TURCK

Your Global Automation Partner

FS501-LI2UPN8-...
Compact flow sensors

Instructions for Use

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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.

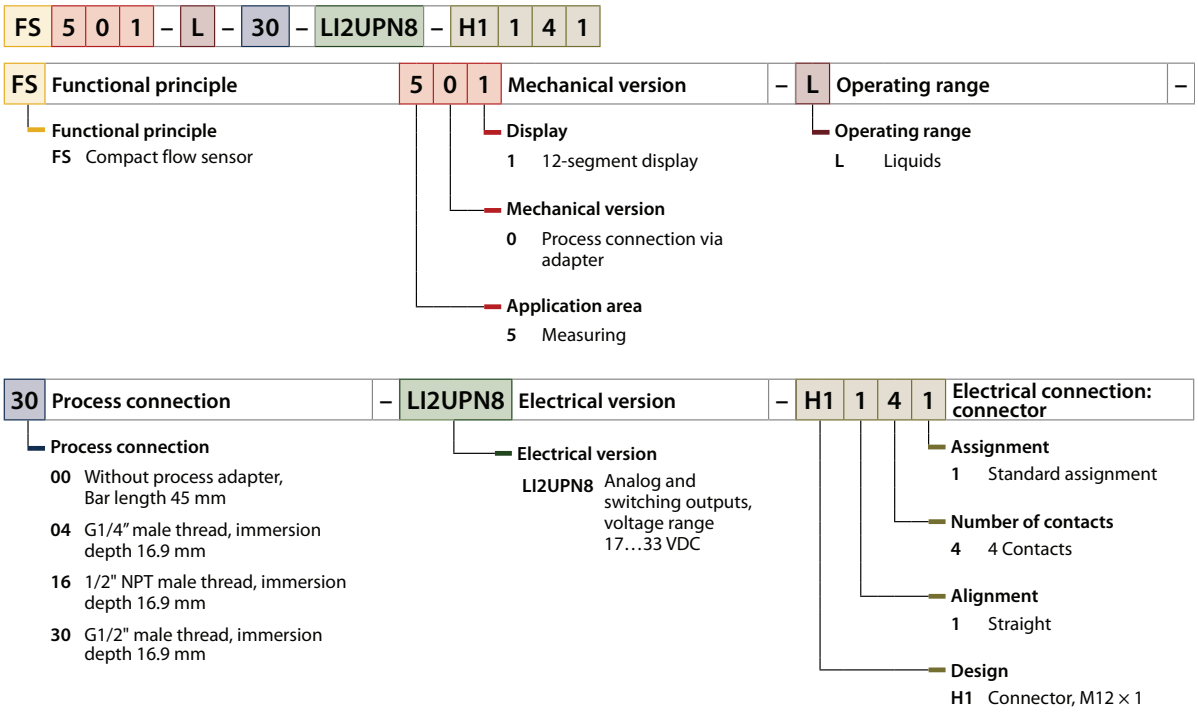
1.3 Feedback about these instructions

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 scope of delivery includes:

- Compact flow meter
- Thread adapter for process connection (not with FS…-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.

For the contact details of our branches worldwide, please see page [▷ 37].

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 Obvious misuse

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

3.2 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 meters in 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 for connecting the sensor cable.

4.1 Device overview

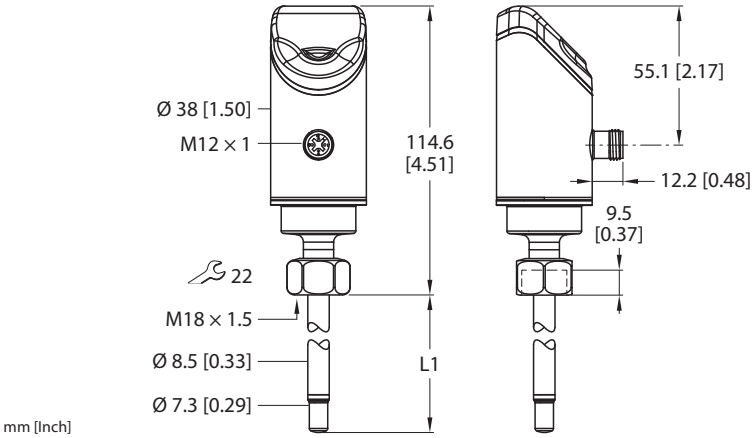


Fig. 1: FS501-L-00-LI2UPN8-H1141

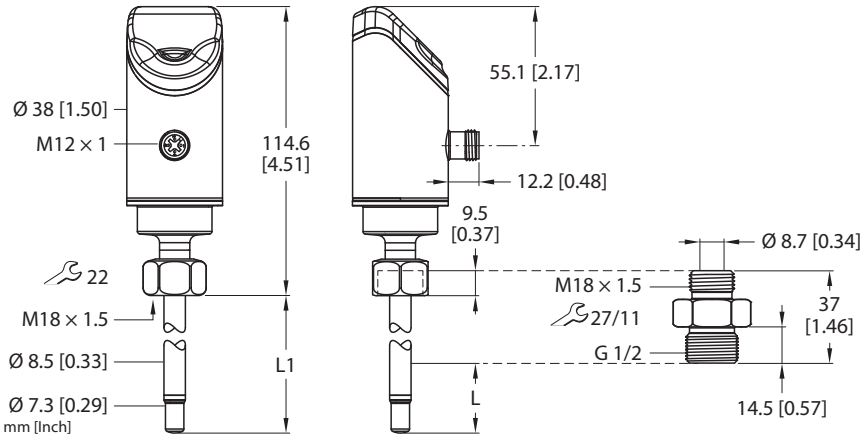


Fig. 2: FS501-L-30-LI2UPN8-H1141

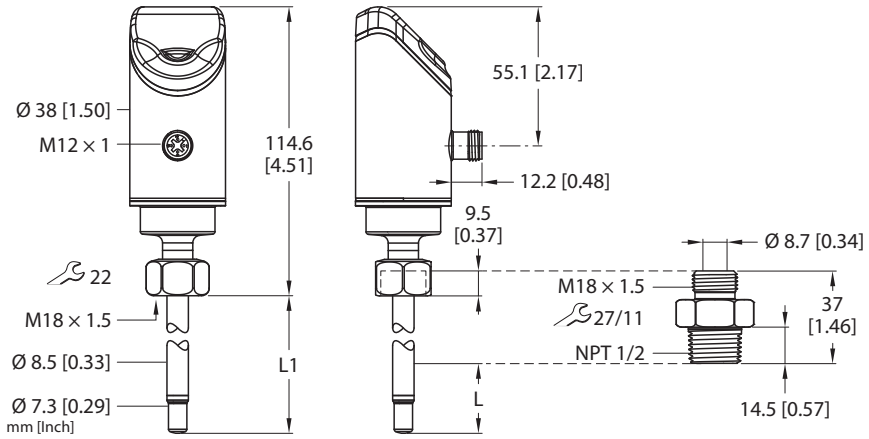


Fig. 3: FS501-L-16-LI2UPN8-H1141

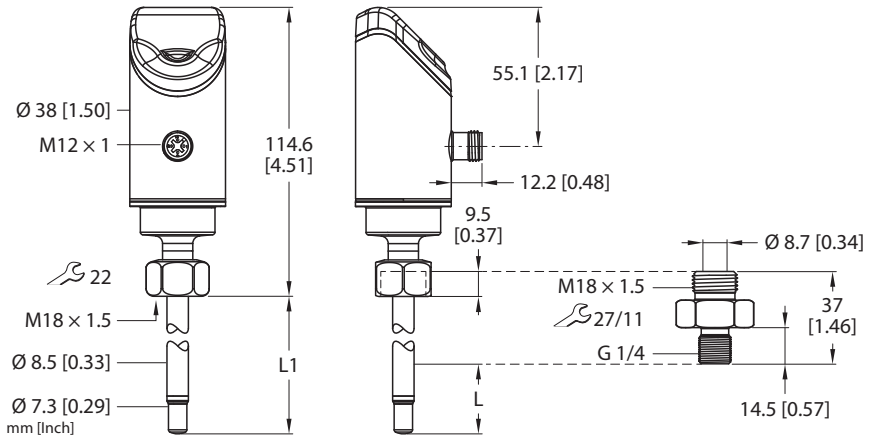


Fig. 4: FS501-L-04-LI2UPN8-H1141

4.2 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.

4.3 Operating principle

The sensors determine the volume flow based on the pipe geometry and the measured flow speed. The speed of the medium in the pipe is recorded and combined with the inside diameter of the pipe. The volume flow is calculated from the flow speed and the pipe size. The higher the measured speed, the greater the amount of media transported per unit of time.

The flow speed is calculated 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.

4.4 Functions and operating modes

The devices show the recorded volume flow rate, flow value or temperature value on the front via status LEDs and a four-digit display.

The devices can be parameterized via the touchpad, TAS and IO-Link.

Output 1 can be set as a switching output or IO-Link interface, and output 2 as a switching or analog output. The parameterization of the outputs can be changed by selecting the process data channel (MDC1 or MDC2). Both outputs can display flow and temperature values. The switching outputs 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.

The output range of the analog output is freely scalable to the measuring range.

The totalizer function can be used to add up the volume flow rate of a medium via IO-Link.

4.4.1 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 changes its switching state when the set switching point is reached for the flow speed. The switching state depends on the switching logic as well as on Single Point Mode, Two Point Mode and Window Mode.

4.4.2 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—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 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.

4.4.3 Output functions — switching output

The switching logic can via IO-Link or via the touchpad (parameter LOGI) be inverted. 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.

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.

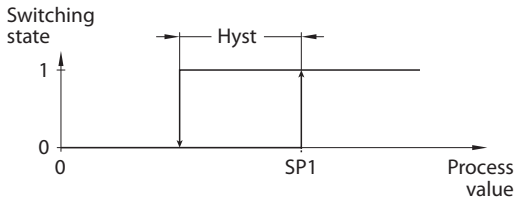


Fig. 5: Single point mode

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.

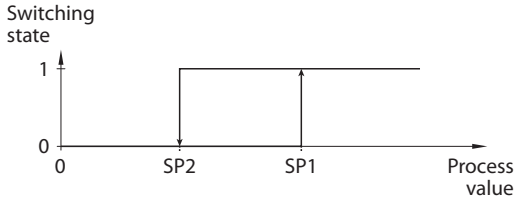


Fig. 6: Two point mode

Window Mode

In Window Mode, an upper and a lower window limit are set for the switching output. A hysteresis can be set for the window limits SP1 and SP2. The switch 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.

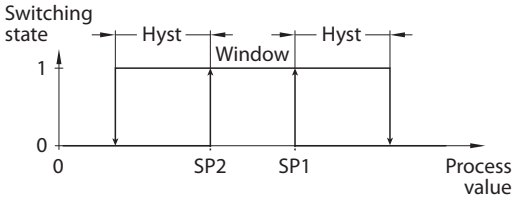


Fig. 7: Window mode

4.4.4 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.

4.4.5 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.

4.4.6 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.

4.4.7 Totalizer

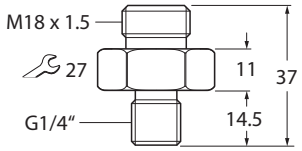
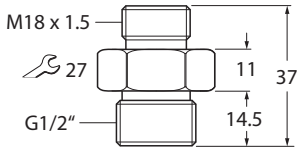
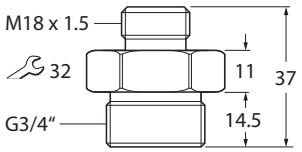
The totalizer function can be used to add up the volume flow rate of a medium. The totalizer calculation can be started, stopped or reset via IO-Link or TAS. The calculation is performed as long as the sensor is supplied with power.

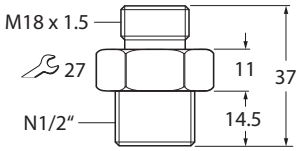
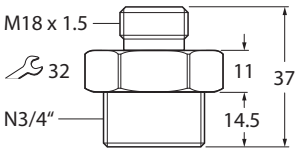
Formula for calculating the totalizer:

Volume = flow speed × pipe diameter × time

4.5 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.

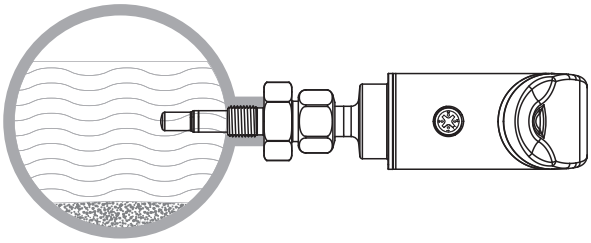


Fig. 8: Lateral mounting

- 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.

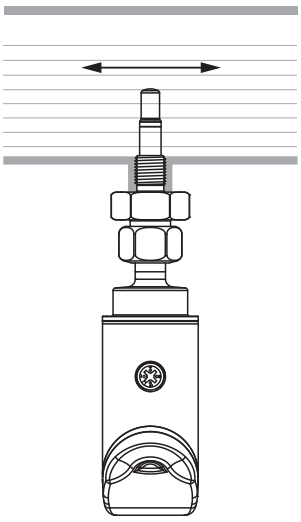


Fig. 9: Mounting below the flow

- 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.

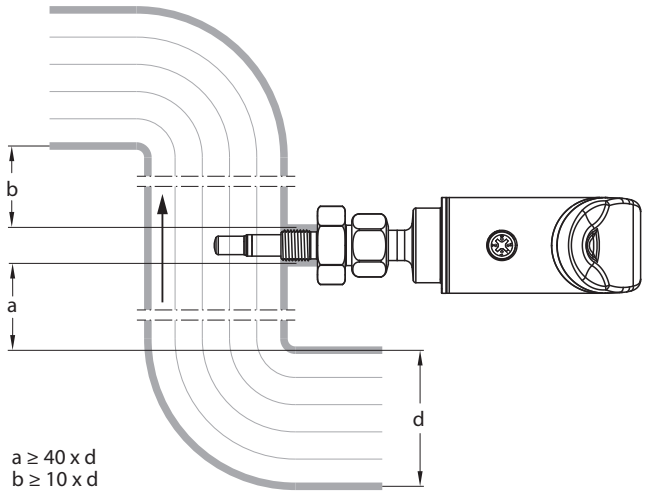


Fig. 10: Minimum distances to interference variables

- 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 (included in delivery).
- 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.
- Before installation, carefully turn the sensor head clockwise as far as it will go to align the connector with the prick punch mark.
- Install the probe rod on the prick punch mark in line with the flow direction.

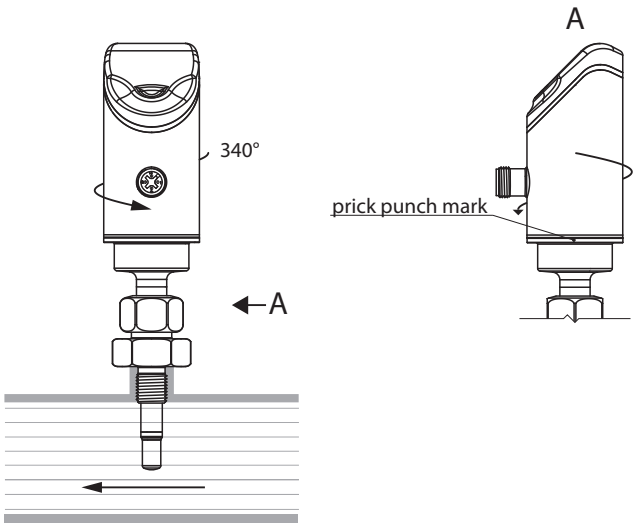


Fig. 11: Mounting the probe rod directed correctly

- Screw an M18 × 1.5 coupling nut onto the screw-in adapter (maximum torque of 40 Nm).
- After installation, carefully turn the sensor head back counterclockwise (max. 340°).

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.

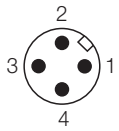


Fig. 12: Pin assignment

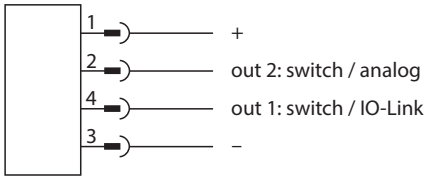


Fig. 13: Wiring diagram

7 Commissioning

NOTE
If the flow speed is not within the detection range after heating, the device displays Oor-.

The device is operational automatically once the power supply is switched on. During heating, 0 is shown in the display until the device is ready. The process value is then displayed.

The sensor is set by default to the flow speed (VELO) operating mode with the value given in m/s. Make changes via the MEAS measurement menu or the TURCK Automation Suite (TAS):

- ▶ Change the operating mode (SELD) to flow rate (FLOW) and adjust the pipe diameter (DIA).
- ⇨ The unit l/m is selected automatically.
- ▶ If necessary, change the unit under UnIF or the medium under MEDI in the Extended Functions menu EF.

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	Display	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 and II	Yellow	Switching output (I and II) ■ NO: Switching point exceeded/within window (active output) ■ NC: Switching point undershot/outside window (active output)	Analog output (II) ■ Active output
	Off	Switching output (I and II) ■ NO: Switching point undershot/outside window (inactive output) ■ NC: Switching point exceeded/within window (inactive output)	Analog output (II) ■ Inactive output
m/s	Green	Flow rate in m/s	
l/min	Green	Volume flow in l/min	
m^3/h	Green	Volume flow rate in m^3/h	
gpm	Green	Flow rate in gallons per minute	
MISC	Green	Display of additional units	

8.2 Displays

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
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

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 TAS and the IO-Link interface (see IODDfinder).

Setting options — via touchpads, TAS 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
- Advanced settings: Reset to the previous settings (pre-settings) or factory settings
- Advanced settings: Selection of the output (OUT1 or OUT2); change NO/NC
- Advanced settings: Switching behavior of the outputs, display settings
- OUT1/OUT2 output configuration for SIO mode: PNP/NPN, auto detection on/off
- Display units: VELO (flow speed in m/s, cm/s or fps) or FLOW (volume flow in l/min, m^3/h, gpm or cfm)

Setting options — via touchpads

- Advanced settings: Password setting

Other setting options — only via TAS or IO-Link

Additional functions and properties can also be set via TAS and 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)
- Set the totalizer to calculate the total volume flow using **START**, **STOP** and **RESET**:
  - The calculation is performed as long as the sensor is supplied with power.
  - The current value can be called up at any time via IO-Link or TAS.

Factory settings

- Auto detection function switched on
- Display mode: Flow rate in m/s
- Default settings for the outputs
  - OUT1: Switching output, flow
  - OUT2: Analog output, flow
- Default values for the switching signal channels:
- SSC1.1 — switching point SP1:
  - Flow: 0.85 m/s
  - Temperature: 70 °C
- SSC 1.1 — switching point SP2:
  - Flow: 0.75 m/s
  - Temperature: 69.5 °C
- SSC2.1 — switching point SP1:
  - Flow: 0.95 m/s
  - Temperature: 30 °C
- SSC 2.1 — switching point SP2:
  - Flow: 1.05 m/s
  - Temperature: 29.5 °C
- Upper limit value:
  - Flow: 3 m/s
  - Temperature: 80 °C
- Lower limit value:
  - Flow: 0.06 m/s
  - Temperature: 0 °C
- 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 — 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, the display menu or the MEAS 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.

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.

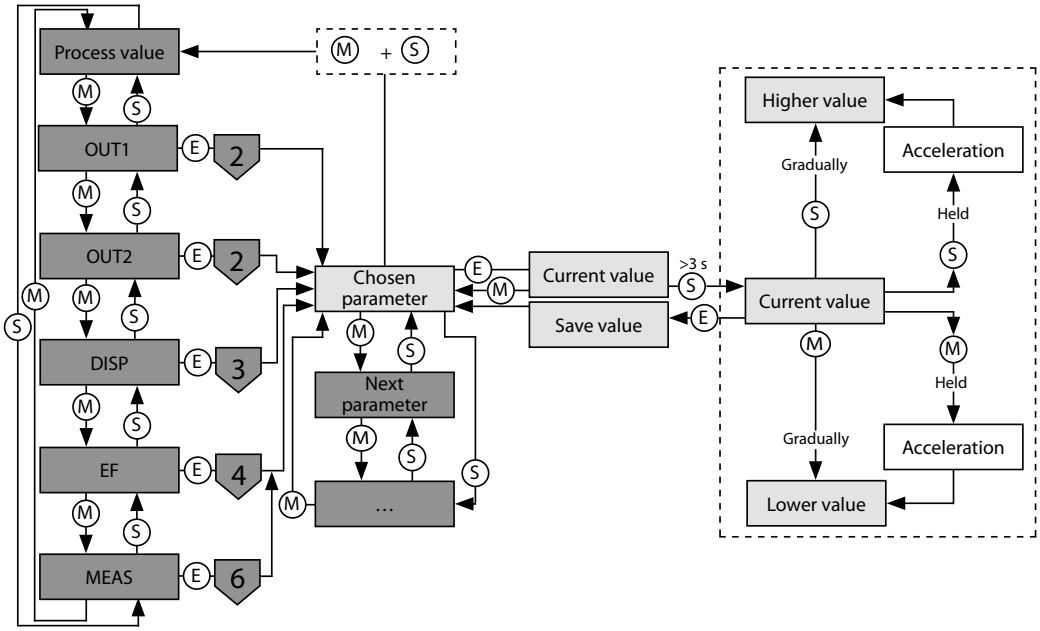


Fig. 14: Selecting parameters

9.2.2 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.

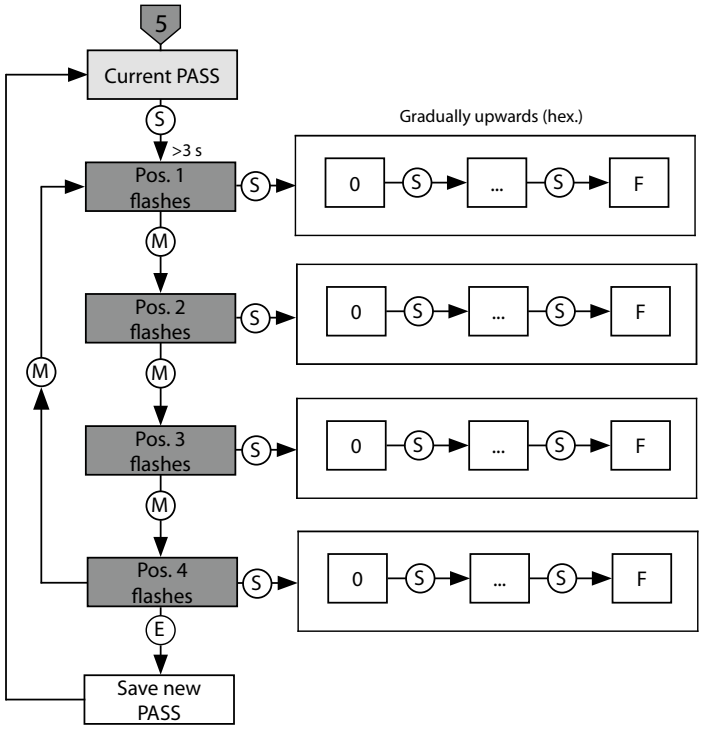


Fig. 15: Setting the password

9.2.3 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.

9.2.4 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.

9.2.5 Parameters in the main menu

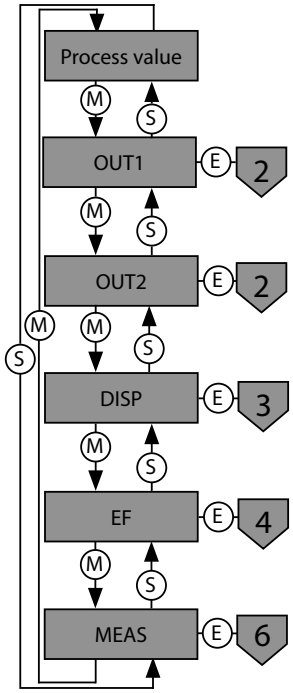


Fig. 16: Main menu

	Explanation	Function
OUT1	Output 1 submenu	Output 1 setting options
OUT2	Output 2 submenu	Output 2 setting options
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
MEAS	Extended Functions submenu	For additional setting options see the “Parameters in the MEAS submenu” table

9.2.6 Parameters in the OUT… (outputs) submenu

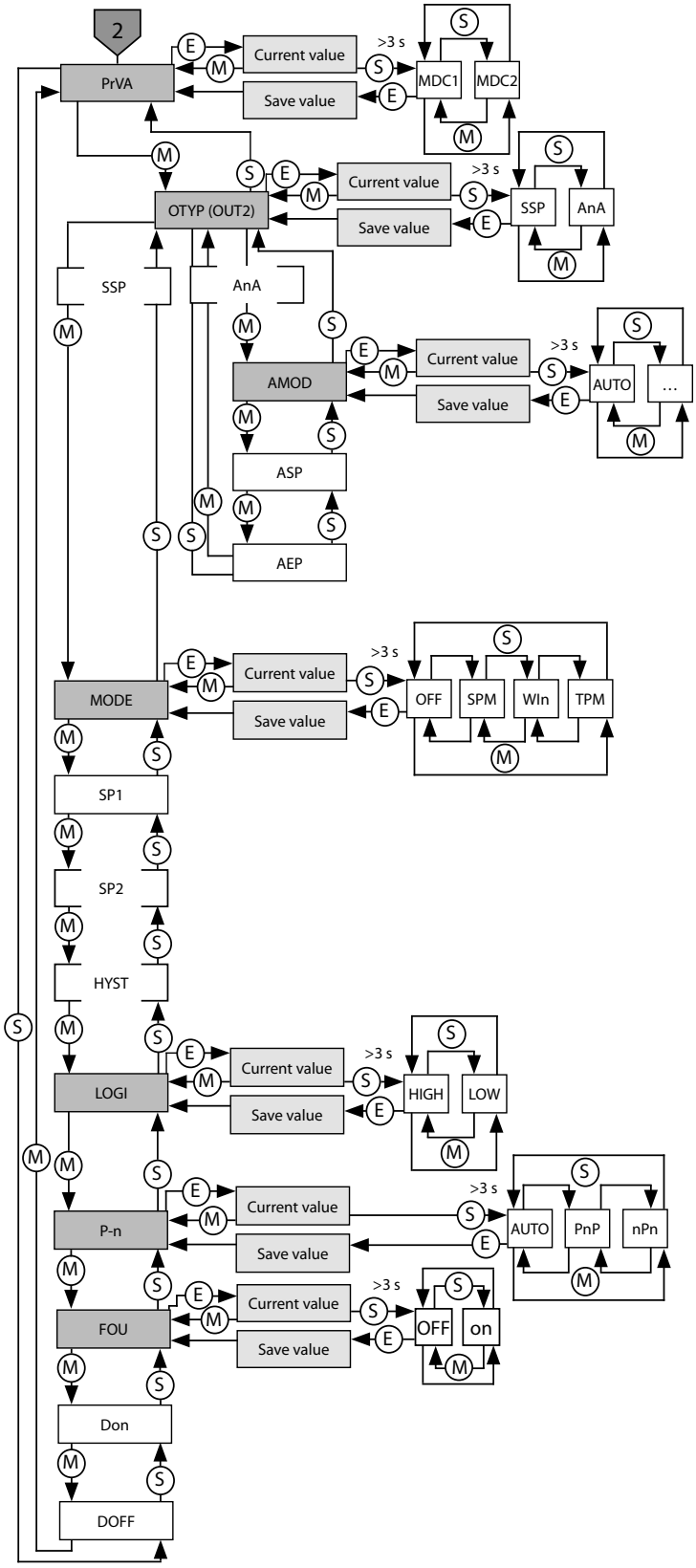


Fig. 17: Flowchart submenu OUT…

	Explanation	Options	Function
PrVA	Process data channel	MDC1	Parameterization of the outputs via process data channel 1 (flow). MDC1 is the default for OUT1. Assignment of process input data: Channel 1 = SSC 1.1, channel 2 = SSC 1.2
		MDC2	Parameterization of the outputs via process data channel 2 (temperature). MDC2 is the default for OUT2. Assignment of process input data: Channel 1 = SSC 2.1, channel 2 = SSC 2.2
OTYP	Output Type (OUT2)	SSP	Switching output Smart Sensor Profile
		AnA	Analog output
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	Starting point for the analog signal		Measured value at which the analog output signal has its start point Default: 0
AEP	End point of analog signal		Measured value at which the analog output signal has its end point Default: 0
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 TPM: Upper limit value at which the switching output changes its switching state as the measured value rises WIn: Upper window limit at which the switching output changes its switching state OUT1: **Flow: 0.85 m/s** Temperature: 70 °C OUT2: Flow: 0.95 m/s Temperature: 30 °C

	Explanation	Options	Function
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 OUT1: **Flow: 0.75 m/s** Temperature: 69.5 °C OUT2: Flow: 1.05 m/s Temperature: 29.5 °C
HYST	Hysteresis (only SPM and WIn)		The min. hysteresis is 0.05 m/s or min. 0.5 K. Adjustable in increments of 0.01 m/s or 0.1 K. The maximum hysteresis comprises the complete value range of the sensor. **Default: 0.05 m/s**
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: The output is activated in the event of a fault. 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. Analog output: Fault 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 active) Default: 0.0 s
DOFF	Switch-off delay		0…60 s in increments of 0.1 s (0 = delay time not active) Default: 0.0 s

9.2.7 Parameters in the DISP (display) submenu

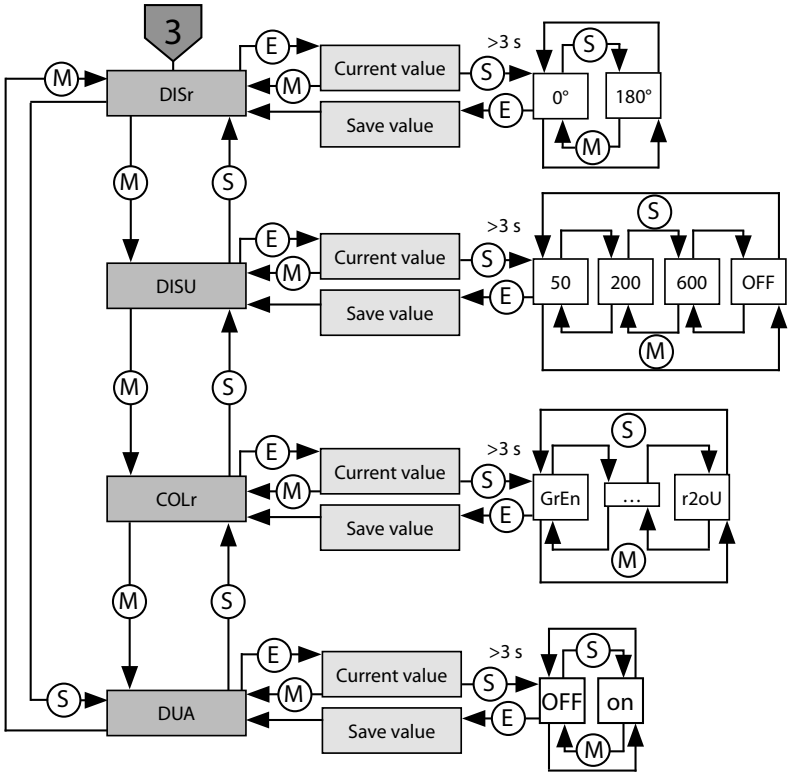


Fig. 18: Flowchart display

	Explanation	Options	Function
DISr	Display orientation	**0°**	Display rotated by 0°
		180°	Display rotated by 180°
		50	50-ms update time
DISU	Display update	**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
DUA	Display	**OFF**	Display of process value
		On	Alternating display of process value and unit

9.2.8 Parameters in the EF submenu (Extended Functions)

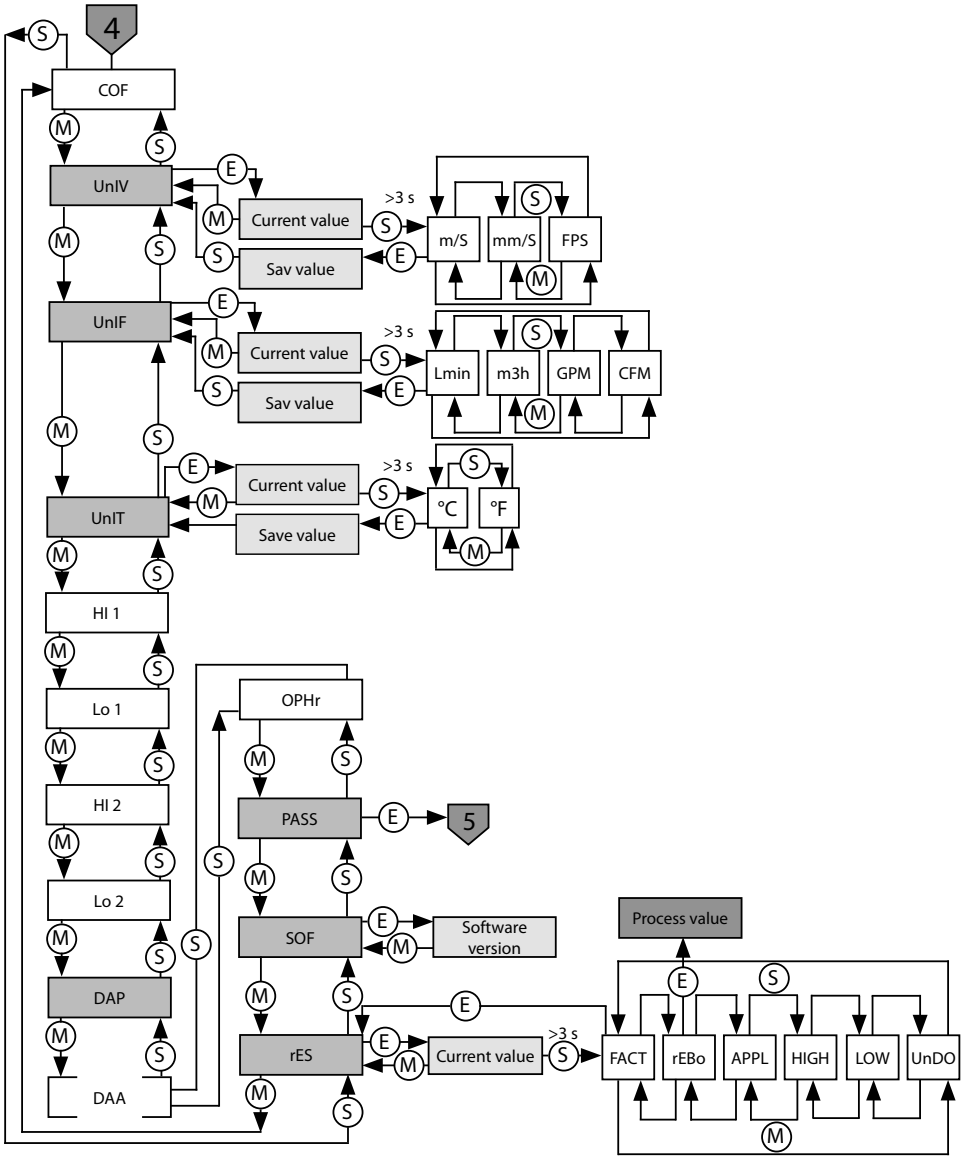


Fig. 19: Flowchart submenu EF

	Explanation	Options	Function
COF	Offset adjustment		Correction of the measured value with offset adjustment. Setting range: -50…+50 % of the measuring range **Default: 0**
UnIV	Flow speed unit	**m/s**	Meters per second
		mm/S	Millimeters per second
		FPS	Feet per second
UnIF	Volume flow unit	**Lmin**	Liters per minute
		m^3h	Cubic meters per hour
		GPM	Gallons per minute
		CFM	Cubic feet per minute

	Explanation	Options	Function
UnIT	Temperature unit	°C	Degrees Celsius
		°F	Degrees Fahrenheit
HI…	Maximum value memory		The highest measured value is stored and displayed.
Lo…	Minimum value memory		The lowest measured value is stored and displayed.
DAP	Damping of the switching output		Filter for momentary or high frequency measurement peaks: 0…5 s in increments of 1 ms **Default: 0**
DAA (OUT2 AnA)	Damping of the analog output		Filter for momentary or high frequency measurement peaks: 0…5 s in increments of 1 ms **Default: 0**
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 of the firmware version
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 value is deleted.
		LOW	Reset the minimum value memory: The lowest value is deleted.
		UnDO	Reset the parameters to the previous settings (last device start)

9.2.9 Parameters in the MEAS Sub-Menu

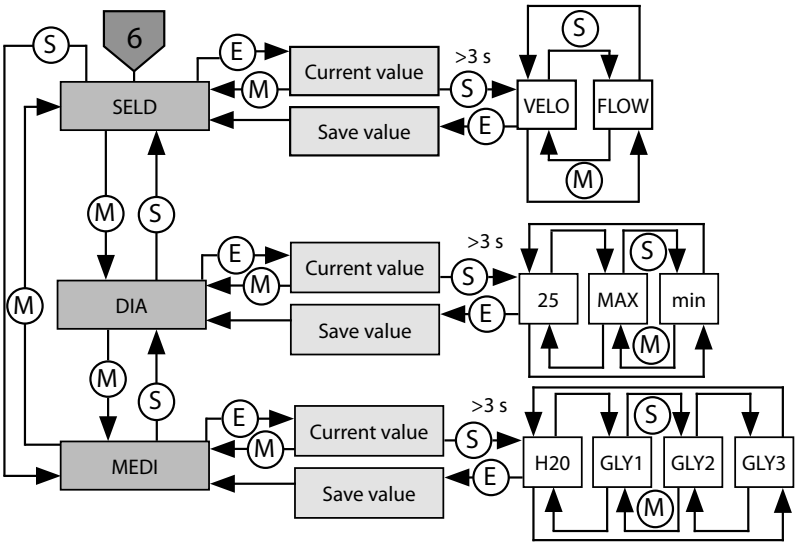


Fig. 20: MEAS submenu

SELD	Measured value	VELO	Flow speed
		FLOW	Volume flow
DIA	Diameter	**25**	in increments of 1 mm
		Min	15 mm
		Max	250 mm
MEDI	Medium	H20	Water
		GLY1	< 30 % share (reference 20 %)
		GLY2	30…40 % (reference 35 %)
		GLY3	> 40 % (reference 50 %)

10 Troubleshooting

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

If no faults are identified, this indicates that the device is faulty. In this case, decommission the device and replace it with a new device of the same type.

11 Maintenance

Ensure regularly that the plug connections and cables are in good condition.

The devices are maintenance-free, clean dry 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	FS501…-LI2UPN8
Application area	
Mounting conditions	Immersion sensor
Application area	Liquid media
Ambient temperature	-40…+80 °C (UL -25…+80 °C)
Media temperature	0…+80 °C
Storage temperature	-40…+80 °C
Pressure resistance	60 bar
Flow rate measurement	
Standard flow range	0.06…3 m/s
Flow measurement accuracy	≤ (± 8 % of measured value + 2 % of full scale)* tested with water at 20 °C ± 5 °C in a DN25 pipe with upstream section 40 × d and downstream section 10 × d inside diameter
Reproducibility	< 2 %
Response time	0.5 s for water 0.8 s for water glycol
Temperature measurement	
Measuring range	0…+80 °C
Switching point accuracy	≤ 2 K
Resolution	0.1 K
Response time T09	1.5 s
Electrical data	
Operating voltage	17…33 VDC
Power consumption	Max. 17 W (2 W internal, 15 W external)
Overload protection	Yes
Protective measures	SELV/PELV (UL requirement): limited energy according to UL61010-1 or LPS according to UL60950-1 or Class 2
Startup delay	30 s
Short-circuit/reverse polarity protection	Yes
Continuous current carrying capacity of the DC switching output	250 mA
Protection class	III
Voltage drop	≤ 2 VDC
Interfaces	
Communication protocol	IO-Link
IO-Link specification	V 1.1
IO-Link port type	Class A
Physical transmission layer	Complies with 3-wire technology (PHY2)
Transmission rate	COM 2 (38.4 kBaud)
Process data width	80 bit (2 × Float32T + IntegerT(10) + 2 × 1 BOOL + 2 × 2 switch)
Measured value information	64 bit (2 × Float32T)
Switching point information	4 bit (2 × 2 switching points)

Technical data	FS501…-LI2UPN8
Frame type	2.2
Minimum cycle time	6 ms
Function of pin 2	DI
Function of pin 4	IO-Link
Maximum cable length	20 m
Profile support	Smart Sensor Profile
Included in the SIDI GSDML	In preparation
Outputs	
Output function	Analog output, switching outputs: NC/NO programmable, PNP/NPN
Electrical output	2 × switching output, IO-Link, current output (3-wire), voltage output (3-wire)
Output 1	Switching output/IO-Link
Output 2	Switching output or analog output
Programming	
Programming options	Automatic switching logic recognition easy switchpoint adjustment via touchpads
Mechanical data	
Design	with indication (integrated probe)
housing designation	FS501
Dimensions	141.4 mm × 38 mm × 49 mm
Housing material	Stainless steel/plastic, 1.4404 (AISI 316L)/Grilamid TR90 UV/ Elastollan C 65 A 15 HPM 000/Ultramid A3X2G5
Adapter material	Stainless steel, 1.4571 (316Ti)
Material (in direct contact with media)	Stainless steel 1.4571 (AISI 316Ti), FKM O-ring
Electrical connection	Connector, M12 × 1, 4-pin
Process connection	M18 × 1.5 female thread
Electromagnetic compatibility	DIN EN 61326-2-3: 2022
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
Type of protection	IP66, IP67, IP69K (UL does not verify the IP protection rating)
Tests/approvals	
Approvals	CE cULus
MTTF	120 years acc. to SN 29500 (Ed. 99) 40 °C
Display	4-digit 12-segment display, rotatable by 180°, red or green
Mounting	Installation exclusively using TURCK process adapters: Screw-in adapters in the FAA… product series; welding adapters in the FAF… product series; adapters can be ordered separately as accessories

15 TURCK branches — contact data

Germany	TURCK GmbH 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 N. V. 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**

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