKM O-ring, AFM flat seal (only for devices with a G…" process connection)	
Electrical connection	Connector, M12 × 1, 4-pin	
Degree of protection	IP66, IP67, IP69K	
EMC (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 (55…2000 Hz), DIN EN 60068-2-6	
Tests/approvals		
Approvals	CE cULus UKCA	
Registration number	E516036	
Indication	LED display function for status of supply voltage, switching states, units and teach processes. Process display via 12-segment display	
MTTF	120 years acc. to SN 29500 (Ed. 99) 40 °C	

15 Turck branches — contact data

Germany	Hans Turck GmbH & Co. KG Witzlebenstraße 7, 45472 Mülheim an der Ruhr **www.turck.de**
Australia	Turck Australia Pty Ltd Building 4, 19-25 Duerdin Street, Notting Hill, 3168 Victoria **www.turck.com.au**
Austria	Turck GmbH Graumanngasse 7/A5-1, A-1150 Vienna **www.turck.at**
Belgium	TURCK MULTIPROX Lion d'Orweg 12, B-9300 Aalst **www.multiprox.be**
Brazil	Turck do Brasil Automação Ltda. Rua Anjo Custódio Nr. 42, Jardim Anália Franco, CEP 03358-040 São Paulo **www.turck.com.br**
Canada	Turck Canada Inc. 140 Duffield Drive, CDN-Markham, Ontario L6G 1B5 **www.turck.ca**
China	Turck (Tianjin) Sensor Co. Ltd. 18,4th Xinghuazhi Road, Xiqing Economic Development Area, 300381 Tianjin **www.turck.com.cn**
Czech Republic	TURCK s.r.o. Na Brne 2065, CZ-500 06 Hradec Králové **www.turck.cz**
France	TURCK BANNER S.A.S. 11 rue de Courtalin Bat C, Magny Le Hongre, F-77703 MARNE LA VALLEE Cedex 4 **www.turckbanner.fr**
Hungary	TURCK Hungary kft. Árpád fejedelem útja 26-28., Óbuda Gate, 2. em., H-1023 Budapest **www.turck.hu**
India	TURCK India Automation Pvt. Ltd. 401-403 Aurum Avenue, Survey. No 109 /4, Near Cummins Complex, Baner-Balewadi Link Rd., 411045 Pune - Maharashtra **www.turck.co.in**
Italy	TURCK BANNER S.R.L. Via San Domenico 5, IT-20008 Bareggio (MI) **www.turckbanner.it**
Japan	TURCK Japan Corporation ISM Akihabara 1F, 1-24-2, Taito, Taito-ku, 110-0016 Tokyo **www.turck.jp**

Korea	Turck Korea Co, Ltd. A605, 43, Iljik-ro, Gwangmyeong-si 14353 Gyeonggi-do www.turck.kr
Malaysia	Turck Banner Malaysia Sdn Bhd Unit A-23A-08, Tower A, Pinnacle Petaling Jaya, Jalan Utara C, 46200 Petaling Jaya Selangor www.turckbanner.my
Mexico	Turck Comercial, S. de RL de CV Blvd. Campestre No. 100, Parque Industrial SERVER, C.P. 25350 Arteaga, Coahuila www.turck.com.mx
Netherlands	Turck B. V. Ruiterlaan 7, NL-8019 BN Zwolle www.turck.nl
Poland	TURCK sp.z.o.o. Wroclawska 115, PL-45-836 Opole www.turck.pl
Romania	Turck Automation Romania SRL Str. Siriului nr. 6-8, Sector 1, RO-014354 Bucuresti www.turck.ro
Sweden	Turck AB Fabriksstråket 9, 433 76 Jonsered www.turck.se
Singapore	TURCK BANNER Singapore Pte. Ltd. 25 International Business Park, #04-75/77 (West Wing) German Centre, 609916 Singapore www.turckbanner.sg
South Africa	Turck Banner (Pty) Ltd Boeing Road East, Bedfordview, ZA-2007 Johannesburg www.turckbanner.co.za
Turkey	Turck Otomasyon Ticaret Limited Sirketi Inönü mah. Kayisdagi c., Yesil Konak Evleri No: 178, A Blok D:4, 34755 Kadiköy/ Istanbul www.turck.com.tr
United Kingdom	TURCK BANNER LIMITED Blenheim House, Hurricane Way, GB-SS11 8YT Wickford, Essex www.turckbanner.co.uk
USA	Turck Inc. 3000 Campus Drive, USA-MN 55441 Minneapolis www.turck.us

TURCK

Your Global Automation Partner

Over 30 subsidiaries and
60 representations worldwide!

100030515 | 2024/03

www.turck.com