

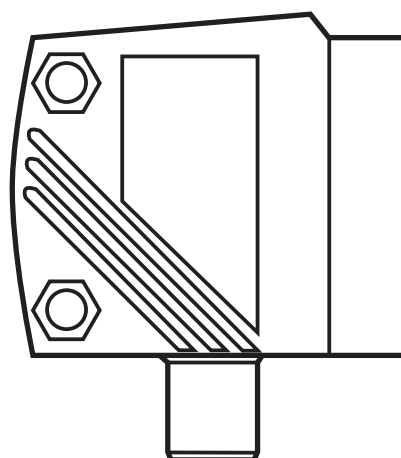


Operating instructions Optical level sensor

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O1D300

11454904 / 00 11 / 2024



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1 Preliminary note

1.1 Symbols used

► Instruction

> Reaction, result

[...] Designation of pushbuttons, buttons or indications

→ Cross-reference



Important note:

Non-compliance can result in malfunctions or interference.



Information

Supplementary note.

1.2 Warning signs used



WARNING

Warning of serious personal injury.

Death or serious irreversible injuries may result.

2 Safety instructions

- The device described is a subcomponent for integration into a system.
 - The manufacturer of the system is responsible for the safety of the system.
 - The system manufacturer undertakes to perform a risk assessment and to create a documentation in accordance with legal and normative requirements to be provided to the operator and user of the system. This documentation must contain all necessary information and safety instructions for the operator, the user and, if applicable, for any service personnel authorised by the manufacturer of the system.
- Read this document before setting up the product and keep it during the entire service life.
- The product must be suitable for the corresponding applications and environmental conditions without any restrictions.
- Only use the product for its intended purpose (→ Functions and features).
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property may occur.

- The manufacturer assumes no liability or warranty for any consequences caused by tampering with the product or incorrect use by the operator.
- Installation, electrical connection, set-up, operation and maintenance of the unit must be carried out by qualified personnel authorised by the machine operator.
- Protect units and cables against damage.

! WARNING

Visible laser light; laser protection class 2.

Use of controls or adjustments other than those specified herein may result in hazardous radiation exposure. Damage to the retina is possible.

- ▶ Do not stare into the laser beam!
- ▶ Apply the enclosed labels (laser warning) in the immediate vicinity of the unit.
- ▶ Adhere to the caution and warning notes on the product label.
- ▶ Use the enclosed label for the power supply cable.
- ▶ EN/IEC 60825-1 : 2007 and EN/IEC 60825-1 : 2014

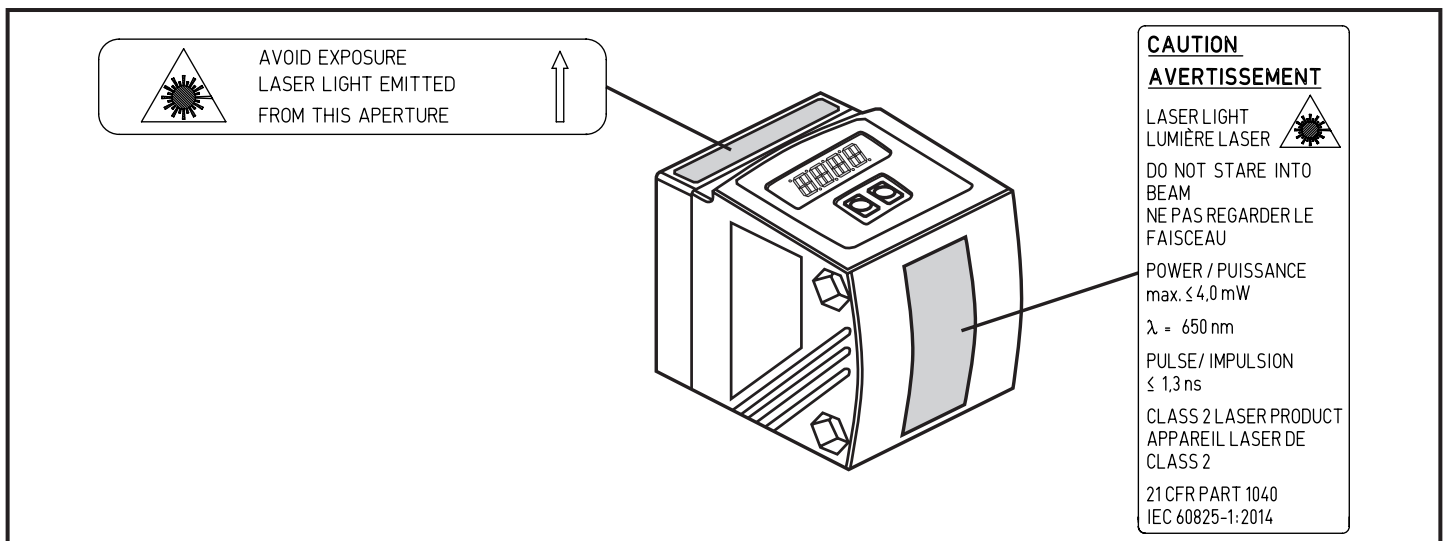
Complies with 21 CFR 1040.10 except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019.

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Label for supply cable



Product label



3 Functions and features

The unit continuously detects the level optically and generates output signals according to the parameter settings.

3.1 Application areas

- The optical level sensor detects media in the measuring range of 20.0...1000.0 cm. They are displayed in relation to a previously defined reference level.
- It has a background suppression at > 10...100 m.
- Two output signals can be generated, depending on the function mode.



The distance between the sensor and the background must be limited to max. 100 m by the customer. Otherwise the measured value may be ambiguous. → 5.1 Installation conditions

3.2 Restriction of the application area

- The unit is suited for granulates, bulk material and cloudy liquids.
- Dust and vapour can impact the quality of the measurements.
- The unit is not suited for oils and clear liquids.

4 Function

4.1 Switching function

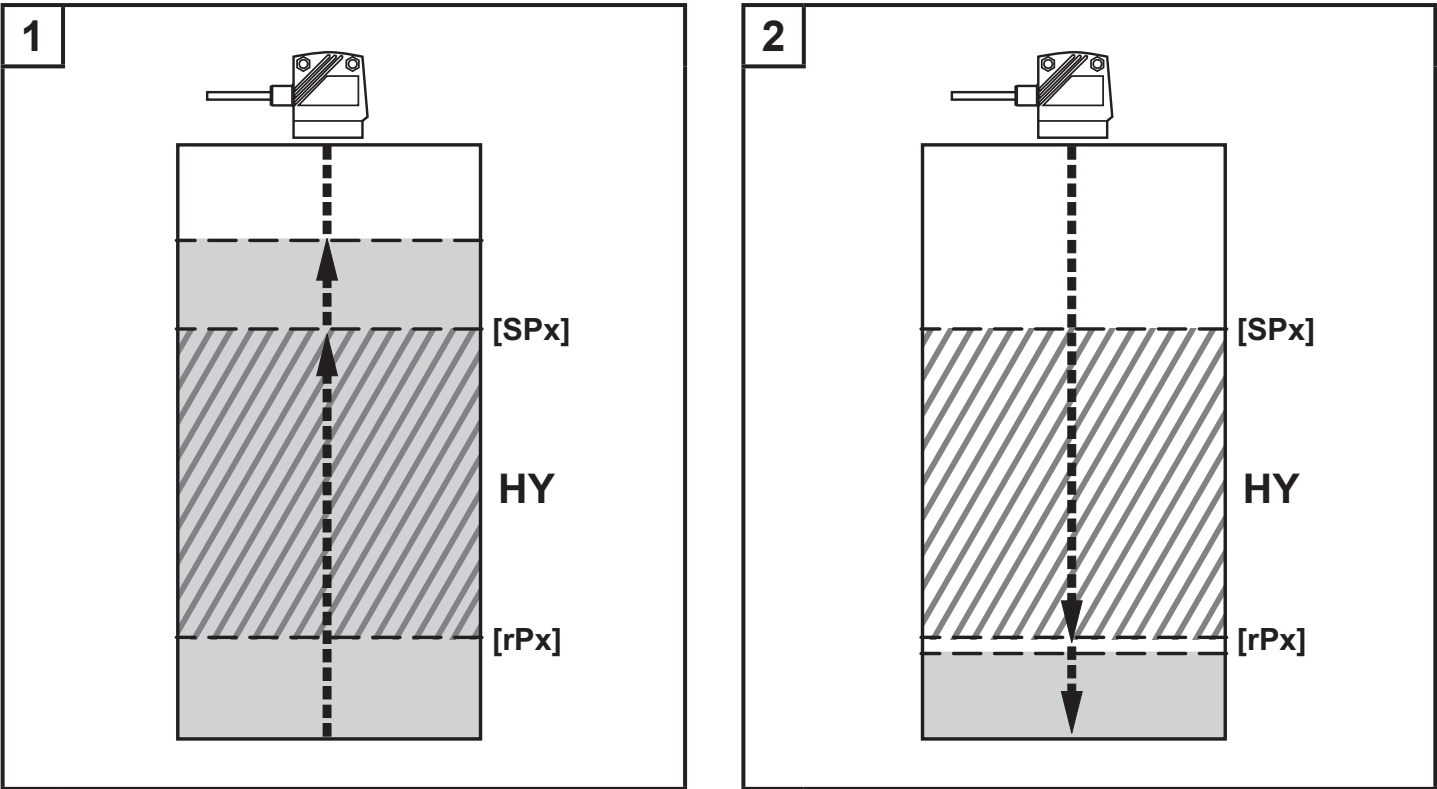
4.1.1 Hysteresis function

The outputs change their switching status when the value is above or below the set switching limits. The hysteresis is the distance between the set and reset points. The hysteresis keeps the switching status of the output stable if the measured value varies about the sensing range.

Both outputs (OUT1 and OUT2) can be set as hysteresis function (→ 10.3.3 and → 10.3.6).

Example Hno

- 1. For the output function [Hno] the output switches on when the set point [SPx] is exceeded in case of a rising level.
- 2. If the level falls again, the output switches off as soon as the level is below the reset point [rPx]. The reset point [rPx] is below the set point [SPx].



[SPx] = set point; [rPx] = reset point; HY = hysteresis

If the output function [Hnc] has been selected, set and reset point are exchanged. The output switches off for rising level. If the level falls below [rPx] again, the output switches on.

Switching status of the outputs

Output function	Level (L)	Output status
[Hno]	$L > [SPx]$	Closed
	$L < [rPx]$	Open
[Hnc]	$L > [SPx]$	Open
	$L < [rPx]$	Closed

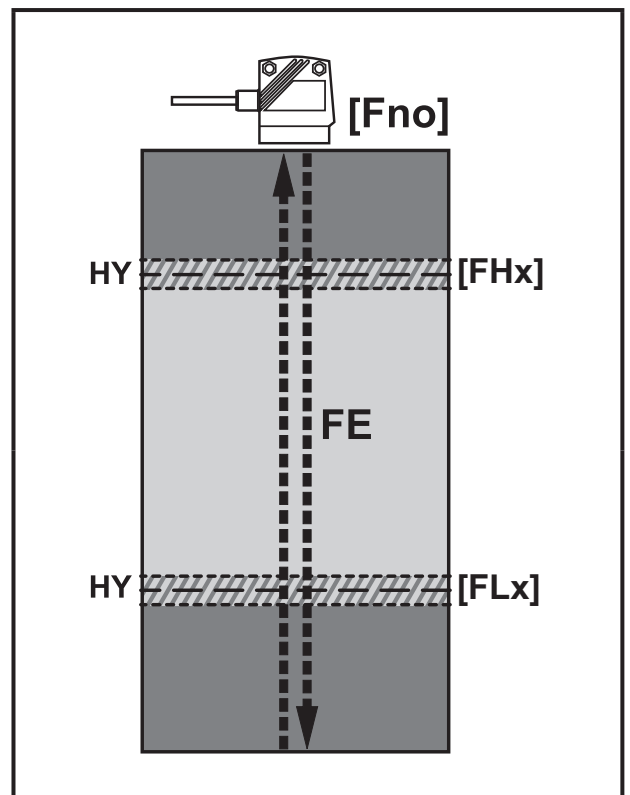
4.1.2 Window function

The window function enables the monitoring of a defined acceptable range. Both outputs (OUT1 and OUT2) can be set as window function (→ 10.3.3 and → 10.3.6).

Switches when the medium is detected

If the measured value is between the lower limit value [FLx] and the upper limit value [FHx], the output is closed (if [OUx] = [Fno]).

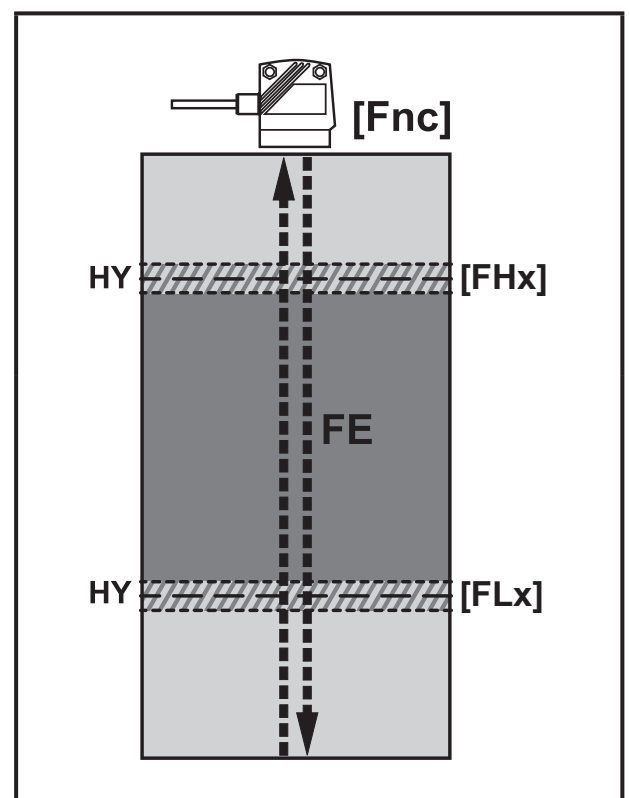
FE = window; HY = hysteresis*;
[FHx] = upper limit value;
[FLx] = lower limit value



Switches off when the medium is detected

If the measured value is between the lower limit value [FLx] and the upper limit value [FHx], the output is open (if [OUx] = [Fnc]).

FE = window; HY = hysteresis*;
[FHx] = upper limit value;
[FLx] = lower limit value



* A switching hysteresis is set for each window limit value. It cannot be configured but depends on distance and sampling rate.

Switching status of the outputs

Output function	Level (L)	Output status
[Fno]	$L < [FHx]$ $L > [FLx]$	Closed
	$[FHx] < L < [FLx]$	Open
[Fnc]	$L < [FHx]$ $L > [FLx]$	Open
	$[FHx] < L < [FLx]$	Closed

Both window limit values ([SPx] and [rPx]) work with a switching hysteresis.

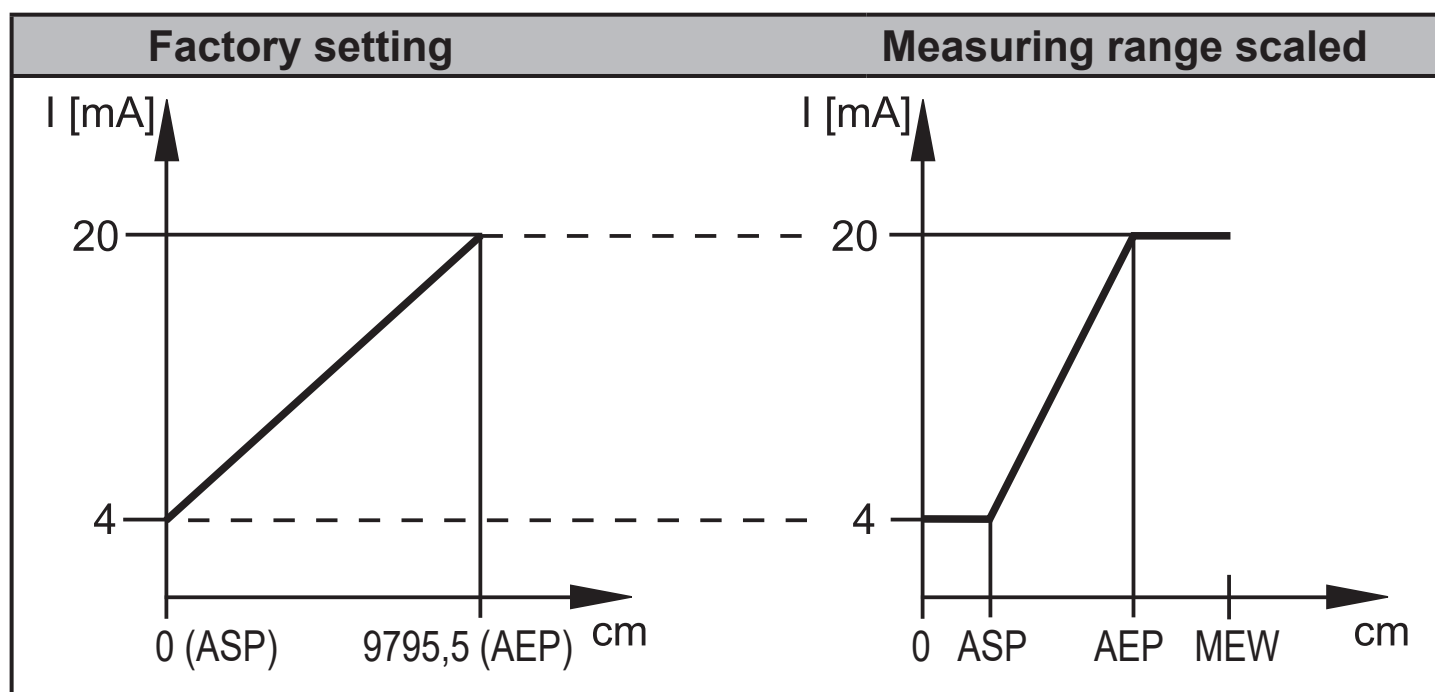
→ 4.1.1 Hysteresis function / example for output function [Hno]

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4.2 Analogue function

An analogue signal, which is proportional to the distance, can be provided at output 2 (OUT2) → 10.3.9 Scaling of the measuring range (analogue output).

4.2.1 Current output

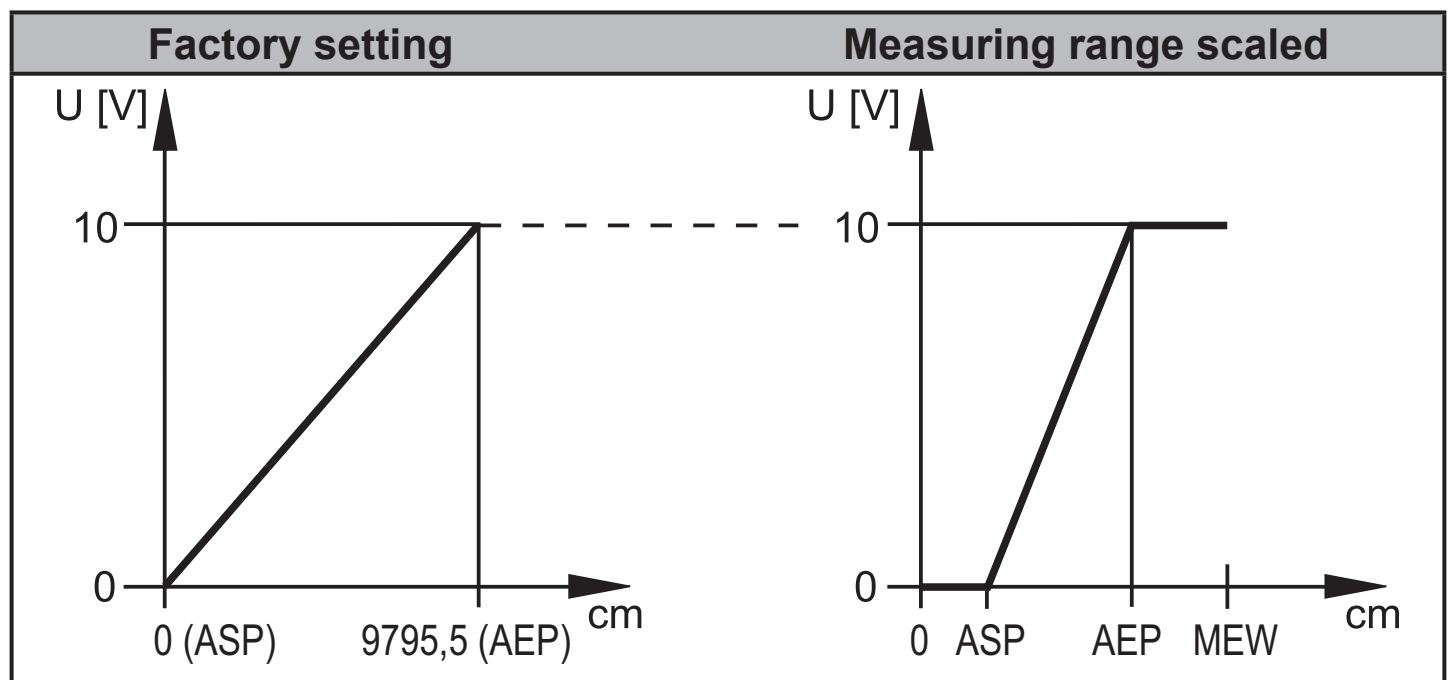


MEW= final value of the measuring range

In the set measuring range the output signal is between 4 and 20 mA.

Faults are also displayed → 12 Troubleshooting.

4.2.2 Voltage output



MEW= final value of the measuring range

In the set measuring range the output signal is between 0 and 10 V.

4.3 Switch off the laser

For safety and maintenance purposes the laser of the unit can be temporarily switched off via the input on pin 5.

Input signal at pin 5	Laser
Low / not connected	On
High	Off

4.4 IO-Link

This unit has an IO-Link communication interface which enables direct access to process and diagnostic data. In addition it is possible to set the parameters of the unit during operation. Operation of the unit via IO-Link interface requires an IO-Link master.

With a PC, suitable IO-Link software and an IO-Link adapter cable communication is possible when the system is not in operation.

The IODDs necessary for the configuration of the unit, detailed information about process data structure, diagnostic information, parameter addresses and the necessary information about the required IO-Link hardware and software can be found at www.ifm.com.

4.4.1 Operation with IO-Link master

The unit is compatible with IO-Link master port class A (type A).



For operation with IO-Link master port class B (type B) observe the following:

As a standard, the unit is not compatible with master port class B (type B).

Pin 2 (OU2) and pin 5 (IN1) are used for manufacturer-specific functions.

That means that the main supply voltage of the unit and the additional voltage supply (master port class B on pins 2/5) are not electrically isolated.

With the following configurations the unit can be used with master port class B:

- Connect unit and IO-Link master via 3 wires: Connect pins 1, 3 and 4 of the unit with the IO-Link master (do not connect pins 2 and 5).
- Connect unit and IO-Link master via 4 wires: Deactivate pin 2 (OU2) via IO-Link (setting OU2 = "off") and connect pins 1, 2, 3 and 4 of the unit with the IO-Link master (do not connect pin 5).

4.4.2 Extended functions

By means of IO-Link extended measured data are available.

The object reflectivity is provided via the display and as process data value (PDV) via IO-Link.

The object reflectivity can, for example, be used to detect sensor soiling.

5 Installation

5.1 Installation conditions

- Install the unit so that the medium to be detected is within a measuring range of 20.0...1000.0 cm.

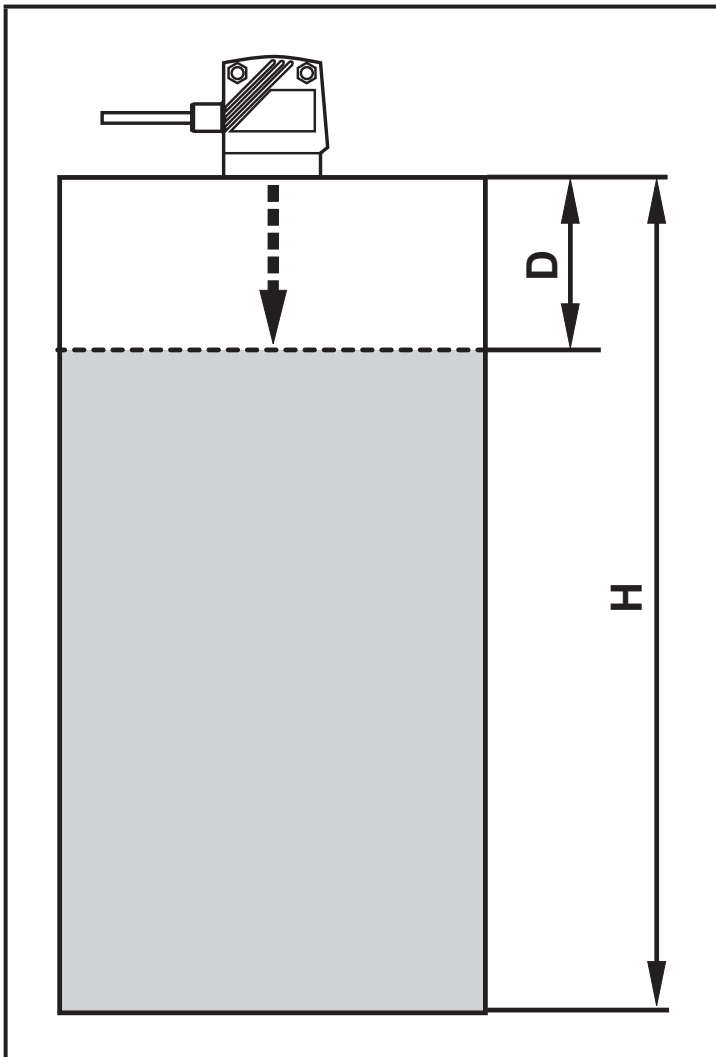
The unambiguity range of the sensor is fixed to 100 m. Levels within a range > 10...100 m are suppressed.



Reflecting surfaces in the direct beam path of the sensor – also in the range > 100 m – are to be avoided by the customer. Otherwise the measured value may be ambiguous.

5.2 Location

- Mount the sensor in a way that a distance (D) of min. 20.0 cm remains between the highest possible level and the front lens of the sensor.
- The maximum measuring distance (H) between the front lens of the sensor and the tank bottom or the programmed level is 10 m. A reference height at a longer distance cannot be set.



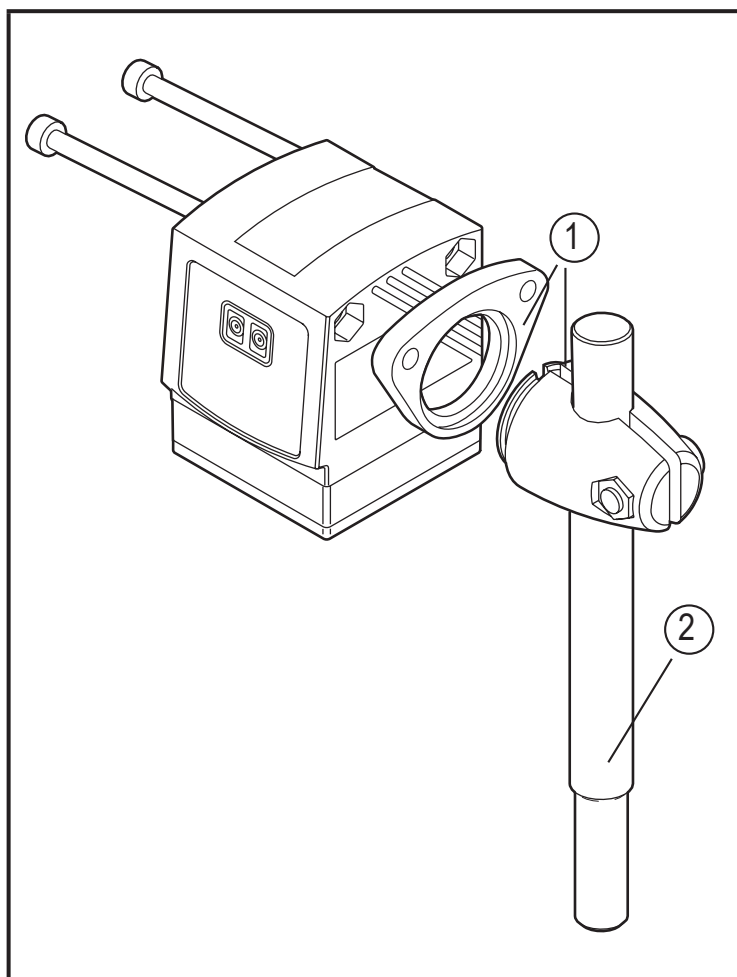
D = min. measuring distance / dead zone
H = max. measuring distance

5.3 Mounting accessories

The unit is supplied without mounting accessories.

Examples of mounting accessories	Art. no.
Protective cover O1D	E21133
Mounting set E2D101 + E20938 + E20951	E21079
Mounting set O1D, O2D (for rod mounting Ø 12 mm)	E2D101
Mounting rod straight Ø 12 mm / M10	E20938
Mounting set O1D, O2D (for rod mounting Ø 14 mm)	E2D111
Mounting rod straight Ø 14 mm / M12	E20939
Fixture for mounting and fine adjustment of O1D laser units (rod or free-standing; depending on the clamp)	E1D100

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Example mounting:

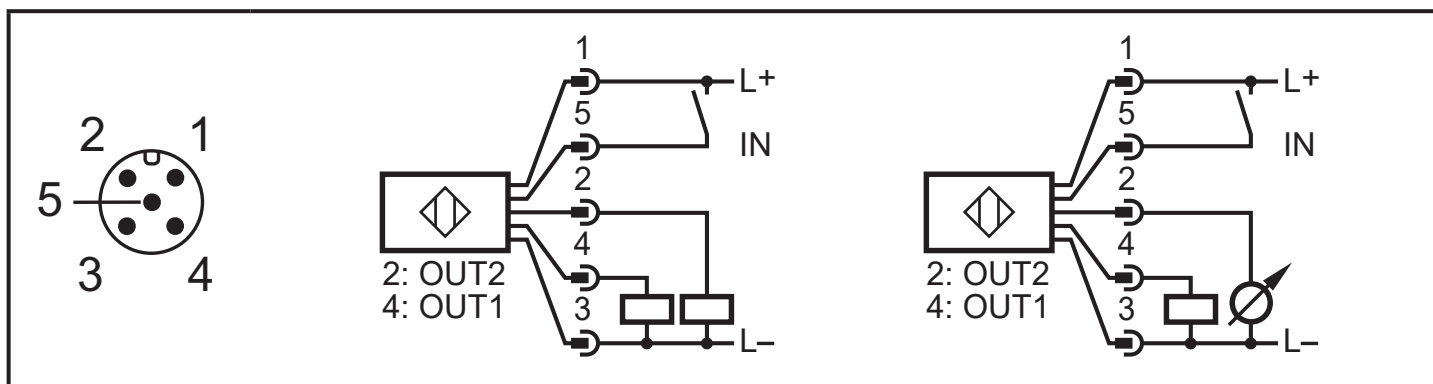
- 1: Mounting set for Ø 12 mm rod
Art. no. E2D101
- 2: Mounting rod straight Ø 12 mm / M10
Art. no. E20938

6 Electrical connection



The unit must be connected by a qualified electrician.

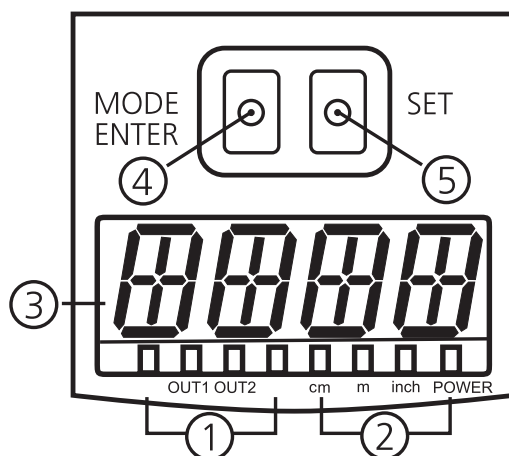
- ▶ The national and international regulations for the installation of electrical equipment must be adhered to.
- ▶ Voltage supply according to EN 50178, SELV, PELV.
- ▶ Disconnect power.
- ▶ Connect the unit as follows:



Core colours of ifm sockets:

1 = BN (brown), 2 = WH (white), 3 = BU (blue), 4 = BK (black), 5 = GR (grey).

7 Operating and display elements

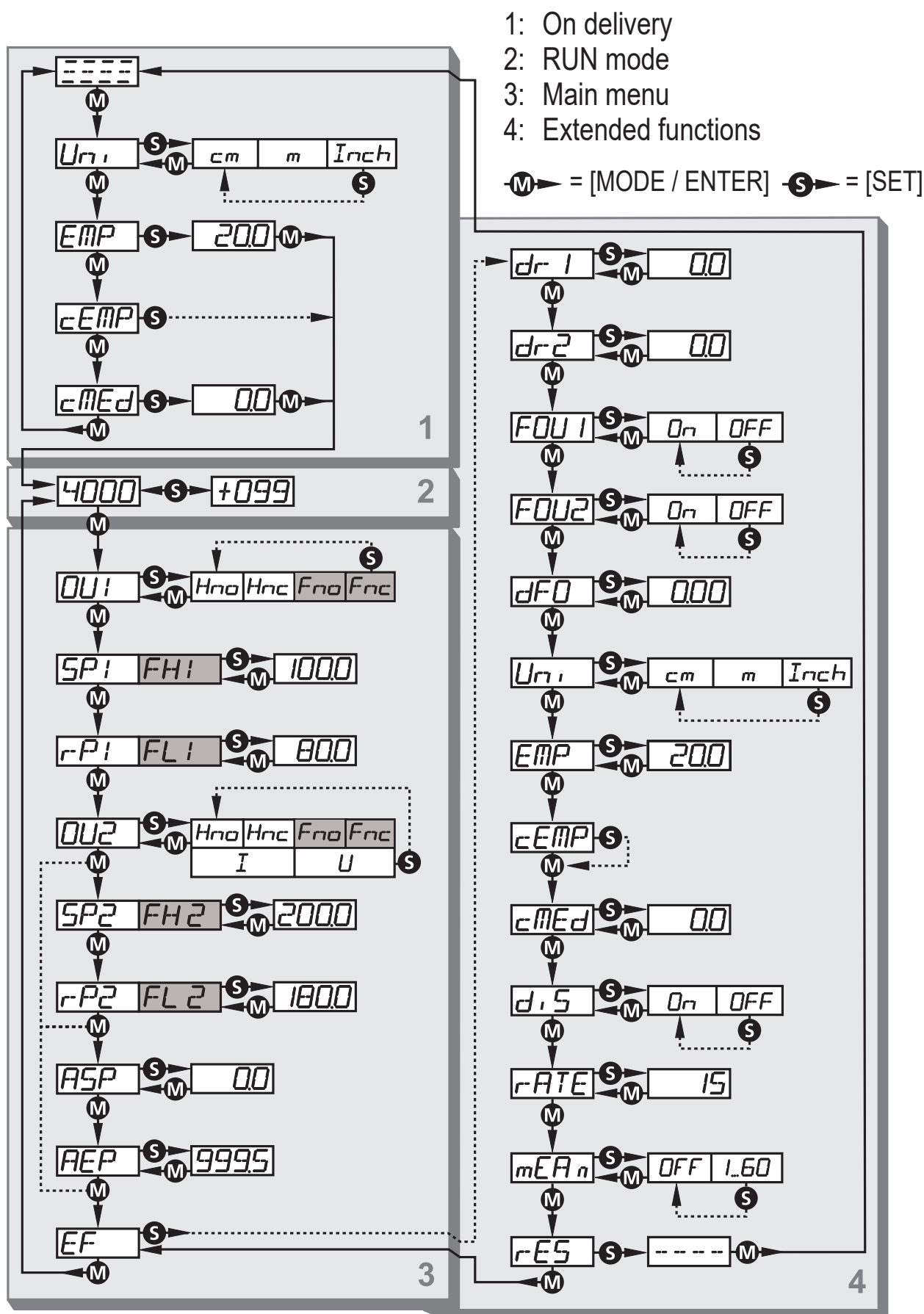


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1: 4 x LED yellow (two not connected)	Indication of the switching status; lit, if the corresponding output is switched.
2: 4 x LED green	Lighting LED = power and set display unit (cm, m, inch).
3: 4-digit alphanumeric display	Indication of the measured distance, the parameters and parameter values.
4: Programming button [MODE/ENTER]	Selection of the parameters and acknowledgement of the parameter values
5: Programming button [SET]	Setting of the parameter values (hold down to scroll; press briefly to increment).

8 Menu

8.1 Menu structure



8.2 Explanation of the menu

For the factory settings please refer to the end of these instructions (→ 14 Factory setting).

8.2.1 Factory setting

U_{rn}	Setting of the display unit Selection of the unit of measurement for [SP1/FH1], [SP2/FH2], [ASP], [AEP] Options: [cm] [m] [inch] → 10.3.1 Selection of the display unit
EMP	Free choice of the tank height If the height of the tank is known, it can be entered without the unit being mounted. The entered distance is used as reference level. Distances between 20.0...999.5 cm can be selected. → 10.2.1 Free choice of the tank height
cEMP	Carry out the basic teach empty state The bottom of an empty tank can be set as reference level. → 10.2.2 Carry out the basic teach empty state
cMED	Adjustment to the reference level The current level of a partly filled tank can be entered as numerical value. Based on this data the future reference level is calculated. → 10.2.3 Carry out the adjustment to the reference level

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8.2.2 Main menu

OU 1	Configuration for output 1 4 switching functions can be selected: [Hno], [Hnc], [Fno], [Fnc] → 10.3.3 Configure OUT1
SP 1 FH 1	Switch point for window and hysteresis function OUT1 Hysteresis function Upper limit value at which the output with selected hysteresis function changes its switching status (medium nearer / farther than distance set). • [SP1] is the set point if [OU1] = [Hno] • [SP1] is the reset point if [OU1] = [Hnc]. → 10.3.4 Setting of the switch points for hysteresis function OUT1 Window function [FH1] is the upper limit value at which the output with selected window function changes its switching status if [OU1] = [Fno] or [Fnc]. → 10.3.5 Setting of the switch points for window function OUT1

rP1 FL1	The reset point for window and hysteresis function OUT1 [rP1 / FL1] must be set separately from [SP1 / FH1]. [rP1 / FL1] < [SP1 / FH1] Hysteresis function Lower limit value at which the output with selected hysteresis function changes its switching status (medium nearer / farther than distance set). • [rP1] is the reset point if [OU1] = [Hno]. • [rP1] is the set point if [OU1] = [Hnc]. → 10.3.4 Setting of the switch points for hysteresis function OUT1 Window function [FL1] is the lower limit value at which the output with selected window function changes its switching status if [OU1] = [Fno] or [Fnc]. → 10.3.5 Setting of the switch points for window function OUT1
OU2	Configuration for output 2 4 switching functions and 2 analogue signals can be selected: [Hno], [Hnc], [Fno], [Fnc], [I], [U] → 10.3.6 Configure OUT2
SP2 FH2	Switch point for window and hysteresis function OUT2 Hysteresis function Upper limit value at which the output with selected hysteresis function changes its switching status (medium nearer / farther than distance set). • [SP2] is the set point if [OU2] = [Hno]. • [SP2] is the reset point if [OU2] = [Hnc]. → 10.3.7 Setting of the switch points for hysteresis function OUT2 Window function [FH2] is the upper limit value at which the output with selected window function changes its switching status if [OU2] = [Fno] or [Fnc]. → 10.3.8 Setting of the switch points for window function OUT2
rP2 FL2	The reset point for window and hysteresis function OUT2 [rP2 / FL2] must be set separately from [SP2 / FH2]. [rP2 / FL2] < [SP2 / FH2] Hysteresis function Lower limit value at which the output with selected hysteresis function changes its switching status (medium nearer / farther than distance set). • [rP2] is the reset point if [OU2] = [Hno]. • [rP2] is the set point if [OU2] = [Hnc]. → 10.3.7 Setting of the switch points for hysteresis function OUT2 Window function [FL2] is the lower limit value at which the output with selected window function changes its switching status if [OU2] = [Fno] or [Fnc]. → 10.3.8 Setting of the switch points for window function OUT2

<i>ASP</i>	Analogue start point Measured value at which 4 mA / 0 V are provided. [ASP] is only active if [OU2] = [I] or [U]. → 10.3.9 Scaling of the measuring range (analogue output)
<i>AEP</i>	Analogue end point Measured value at which 20 mA / 10 V are provided. [AEP] is only active if [OU2] = [I] or [U]. → 9.3.11 Scaling of the measuring range (analogue output)

8.2.3 Extended functions

<i>EF</i>	Extended functions Press [SET] to open the submenu "Extended functions" → 10.4 Extended functions
<i>dr-1</i> <i>dr-2</i>	Delay for the switching outputs [drx] = switch-off delay. The output changes its switching status only after the delay has elapsed. If the switching condition is no longer met after the delay has elapsed, the switching status of the output does not change. → 10.4.1 Setting of the delay time for switching outputs
<i>FOU1</i> <i>FOU2</i>	Error reply for the switching outputs With [FOUx] the behaviour of [OUx] can be defined in case of an internal error. [FOUx] = [ON] The switching output is switched or the analogue value 20 mA / 10 V is provided. [FOUx] = [OFF] The switching output is not switched or the analogue value 4 mA / 0 V is provided. → 10.4.2 Response of the outputs in case of a fault
<i>dFo</i>	Time delay after signal loss A time delay of 0...5 s can be set for the switching behaviour of OUT1 and OUT2. Error situations can be suppressed for a short period. At [0] the delay time is not active. → 10.4.3 Setting of the delay time after signal loss
<i>d15</i>	Display setting 2 settings can be selected: [ON], [OFF]. → 10.3.2 Setting the display
<i>r-ATE</i>	Setting of the sampling rate The sampling rate indicates the maximum time after which a new result of measurement is provided and the outputs are updated. → 10.4.4 Setting of the sampling rate

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mEAr	Setting of the mean filter The mean filter suppresses level fluctuations during the set period. The measurement results during this period are averaged and influence the switching status accordingly. Then a new averaging starts. Setting range is [OFF] or 1...60 s. → 10.4.6 Setting of the mean filter
r-ES	Restore the factory setting → 10.4.7 Reset of all parameters to factory setting

9 Set-up

- After installation, electrical connection and parameter setting, check whether the unit operates correctly.
- > If the unit has been correctly set up, the distance to the level is indicated.
 → 10.2 Entering the reference level (unit on delivery).



Lifetime of a laser diode: 50 000 hours.

10 Parameter setting

During parameter setting the unit remains in the operating mode internally. It continues its monitoring function with the existing parameters until the change has been completed.



On delivery the reference level has to be set first, otherwise the unit is not operational. → 10.2 Entering the reference level (unit on delivery)



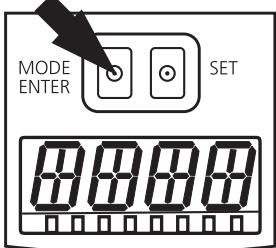
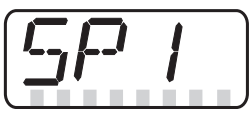
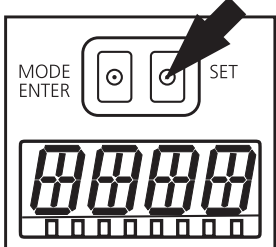
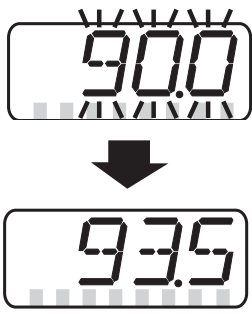
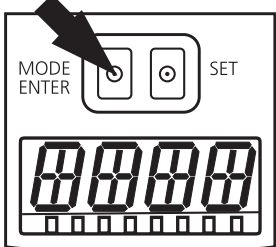
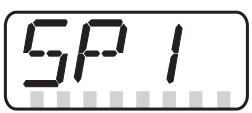
The parameters can also be set via the IO-Link interface → 4.4 IO-Link.

10.1 General parameter setting

10.1.1 Setting of the parameter value

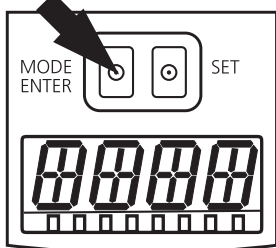
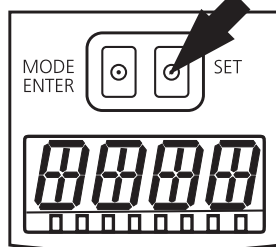


Set the display unit [Uni] before the values for the parameters are defined. In case of subsequent changes of the display unit rounding errors during internal conversion to other units may falsify the set values → 10.3.1 Selection of the display unit.

1	Selection of the parameter ► Press [MODE/ENTER] so often until the requested parameter is displayed.		
2	Setting of the parameter value ► Press [Set] and keep it pressed. > The current parameter value flashes for 5 s. ► Increase the setting value step by step by pressing the button once or continuously by holding it down.		
Decrease the value: let the display move to the maximum setting value. Then the cycle starts again at the minimum setting value.			
3	Confirmation of the parameter value ► Press [MODE/ENTER] briefly. > The parameter is displayed again; the new parameter value is effective.		
4	Setting of other parameters ► Start again with step 1.		
5	Finishing the parameter setting ► Wait for 15 s or press [MODE/ENTER]. > The current measured value is displayed.		

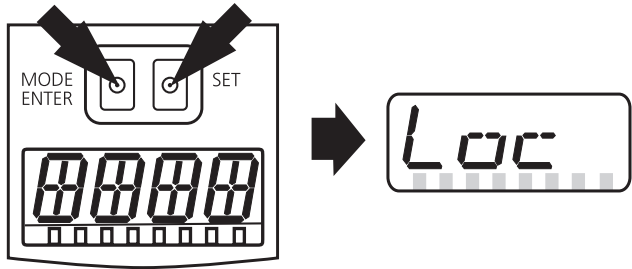
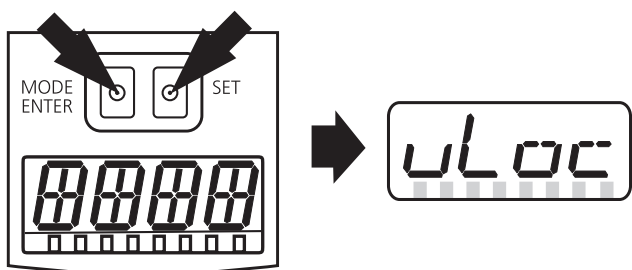
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10.1.2 Change from menu level 1 to menu level 2

► Press [MODE/ENTER] until [EF] is displayed.		
► Press [SET] briefly. > The first parameter of the sub-menu is displayed (here: [dr1]).		

10.1.3 Electronic lock

The unit can be locked electronically to prevent unauthorised setting. On delivery the unit is not locked.

Locking ▶ Make sure that the unit is in the normal operating mode. ▶ Keep [MODE/ENTER] + [SET] pressed until [Loc] is displayed. > The unit is locked.	
[Loc] is displayed briefly if you try to change parameter values on the locked unit during operation.	
Unlocking ▶ Keep [MODE/ENTER] + [SET]] pressed until [uLoc] is displayed. > The unit is unlocked.	

Timeout



If no button is pressed for 15 s during the setting procedure, the unit changes to the Run mode with unchanged values.

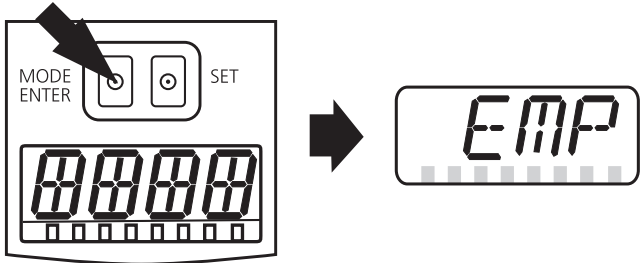
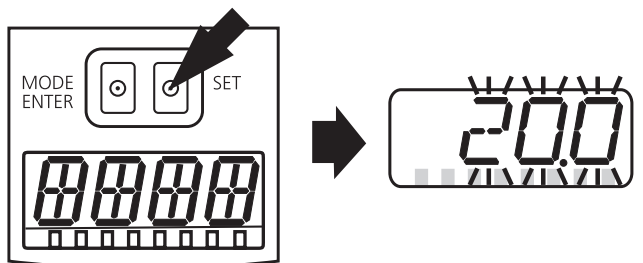
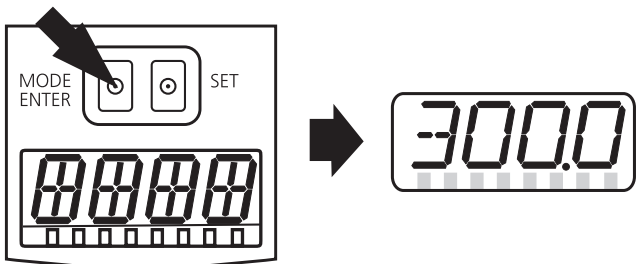
10.2 Entering the reference level (unit on delivery)

On delivery the unit is not operational. The reference level has to be set first. The complete parameter setting menu cannot be accessed before this has been done. There are three different ways to define the reference level.

10.2.1 Free choice of the tank height

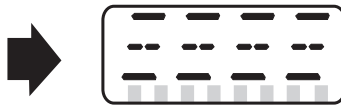
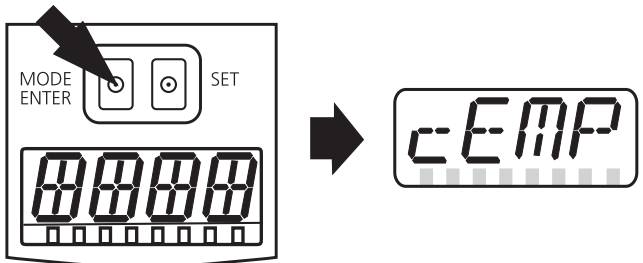
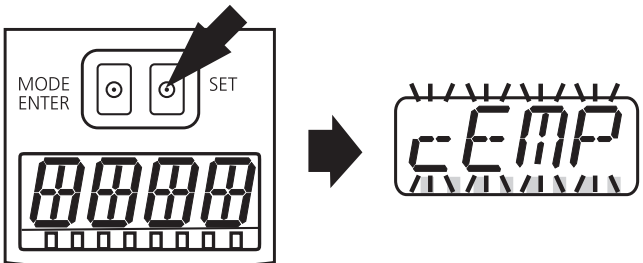
If the height of the tank (distance between the front lens of the O1D to the tank bottom) is known, it can be entered without the unit being mounted. The distance entered is used as reference level.

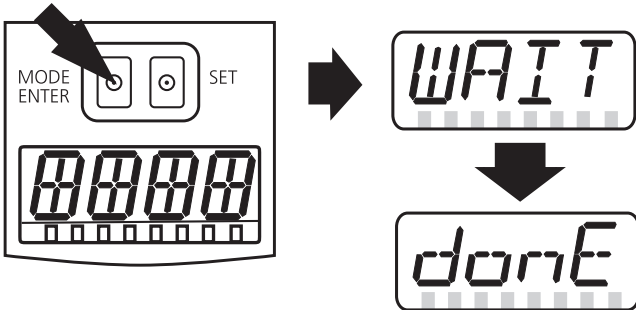
1	▶ Apply operating voltage. > Initial display is shown.	
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2	► Press [MODE/ENTER] until [EMP] is displayed.	
3	► Press [SET] and keep it pressed until the preset value is flashing. ► After 5 s the setting value can be set incrementally by pressing the button once or continuously by keeping the button pressed.	
	The value is incremented continuously. For reducing the value: let the display move to the maximum setting value. Then the cycle starts again at the minimum setting value.	
4	► Confirm with [MODE/ENTER].	

10.2.2 Carry out the basic teach empty state

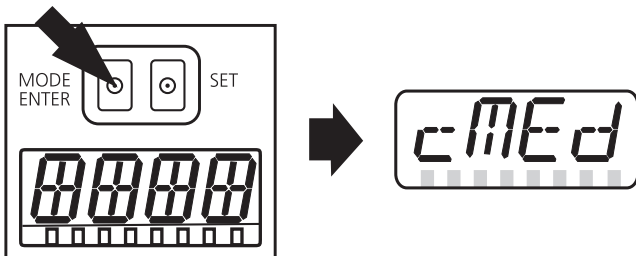
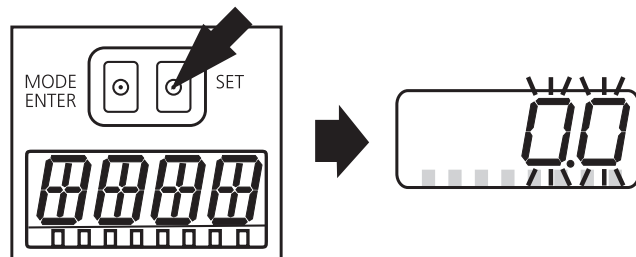
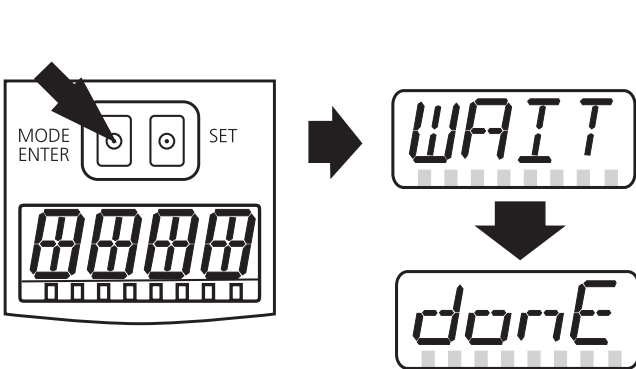
The bottom of an empty tank can be set as reference level.

1	► Apply operating voltage. > Initial display is shown.	
2	► Press [MODE/ENTER] until [cEMP] is displayed.	
3	► Press [SET] and keep it pressed until [cEMP] is flashing.	

4	> After 5 s [WAIT] is displayed while the measurement is being made. > [donE] shows that the new setting value has been stored. If the setting was unsuccessful the cause is displayed briefly and then [FAIL] is displayed. The new reference point is rejected.	
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10.2.3 Carry out the adjustment to the reference level

The current level of a partly filled tank can be entered as numerical value. On this basis the reference level is calculated.

1	▶ Apply operating voltage. > Initial display is shown.	
2	▶ Press [MODE/ENTER] until [cMEd] is displayed.	
3	▶ Press [SET] and keep it pressed until the display flashes. ▶ After 5 s the setting value can be set incrementally by pressing the button once or continuously by keeping the button pressed.	
The value is incremented continuously. For reducing the value: let the display move to the maximum setting value. Then the cycle starts again at the minimum setting value.		
4	▶ Confirm with [MODE/ENTER]. > [WAIT] is displayed while the measurement is being made. > [donE] shows that the new setting value has been stored. If the setting was unsuccessful the cause is displayed briefly and then [FAIL] is displayed. The new reference point is rejected.	

10.2.4 Unsuccessful adjustment

In case of unsuccessful adjustment, the cause is displayed briefly([++], [- -], [nEAr], [Far], [bAd], [dEEP]), then [FAIL]. The new reference point is rejected.

Display	Possible cause
[++]	too much light, e.g reflective surface
[- -]	not enough light, no medium
[nEAr]	The level is below the min. measuring distance < 20.0 cm
[Far]	The level exceeds the max. measuring distance > 1 000.0 cm
[bAd]	The measurement is too noisy
[dEEP]	Reference level > 1 000.0 cm

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10.2.5 Successful setting of the reference level

Parameter values ([SPx / FHx], [rPx / FLx], [ASP], [AEP]) which are not possible with the newly set reference level are recalculated on the basis of the new measuring range available.

10.3 Configuration of the basic settings

10.3.1 Selection of the display unit

Set [Uni] before the values for the parameters [SPx / FHx], [ASP], [AEP] are defined. In case of subsequent changes of the display unit rounding errors during internal conversion to other units may falsify the set values. ► Change to [EF]. ► Select [Uni] and set the unit of measurement. Selection of the unit of measurement: [cm], [m], [inch] ► Confirm with [MODE/ENTER]. > The selected unit is indicated by a green LED on the display.	EF Unit
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10.3.2 Setting the display

▶ Change to [EF]. ▶ Select [diS] and make settings. 2 settings can be selected: • [ON] = the measured value display is activated in the Run mode. Update of the measured values every 600 ms. • [OFF] = The measured value display is deactivated in the Run mode. Press one button to indicate the current measured value for 15 s. The update of the measured value only refers to the display. It has no effect on the outputs. ▶ Confirm with [MODE/ENTER]. The LEDs remain active even if the display is deactivated.	EF di S
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10.3.3 Configure OUT1

▶ Select [OU1] and set the switching functions. Switching functions: • [Hno] = hysteresis function / normally open • [Hnc] = hysteresis function / normally closed • [Fno] = window function / normally open • [Fnc] = window function / normally closed ▶ Confirm with [MODE/ENTER].	OU 1
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10.3.4 Setting of the switch points for hysteresis function OUT1

▶ In [OU1] select the output function [Hno] or [Hnc]. ▶ Confirm with [MODE/ENTER]. ▶ Select [SP1] and set the set point. ▶ Confirm with [MODE/ENTER]. ▶ Select [rP1] and set the reset point. ▶ Confirm with [MODE/ENTER].	OU 1 SP 1 r-P 1
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10.3.5 Setting of the switch points for window function OUT1

▶ In [OU1] select the output function [Fno] or [Fnc]. ▶ Confirm with [MODE/ENTER]. ▶ Select [FH1] and set the upper limit value. ▶ Confirm with [MODE/ENTER]. ▶ Select [FL1] and set the lower limit value. ▶ Confirm with [MODE/ENTER].	OU 1 FH 1 FL 1
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10.3.6 Configure OUT2

▶ Select [OU2]. ▶ Set switching functions or analogue signals: • [Hno] = hysteresis function / normally open • [Hnc] = hysteresis function / normally closed • [Fno] = window function / normally open • [Fnc] = window function / normally closed • [I] = current output analogue 4...20 mA • [U] = voltage output analogue 0...10 V ▶ Confirm with [MODE/ENTER].	OU2
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10.3.7 Setting of the switch points for hysteresis function OUT2

▶ In [OU2] select the output function [Hno] or [Hnc]. ▶ Confirm with [MODE/ENTER]. ▶ Select [SP2] and set the set point. ▶ Confirm with [MODE/ENTER]. ▶ Select [rP2] and set the reset point. ▶ Confirm with [MODE/ENTER].	OU2 SP2 r-P2
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10.3.8 Setting of the switch points for window function OUT2

▶ In [OU2] select the output function [Fno] or [Fnc]. ▶ Confirm with [MODE/ENTER]. ▶ [Select FH2] and set the upper limit value. ▶ Confirm with [MODE/ENTER]. ▶ Select [FL2] and set the lower limit value. ▶ Confirm with [MODE/ENTER].	OU2 FH2 FL2
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10.3.9 Scaling of the measuring range (analogue output)

▶ In [OU2] select [I] or [U]. ▶ Confirm with [MODE/ENTER]. ▶ Select [ASP] and set the "Analogue start point". With [ASP] you define at which measured value the output signal is 4 mA / 0 V. ▶ Confirm with [MODE/ENTER]. ▶ Select [AEP] and set the "Analogue end point". With [AEP] you define at which measured value the output signal is 20 mA / 10 V. [AEP] can also be selected so that it is below [ASP]. This implements a falling edge. ▶ Confirm with [MODE/ENTER]. Minimum distance between [ASP] and [AEP]: 10.0 cm. When the minimum distance is not reached, the error message "SIZE" is displayed.	OU2 ASP AEP
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10.4 Extended functions

10.4.1 Setting of the delay time for switching outputs

▶ Select [EF]. ▶ Press [SET] to change to the menu [EF]. ▶ Select parameters with [MODE/ENTER]: [drx] = switch-off delay. ▶ Set the parameter value with [SET]: Setting range [s]: 0 / 0.1...5 s in steps of 0.1 s (0 = delay time is not active) ▶ Confirm with [MODE/ENTER].	<i>EF</i> <i>dr 1</i> <i>dr 2</i>
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10.4.2 Response of the outputs in case of a fault

▶ Select [EF]. ▶ Press [SET] to change to the menu [EF]. ▶ Select [FOUx]. ▶ Set the parameter value with [SET]: • [ON] = The output switches in case of a fault or analogue value 20 mA / 10 V is provided. • [OFF] = The output switches back in case of a fault or analogue value 4 mA / 0 V is provided. ▶ Confirm with [MODE/ENTER].	<i>EF</i> <i>FOU 1</i> <i>FOU 2</i>
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10.4.3 Setting of the delay time after signal loss

▶ Select [EF]. ▶ Press [SET] to change to the menu [EF]. ▶ Select [dFo]. ▶ Set the parameter value with [SET]: Setting range [s]: 0.0...1.0...5.0. ▶ Confirm with [MODE/ENTER].	<i>EF</i> <i>dFo</i>
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10.4.4 Setting of the sampling rate

▶ Select [EF]. ▶ Press [SET] to change to the menu [EF]. ▶ Select [rATE]. ▶ Press [SET] until the preset measured sampling rate value flashes. ▶ Enter a value incrementally by pressing [SET] once. ▶ Confirm with [MODE/ENTER]. > [rATE] is displayed again.	<i>EF</i> <i>r-ATE</i>
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10.4.5 Table repeatability and accuracy

Values for sampling rate 15 Hz, extraneous light of max. 40 klx*

Distance in [cm]	Repeatability		Accuracy	
	white 90 % remission	grey 18 % remission	white 90 % remission	grey 18 % remission
20.0...100.0	± 0.45 cm	± 0.6 cm	± 1.5 cm	± 1.6 cm
100.0...200.0	± 0.5 cm	± 0.8 cm	± 1.5 cm	± 1.8 cm
200.0...400.0	± 1.6 cm	± 1.9 cm	± 2.5 cm	± 3.0 cm
400.0...600.0	± 2.4 cm	± 3.3 cm	± 3.5 cm	± 4.5 cm
600.0...1000.0	± 5.0 cm	—	± 6.5 cm	—

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Values for sampling rate 15 Hz, extraneous light of 40...100 klx*

Distance in [cm]	Repeatability		Accuracy	
	white 90 % remission	grey 18 % remission	white 90 % remission	grey 18 % remission
20.0...200.0	± 1.4 cm	± 1.4 cm	± 2.4 cm	± 2.4 cm
200.0...400.0	± 2.5 cm	± 3.0 cm	± 3.5 cm	± 4.0 cm
400.0...600.0	± 3.1 cm	± 4.5 cm	± 4.1 cm	± 5.5 cm
600.0...1000.0	± 6.0 cm	—	± 7.0 cm	—

Values for sampling rate 1 Hz, extraneous light of max. 40 klx*

Distance in [cm]	Repeatability		Accuracy	
	white 90 % remission	grey 18 % remission	white 90 % remission	grey 18 % remission
20.0...100.0	± 0.40 cm	± 0.45 cm	± 1.4 cm	± 1.5 cm
100.0...200.0	± 0.45 cm	± 0.6 cm	± 1.5 cm	± 1.6 cm
200.0...400.0	± 1.35 cm	± 1.4 cm	± 2.3 cm	± 2.4 cm
400.0...600.0	± 1.9 cm	± 2.1 cm	± 2.9 cm	± 3.1 cm
600.0...1000.0	± 3.7 cm	—	± 4.7 cm	—

Values for sampling rate 1 Hz, extraneous light of 40...100 klx*

Distance in [cm]	Repeatability		Accuracy	
	white 90 % remission	grey 18 % remission	white 90 % remission	grey 18 % remission
20.0...200.0	± 1.0 cm	± 1.0 cm	± 2.0 cm	± 2.0 cm
200.0...400.0	± 1.8 cm	± 1.9 cm	± 2.8 cm	± 2.9 cm
400.0...600.0	± 2.3 cm	± 2.7 cm	± 3.3 cm	± 3.7 cm
600.0...1000.0	± 3.8 cm	—	± 4.8 cm	—

* Range referred to black (6 % remission) ≤ 400.0 cm.

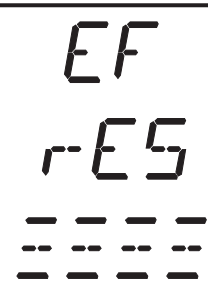
The values apply at:

- constant ambient conditions (23°C /960 hPa)
- only after unit powered up for 10 minutes.

10.4.6 Setting of the mean filter

▶ Select [EF]. ▶ Press [SET] to change to the menu [EF]. ▶ Select [mEAn]. ▶ Set the parameter value with [SET]: ▶ Setting range [s]: 1...60 ▶ [OFF] = mean filter not active ▶ Confirm with [MODE/ENTER].	
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10.4.7 Reset of all parameters to factory setting

▶ Select [EF]. ▶ Press [SET] to change to the menu [EF]. ▶ Select [rES]. ▶ Press [SET] and keep it pressed until [- - -] is displayed. ▶ Confirm with [MODE/ENTER]. > The unit returns to the factory setting. > Initial display is shown.	
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11 Operation

11.1 Operating modes

11.1.1 Run mode

The run mode is the normal operating mode.

After power on the unit is in the Run mode. It carries out its monitoring function and generates output signals according to the set parameters.

The display indicates the current level (relative to the reference level), the yellow LEDs signal the switching status of the outputs.

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11.1.2 Display mode

Indication of the parameters and the set parameter values

► Press [MODE/ENTER] briefly.

> Unit goes to the Display mode. Internally it remains in the operating mode. The set parameter values can be read:

► To scroll through the parameters, press [MODE/ENTER] briefly.

► To display the respective parameter value, press [SET] briefly.

> After another 15 s the unit returns to the Run mode.

11.1.3 Object reflectivity

Indication of object reflectivity:

► Press [SET] in the Run mode.

> The unit displays an orientation value for the object reflectivity (for instance +100 corresponds to a white object, +020 corresponds to a grey object).

11.1.4 Programming mode

Setting the parameter values → 10.1 General parameter setting.

12 Troubleshooting

Display	Possible causes	Switching output				Current output	
		Hno	Hnc	Fno	Fnc	AEP < ASP	ASP < AEP
	Initial display Reference level not taught	OFF	Not active				3.5 mA
++	Too much light, e.g. reflective surface	Depending on settings FOU1 / FOU2 FOU = [ON]: Switching output switched or analogue value = 20.5 mA / 10 V FOU = [OFF]: Switching output off or analogue value = 3.5 mA / 0 V					
--	Not enough light, no medium						
near	Level < 20 cm						
far	Level > 999.5 cm						
Errp	Plausibility (e.g. medium is too fast)						
LoFF	Laser switched off						
----	Underfill. Level is below the taught reference level.	OFF	ON	OFF	ON	20.5 mA 10 V	3.5 mA 0 V
SC1	Short circuit channel 1						
SC2	Short circuit channel 2					[SC2] or [SC] only active if OUT2 is configured as switching output.	
SC	Short circuit channel 1 & 2						

Display	IO-Link process value		IO-Link device status *)
	Level *)	Object reflectivity *)	
	NoData	Normal operation	Functional check
++		OL	Out of specification
--		UL	
near	OL	NoData	
far	UL		
Errp	Last valid measured value		
LoFF	NoData		Device is operating properly
----	UL	Normal operation	
SC1	IO-Link disturbed		
SC2	Normal operation		Functional check
SC	IO-Link disturbed		

GB

*) see device-related IODD

13 Maintenance, repair, disposal

Faulty sensors must only be repaired by the manufacturer.

- ▶ Keep the front lens of the sensor clean.
- ▶ After use dispose of the unit in an environmentally friendly way in accordance with the applicable national regulations.

14 Factory setting

On delivery the parameter setting menu is not displayed completely. Only the parameter values [Uni], [EMP], [cEMP], [cMED] can be set. The complete parameter setting menu is only accessible when the reference level has been set.

Parameter	Setting range	Factory setting	Own setting
Uni	cm, m, inch	Cm	
OU1	Hno, Hnc, Fno, Fnc	Hno	
SP1 / FH1 [cm]	20.0...999.5	100	
rP1 / FL1 [cm]	20.0...999.5	80	
OU2	Hno, Hnc, Fno, Fnc, I, U	I	
SP2 / FH2 [cm]	20...999.5	200	
rP2 / FL2 [cm]	20...999.5	180	
ASP [cm]	20...999.5	0	
AEP [cm]	20...999.5	979.5	
dr1 [s]	0...0.1...5	0	
dr2 [s]	0...0.1...5	0	
FOU1	ON ; OFF	OFF	
FOU2	ON ; OFF	OFF	
DFO [s]	0...0.1...5	0,2	
EMP [cm]	20.0...999.5	20.0	
CMEd [cm]	20.0...999.5	—	
DiS	ON ; OFF	ON	
rATE [Hz]	1...33	15	
mEAn [s]	OFF; 1...60	OFF	

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