Your Global Automation Partner

TURCK

LRS510...
Radar Level Sensors

Instructions for Use

Contents

1 About These Instructions

These instructions for use 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 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 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
- Commissioning manual IO-Link devices
- IO-Link parameters manual
- EU Declaration of Conformity (current version)
- Approvals

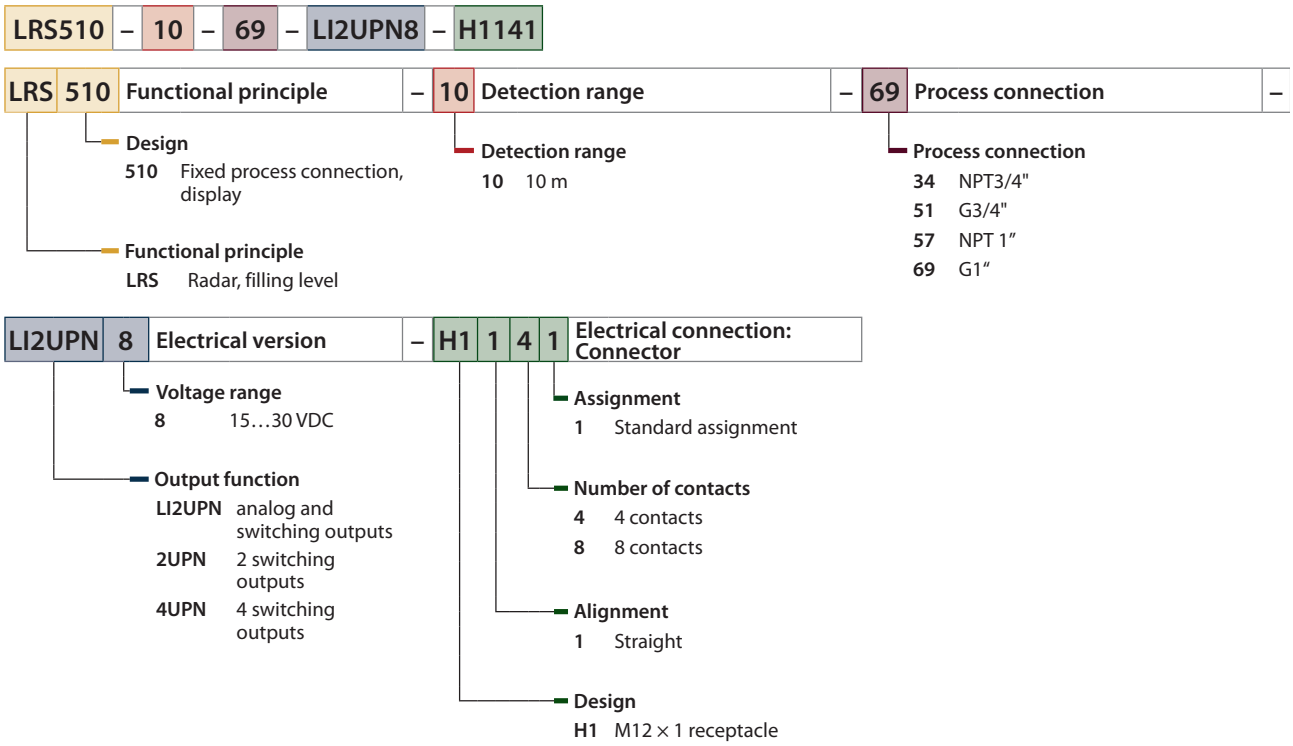
1.4 Feedback about these instructions

We make every effort to ensure that these instructions are as informative and as clear as possible. If you have any suggestions for improving the design or if some information is missing in the document, please send your suggestions to **techdoc@turck.com**.

2 Notes on the Product

2.1 Product identification

These instructions apply to the following radar level sensors:



2.2 Scope of delivery

- Radar level sensor
- Quick Start Guide
- LRS510-51… and LRS510-69…: Sealing ring made from passivated steel with NBR seal

2.3 Legal requirements

The devices are subject to the following EU directives:

- 2014/30/EU (electromagnetic compatibility)
- 2011/65/EU (RoHS directive)
- 2014/53/EU (RED Directive)

2.4 Turck service

Turck supports you with your projects, from initial analysis to the commissioning of your application. The Turck product database under www.turck.com contains software tools for programming, configuration or commissioning, data sheets and CAD files in numerous export formats.

The contact details of Turck subsidiaries worldwide can be found on p. [▷ 46].

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 LRS510… radar level sensors monitor the levels of liquid media. The sensors are pressure and vacuum proof in accordance with the specifications on the data sheet.

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 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 transmission output of the sensor is within the approved limit values specified in ETSI EN 305550-2 and FCC/CFR. 47 Part 15.
- Only operate the device within the limits stated in the technical specifications.

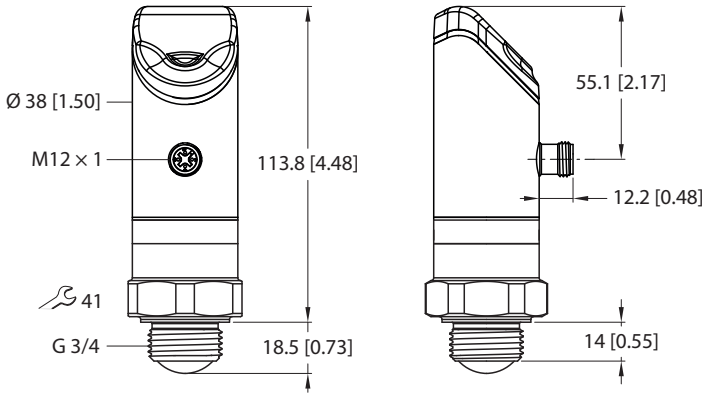
4 Product Description

The radar level sensors of the LRS510… series are contained in a metal housing and are provided with different standard process connections. The sensor head can be rotated by 340° after installation. The devices are provided with a metal-bodied M12 connector for connecting the sensor cable. The process values are shown on the display. The device functions can be set via touch pads or via IO-Link.

Devices with the following output functions are available:

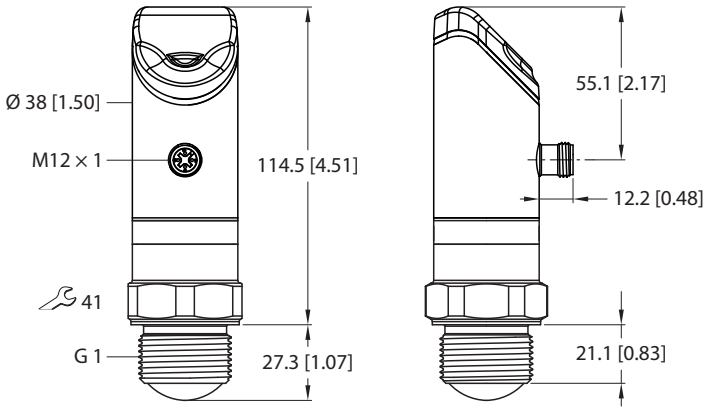
- LRS510-…-2UPN8…: 2 switching outputs (PNP/NPN/Auto)
- LRS510-…-4UPN8…: 4 switching outputs (PNP/NPN/Auto)
- LRS510-…-LI2UPN8…: 1 switching output (PNP/NPN/Auto) as well as 1 switching output (PNP/NPN/Auto) or 1 analog output (I/U/Auto)

4.1 Device overview



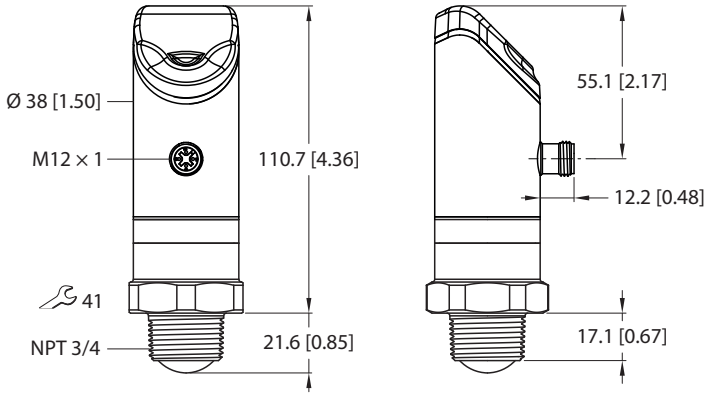
mm [Inch]

Fig. 1: Dimensions LRS510-…51…



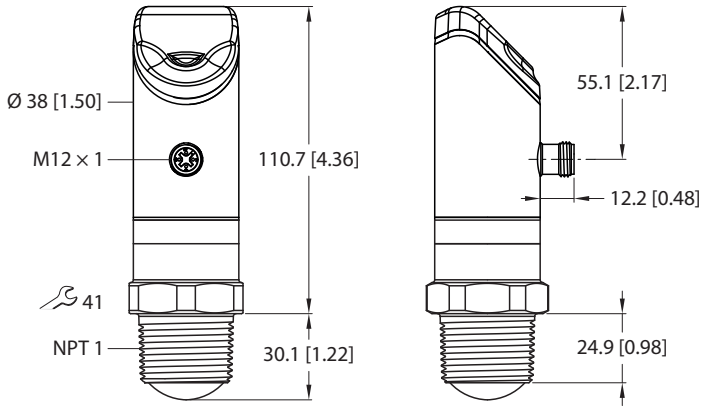
mm [Inch]

Fig. 2: Dimensions LRS510-…69…



mm [Inch]

Fig. 3: Dimensions LRS510-…34…



mm [Inch]

Fig. 4: Dimensions LRS510-…57…

4.2 Properties and features

- Range: 10 m
- Blind zone: 35 cm
- Resolution: 1 mm
- Distance, level, volume or % output
- Approved in accordance with ETSI 305550-2
- Approved in accordance with FCC/CFR. 47 Part 15
- 4-digit, 2-color, 12-segment display, rotatable by 180°
- Housing rotatable after mounting the process connection
- Process connection G3/4", G1/2", NPT3/4" or NPT1"
- NO/NC programmable
- Transmission of process values and parameterization via IO-Link
- Pressure resistance 0…16 bar

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 FMCW radar (frequency modulated continuous wave) measures the distance to stationary objects.

The sensor outputs a radar signal that changes in frequency. A periodic, linear frequency which varies upwards and downwards is used to limit the frequency range and to simplify the signal evaluation. The rate of change df/dt of frequency remains constant. Objects in the detection range reflect the transmitted signal. The change in the signal delay and frequency of the reflected signal are used to determine the distance to the object.

The frequency modulated continuous wave radar therefore has a clear advantage over the unmodulated continuous wave radar, which cannot detect distances.

4.5 Functions and operating modes

4.5.1 Setting options

The devices feature the following three setting options:

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

4.5.2 Normal operation – run mode

The device detects the distance to the surface of the medium and shows the required switching or analog behavior according to the factory set or customer-specific parameters. The measured distance to the medium is shown in the display. The selected unit and the status of the existing switching outputs are indicated via LEDs.

4.5.3 Programming mode

If the sensor is unlocked, the display switches to Programming mode after the [MODE] touchpad is pressed. All parameters and their associated values can be read and modified in Programming mode. A short press of the [ENTER] touchpad displays the values of a parameter. The [MODE] and [SET] touchpads are used to navigate in Programming mode.

4.5.4 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 measuring range. If the upper limit value is changed, the lower limit value is automatically adjusted.

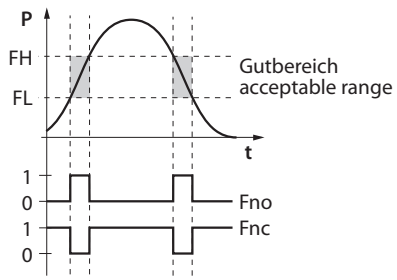


Fig. 5: Behavior of the switching output – window function

Hysteresis function

The hysteresis function is used to teach in a stable switching state that is not affected by system-related fluctuations and the defined setpoint. The switching range is defined with a switching point and a reset point. The minimum hysteresis is 0.5 % of the measuring range. If the switching point is changed, the reset point is automatically adjusted.

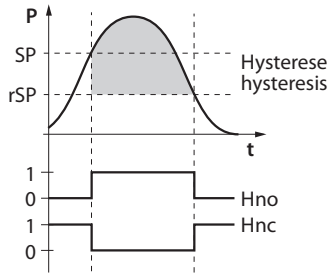


Fig. 6: Behavior of the switching output – hysteresis function

4.5.5 Output functions – analog output

The analog output of the LRS…LI2UPN8 sensors can be set as either a current or voltage output. The measuring range can be defined as required.

The minimum distance between the start and end point is 500 mm.

Current output

In the defined measuring range between ASP (analog start point) and AEP (analog end point), the device supplies an analog current signal. The following output configurations can be set:

- 4…20 mA (factory setting)
- 0…20 mA
- 20…4 mA
- 20…0 mA

Voltage output

In the defined measuring range between ASP (analog start point) and AEP (analog end point), the device supplies an analog voltage signal. The following output configurations can be set:

- 0…10 V (factory setting)
- 0…5 V
- 1…6 V
- 0.5…4.5 V
- 10…0 V
- 5…0 V
- 6…1 V

4.5.6 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.

4.5.7 SIO mode (standard I/O mode)

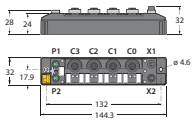
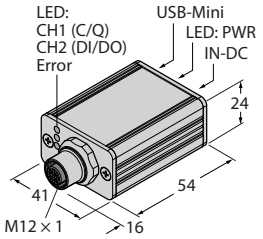
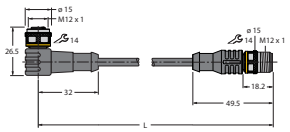
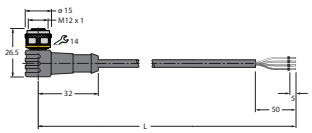
In standard I/O mode no IO-Link communication takes place between the device and the master. The device only transfers the switching state of its binary outputs and can also be run via a fieldbus device or controller with digital PNP or NPN inputs. An IO-Link master is not required for operation.

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

4.5.8 Auto sensing function

When connected to an I/O module, the auto sensing function enables the device to support the set switching output behavior (PNP/NPN) or analog output characteristics. The auto sensing functions are activated by default.

4.6 Technical accessories

Figure	Type	Description
	TBEN-S2-4IOL	Compact multiprotocol I/O module for Ethernet, 4 IO-Link master channels, 4 universal digital PNP channels, 0.5 A, channel diagnostics
	USB-2-IOL-0002	IO-Link adapter V1.1 with integrated USB interface
	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, black; cULus approval
	WKC4.4T-2/TXL	Connection cable, M12 female connector, angled, 4-pin, cable length: 2 m, sheathing material: PUR, black; cULus approval

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

5 Installing

The lens curvature does not have to be taken into account for the installation. The sensor detects the surface of the medium nearest to the sensor and outputs the distance. Object reflections can be filtered out using the sensor parameters.

The sensors can be installed in any alignment according to application requirements. The radar wave propagates perpendicular to the surface of the radar lens with an opening angle of ±3°. The display of the unit can be rotated by 180° (see parameter DiSr). The maximum tightening torque for fastening the sensors is 45 Nm.

Multiple radar sensors can be mounted directly next to each other without the risk of any mutual interaction between the devices.

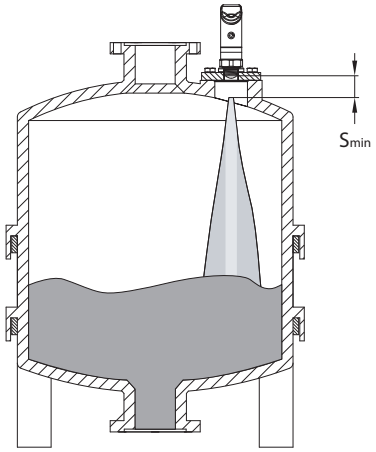


Fig. 7: Installing LRS510…

- ▶ Install the sensor at the intended mounting location. Observe blind zone s_{min}, in which no object detection is possible.
- ▶ For optimum operation, install the sensor in such a way that no foreign objects are located in the detection range.
- ▶ Install the sensor so that the limits of the detection range are not located on a container wall.
- ▶ Use short connection pieces to ensure unhindered signal propagation in the short range (see range diagrams).
- ▶ To prevent any disturbance signals do not direct the filling stream of the media through the detection range of the sensor.

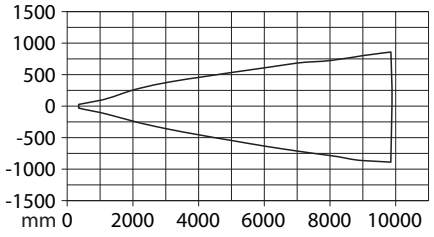


Fig. 8: LRS510-…-34-…, LRS510-…-51-… range diagram

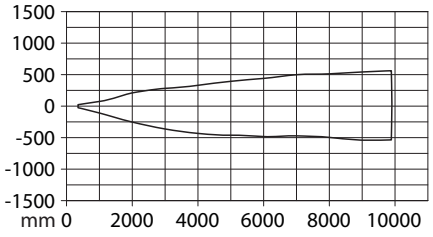


Fig. 9: LRS510-…-57-…, LRS510-…-69-… range diagram

- ▶ Optional: Rotate the sensor head within the 340° range to align the connection to the I/O level as well as to ensure optimum operability and readability.

6 Connection

NOTE
The device must be provided with an SELV/PELV power supply compliant with a limited energy circuit in accordance with UL61010-1 3rd Edition (IEC/EN 61010-1).

- 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

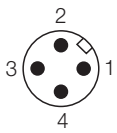


Fig. 10: LRS…LI2UPN pin layout

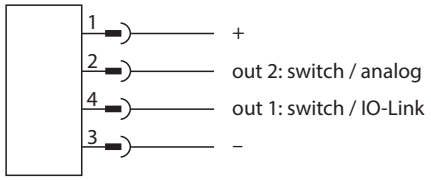


Fig. 11: LRS…LI2UPN wiring diagram

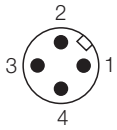


Fig. 12: LRS…2UPN… pin layout

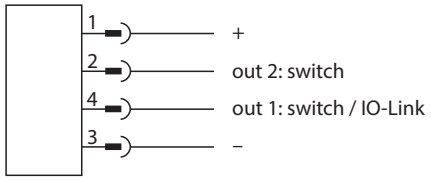


Fig. 13: LRS…2UPN... wiring diagram

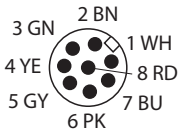


Fig. 14: LRS…4UPN… pin layout

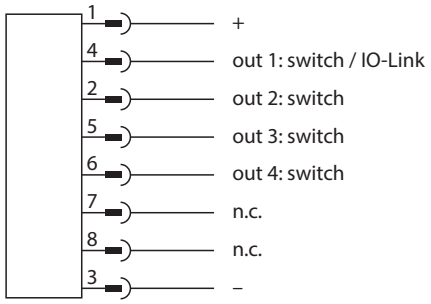


Fig. 15: LRS…4UPN wiring diagram

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7 Commissioning

After connecting and switching on the power supply, the device is automatically ready for operation.

8 Operation

8.1 LEDs – operation

LED	Indication	Meaning
PWR	Green	Device is operational
	Green flashing	IO-Link communication
FLT	Red	Error
DST	Green	Distance between the sensor and the surface in % or selected unit
LVL	Green	Level display in % or selected unit
VOL	Green	Filling volume in % or selected unit
SSI	Yellow flashing (1 Hz)	Signal strength ≤ 20 %
	Yellow flashing (2 Hz)	Signal strength > 20 % ≤ 40 %
	Yellow flashing (4 Hz)	Signal strength > 40 % ≤ 60 %
	Yellow	Signal strength > 60 % ≤ 80 %
	Green	Signal strength > 80 %
PCT	Off	Display of the selected unit
	Green	Displayed in %
LOC	Yellow	Device locked
	Yellow flashing	“Lock/unlock” process active
	Off	Device unlocked
I	Yellow	Switching output 1 active
II	Yellow	Switching output 2 active

8.2 Display indications

Display	Meaning
d-OR	Value not displayable (> 9999)
d-UR	Value not displayable (< -1999)
Err	Unspecified, internal error
ErrG	Incorrect geometrical information on the dimensions of the medium container
ErrL	Burden at the analog output outside of the permissible range
ErrT	No object detected
SC	Short circuit
Loc	Device locked
uLoc	Device unlocked
- - - -	Sensor failure

9 Setting and Parameterization

9.1 Settable functions and features

Setting options via touchpads and IO-Link interface

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

- Locking/unlocking the device
- Window function
- Hysteresis function
- Analog range
- Advanced settings: Reset to the previous settings (presettings)
- Advanced settings: Resetting to factory settings
- Advanced settings: Measured variable and unit
- Advanced settings: Container geometry
- Advanced settings: Minimum and maximum value memory
- Advanced settings: Display color and behavior
- Advanced settings: Password setting

Other setting options via IO-Link

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

- OUT1 output configuration for SIO mode: PNP/NPN, automatic detection on/off
- OUT2 output configuration for SIO mode: PNP/NPN, automatic detection on/off
- Setting display units for IO-Link mode: metric, imperial
- Lock data storage on IO-Link master
- Fully lock user interface (display and touchpads locked)
- Lock parameters (parameters are displayed but cannot be changed)
- Operating hours counters including warning limits

Auto sensing function

When connected to an I/O module, the auto sensing function enables the device to support the set switching output behavior (PNP/NPN) or analog output characteristics. The auto sensing functions are activated by default.

9.2 Setting via touchpads

Use the [MODE] or [SET] touchpads to navigate through the main menu and the EF extended functions menu. A Turck-specific default menu guidance as well as a VDMA menu can be selected. The menu guidance can be set via the **SoF** parameter.

9.2.1 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.

9.2.2 Unlocking the device

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

9.2.3 Standard menu – overview

Standard menu guidance – main menu

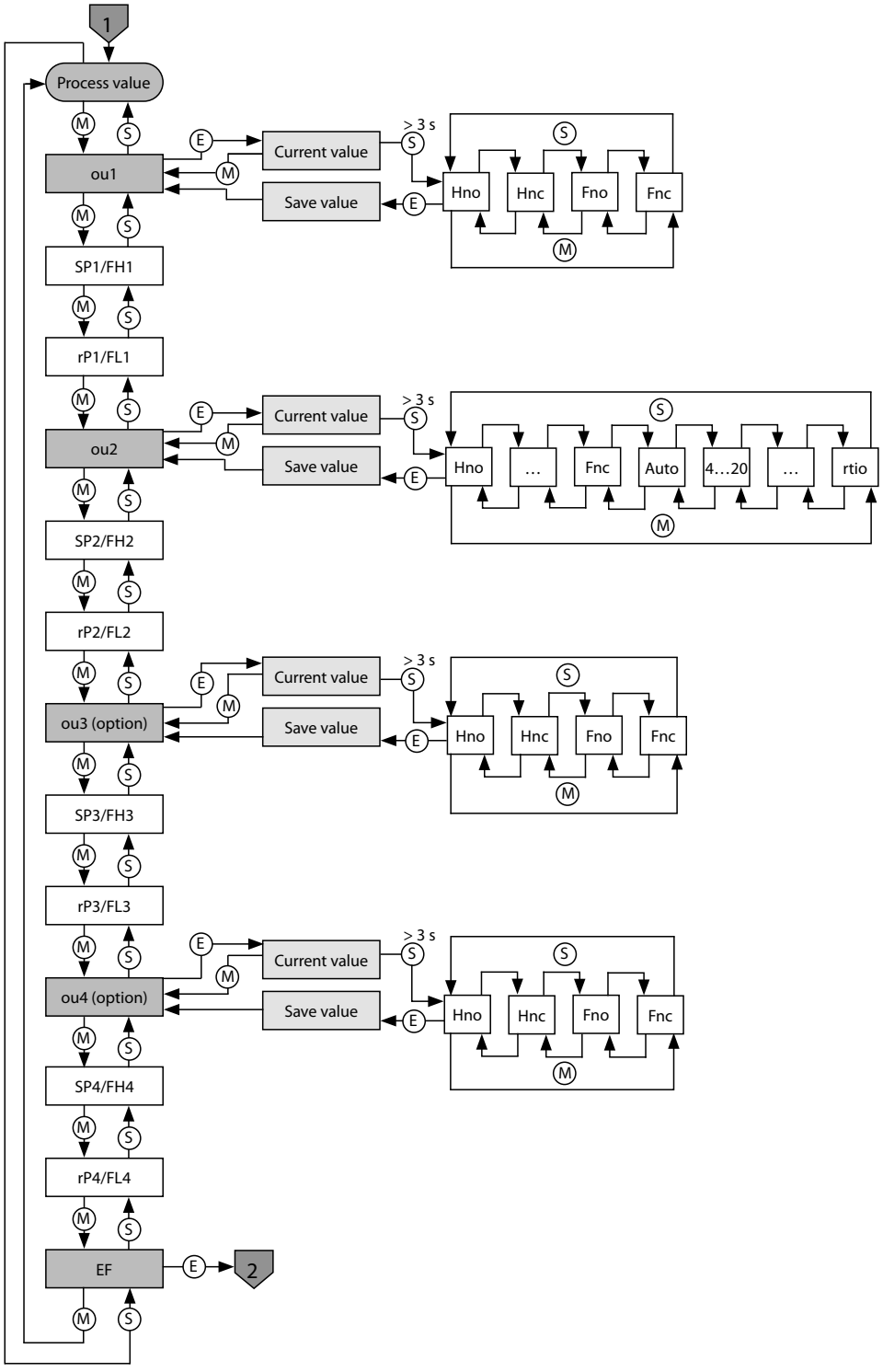

Fig. 16: Main menu

Standard menu guidance – EF extended functions menu

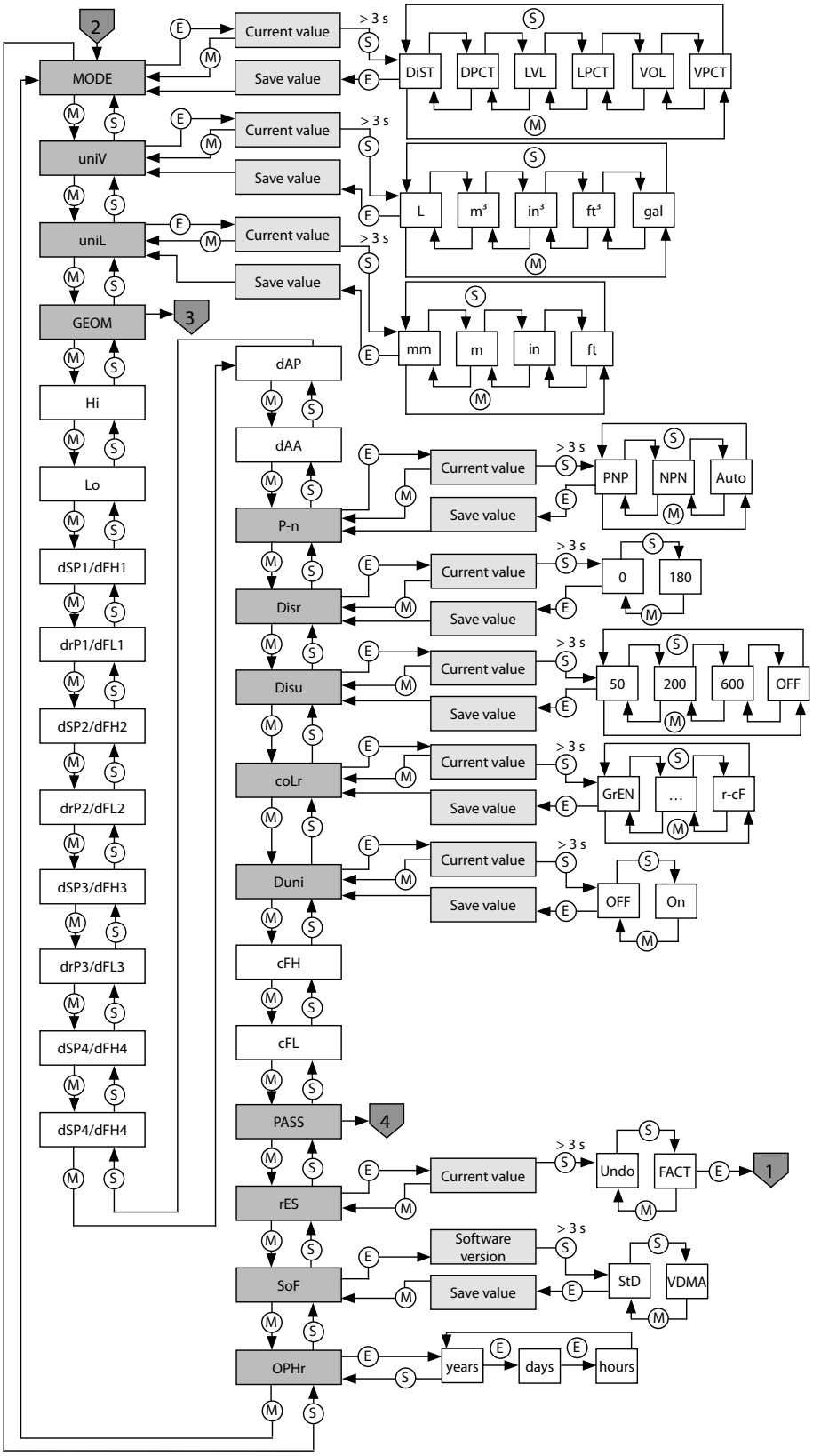

Fig. 17: EF extended functions menu

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9.2.4 VDMA menu – overview

VDMA menu – main menu

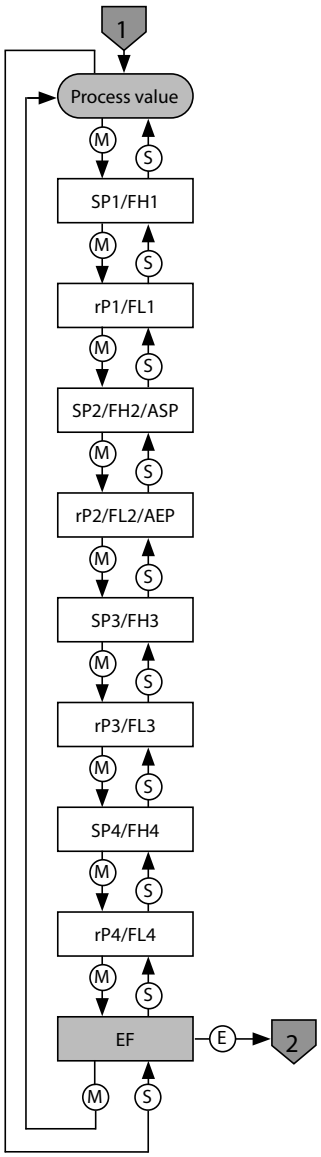

Fig. 18: VDMA main menu

VDMA menu – EF extended functions menu

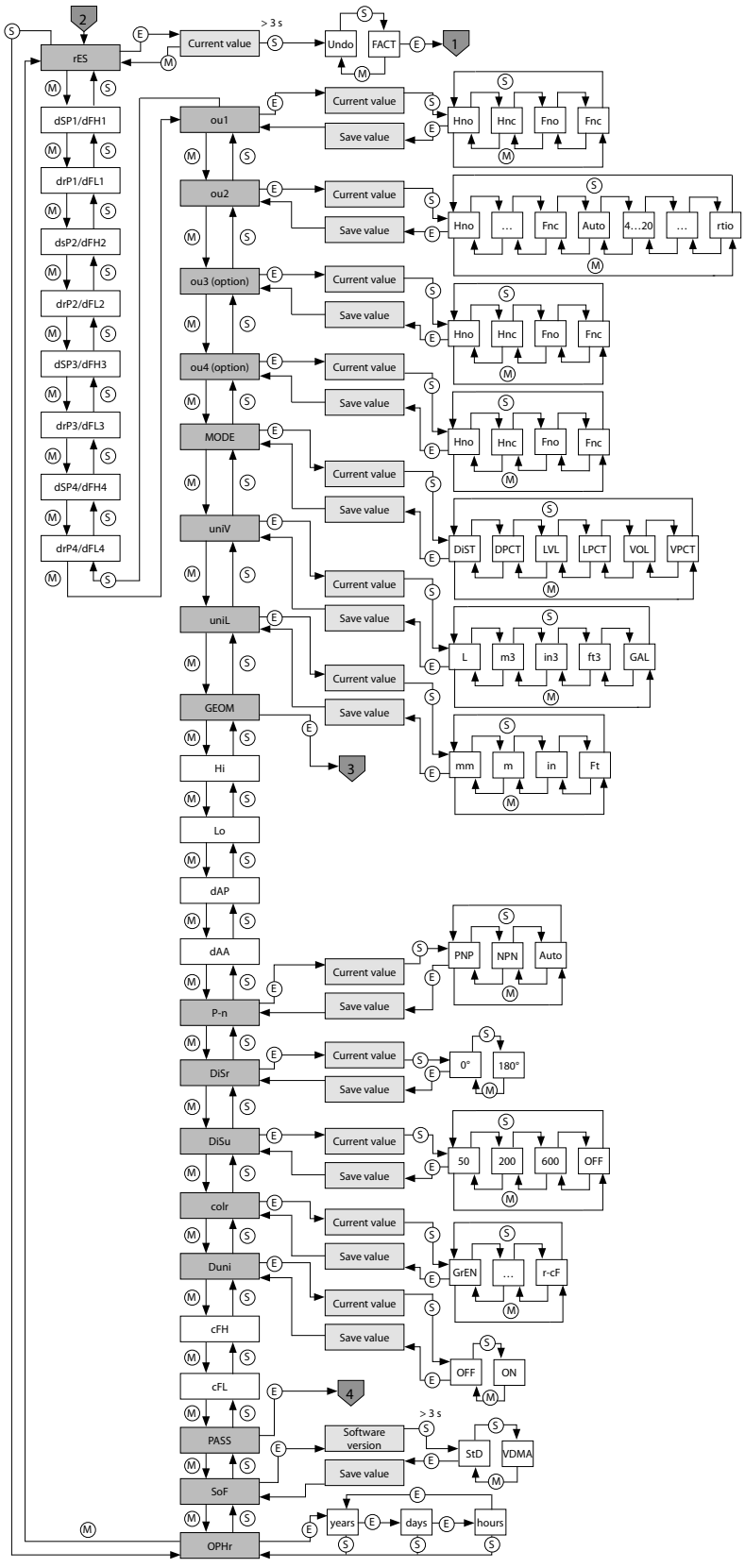

Fig. 19: VDMA EF extended functions menu

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9.2.5 Setting parameter values via touchpads

Turck standard menu

- 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] in order to return to parameter selection.
- Increase or decrease the value incrementally via [MODE] or [SET]. Certain values can be changed by continuously touching [MODE] or [SET].
- Touch [ENTER] to save the modified value. The saved value flashes twice.

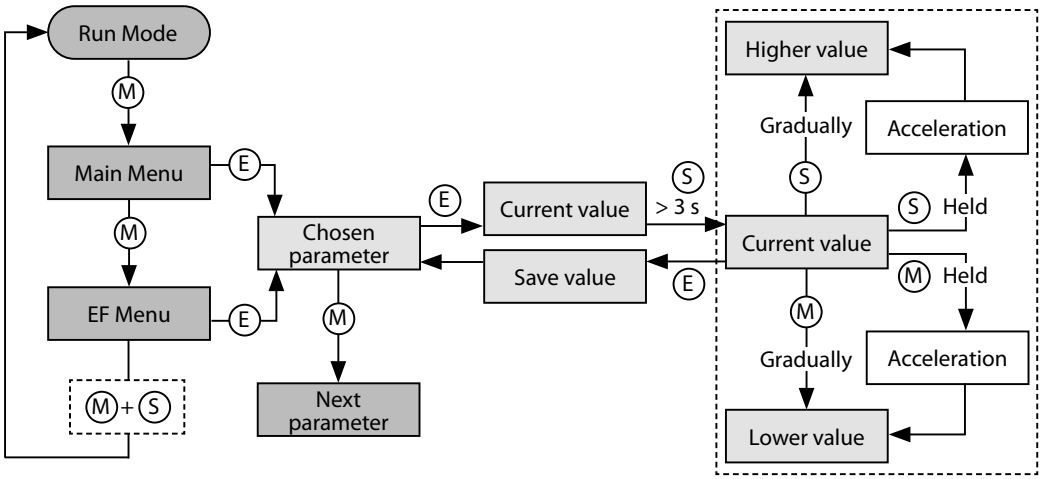

Fig. 20: Setting parameter values

VDMA menu

- 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.
- Increase or decrease the value incrementally via [MODE] or [SET]. Certain values can be changed by continuously touching [MODE] or [SET].
- Touch [ENTER] to save the modified value. The saved value flashes twice.

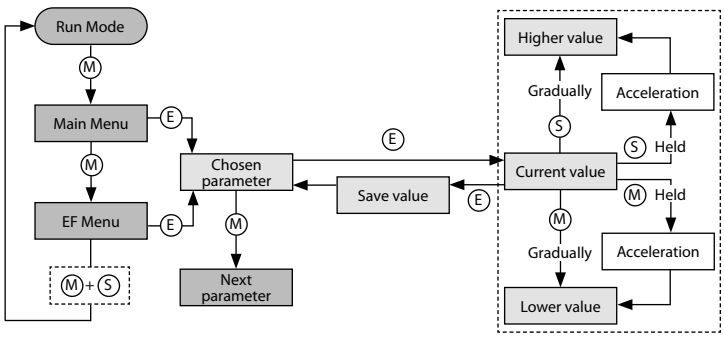

Fig. 21: Setting parameter values

9.2.6 Setting parameter values via touchpads – GEOM menu

- Touch [ENTER]: The next parameter is displayed.
- Touch [ENTER]: The parameter value is displayed.
- 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 stored value flashes twice and the next parameter is displayed.

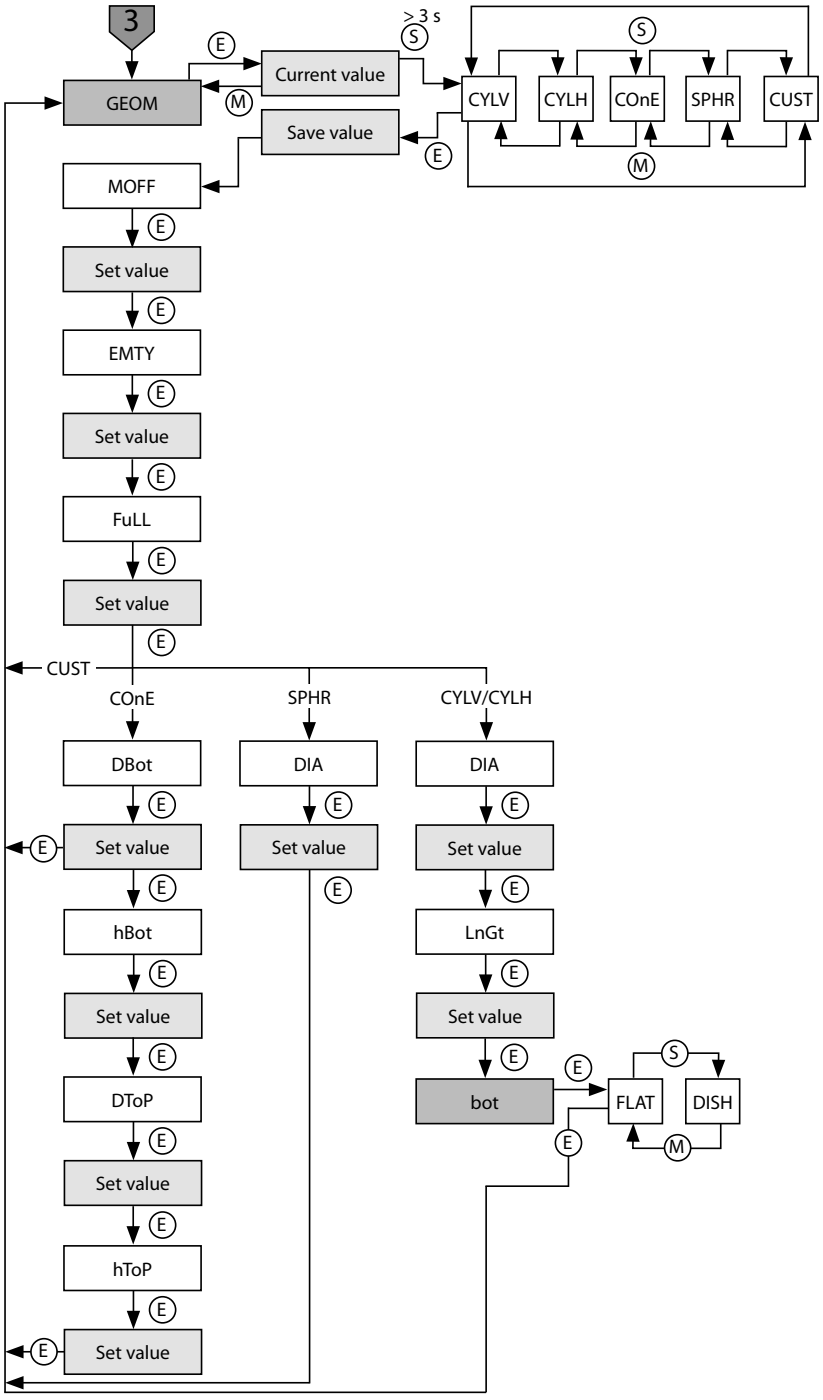

Fig. 22: GEOM menu

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9.2.7 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.

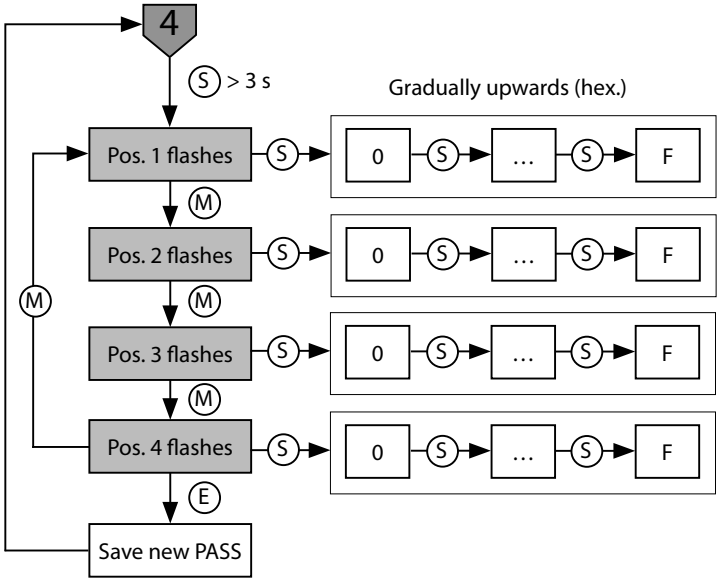

Fig. 23: Password setting

9.2.8 Parameters in the main menu

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

	Explanation	Options	Function
ou1	Function of output 1	**Hno**	Hysteresis function (NO = NO contact)
		Hnc	Hysteresis function (NC = NC contact)
		Fno	Window function (NO = NO contact)
		Fnc	Window function (NC = NC contact)
SP1…SP4	Switching point 1...4 for hysteresis function ou1…ou4: Hno/Hnc		Upper level at which the outputs 1…4 change their switching state **Default: 50 % of the detection range**
rP1…rP4	Reset switching point 1...4 for hysteresis function ou1…ou4: Hno/Hnc		Lower level at which the outputs 1…4 change their switching state **Default: 75 % of the detection range**
FH1…FH4	Upper switching point for window function ou1…ou4: Fno/Fnc		Upper switching point at which outputs 1…4 change their switching status **Default: 50 % of the detection range**
FL1…FL4	Lower switching point for window function ou1…ou4: Fno/Fnc		Lower switching point at which outputs 1…4 change their switching status **Default: 75 % of the detection range**
ou2	Function of output 2	**Hno**	Hysteresis function (NO = NO contact)
		Hnc	Hysteresis function (NC = NC contact)
		Fno	Window function (NO = NO contact)
		Fnc	Window function (NC = NC contact)
	Analog output	**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
		rtio	0.5…4.5 V
ASP	Start point of the analog signal ou2: Auto/analog values/rtio		Measured value at which the analog output signal has its start point **Default: Min. detection distance**
AEP	End point of the analog signal ou2: Auto/analog values/rtio		Measured value at which the analog output signal has its end point **Default: Max. detection distance**
ou3	Function of output 3	**Hno**	Hysteresis function (NO = NO contact)
		Hnc	Hysteresis function (NC = NC contact)
		Fno	Window function (NO = NO contact)
		Fnc	Window function (NC = NC contact)

	Explanation	Options	Function
ou4	Function of output 4	**Hno**	Hysteresis function (NO = NO contact)
		Hnc	Hysteresis function (NC = NC contact)
		Fno	Window function (NO = NO contact)
		Fnc	Window function (NC = NC contact)
EF	Submenu for additional setting options		See table “Parameters in the EF submenu”

9.2.9 Parameters in the EF submenu (Extended Functions)

	Explanation	Options	Function
MODE	Measured variable	**DIST**	Distance to the sensor
		DPCT	Distance to the sensor in % (scaled to Full-EMTY)
		LVL	Level
		LPCT	Level in % (scaled to FuLL-EMTY)
		VOL	Volume
		VPCT	Volume in % (scaled to FuLL-EMTY)
uniV	Volume unit	**A**	Liter
		m^3	Cubic meters
		in^3	Cubic inch
		ft^3	Cubic foot
		gal	Gallons
uniL	Unit of length	mm	Millimeters
		m	Meters
		in	Inches
		ft	Feet
GEOM	Geometry submenu		For additional setting options for the container geometry, see the Parameters in the GEOM submenu table
Hi	Maximum value memory		The highest level is stored and can be displayed/ deleted (hold down [SET]).
Lo	Minimum value memory		The lowest level is stored and can be displayed/ deleted (hold down [SET]).
dSP1… dSP4	Switch delay of SP1…SP4		0…60 s in increments of 0.1 s (0 = delay time not active) **Default: 0.0**
drP1…drP4	Switch delay of rP1…rP4		0…60 s in increments of 0.1 s (0 = delay time not active) **Default: 0.0**
dFH1… dFH4	Switch delay of FH1…FH4		0…60 s in increments of 0.1 s (0 = delay time not active), only available with window mode Fno or Fnc **Default: 0.0**
dFL1…dFL4	Switch delay of FL1…FL4		0…60 s in increments of 0.1 s (0 = delay time not active), only available with window mode Fno or Fnc **Default: 0.0**
dAP	Damping of switching output (filter)		Filter for momentary or high frequency measurement peaks: 0…8 s in increments of 0.01 s (0 = filter is deactivated) **Default: 0.0**
dAA	Damping of analog output		Filter for momentary or high frequency measurement peaks: 0…8 s in increments of 0.01 s (0 = filter is deactivated) **Default: 0.0**
P-n	Behavior of the switching output	**Auto**	Automatic detection (NPN/PNP)
		NPN	N switching
		pnp	P switching

	Explanation	Options	Function
diSr	Display orientation	**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**	Always green
		rEd	Always red
		G1ou	Green if ou1 is switched, otherwise red
		r1ou	Red if ou1 is switched, otherwise green
		G2ou	Green if ou2 is switched, otherwise red
		r2ou	Red if ou2 is switched, otherwise green
		G-cF	Green if the measured value is between switching points cFL and cFH
		r-cF	Red if the measured value is between switching points cFL and cFH
Duni	Display of measured value and unit		Measured value and unit are displayed alternately (measured value: 4 s, unit: 1 s)
		Off	Unit is not displayed.
		ON	Unit is displayed.
cFH	Virtual upper switching point		Upper switching point at which the display changes color (if display color G-cF or r-cF is selected) **(default in distance mode: 0.5 × measuring range)**
cFL	Virtual lower switching point		Lower switching point at which the display changes color (if display color G-cF or r-cF is selected) **(default in distance mode: 0.75 × measuring range)**
PASS	Password protection		Define password and activate password protection
		0000	No password
rES	Reset	FacT	Reset the parameters to the factory settings
		Undo	Reset the parameters to previous settings (last device start)
SOF	Soft menu version	**StD**	Standard menu guidance
		VDMA	VDMA menu guidance
OPHr	Operating hours counter		Display of operating hours in years (y), days (d) and hours (h)

9.2.10 Parameters in the GEOM submenu (geometry)

The following two diagrams show the settable parameters depending on different tank forms.

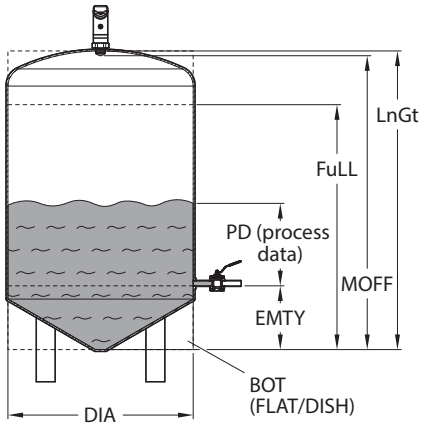

Fig. 24: Parameters – vertical cylinder

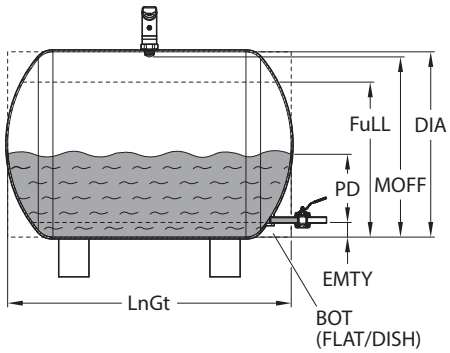

Fig. 25: Parameters – horizontal cylinder

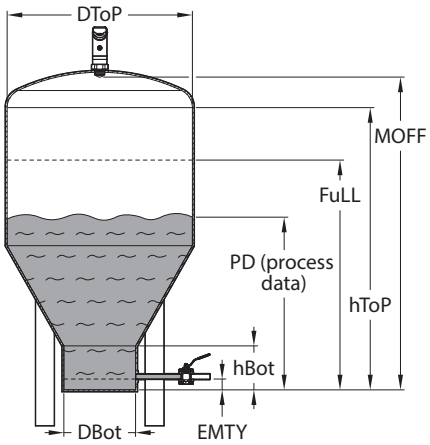

Fig. 26: Parameters – conical container

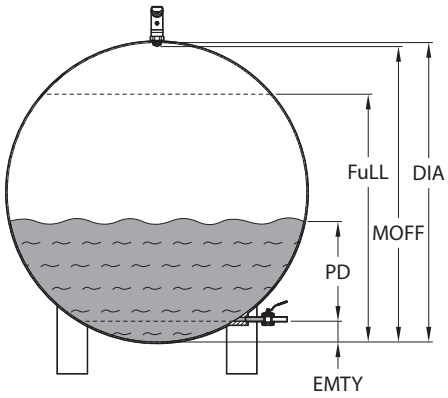

Fig. 27: Parameters – spherical container

	Explanation	Options	Function
GEOM	Container shape	**CYLV**	Vertical cylinder
		CYLH	Horizontal cylinder
		COnE	Conical container
		SPHR	Spherical container
		CUST	Customized
MOFF	Sensor position		Mounting offset of the sensor (threaded end to container bottom) **Default: Detection range**
EMTY	Lowest level (DPCT, LVL, LPCT, VOL, VPCT)		Measured from container bottom (MOFF - EMTY ≤ s_max.) **Default: 0**
FuLL	Highest level (DPCT, LVL, LPCT, VOL, VPCT)		Measured from container bottom (MOFF - FuLL ≥ s_min, FuLL - EMTY > a_min) **Default: Measuring range minus blind zone**
DIA	Container diameter (CYLV, CYLH, SPHR)		Diameter of cylindrical and spherical containers; DIA must be ≥ FuLL for CYLH and SPHR. **Default: 564.1895 mm**

	Explanation	Options	Function
LnGt	Container length (CYLV, CYLH)		Total length of cylindrical containers; with CYLV LnGt must be ≥ FuLL. **Default: Measuring range minus blind zone**
BOT	Type of container bottom (CYLV, CYLH)	**FLAT**	Flat bottom
		DISH	Two dish-shaped (convex bottoms at both ends)
DBot	Diameter at the bottom edge of cone (COnE)		Lower diameter of conical containers **Default: 0.0**
hBot	Bottom edge of cone (COnE)		Position and height of bottom diameter of conical containers (= length of cylindrical section at the bottom) **Default: 0.0**
DToP	Diameter of the upper edge of the cone (COnE)		Upper diameter of the conical containers **Default: 0.0**
hToP	Upper edge of cone (COnE)		Position or height of the upper diameter of conical containers (hToP > hBot) **Default: 0.0**

9.3 Setting via IO-Link

The device can be parameterized within the technical specifications (see data sheet) via the IO-Link communication interface – both offline, e.g. with the configuration tool as well as also online via the controller. An overview of the different functions and properties that can be set and used for IO-Link or SIO mode can be found in the chapter “Setting” and 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.

9.4 Setting and visualization with the Turck Radar Monitor

The device can be parameterized and tested via a Turck IO-Link master (e.g. TBEN-S2-4IOL). The integrated web server of the IO-Link master offers access to all parameters of the sensor IODD. For an overview of IO-Link parameters and descriptions see the IO-Link parameter manual. The Turck Radar Monitor is also available for the visualization of process data.

A Turck IO-Link master is required for accessing the sensor parameters and the Turck Radar Monitor. The following table shows the firmware version of the IO-Link master, which is required for using the Turck Radar Monitor:

IO-Link master	Firmware status
FEN20-4IOL	V1.1.0.0
TBEN-L4/5-8IOL	V3.3.0.0
TBEN-LL-8IOL	V1.1.0.0
TBEN-S2-4IOL	V3.4.0.0

Refer to the specific device instructions for use to obtain information on the Turck IO-Link masters.

- ▶ Connect the IO-Link master to the power supply.
- ▶ Connect the IO-Link master to a PC via the Ethernet interface.
- ▶ Connect the radar sensor to an IO-Link port of the IO-Link master.

9.4.1 IO-Link master – opening the web server

- ▶ To open the web server of the IO-Link master, enter the IP address in the address bar of a web browser (default: **http://192.168.1.254**).

A login is required on the IO-Link master in order to edit settings via the web server and to call up the Turck Radar Sensor.

- ▶ Enter the password in the Login field on the start page of the web server. The default password is “password”.
- ▶ Click **Login**.

9.4.2 Reading in IODD in the web server

- Set the input port of the IO-Link master as an IO-Link port.
- Open the **IODD Configurator** tab in the web server.

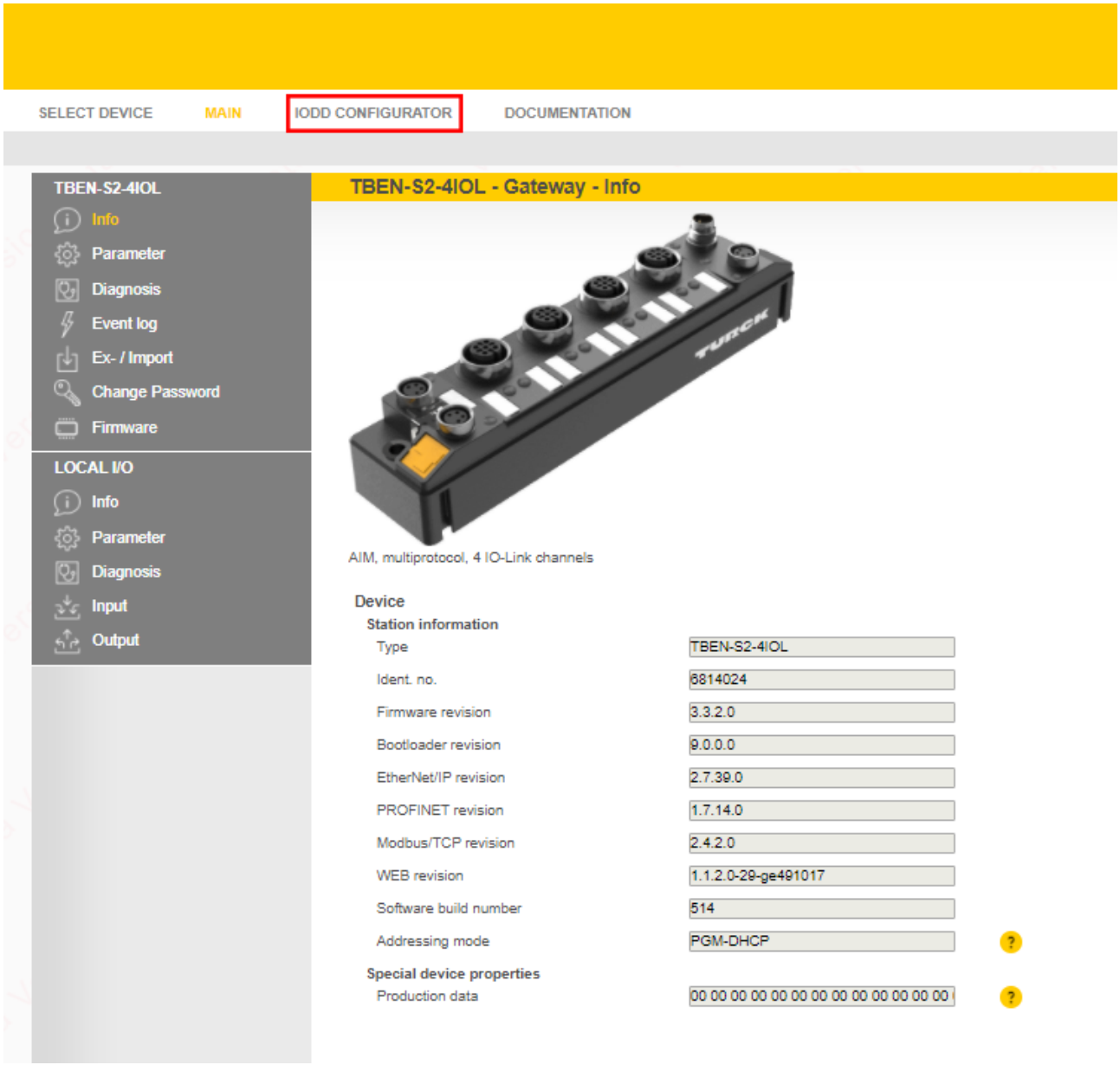

Fig. 28: Web server – IODD Configurator

▶ Load the specific device IODD in the web server via **Load IODD**.

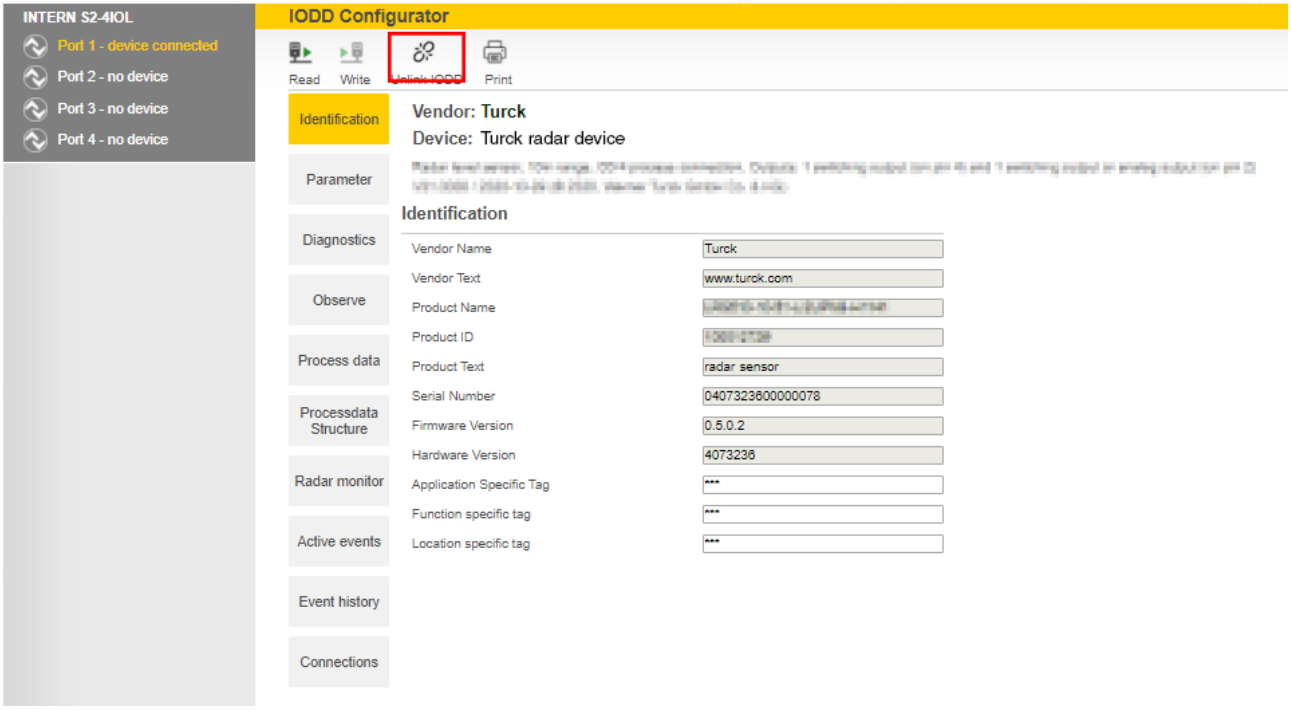

Fig. 29: Loading IODD

9.4.3 Turck Radar Monitor – overview

The Turck Radar Monitor makes it possible to visualize the process data and filter signals. The display consists of:

- FFT diagram and envelope curve
- Object detection

▶ To launch the Turck Radar Monitor, choose **Radar monitor**.

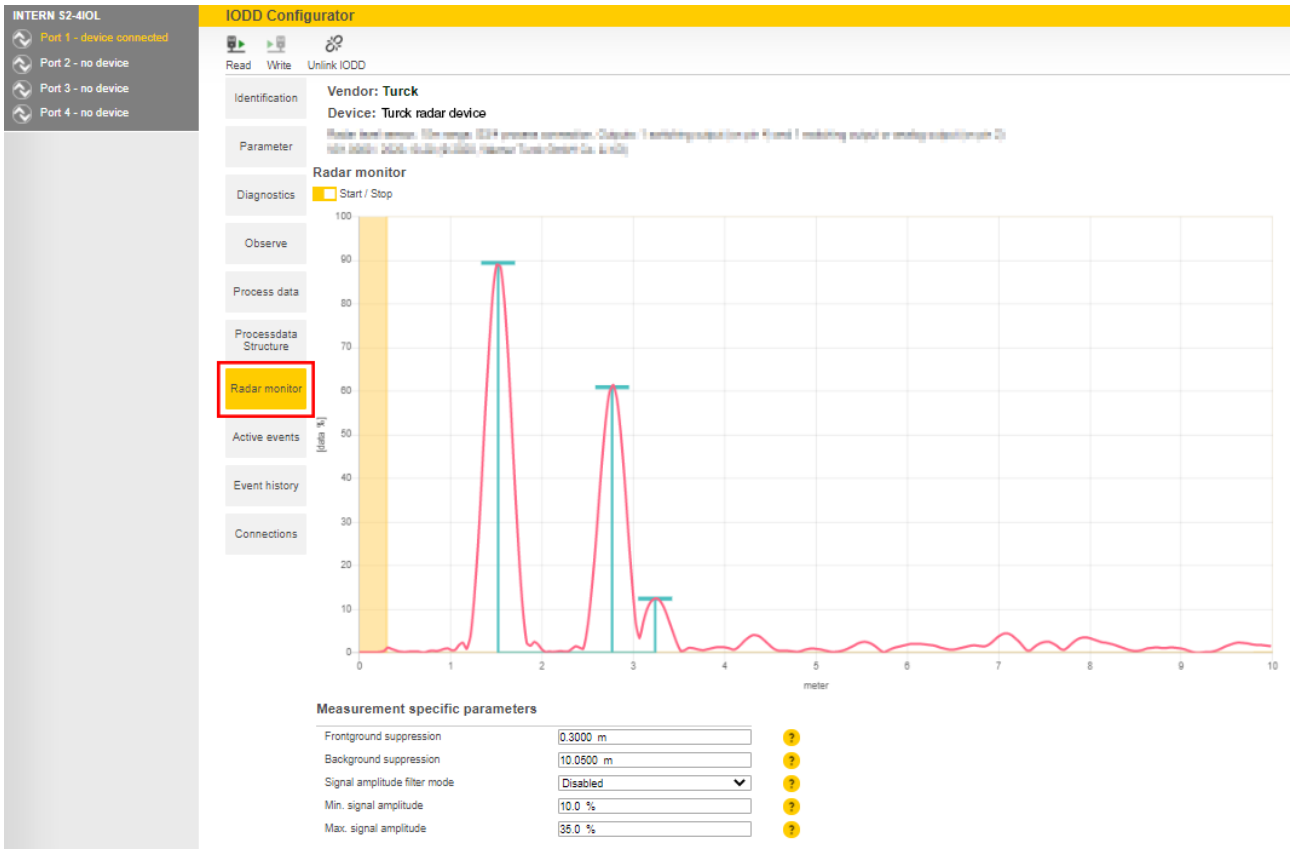

Fig. 30: Turck Radar Monitor – overview

Each displayed peak represents an object detected by the sensor in the detection range. The following points must be observed:

- Peaks with a blue bar (max. 10 value pairs consisting of distance value and intensity value) are forwarded for signal processing.
- The first peak is output as a process value.
- Peaks below a device specific signal intensity limit are no longer detected.
- Background noise can produce small ghost objects (see distance range from approx. 5 m in the figure above).

9.4.4 Turck Radar Monitor – filtering signals

The Turck Radar Monitor is provided via four filter options for suppressing disturbance signals:

- Foreground suppression (min. 0.3 m)
- Background suppression (max. 10.05 m)
- Min. signal intensity filter
- Max. signal intensity filter (min. 10 %)

The minimum distance between the foreground and background suppression is 0.1 mm. Example: If the foreground suppression is set to 1 m, the background suppression must be ≤ 0.9 m or ≥ 1.1 m.

Minimum and maximum signal intensity filters can be activated individually or together. The step width is 1 %. The minimum distance between the minimum and maximum signal intensity filter is 10 %.

Only peaks located within the signal ranges are forwarded for data processing.

▶ Adjust the filter in the **Measurement specific parameters**.

⇨ The signal limits are displayed in a white area in the Turck Radar Monitor. Peaks without a blue bar are not forwarded for data processing.

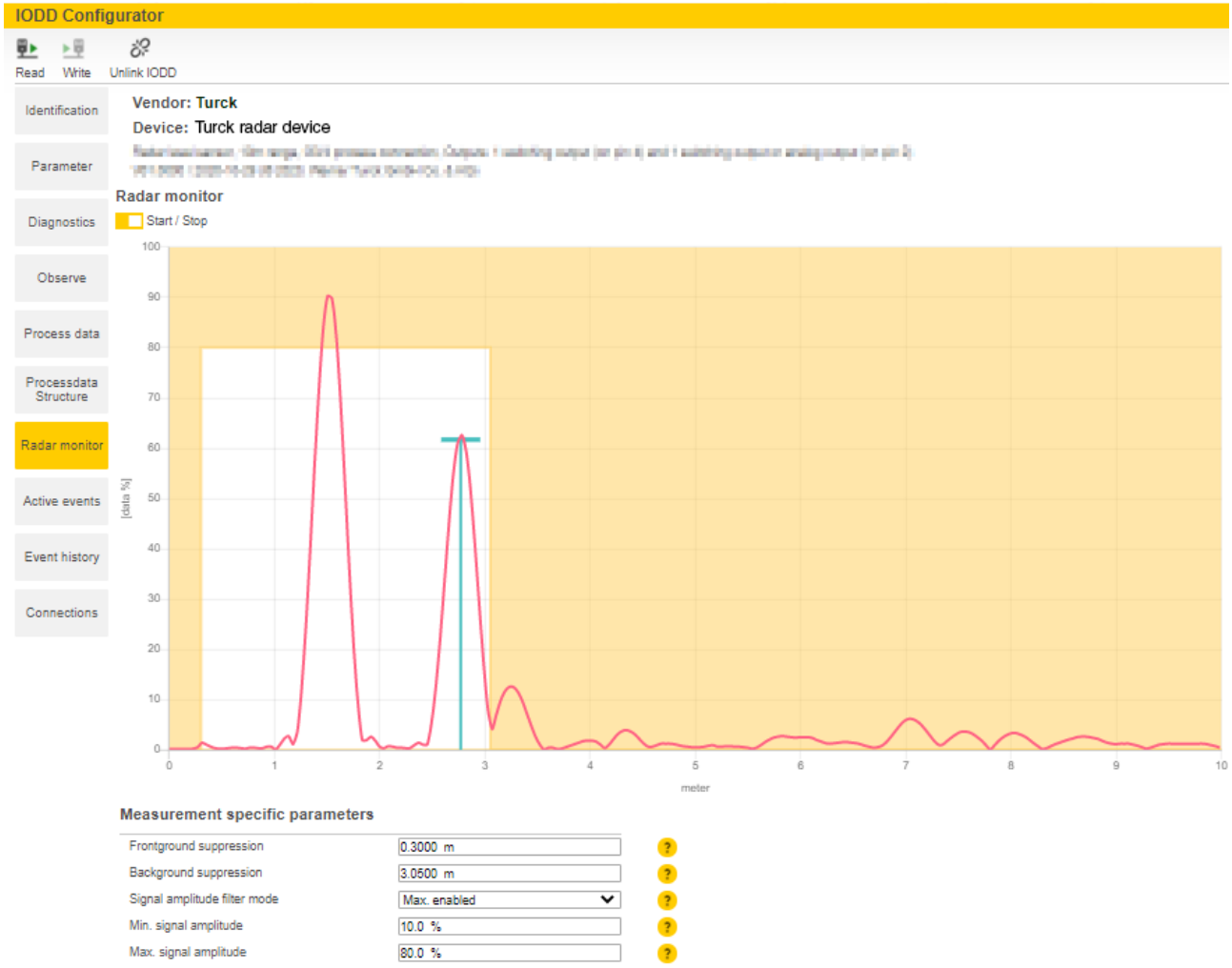

Fig. 31: Example– filtering signals

10 Troubleshooting

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

If there are no faults, there is a device malfunction. In this case, decommission the device and replace it with a new device of the same type.

11 Maintenance

The device is maintenance-free. Clean with a damp cloth if required.

12 Repair

The device 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 general household garbage.

14 Technical Data

14.1 Technical data – LRS510-10-…-2UPN8-H1141

Technical data	LRS510-10-34…	LRS510-10-51…	LRS510-10-57…	LRS510-10-69…
ID	100012732	100012731	100012726	100012725
Radar data				
Frequency range	122…123 GHz			
Range	35…1000 cm			
Resolution	1 mm			
Minimum size measuring range	500 mm			
Minimum size switching range	50 mm			
Linearity tolerance	≤ ± 0.1 %			
Edge length of the standard target	100 mm			
EIRP radiant power	10 dBm			
Opening angle	10°		6°	
Repetition accuracy	2 mm			
Hysteresis	≤ 50 mm			
Electrical data				
Operating voltage	10…33 VDC			
Ripple	< 10 % U_{SS}			
DC rated operational current	≤ 250 mA			
No-load current	≤ 100 mA			
Residual current	≤ 0.1 mA			
Short-circuit protection	Yes/cyclic			
Reverse polarity protection	Yes			
Communication protocol	IO-Link			
Output function	NC/NO programmable, PNP/NPN			
Output 2	Switching output			
Voltage drop at I_e	≤ 2 V			
Switching frequency	≤ 10 Hz			
Typical response time	< 10 ms			
IO-Link				
IO-Link specification	V1.1			
IO-Link port type	Class A			
Communication mode	COM 2 (38.4 Kbaud)			
Process data width	32-bit			

Technical data	LRS510-10-34…	LRS510-10-51…	LRS510-10-57…	LRS510-10-69…
Measured value information	28-bit			
Switching point information	2-bit			
Frame type	2.2			
Minimum cycle time	3 ms			
Function Pin 4	IO-Link			
Function Pin 2	DI			
Maximum cable length	20 m			
Profile support	Smart sensor profile			
Mechanical data				
Design	With display, LRS			
Dimensions	127.1 × Ø 38 mm			
Housing material	Stainless steel/plastic, 1.4404 (316L)/polyacrylamide 50% GF UL 94 V-0			
Max. tightening torque of housing nuts	45 Nm			
Electrical connection	Male connector, M12 × 1			
Process connection	3/4" NPT	G3/4"	1" NPT	G1"
Ambient temperature	-25…+65 °C			
Storage temperature	-40…+85 °C			
Protection type	IP67/IP69K, ISO 20653 (not UL assessed)			
Switching state indication	2 × LED, yellow			
Vibration resistance	20 g (10…2000 Hz), EN 600068-2-6			
EMC	EN 61000-6-2:2019 ETSI EN 301489-3 V1.6.1			
Approvals	CE, UL, ETSI I 305550-2, FCC/CFR. 47 Part 15			

14.2 Technical data – LRS510-10-…-4UPN8-H1181

Technical data	LRS510-10-34…	LRS510-10-51…	LRS510-10-57…	LRS510-10-69…
ID	100012734	100012733	100012728	100012727
Radar data				
Frequency range	122…123 GHz			
Range	35…1000 cm			
Resolution	1 mm			
Minimum size measuring range	500 mm			
Minimum size switching range	50 mm			
Linearity tolerance	≤ ± 0.1 %			
Edge length of the standard target	100 mm			
EIRP radiant power	10 dBm			
Opening angle	10°		6°	
Repetition accuracy	2 mm			
Hysteresis	≤ 50 mm			
Electrical data				
Operating voltage	10…33 VDC			
Ripple	< 10 % U_{SS}			
DC rated operational current	≤ 250 mA			
No-load current	≤ 100 mA			
Residual current	≤ 0.1 mA			
Short-circuit protection	Yes/cyclic			
Reverse polarity protection	Yes			
Communication protocol	IO-Link			
Output function	NC/NO programmable, PNP/NPN			
Output 2	Switching output			
Output 3	Switching output			
Output 4	Switching output			
Voltage drop at I_e	≤ 2 V			
Switching frequency	≤ 10 Hz			
Typical response time	< 10 ms			
IO-Link				
IO-Link specification	V1.1			
IO-Link port type	Class A			
Communication mode	COM 2 (38.4 Kbaud)			
Process data width	32-bit			

Technical data	LRS510-10-34…	LRS510-10-51…	LRS510-10-57…	LRS510-10-69…
Measured value information	28-bit			
Switching point information	2-bit			
Frame type	2.2			
Minimum cycle time	3 ms			
Function Pin 4	IO-Link			
Function Pin 2	DI			
Maximum cable length	20 m			
Profile support	Smart sensor profile			
Mechanical data				
Design	With display, LRS			
Dimensions	127.1 × Ø 38 mm			
Housing material	Stainless steel/plastic, 1.4404 (316L)/polyacrylamide 50% GF UL 94 V-0			
Max. tightening torque of housing nuts	45 Nm			
Electrical connection	Male connector, M12 × 1			
Process connection	3/4" NPT	G3/4"	1" NPT	G1"
Ambient temperature	-25…+65 °C			
Storage temperature	-40…+85 °C			
Protection type	IP67/IP69K, ISO 20653 (not UL assessed)			
Switching state indication	2 × LED, yellow			
Vibration resistance	20 g (10…2000 Hz), EN 600068-2-6			
EMC	EN 61000-6-2:2019 ETSI EN 301489-3 V1.6.1			
Approvals	CE, UL, ETSI I 305550-2, FCC/CFR. 47 Part 15			

14.3 Technical data – LRS510-10-…-LI2UPN8-H1141

Technical data	LRS510-10-34…	LRS510-10-51…	LRS510-10-57…	LRS510-10-69…
ID	100012730	100012729	100012723	100012722
Radar data				
Frequency range	122…123 GHz			
Range	35…1000 cm			
Resolution	1 mm			
Minimum size measuring range	500 mm			
Minimum size switching range	50 mm			
Linearity tolerance	≤ ± 0.1 %			
Edge length of the standard target	100 mm			
EIRP radiant power	10 dBm			
Opening angle	10°		6°	
Repetition accuracy	2 mm			
Hysteresis	≤ 50 mm			
Electrical data				
Operating voltage	18…33 VDC			
Ripple	< 10 % U_{SS}			
DC rated operational current	≤ 250 mA			
No-load current	≤ 100 mA			
Residual current	≤ 0.1 mA			
Short-circuit protection	Yes/cyclic			
Reverse polarity protection	Yes			
Communication protocol	IO-Link			
Output function	NC/NO programmable, PNP/NPN, analog output			
Output 2	Analog output			
Current output	Default: 4…20 mA			
Voltage output	Default: 0…10 V			
Load resistance current output	≤ 0.5 kΩ			
Load resistance voltage output	≥ 8 kΩ			
Voltage drop at I_e	≤ 2 V			
Switching frequency	≤ 10 Hz			
Typical response time	< 10 ms			
IO-Link				
IO-Link specification	V1.1			
IO-Link port type	Class A			

Technical data	LRS510-10-34…	LRS510-10-51…	LRS510-10-57…	LRS510-10-69…
Communication mode	COM 2 (38.4 Kbaud)			
Process data width	32-bit			
Measured value information	28-bit			
Switching point information	2-bit			
Frame type	2.2			
Minimum cycle time	3 ms			
Function Pin 4	IO-Link			
Function Pin 2	Analog			
Maximum cable length	20 m			
Profile support	Smart sensor profile			
Mechanical data				
Design	With display, LRS			
Dimensions	127.1 × Ø 38 mm			
Housing material	Stainless steel/plastic, 1.4404 (316L)/polyacrylamide 50% GF UL 94 V-0			
Max. tightening torque of housing nuts	45 Nm			
Electrical connection	Male connector, M12 × 1			
Process connection	3/4" NPT	G3/4"	1" NPT	G1"
Ambient temperature	-25…+65 °C			
Storage temperature	-40…+85 °C			
Protection type	IP67/IP69K, ISO 20653 (not UL assessed)			
Switching state indication	2 × LED, yellow			
Vibration resistance	20 g (10…2000 Hz), EN 600068-2-6			
EMC	EN 61000-6-2:2019 ETSI EN 301489-3 V1.6.1			
Approvals	CE, UL, ETSI I 305550-2, FCC/CFR. 47 Part 15			

15 Appendix: Conformity and Approvals

15.1 EU Declaration of Conformity

Hans Turck GmbH & Co. KG hereby declares that the level sensors of the LRS510-… series comply with Directive 2014/53/EU. The complete text of the EU declaration of conformity can be obtained from the following Internet address: **www.turck.com**

15.2 FCC Digital Device Limitations

FCC ID: YQ7-LRS-510-10

This device complies with Part 15 of the FCC Rules standard(s). Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

16 Turck Subsidiaries - Contact Information

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