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TURCK

PS310... | PS510...
Pressure Sensors

Instructions for Use

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1 About these Instructions

These operating instructions describe the structure, functions and the use of the product and will help you to operate the product as intended. Read these instructions carefully before using the product. This is to avoid possible damage to persons, property or the device. Retain the instructions for future use 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 a qualified personal and must be carefully read by anyone mounting, commissioning, operating, maintaining, dismantling or disposing of the device.

1.2 Explanation of symbols used

The following symbols are used in these instructions:

	**DANGER** DANGER indicates a dangerous situation with high risk of death or severe injury if not avoided.
	**WARNING** WARNING indicates a dangerous situation with medium risk of death or severe injury if not avoided.
	**CAUTION** CAUTION indicates a dangerous situation of medium risk which may result in minor or moderate injury if not avoided.
	**NOTICE** NOTICE indicates a situation which may lead to property damage if not avoided.
	**NOTE** NOTE indicates tips, recommendations and useful information on specific actions and facts. The notes simplify your work and help you to avoid additional work.
▶	**CALL TO ACTION** This symbol denotes actions that the user must carry out.
⇨	**RESULTS OF ACTION** This symbol denotes relevant results of actions.

1.3 Other documents

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

- Data sheet
- Quick-Start Guide
- IO-Link parameters manual
- 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

PS 310 – 1V – 03 – LI2UPN 8 – H1 1 4 1

PS 310 Measuring cell – 1V Measuring range – 03 Mechanical version –

Measuring cell
310 Ceramic measuring cell
510 Metal measuring cell

Functional principle
PS Pressure sensor

Measuring range
Ceramic measuring cell
OV -1 … 0 bar
1V -1 … 1 bar
1 0 … 1 bar
1A 0 … 1 bar absolute
2.5V -1 … 2.5 bar
2.5 0 … 2.5 bar
2.5A 0 … 2.5 bar absolute

Metal measuring cell
10V -1 … 10 bar
10 0 … 10 bar
10A 0 … 10 bar absolute
16 V -1 … 16 bar
16A 0 … 16 bar absolute
25V -1 … 25 bar
25A 0 … 25 bar absolute
40V -1 … 40 bar
100 0 … 100 bar
250 0 … 250 bar
400 0 … 400 bar
600 0 … 600 bar

Mechanical version
01 G1/4" female thread
02 1/4"-18NPT female thread
03 1/4"-18NPT male thread
04 G1/4" male thread
05 7/16" UNF male thread
08 G1/2" manometer

LI2UPN 8 Electrical version / H1 1 4 1 Electrical connection: connector / X Special version

Operating voltage
8 18...30 VPC

Output function
2UPN 2 switching outputs/ IO-Link
LI2UPN Current and switching output/ IO-Link

Assignment
1 Standard assignment

Number of contacts
4 4 Contacts

Alignment
1 Straight

Design
H1 Connector M12 × 1

Special version
X Peak pressure aperture

2.2 Scope of delivery

The scope of delivery includes:

- Pressure sensor
- Quick-Start Guide

2.3 Legal requirements

The device is subject to the following EC directives:

- 2014/30/EU (electromagnetic compatibility)
- 2011/65/EU (RoHS Directive)

2.4 Manufacturer and service

Hans Turck GmbH & Co. KG
Witzlebenstraße 7
45472 Mülheim an der Ruhr
Germany

Turck supports you with your projects, from initial analysis to the commissioning of your application. The Turck product database contains software tools for programming, configuration or commissioning, data sheets and CAD files in numerous export formats. You can access the product database at the following address: **www.turck.de/products**

For further inquiries in Germany contact the Sales and Service Team on:

- Sales: +49 208 4952-380
- Technology: +49 208 4952-390

Outside Germany, please contact your local Turck representative.

3 For Your Safety

The product is designed according to state-of-the-art technology. However, residual risks still exist. Observe the following warnings and safety notices to prevent damage to persons and property. Turck accepts no liability for damage caused by failure to observe these warning and safety notices.

3.1 Intended use

The devices are intended for use in the industrial sector.

The pressure sensors of the PS series monitor media belonging to fluid group 2 and show the measured values in a display. The sensors are vacuum-tight.

The devices may 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 only meets the EMC requirements for industrial areas and is not suitable for use in residential areas.
- The device may only be assembled, installed, operated, parameterized and maintained by professionally-trained personnel.
- The device may only be used in accordance with applicable national and international regulations, standards and laws.
- The maximum permissible overpressure must not be exceeded.

4 Product Description

The pressure sensors of the PS+ series are contained in a metal housing with a display and are available with different process connections. The housing can also be aligned and fastened as required after mounting. All devices are provided with a metal-bodied M12 connector for connecting the sensor cable.

The devices can be set via the touchpads, FDT/DTM or IO-Link. The measured pressure can be displayed in bar, psi, kPa, MPa and in ten other units of pressure (Ud1...Ud10).

Devices with the following output functions are available for selection:

- PS…2UPN8…: Two switching outputs (PNP/NPN)
- PS…LI2UPN8…: One switching output (PNP/NPN) as well as one switching output (PNP/NPN) or one analog output (adjustable as current or voltage output)

4.1 Device overview

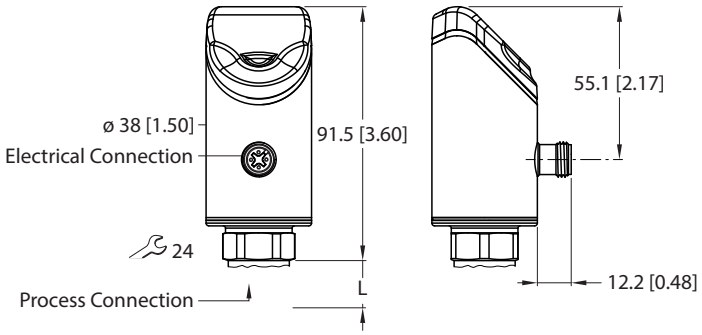


Fig. 1: Dimensions in mm [inch]

4.2 Properties and features

- Pressure monitoring of fluid group 2
- IO-Link 1.1
- Automatic signal detection
- Up to 7-fold overpressure resistance
- Protection types IP6K6K, IP6K7, IP6K9K
- 180° invertible multi-color display
- Rotatable sensor body
- Stainless steel housing 1.4305 (AISI 303) or 1.4404 (316 L)
- Electronic output:
  - 1 PNP/NPN output + 1 analog or PNP/NPN output
  - 2 PNP/NPN outputs

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 taught switch points.

4.4 Operating principle

The pressure sensors of the PS310 series operate with ceramic measuring cells. The pressure exerted on the ceramic carrier generates a signal proportional to the pressure, which is then electronically processed. Depending on the sensor version, the processed signal is converted either into a switching or an analog output with an accuracy of 0.5 % of full scale.

The pressure sensors of the PS510 series operate with fully welded metal measuring cells. The pressure exerted on the metal carrier material generates a signal proportional to the pressure, which is then electronically processed. Depending on the sensor version, the processed signal is converted either into a switching or an analog output with an accuracy of 0.25 % of full scale.

4.5 Functions and operating modes

The sensors of the PS series monitor media belonging to fluid group 2 and show the measured values in a display.

The device parameters can be set via IO-Link and with the touchpads. A window function and a hysteresis function can be set for the switching outputs. The measuring range of the analog output can be defined as required. The measured pressure is displayed in bar, psi, kPa, MPa and 10 other units of pressure (Ud1...Ud10).

Type	Output
PS…2UPN8…	Two switching outputs (PNP/NPN)
PS…LI2UPN8…	One switching output (PNP/NPN) as well as one switching output (PNP/NPN) or one analog output (adjustable as current or voltage output)

4.5.1 Setting options

The devices offer three setting options:

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

4.5.2 Normal operation – Run mode

The sensor detects the system pressures and shows the measured process values according to the preset switching and analog behavior. The display indicates the system pressure present, the selected unit and the status of the switching outputs present.

4.5.3 Menu mode

Pressing the [MODE] touchpad switches the display to Menu mode. In this mode all parameters and the associated values can be read. A short press of the [SET] touchpad displays the values of a parameter.

4.5.4 Programming mode

Programming mode enables the setting of all adjustable parameter values. A short press of the [SET] touchpad displays the values of a parameter.

4.5.5 Output functions – Switching output

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

Window function

The window function is used to teach a switching range in which the switching output takes on a defined switching state. The switching range is defined by an upper and lower limit value. The minimum distance between the limit values is 0.5 % of the nominal pressure range. If the upper limit value is changed, the lower limit value is automatically adjusted.

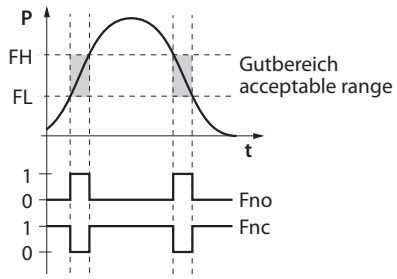


Fig. 2: Behavior of the switching output (window function)

Hysteresis function

The hysteresis function ensures a stable switching state that is not affected by system-related pressure fluctuations and the adjusted setpoint. The switching range is defined with a switch point and a reset point. The minimum hysteresis is 0.5 % of the nominal pressure range. If the switch point is changed, the reset point is automatically adjusted.

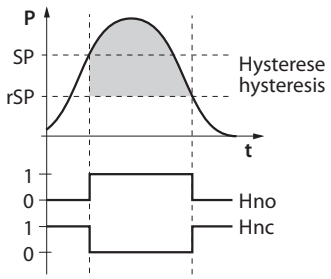


Fig. 3: Behavior of the switching output – Hysteresis function

4.5.6 Output functions – Analog output

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

Current output

In the defined measuring range between ASP (analog start point) and AEP (analog end point), the output signal is between 4 and 20 mA or between 0 and 20 mA. The minimum distance between the start and end point is 10 % of the set measuring range.

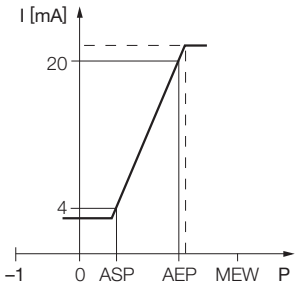


Fig. 4: Behavior of the current output (4… 20 mA)

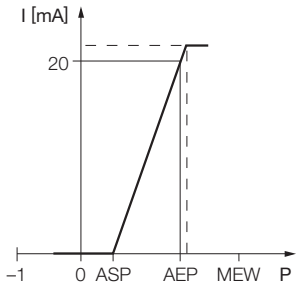


Fig. 5: Behavior of the current output (0…20 mA)

Voltage output

In the defined measuring range between ASP (analog start point) and AEP (analog end point), the output signal is between 0 and 10 V, between 0 and 5 V, or between 1 and 6 V.

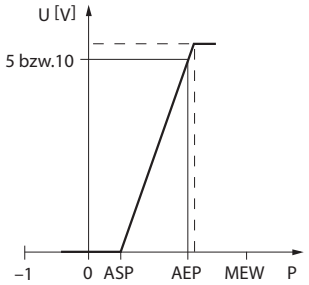


Fig. 6: Behavior of the voltage output (0…10 V or 0…5 V)

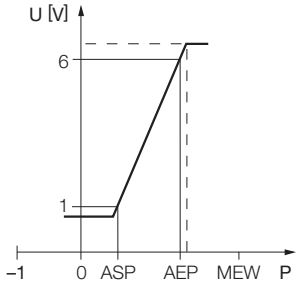
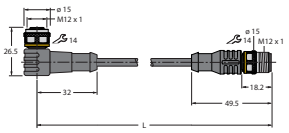
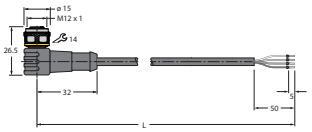
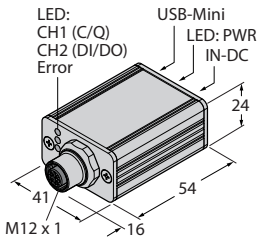


Fig. 7: Behavior of the voltage output (1…6 V)

4.5.7 IO-Link mode

The devices must be connected to an IO-Link master for operation in IO-Link mode. If the port is configured in IOL mode, bidirectional IO-Link communication is provided between the IO-Link master and the device. For this the device is integrated in the controller level via an IO-Link master. The communication parameters are exchanged first of all; the cyclic data exchange of the process data (process data objects) then starts.

4.6 Technical accessories

Type name	Description	Figure
WKC4.4T-2-RSC4.4T/TXL	Connection cable, M12 female connector, angled to M12 connector, straight, 4-pin, cable length: 2 m, sheathing material: PUR, green; cULus approval	
WKC4.4T-2/TXL	Connection cable, M12 female connector, angled, 4-pin, cable length: 2 m, sheathing material: PUR, black; cULus approval	
USB-2-IOL-0002	IO-Link adapter with integrated USB interface	
PAM-P3	Pressure peak aperture for mounting on the process connection	

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 provided in the Turck product database at **www.turck.de/products** in the Connectivity area.

5 Installing

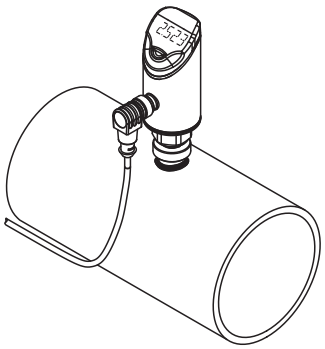


Fig. 8: Vertical mounting

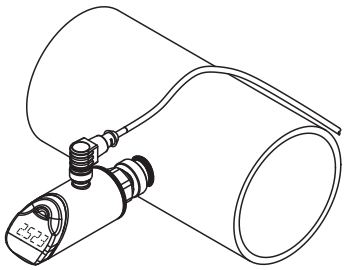


Fig. 9: Horizontal mounting

- Depressurize the installation before mounting.
- Do not install the device at a location where high pressure pulses can occur.
- Fit the device to the pressure connection using the corresponding counterpiece as shown in the figure.
- Note the different pressure connections.
- Mount the sensor in any direction.
- The display of the unit can be rotated by 180°.
- The maximum tightening torque for fastening the sensor is 35 Nm (15 Nm for 7/16 UNF).
- The housing can be rotated by 340°.

Severe temperature changes in the environment of the sensor can cause the shifting of the zero point. In this case, the displayed measured value will not be zero when the sensor is in a depressurized state. If the zero point is offset, an offset value can be set via the CoF parameter (see chapter “Settings”).

6 Connecting

- Connect the female connector of the connection cable to the male connector of the sensor.
- Connect the open end of the connection cable to the power supply and/or processing units.

6.1 Wiring diagrams

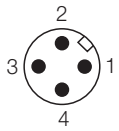


Fig. 10: Pin layout PS…2UPN…

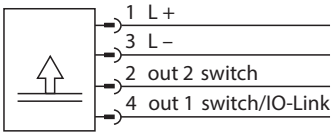


Fig. 11: Wiring diagram PS…2UPN…

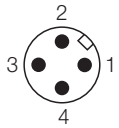


Fig. 12: Pin layout PS…LI2UPN…

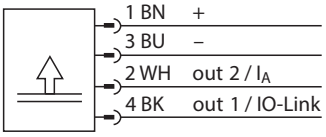


Fig. 13: Wiring diagram PS…LI2UPN…

7 Commissioning

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

8 Operation

8.1 LED status indications – Operation

LED	Indication	Meaning
PWR	Green	Device is operational
	Green flashing	IO-Link communication
FLT	Red	Error
bar	Green	Display in bar
psi	Green	Display in psi
kPa	Green	Display in kPa
MPa	Green	Display in MPa
MISC	Green	Other display unit
LOC	Yellow	Device locked
	Yellow flashing	“Lock/unlock” process active
	Off	Device unlocked

8.2 Display indications

Display	Meaning
Flashing	Measured value out of analog range
OL	Value outside of the measuring range, pressure more than 5 % of full scale above the limit value
UL	Value outside of the measuring range, pressure more than 5 % of full scale below the limit value
SC1	Short circuit at output 1
SC2	Short circuit at output 2
SC12	Short circuit at both outputs
boot	EEPROM error
Loc	Device locked
uLoc	Device unlocked
----	Sensor failure

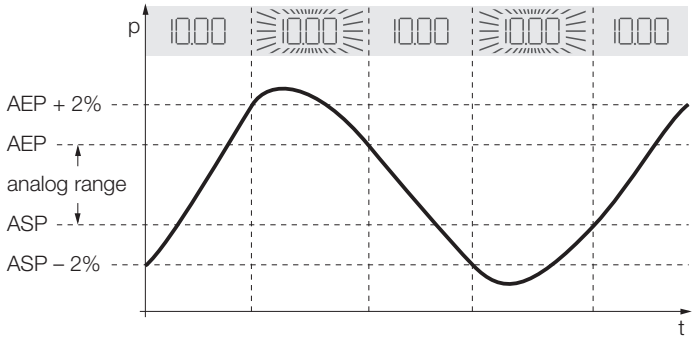


Fig. 14: Display – Value within the set measuring range

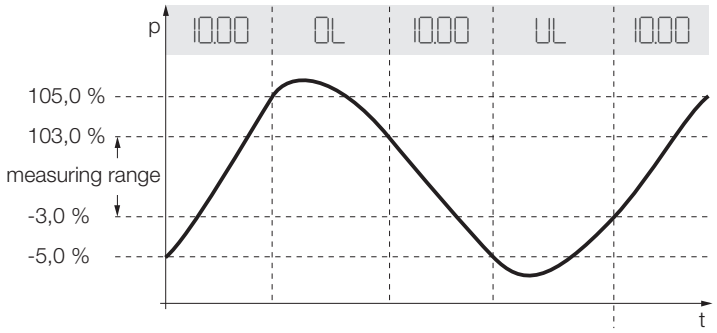


Fig. 15: Display indications – Value outside the set measuring range

8.3 Display indications – Diagnostic messages

Display	Meaning
ErrP	Error in measuring cell
ErrC	Communication error
ErrA	Ambient pressure error
SC1	Short circuit at output 1
SC2	Short circuit at output 2
SC12	Short circuit at both outputs
ErrL	Error on electrical resistance
Err	Undefined error
…	Sensor failure
OL	Value outside of the measuring range, > 5 % of full scale above limit
UL	Value outside of the measuring range, > 5 % of full scale below limit

9 Setting

The device can be assigned parameters as follows:

- Setting via touchpad
- Setting via IO-Link

The following flow charts illustrate the operating steps during the teach-in process.

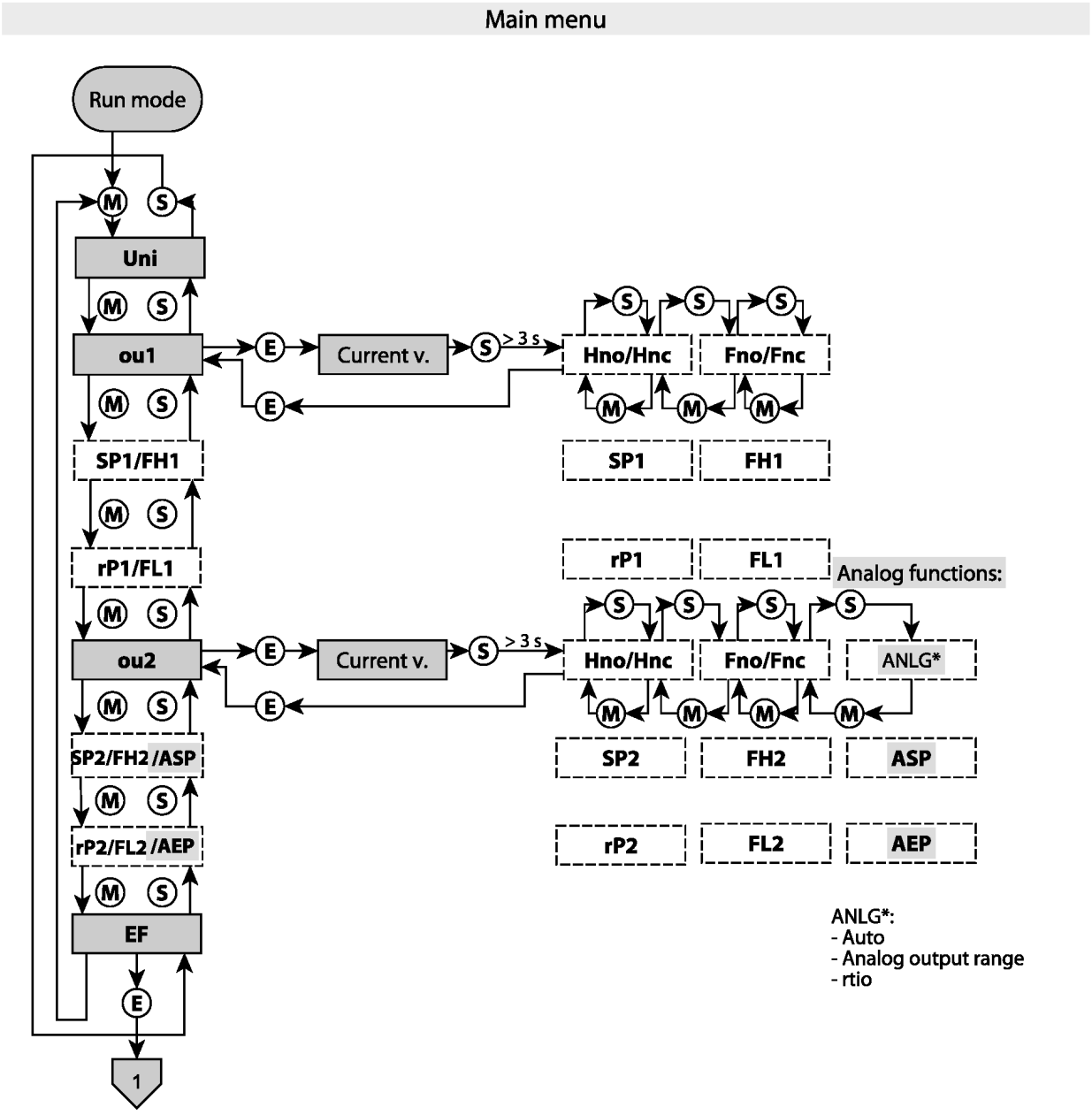


Fig. 16: Overview of the teach main menu

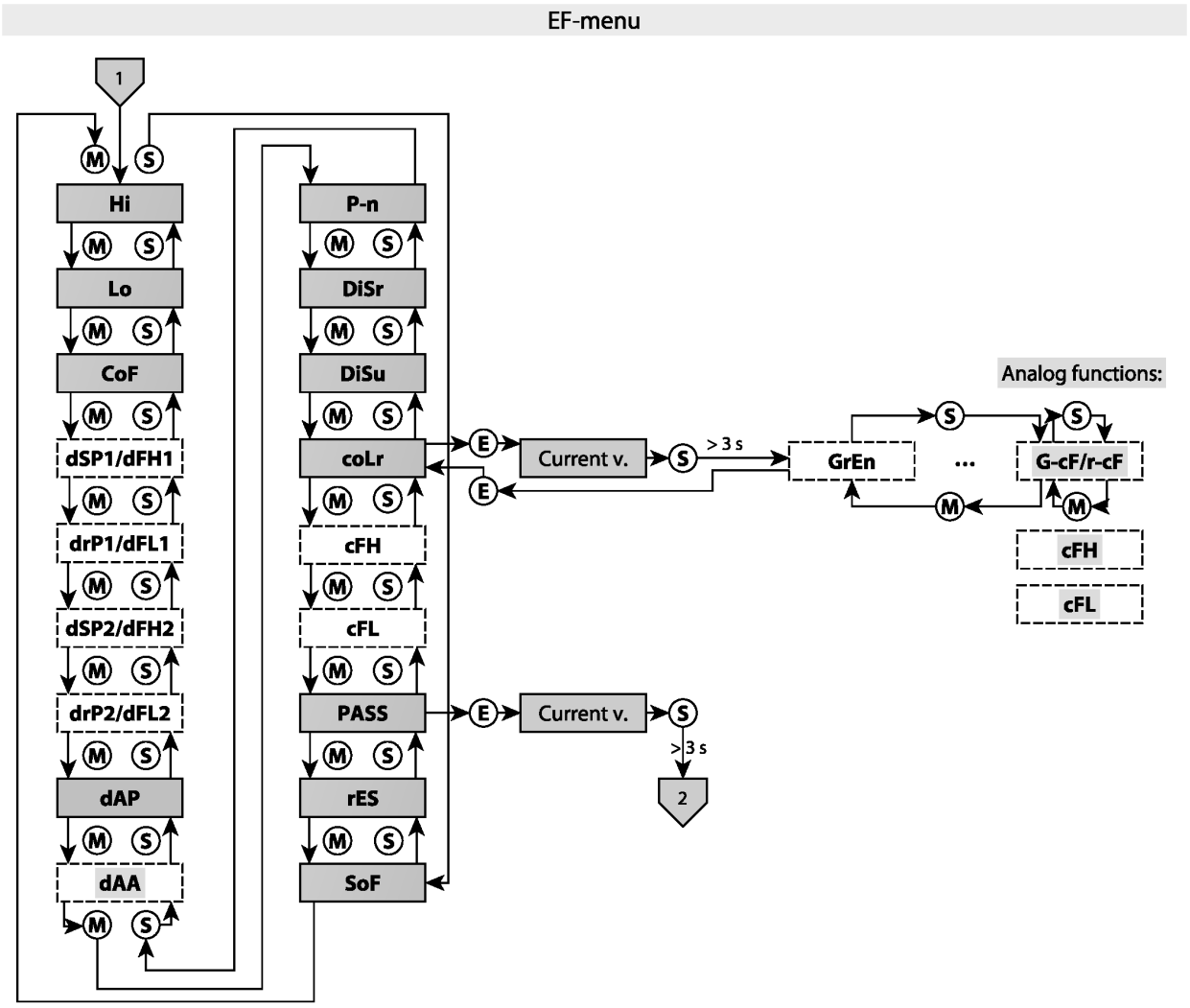


Fig. 17: Overview of the teach EF menu

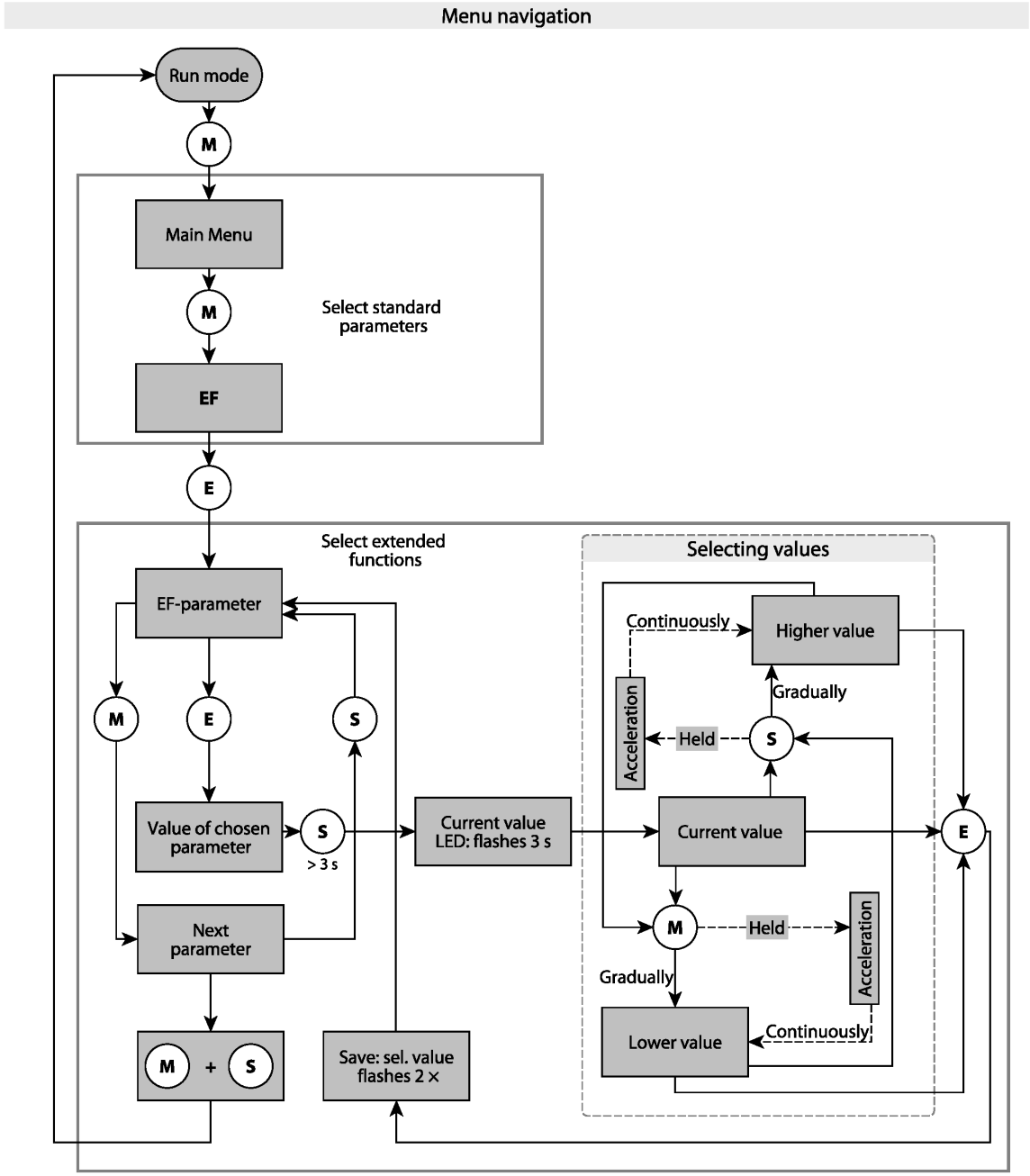


Fig. 18: Overview of the menu navigation

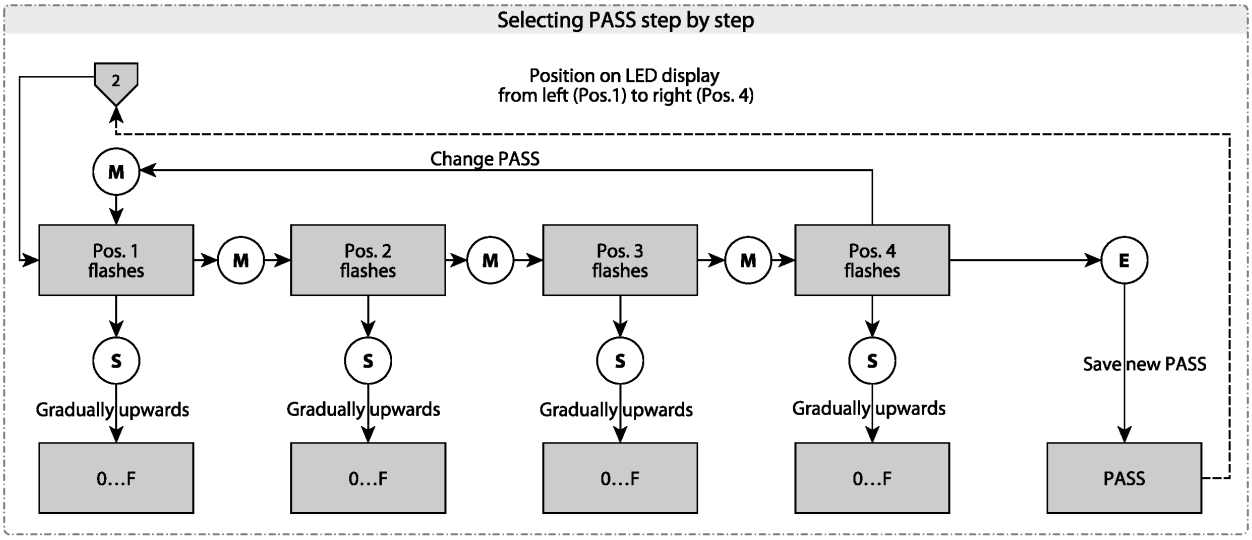


Fig. 19: Password setting

9.1 Setting via touchpads

Use the [MODE], [SET] or [ENTER] touchpads to set the parameters.

9.1.1 Unlocking the touchpads

- ▶ Touch [ENTER] for 3 s until all green bars are flashing on the display.
- ▶ Swipe the [MODE], [ENTER], [SET] touchpads in that order in succession: Two red flashing bars appear on the display when each touchpad is touched.
- ▶ Swipe the next touchpad once the two red bars turn green.
- ▶ Release the touchpads when six green bars are lit on the display.
- ⇨ LED LOC flashes first and then goes out.

9.1.2 Locking the touchpads

- ▶ Touch and hold down [MODE] and [SET] for 3 s.
- ⇨ LOC flashes first and then is permanently lit yellow.

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

9.1.3 Setting parameter values via touchpads

- ▶ If the display shows a red running light when [MODE] and [SET] are touched, unlock the device.
- ▶ Touch [MODE] or [SET] until the required parameter appears in the display.
- ▶ Touch [ENTER] to select the parameter.
- ▶ Changing the displayed value: Touch [SET] for 3 s until the display is no longer flashing.
- ▶ Increase or decrease the value gradually via [MODE] or [SET]. Certain values can also be continuously changed by holding down [MODE] or [SET].
- ▶ Touch [ENTER] to save the modified value. The saved value flashes twice and all unit LEDs are lit once.
- ▶ Protect 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.

9.1.4 Parameters in the main menu

	Explanation	Options	Function
Uni	Display unit	bar	bar
		psi	psi
		kPa	kPa
		MPa	MPa
		Ud1	mBar
		Ud2	Torr = mmHg (0 °C)
		Ud3	Inch of water (60 °F)
		Ud4	Inch of water (39 °F)
		Ud5	Foot of water (39 °F)
		Ud6	Inch of Hg (60 °F)
		Ud7	Inch of Hg (32 °F)
		Ud8	mH20 (16 °C)
		Ud9	mH20 (4 °C)
		Ud10	kg/Cm^2
ou1	Function of output 1	Hno	Hysteresis function (NO contact)
		Hnc	Hysteresis function (NC contact)
		Fno	Window function (NO contact)
		Fnc	Window function (NC contact)
SP1	Switching point 1 for hysteresis function ou1: Hno/Hnc		Upper limit value at which output 1 changes its switching state when the pressure increases
rP1	Reset switching point 1 for hysteresis function ou1: Hno/Hnc		Lower limit value at which output 1 changes its switching state when the pressure drops
FH1	Upper switch point for window function ou1: Fno/Fnc		Upper switch point at which output 1 changes its switching state
FL1	Lower switch point for window function ou1: Fno/Fnc		Lower switch point at which output 1 changes its switching state
ou2	Function of output 2	Hno	Hysteresis function (N/O = NO contact)
		Hnc	Hysteresis function (N/C = NC contact)
	Window function	Fno	Window function (N/O = NO contact)
		Fnc	Window function (N/C = NC contact)

	Explanation	Options	Function
ou2	Analog output	auto	
		4-20	4…20 mA
		0-20	0…20 mA
		20-4	20…4 mA
		20-0	20…0 mA
		0-10	0…10 V
		0-5	0…5 V
		1-6	1…6 V
		10-0	10…0 V
		5-0	5…0 V
		6-1	6…1 V
		rtio	0.5…4.5 V
SP2	Switching point 2 ou2: Hno/Hnc		Upper limit value at which output 2 changes its switching state when the pressure increases
rP2	Reset point 2 ou2: Hno/Hnc		Lower limit value at which output 2 changes its switching state when the pressure drops
FH2	Upper switch point for window function ou2: Fno/Fnc		Upper switch point at which output 2 changes its switching state
FL2	Lower switch point for window function ou2: Fno/Fnc		Lower switch point at which output 2 changes its switching state
ASP	Start point of the analog signal ou2: Auto/analogvalues/rtio		Pressure value at which the analog signal has its start point
AEP	End point of the analog signal ou2: Auto/analogvalues/rtio		Pressure value at which the analog signal has its end point
EF	Submenu for additional setting options		See table “Parameters in the EF submenu”

9.1.5 Parameters in the EF submenu (Extended Functions)

	Explanation	Options	Function
Hi	Maximum value memory		The highest pressure is stored and can be displayed/deleted here.
Lo	Minimum value memory		The lowest pressure is stored and can be displayed/deleted here.
CoF	Offset adjustment		Severe temperature changes in the environment of the sensor can cause the shifting of the zero point. In this case, the displayed measured value will not be zero when the sensor is in a depressurized state. An offset value can be set in order to correct this drift: -5 …+5 % of the measuring range.
dSP1	Switch delay of SP1		0…60 s in increments of 0.1 s (0 = delay time not active)
drP1	Switch delay of rP1		0…60 s in increments of 0.1 s (0 = delay time not active)

	Explanation	Options	Function
dFH1	Switch delay of FH1		0…60 s in increments of 0.1 s (0 = delay time not active), only available with window mode Fno or Fnc
dFL1	Switch delay of FL1		0…60 s in increments of 0.1 s (0 = delay time not active), only available with window mode Fno or Fnc
dSP2	Switch delay of SP2		0…60 s in increments of 0.1 s (0 = delay time not active).
drP2	Switch delay of rP2		0…60 s in increments of 0.1 s (0 = delay time not active).
dFH2	Switch delay of FH2		0…60 s in increments of 0.1 s (0 = delay time not active), only available with window mode Fno or Fnc
dFL2	Switch delay of FL2		0…60 s in increments of 0.1 s (0 = delay time not active), only available with window mode Fno or Fnc
dAP	Damping of switching output (filter)		Momentary or high frequency pressure peaks can be filtered: 0…8 s in increments of 0.01 s (0 = filter is deactivated)
dAA	Damping of the analog output		Filter for momentary or high frequency pressure peaks: 0… 8 s in increments of 0.01 s (0 = filter is deactivated)
P-n	Behavior of the switching output	auto	
		npn	n switching
		pnp	p switching
diSr		0°	Display rotated by 0°
		180°	Display rotated by 180°
diSu	Measured value display	50	50 ms update time
		200	200 ms update time
		600	600 ms update time
		Off	Display update deactivated
coLr	Display color	GrEn	Display is always green.
		rEd	Display is always red.
		G1ou	Display is green if ou1 is switched, otherwise red.
		r1ou	Display is red if ou1 is switched, otherwise green.
		G2ou	Display is green if ou2 is switched, otherwise red.
		r2ou	Display is red if ou2 is switched, otherwise green.
		G-cF	Display is green if the measured value is between switching points cFL and cFH.
		r-cF	Display is red if the measured value is between switching points cFL and cFH.

	Explanation	Options	Function
PASS	Password protection		Define password and activate password protection
		0000	No password
rES	Reset	FacT	Reset the parameters to the factory setting
		Undo	Reset of the parameters since the last unlocking of the sensor
SOF	Software version		

9.2 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 in the IO-Link parameter manual of the device. Detailed instructions on the parameterization of devices via the IO-Link interface are provided in the IO-Link commissioning manual.

All the parameters can be changed in IO-Link mode via the controller during commissioning as well as during operation. In SIO mode the device operates according to the last setting made 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

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

The devices are maintenance-free, clean dry if required.

12 Repair

The device must not be repaired 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

Returns to Turck can only be accepted if the device has been equipped with a Decontamination declaration enclosed. The decontamination declaration can be downloaded from
https://www.turck.de/en/retoure-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 correctly and must not be included in normal household garbage.

14 Technical Data

Type code	PS 310	PS 510
Pressure range	Sensor-dependent	
Pressure type	See data sheet	
Outputs	Transistor switching output, analog outputs and IO-Link (freely configurable)	
IO-Link COM2	38.4 kBaud frame type 2.2	
Current output	(0) 4…20 mA	
Voltage output	0…10 V, 0…5 V, 1…6 V	
Accuracy of analog output (NLHR), non-linearity, hysteresis and repeatability	Sensor-dependent See data sheet	
Switching output		
Accuracy/switch point		
Switching point distance		
Switch point		
Reset switch points		
Switching frequency		
Operating voltage	18…33 VDC	
Temperature of medium	-40…+90 °C	
Ambient temperatur	-40…+80 °C	
Storage temperature	-40…+100 °C	
T_K: – Zero point/10_K – Range/10_K		
Voltage drop at I_e		
Burst protection	Sensor-dependent See data sheet	
Short-circuit/reverse polarity protection	Yes, cyclic / yes (power supply)	
Rated operational current	0.25 A	
Type of protection	IP6K6K/IP6K7/IP6K9K acc. to ISO 20653	
Protection class	III	
EMC	EN 61000-4-2 EN 61000-4-3 EN 61000-4-4 EN 61000-4-5 EN 61000-4-6	
Housing material	Stainless steel/plastic, 1.4404 (316L)/ polyarylamide 50% GF UL 94 V-0	
Materials with medium-contact	Stainless steel 1.4404 (316L) , Al_2O_3, FKM (Viton)	Stainless steel 1.4404 (316L) / 1.4542
Pressure connection wrench size	24	

Type code	PS 310	PS 510
Housing nut with tightening torque	35 Nm	
Rotatable display	Yes	
Sensor body adjustable	Yes	
Vibration resistance	20 g (10…2000 Hz) acc. to EN 60068-2-6	
Shock resistance	50 x g (11 ms) acc. to EN 60068-2-27	
Type of display	4-digit 12-segment display, rotatable by 180°. Red or green.	
Number of touchpads	3	

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