Your Global Automation Partner

TURCK

PSD Series
Differential Pressure Sensors

Operating Instructions

Contents

1 About These Instructions

These instructions describe the setup, the functions and use of the product and help you to operate the product for its intended use. Read the instructions carefully prior to 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

This document is are written for suitably qualified and trained personnel and must be read by anyone entrusted with the mounting, commissioning, operation, maintenance, disassembly or disposal of the device.

1.2 Explanation of symbols

The following symbols are used in these instructions:

DANGER
DANGER indicates an immediate hazardous situation, which, if not avoided, will result in death or serious injury.

WARNING
WARNING indicates a possible hazardous situation with the risk of death or serious injury if it is not prevented.

NOTICE
NOTICE indicates a situation that may cause possible damage to property if it is not prevented.

NOTE
NOTE indicates tips, recommendations and important information. The notes contain information, particular operating steps that facilitate work and possibly help to avoid additional work resulting from incorrect procedures.

➤ **MANDATORY ACTION**
This symbol denotes actions that the user must carry out.

➥ **RESULT OF ACTION**
This symbol denotes the relevant results of actions and procedures.

1.3 Other documents

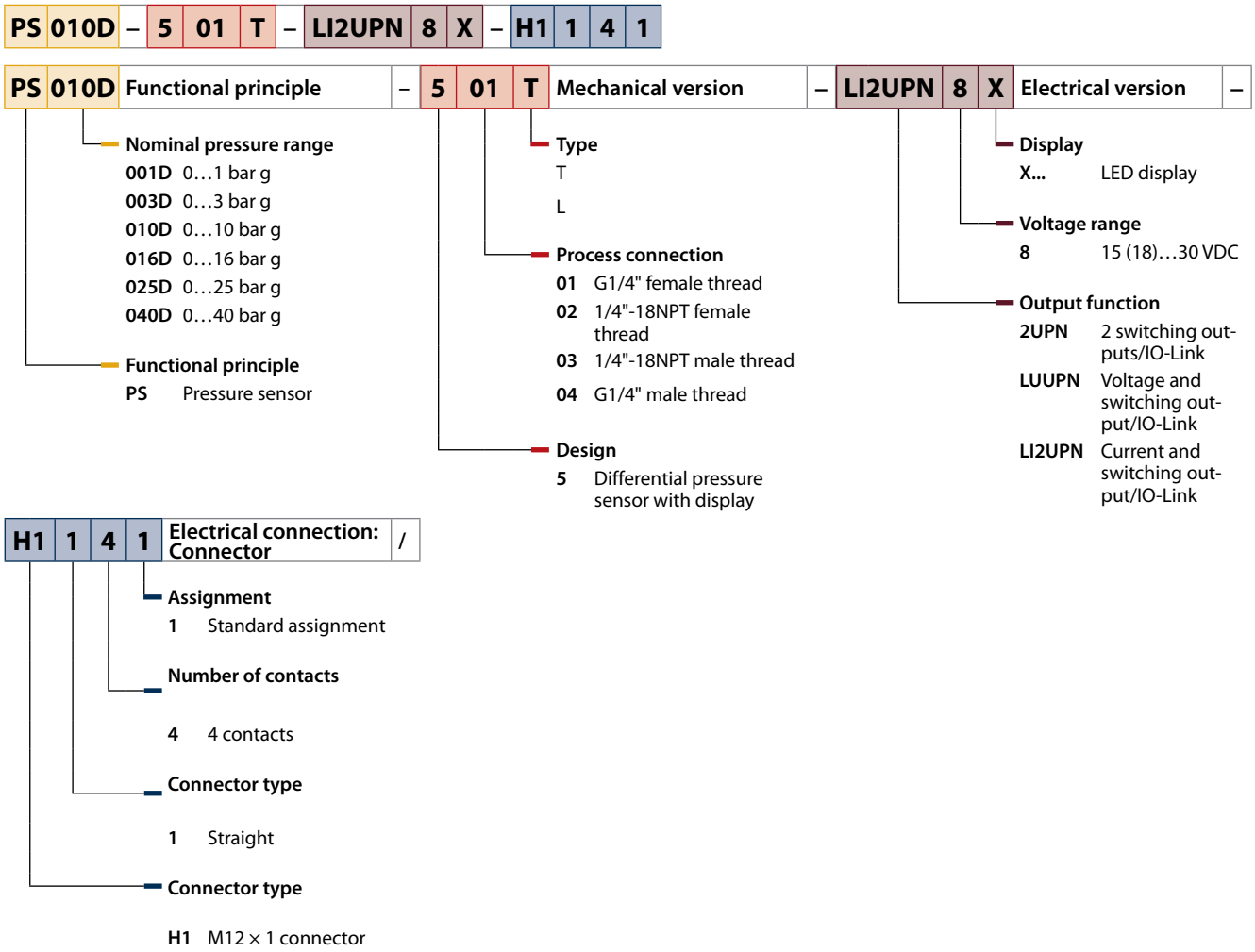
Besides this document the following material can be found on the Internet at www.turck.com:
- Data sheet
- Quick start guide
- IO-Link parameter manual
- IO-Link devices commissioning manual

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



2.2 Scope of delivery

The following are included in the scope of delivery:
- 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 2)

2.4 Manufacturer and service

Turck supports you in your projects – from the initial analysis right through to the commissioning of your application. The Turck product database offers you several software tools for programming, configuring or commissioning, as well as data sheets and CAD files in many export formats. You can access the Product Database directly via the following address: **www.turck.de/produkte**
For further inquiries in Germany contact the Sales and Service Team on:
Sales: +49 208 4952-380
Technical: +49 208 4952-390

For overseas inquiries contact your national Turck representative.

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

3 For Your Safety

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

3.1 Intended use

The device is designed only for use in industrial areas.
The sensors of the PSD series monitor the differential pressure of media belonging to fluid group 2 and show the measured values in a display. The sensors are vacuum-tight.
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 device is not a safety devices Do not use the device for the protection of persons or machines.

3.3 General safety notes

- The device only fulfills the EMC requirements for industrial applications and is not suitable for use in residential areas.
- The device must only be mounted, 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.
- Do not paint or coat the housing surface.
- The permissible burst pressure must not be exceeded.

4 Product description

The differential pressure sensors of the PSD series are contained in a metal housing with a display and are available with different process connections. The housing can also be rotated (320°) and fixed 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 pushbuttons or the FDT/DTM. The measured pressure can be displayed in bar, psi, kPa, MPa and in ten other units of pressure (Ud1...Ud10). The devices with the following output functions are available for selection:

- PS…D…LI2UPN8X: 1 switching output (pnp/npn) and 1 output switching (pnp/npn) or analog output (current and voltage)
- PS…D…2UPN8X: 2 switching outputs (pnp/npn)

4.1 Device overview

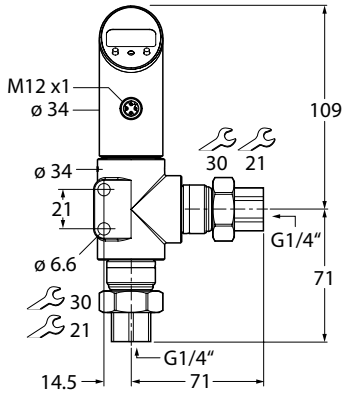


Fig. 1: Dimensions – PS…D-501L…

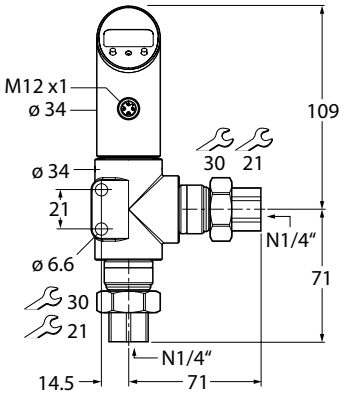


Fig. 2: Dimensions – PS…D-502L…

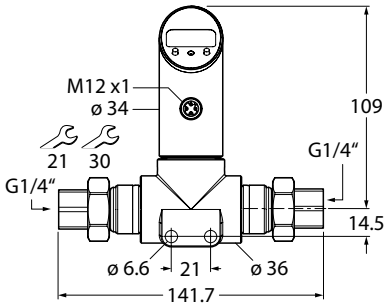


Fig. 3: Dimensions – PS…D-501T…

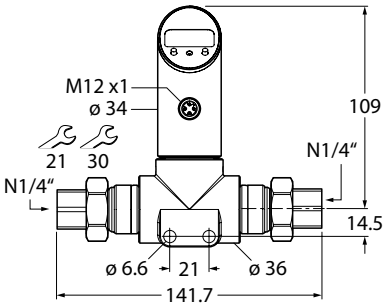


Fig. 4: Dimensions – PS…D-502T…

4.1.1 Operating elements

The devices are provided with three buttons for setting the device functions.

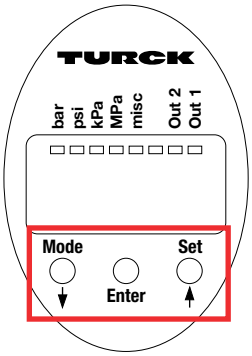


Fig. 5: Button

4.1.2 Indication elements

The devices have a 4-digit 7-segment display.

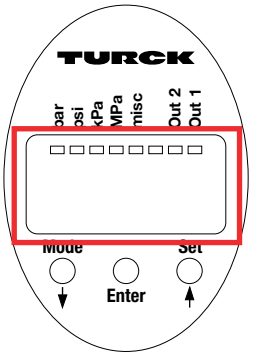


Fig. 6: Display

The following units can be displayed on the display:

Display	LED	Unit
bar	bar	bar
Psi	Psi	Psi
kPa	kPa	kPa
MPa	MPa	MPa
Ud1	misc	Millibar/hectopascal
Ud2	misc	mmHg (0 °)/Torr
Ud3	misc	inH_2O (68 °F)
Ud4	misc	inH_2O (39 °F)
Ud5	misc	ftH_2O (39 °F)
Ud6	misc	inHg (60 °F)
Ud7	misc	inHg (32 °F)
Ud8	misc	mH_2O (16 °C)
Ud9	misc	mH_2O (4 °C)
Ud10	misc	kg/cm^2

The units for the different measuring ranges can be shown as follows:

Measuring range (bar)	bar	psi	kPa	MPa	Ud1	Ud2	Ud3	Ud4	Ud5	Ud6	Ud7	Ud8	Ud9	Ud10
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
10	✓	✓	✓	✓	–	✓	✓	✓	✓	✓	✓	✓	✓	✓
16	✓	✓	✓	✓	–	–	✓	✓	✓	✓	✓	✓	✓	✓
25	✓	✓	✓	✓	–	–	–	–	✓	✓	✓	✓	✓	✓
40	✓	✓	✓	✓	–	–	–	–	✓	✓	✓	✓	✓	✓

4.2 Properties and features

- Process connection available either rigid or with a rotatable sensor head
- Reading of the set values without tools
- Programming protection via recessed push button and lock function
- Permanent display of the pressure unit (bar, psi, kPa, MPa, misc)
- Peak pressure memory
- Devices for different pressure ranges available

4.3 Operating principle

The differential pressure sensors of the PSD 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 signal.

4.4 Functions and operating modes

The devices detect the differential pressure between two measuring points. For this, the pressures are measured and compared with each other.

The pressure sensors are available as two different output variants:

Type	Output
PS…D…2UPN8X…	2 switching outputs (pnp/npn)
PS…D…LI2UPN8X…	1 switching output (pnp/npn) and 1 output switching (pnp/npn) or analog output (adjustable as current or voltage output)

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

4.4.1 Setting options

The devices offer two setting options:
- Setting via IO-Link
- Setting via the pushbuttons

4.4.2 Normal operation – Run mode

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

4.4.3 Menu mode

Pressing the Mode button switches the display to Menu mode. In this mode all parameters and the associated values can be read. A short press of the Set button displays the values of a parameter.

4.4.4 Programming mode

Programming mode enables the setting of all adjustable parameter values. A short press of the Set button displays the values of a parameter.

4.4.5 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 define 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.

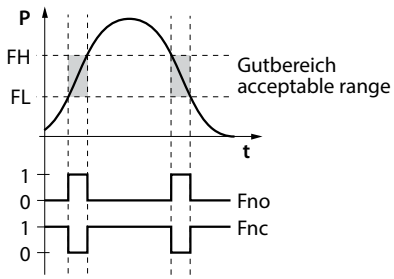


Fig. 7: Behavior of the switching output (window function)

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.

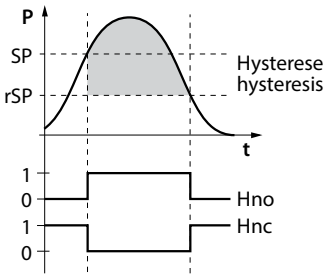


Fig. 8: Behavior of the switching output – Hysteresis function

4.4.6 Output functions – Analog output

The analog output of the PS…D…LI2UPN8X 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 20mA. The minimum distance between the start and end point is 10 % of the set measuring range.

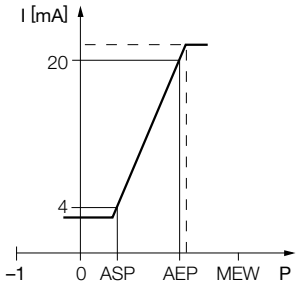


Fig. 9: Behavior of the current output (4… 20 mA)

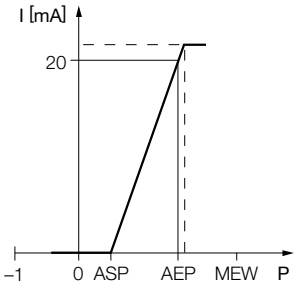


Fig. 10: Behavior of the current output (0…20 mA)

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.

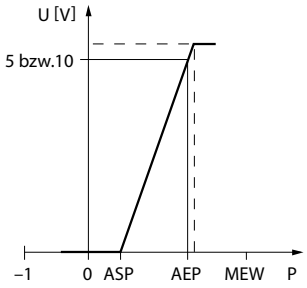


Fig. 11: Behavior of the voltage output (0…10 V or 0…5 V)

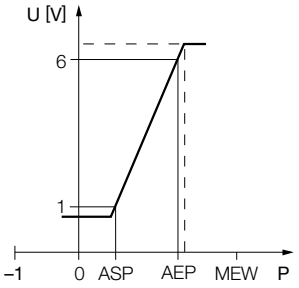


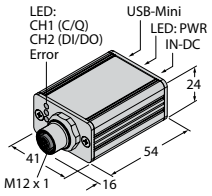
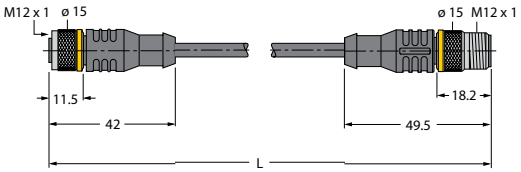
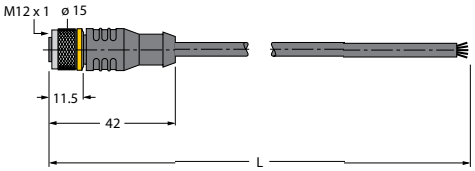
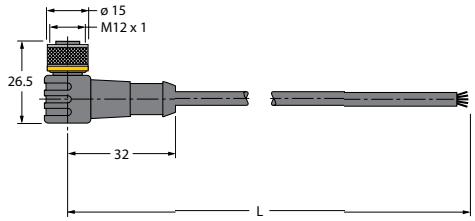
Fig. 12: Behavior of the voltage output (1…6 V)

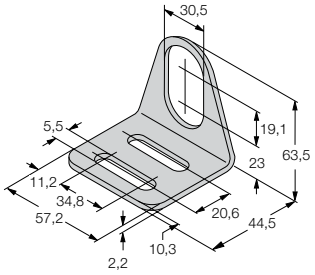
4.4.7 IO-Link operation

In IO-Link mode the device can be assigned parameters from a PC via IO-Link. In addition to manually settable functions, additional operating modes can be set via IO-Link. The IO-Link parameters are described in the IO-Link parameter manual. The sensor operates in COM2 mode at 38.4 kBaud.

4.5 Technical Accessories

The following accessories are supplied with the device:

Type name	Description	Figure
USB-2-IOL-0002	IO-Link adapter V1.1 with integrated USB interface	
RKC4.5T-2-RSC4.5T/TEL	Connection cable between sensor and USB-2-IOL-002, length 2 m	
RKC4.5-5T-2/TEL	Female connector, straight, with 2 m PVC cable, open end	
RKC4.5-5T-5/TEL	Female connector, straight, with 5 m PVC cable, open end	
RKC4.5-5T-10/TEL	Female connector, straight, with 10 m PVC cable, open end	
WKC4.5-5T-2/TEL	Female connector, angled, with 2 m PVC cable, open end	
WKC4.5-5T-5/TEL	Female connector, angled, with 5 m PVC cable, open end	
WKC4.5-5T-10/TEL	Female connector, angled, with 10 m PVC cable, open end	

Type name	Description	Figure
MW-30	Mounting bracket, stainless steel, for M30	

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

5 Mounting

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 Parameter setting instructions).

The sensors can be mounted in any direction. The maximum tightening torque is 20 Nm when the sensor is fastened. The housing can be rotated 320° when it is in a depressurized state.

➤ Depressurize 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.

6 Connection

➤ 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

Pin	Pin layout
1	+24 VDC
Pin 2)	Out 2
Pin 3	GND
Pin 4	Out 1/IO-Link

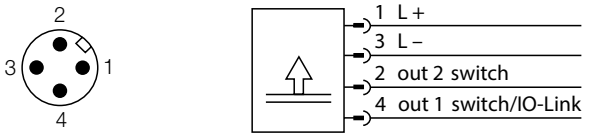


Fig. 13: Wiring diagram PS…D…2UPN…

Pin	Pin layout
1	+24 VDC
Pin 2)	Out 2/I_A/V_A
Pin 3	GND
Pin 4	Out 1/IO-Link

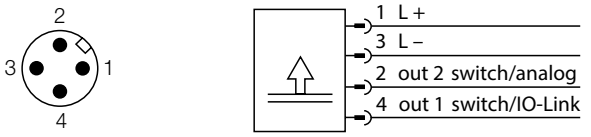


Fig. 14: Wiring diagram PS…D…LIUPN…

7 Commissioning

The device is operational automatically once the cables are connected and the power supply is switched on.

8 Operation

8.1 Display functions

Display	Meaning
Flashing	Value within the set measuring range, pressure more than 2 % below or above the set limits
OL	Value outside of the set measuring range, pressure more than 5 % of full scale above set limit
UL	Value outside of the set measuring range, pressure more than 5 % of full scale below set limit
SC1	Short circuit at output 1
SC2	Short circuit at output 2
SC12	Short circuit at both outputs
boot	EEPROM error

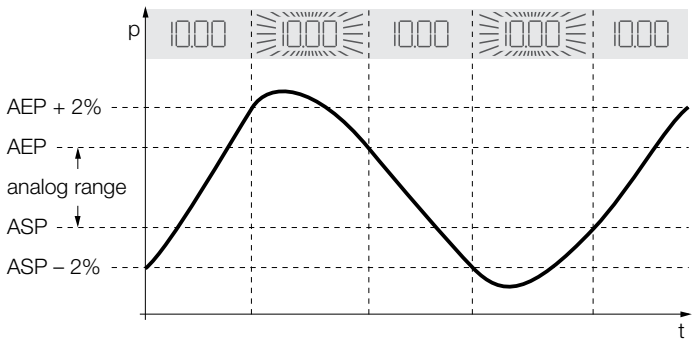


Fig. 15: Display – Value within the set measuring range

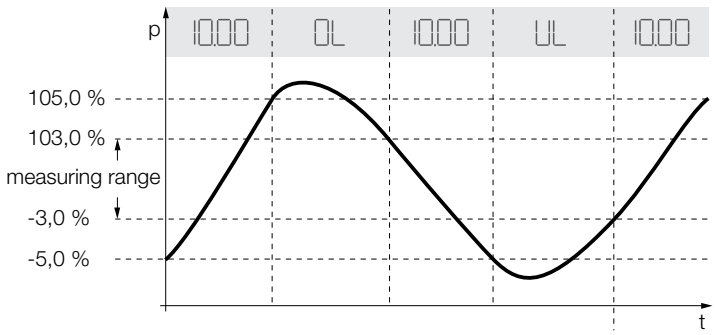


Fig. 16: Display – Value outside the set measuring range

9 Setting

The device can be assigned parameters as follows:

- Setting via pushbuttons
- Setting via IO-Link

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

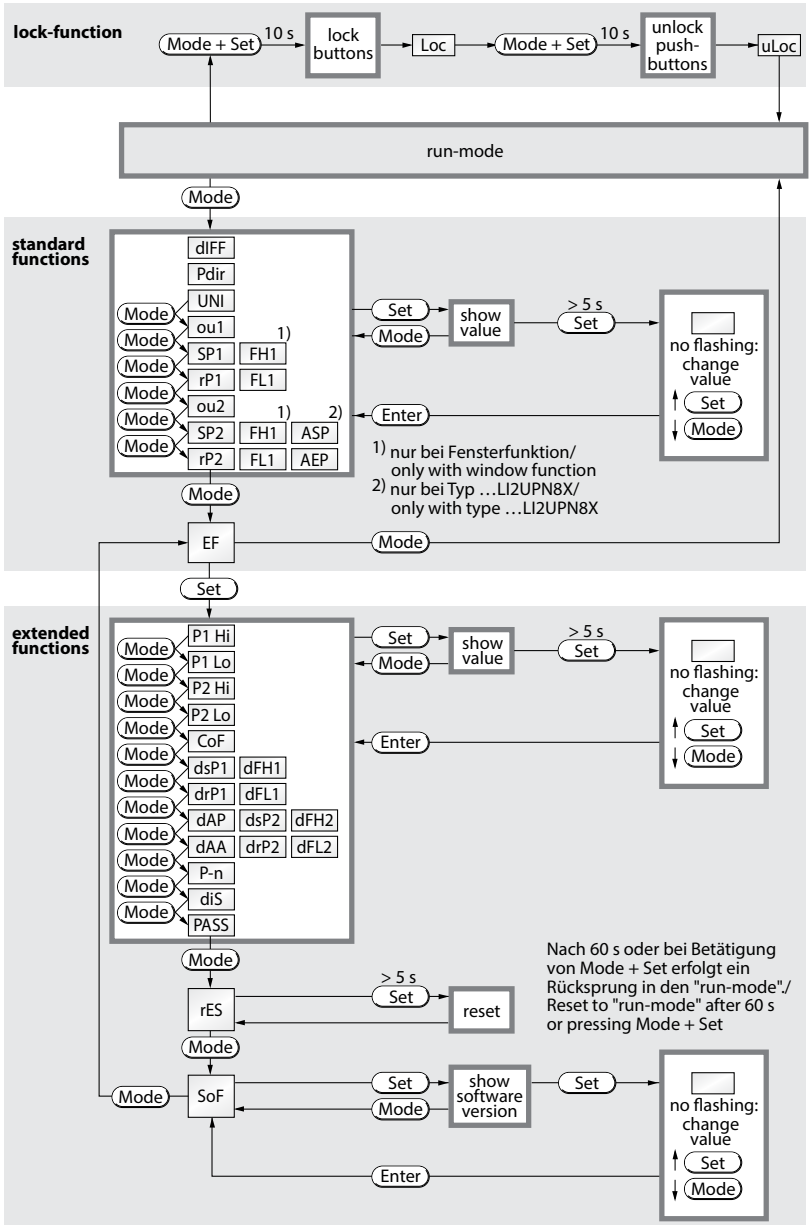


Fig. 17: Overview of the teach-in process

9.1 Setting via pushbuttons

The device is provided with 3 buttons for setting parameters.

- Mode/↓
- Enter
- Set/↑

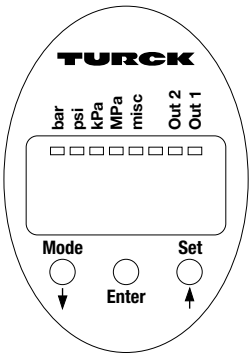


Fig. 18: Buttons on the device

9.1.1 Setting parameters via pushbuttons

➤ Press the Mode button until the required parameter appears in the display. The parameters are explained in the table below.
➤ Unlock the device if **Loc** is shown in the display.
➤ Displaying the parameter value: Press the Set button momentarily.
➤ Changing the displayed value: Press the Set button for at least 5 s until the display no longer flashes.
➤ Increase or decrease the value via the ↑ or ↓ button.
➤ Press Enter to save the modified value.

Parameters in the main menu

Default values are shown in **bold** type.

	Explanation	Options	Function
Loc	Locking of the programming menu		Programming menu is locked
uLoc	Unlocking of the programming menu		Programming menu is unlocked (default state)
diFF	Selection of the port pressure display	P1 P2 P1-P2 P2-P1	Pressure of Port 1 is shown on the display Pressure of Port 2 is shown on the display Differential pressure of Port 1 to Port 2 Differential pressure of Port 2 to Port 1
Pdir	Selection of high pressure (HI) connection	P1-2 P2-1	High pressure on P1, P2 = Low High pressure on P2, P1 = Low
Uni	Display unit	**bar** psi kPa MPa Ud1-Ud10	bar psi kPa MPa

	Explanation	Options	Function
ou1	Function of output 1	**Hno1**	Hysteresis function (NO contact)
		Hnc1	Hysteresis function (NC contact)
		Fno1	Window function (NO contact)
		Fnc1	Window function (NC contact)
SP1	Switch point 1 for hysteresis function		Upper limit value at which output 1 changes its switching state when the pressure increases, **Default: 50 % full scale:**
rP1	Reset switch point 1 for hysteresis function		Lower limit value at which output 1 changes its switching state when the pressure drops **Default: 25 % full scale:**
FH1	Upper switch point for window function		Upper switch point at which output 1 changes its switching state **Default: 50 % full scale:**
FL1	Lower switch point for window function		Lower switch point at which output 1 changes its switching state **Default: 25 % full scale:**
ou2	Function of output 2 (switching output)	**Hno2**	Hysteresis function (N/O = NO contact)
		Hnc2	Hysteresis function (N/C = NC contact)
		Fno2	Window function (N/O = NO contact)
		Fnc2	Window function (N/C = NC contact)
ou2	Current output	**4-20** 0-20	Rising line
		20-4 20-0	Falling line
ou2	Voltage output	0-10 0-5 1-6	Rising line
		10-0 5-0 6-1	Falling line
SP2	Switch point 2		Upper limit value at which output 2 changes its switching state when the pressure increases **Default: 50 % full scale:**
rP2	Reset point 2		Lower limit value at which output 2 changes its switching state when the pressure drops **Default: 25 % full scale:**
FH2	Upper switch point for window function		Upper switch point at which output 2 changes its switching state **Default: 50 % full scale:**
FL2	Lower switch point for window function		Lower switch point at which output 2 changes its switching state **Default: 25 % full scale:**
ASP	Start point of analog signal Only for type: …-LI2UPN8X		Pressure value at which the analog signal has its start point **Default: -1 (with measuring range 0…-1)** **Default: 0 (with all other measuring ranges)**
AEP	End point of analog signal Only for type: …-LI2UPN8X		Pressure value at which the analog signal has its end point **Default: End of measurement range**
EF	Submenu for additional setting options		Pressing the Set button enables you to carry out different additional settings in a submenu

Parameters in the EF submenu

	Explanation	Options	Function
P1Hi	Maximum value memory		The highest pressure is stored and can be displayed/deleted here. **Default: Peak value (max.)**
P1Lo	Minimum value memory		The lowest pressure is stored and can be displayed/deleted here. **Default: Peak value (min.)**
P2Hi	Maximum value memory		The highest pressure is stored and can be displayed/deleted here. **Default: Peak value (max.)**
P2Lo	Minimum value memory		The lowest pressure is stored and can be displayed/deleted here. **Default: Peak value (min.)**
CoF	Offset adjustment		Severe temperature changes in the environment of the sensor can cause the shifting of the zero point. This will result in the displayed measured value not being zero when the sensor is in a depressurized state. This drift can be corrected. Setting range: -5 to +5 % of the measuring range **Default: 0**
dSP1	Switch delay of SP1		Setting range: 0 to 50 s in 0.1 s steps (0 = delay time not active). **Default: 0.0**
drP1	Switch delay of rP1		Setting range: 0 to 50 s in 0.1 s steps (0 = delay time not active) **Default: 0.0**
dFH1	Switch delay of FH1		Setting range: 0 to 50 s in 0.1 s steps (0 = delay time not active), only available with window function Fno or Fnc **Default: 0.0**
dFL1	Switch delay of FL1		Setting range: 0 to 50 s in 0.1 s steps (0 = delay time not active), only available with window function Fno or Fnc **Default: 0.0**
dSP2	Switch delay of SP2		Setting range: 0 to 50 s in 0.1 s steps (0 = delay time not active). **Default: 0.0**
drP2	Switch delay of rP2		Setting range: 0 to 50 s in 0.1 s steps (0 = delay time not active). **Default: 0.0**
dFH2	Switch delay of FH2		Setting range: 0 to 50 s in 0.1 s steps (0 = delay time not active), only available with window function Fno or Fnc **Default: 0.0**
dFL2	Switch delay of FL2		Setting range: 0 to 50 s in 0.1 s steps (0 = delay time not active, only available with window function Fno or Fnc **Default: 0.0**
dAP	Damping of switching output (filter)		Momentary or high frequency pressure peaks can be filtered. 0 to 4 s in 0.01 s steps (**0 = filter is deactivated**)

	Explanation	Options	Function
dAA	Damping of the analog output Only for type: …LI2UPN8X (only displayed if Out2 is set as an analog output)		Momentary or high frequency pressure peaks can be filtered. 0 to 4 s in 0.01 s steps (**0 = delay time is deactivated**)
P-n	Behavior of the switching output	npn **pnp**	N-switching P-switching
diS	Display -measured value display	**50**	50 ms update time
		200	200 ms update time
		600	600 ms update time
		r50	50 ms update time/display rotated 180°
		r200	200 ms update time/display rotated 180°
		r600	600 ms update time/display rotated 180°
		Off	Measured value display deactivated. Pressing the Set button temporarily shows the measured value.
PASS	Password protection		Password is hexadecimal coded, 4-digit (default value "0000"). If the default value is set, no password is requested for unlocking
rES	Reset the parameters to the factory setting		
SOF	Software version	**Std** UdΠA	Change between Turck standard and VDMA menu

9.1.2 Locking and unlocking the pushbuttons

➤ Locking the buttons: Press the Mode and Set buttons simultaneously until **Loc** appears in the display.
➤ Unlocking the pushbuttons: Press the Mode and Set buttons simultaneously until **uLoc** appears in the display.
➤ If password protection is set, enter the password for unlocking: unlock buttons and set the password via Set and Mode button.
➤ Confirm the password with the Enter button.

9.2 Setting via IO-Link

The devices can be set via a PC with an FDT frame application (e.g. PACTware™) or via a controller.

For further information for setting the devices via IO-Link, refer to the IO-Link parameter manual and the IO-Link commissioning manual (D900063).

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 regularly that the plug connections and cables are 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

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/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	PSD 500
Pressure range	0…40 bar
Pressure type	Relative
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	± 1 % of range
Switching output	2 PNP/NPN, NC contact / NO contact, programmable
Accuracy/switch pnt.	± 1 % of range
Switching point distance	≥ 0.5 % of range
Switch point	(min + 0.005 x range) up to 100 % of range
Reset switch points	Min. up to (SP -0.005 x range)
Switching frequency	≤ 180 Hz
Operating voltage	15…30 VDC with 2 switching outputs 18…30 VDC with analog output SELV, PELV to EN 50178
No-load current I_0	≤ 50 mA
Temperature of medium	-40…85 °C
Ambient temp.	-40…80 °C
Storage temperature	-40…80 °C
T_K: – Zero point/10K – Range/10K	 ± 0.3 % ± 0.3 %
Voltage drop at I_e	≤ 2 V (150 mA) or ≤ 2.5 V (200 mA)
Burst protection	Pat. Medium stop
Short-circuit protection	Yes
Reverse polarity protection	Yes
Rated operational current	200 mA
Degree of protection	IP67
Protection class	III
EMC	
EN 61000-4-2	ESD: 4 KV CD/8 KV AD
EN 61000-4-3	HF radiated: 15 V/m
EN 61000-4-4	Burst: 2 KV
EN 61000-4-5	Surge: 1 kV, 42 Ω
EN 61000-4-6	HF line conducted: 10 V
Housing material	Stainless steel 1.4305 (AISI 303)
Pressure module	Ceramic Al_2O_3
Materials with medium-contact	FPM, 1.4305 (AISI 303) ceramic Al_2O_3

Type code	PSD 500
Pressure connection with tightening torque	SW21, max. 50 Nm
Coupling nut with tightening torque	SW30, max. 35 Nm
Diaphragm seal attachment	No
Rotatable display	180°
Sensor body adjustable	320°
Vibration resistance	20 g (10…2000 Hz) per IEC 60068-2-6
Shock resistance	50 x g (11 ms) per IEC 60068-2-27
Connection	Male connector M12 x 1
Type of display	4-digit 7-segment display
Number of programming buttons	3

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