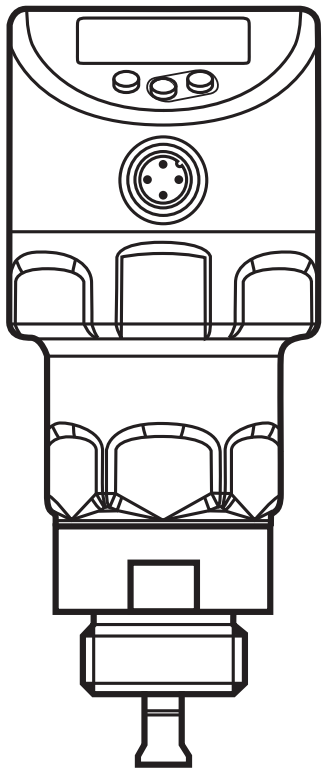
ifm electronic

Operating instructions
Electronic level sensor

efector160

LR2050

UK



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Contents

1 Preliminary note

1.1 Symbols used

▶ Instructions

> Reaction, result

[…] Designation of keys, buttons or indications

→ Cross-reference

Important note
Non-compliance may result in malfunction or interference.

Information_Supplementary note.

2 Safety instructions

- Please read this document prior to set-up of the unit. Ensure that the product is suitable for your application without any restrictions.
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property can occur.

- Improper or non-intended use may lead to malfunctions of the unit or to unwanted effects in your application. That is why installation, electrical connection, set-up, operation and maintenance of the unit must only be carried out by qualified personnel authorised by the machine operator.
- In order to guarantee the correct condition of the device for the operating time it is necessary to use the device only for media to which the wetted materials are sufficiently resistant (→ Technical data).
- It is the operator's responsibility to verify whether the device is suitable for the respective application. The manufacturer assumes no liability for consequences of misuse by the operator.
- Improper installation and use of the device result in a loss of the warranty claims
- The unit may cause radio interference in domestic areas. If interference occurs, the user must take appropriate remedial actions.
- The unit complies with the standard EN 61000-6-4 and is a class A product. The radiated energy of the microwaves is, for example, much below that of mobile phones. According to the current state of science the operation of the unit can be classified to be harmless to human health.

3 Items supplied

- LR2050 level sensor
- Operating instructions

In addition, the following is necessary for installation and operation:

- Rod (for operation of the unit with single probe → 5.1)
- plus 1 coaxial pipe (for operation of the unit with coaxial probe → 5.2)
- Mounting adapter / welding adapter (a launching plate if required → 7.4)

Available accessories: www.ifm.com → Data sheet search → Accessories

Only use accessories from ifm electronic gmbh. The optimum function is not ensured when using components from other manufacturers.

4 Getting started

For fast set-up and unless there are any other requirement the quick set-up described below is possible for most applications. The quick set-up does not replace observance of the other chapters.

▶ Install the unit correctly (→ 7.1 and → 8).

▶ Make basic settings (→ 11.2).

> **The unit is ready for operation.**

▶ If required, carry out tank adjustment (parameter [tREF → 11.2.4).

▶ If required, set switching limits for OUT1 (parameter [SP1] / [rP1] → 11.4.3).

▶ If required, scale analogue output OUT2 (parameter [ASP2] / [AEP2] → 11.4.4).

5 Functions and features

The unit continuously detects the level of liquids and viscous media in tanks and generates output signals according to the parameter settings.

2 outputs are available. They can be set separately.

OUT1	Switching signal for level limit value / IO-Link
OUT2	• Analogue signal proportional to level 4...20 mA / 20...4 mA or • switching signal for level limit value

5.1 Operation with single probe

The single probe is made up of one individual rod. Operation with single probe is suited for the detection of aqueous media, in particular of heavily soiled aqueous media.

For correct function with single probe, the unit needs a sufficiently large metal launching surface / launching plate ("antenna"). It is necessary for transferring the microwave pulse to the tank with optimum transmission power.

The flange plates that are available as accessories are not sufficient as launching plates (for suitable launching plates → 7.4).

For installation in closed metal tanks / metal bypass pipes, the tank lid / upper pipe section serves as a launching surface / launching plate. For installation in open metal tanks, tanks made of plastic or metal tanks with plastic lids a sufficiently large fixing plate, a metal plate or similar must be used (→ 7.4.1 / → 7.4.2).

For operation with single probe, minimum distances to tank walls, objects in the tank, bottom of the tank and further level sensors must be adhered to (→ 7.1.1).

5.2 Operation with coaxial probe

The coaxial probe is made up of an inner rod and an outer coaxial pipe. The rod is centred in the coaxial pipe by one or several spacers.

In case of operation with a coaxial probe media with a low dielectric constant (e.g. oil and oil-based media) are detected in addition to aqueous media.

No launching plate is required for operation with coaxial probe. Furthermore, no minimum distances to tank walls and objects in the tank are required.

Operation with coaxial probe is not suitable for:

- liquids containing solids
- viscous media
- media prone to formation of deposit

5.3 Applications

- Water, water-based media
- Oils, oil-based media (only for operation with coaxial probe)
- If the unit is to be used in acids or alkalis / in electroplating applications:
  - ▶ Check the compatibility of the product materials (→ Technical data sheet) with the media to be monitored.

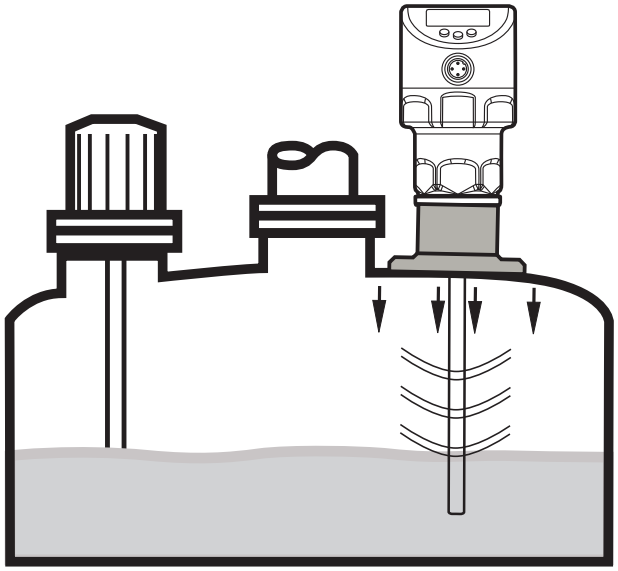
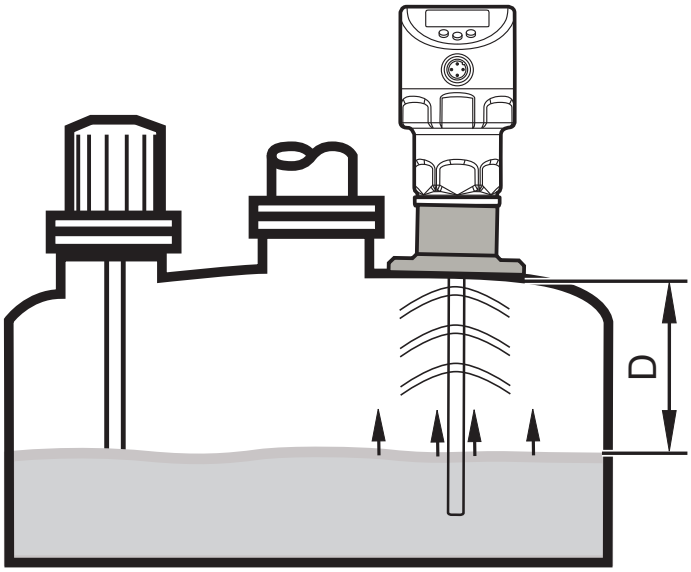
- Compatible with G¾ process connections

Application examples:

- Detection of cleaning liquid in a parts cleaning system.
- Monitoring of hydraulic oil in a hydraulic power unit (only for operation with coaxial probe).
- Detection of cooling water in an industrial cooling system.
- Detection of hot glue in corrugated cardboard manufacture.

6 Function

6.1 Measuring principle

Fig. 5-1	Fig. 5-2
	

The unit operates to the principle of guided wave radar. It measures the level using electromagnetic pulses in the nanosecond range.

The pulses are transmitted by the sensor head and guided along the rod (Fig. 5-1). When they hit the medium to be detected they are reflected and guided back to the sensor (Fig. 5-2). The time between transmitting and receiving the pulse directly relates to the travelled distance (D) and the current level. The reference for distance measurement is the lower edge of the process connection.

The figures show the operation with single probe. In case of operation with a coaxial probe, the guided wave runs only along the inside of the coaxial pipe.

The signal quality may be affected with:

- intensely absorbing surfaces (e.g. strong foam formation)
- intensely bubbling surfaces
- media which are very inhomogeneous, separate from each other thus forming separation layers (e.g. oil layer on water)

▶ Check the function by an application test

6.2 Other features of the unit

- High temperature range (→ Technical data sheet).
- Special operating mode for media with increased foam formation → 11.2.3.
- Tank adjustment enables suppression of undesired interference (e.g. caused by installations in the tank or when mounted in a connection piece (→ 11.2.4)).
- Display of the level and the switching status via display / LEDs.
- IO-Link function (→ 6.2.6).

Technical data sheet at www.ifm.com → New search → Enter the article number

6.2.1 Display functions

The unit displays the current level, either in mm, inch or in percent of the scaled final value of the measuring range. Factory setting: mm.
The display unit is defined by programming (→ 11.3).

In the operating mode, it can be temporarily switched between mm, inch and percentage (→ 12.3).

The set unit of measurement and the switching status of the outputs are indicated by LEDs) (→ 9).

6.2.2 Analogue function

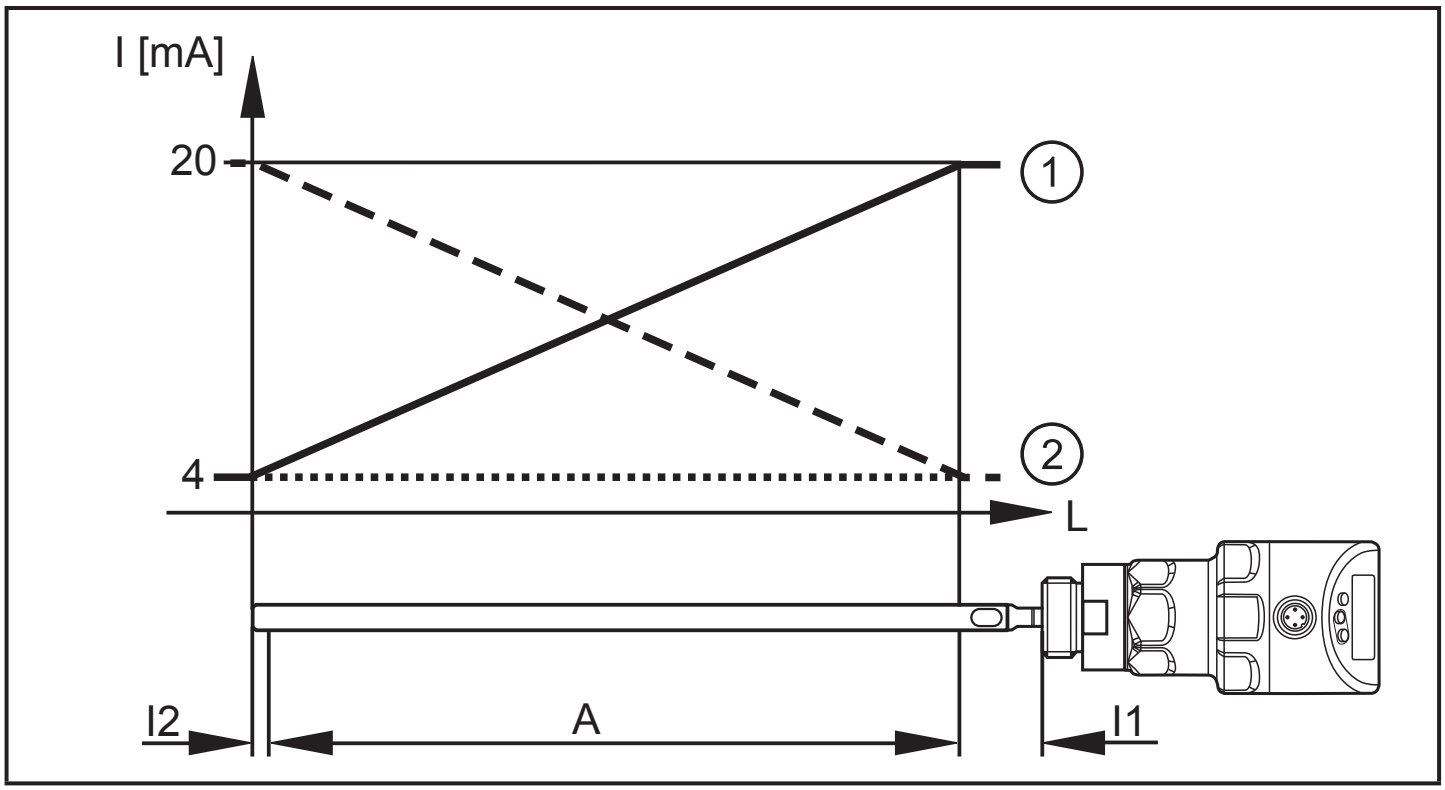
The unit provides an analogue signal proportional to level. The analogue output (OUT2) can be configured) (→ 11.4).

- [ou2] defines the output function of the analogue output) (→ 11.4.2).
- Analogue start point [ASP2] defines at which measured value the output signal is 4 mA ([ou2] = [I]) or 20 mA ([ou2] = [InEG) (→ 11.4.4).

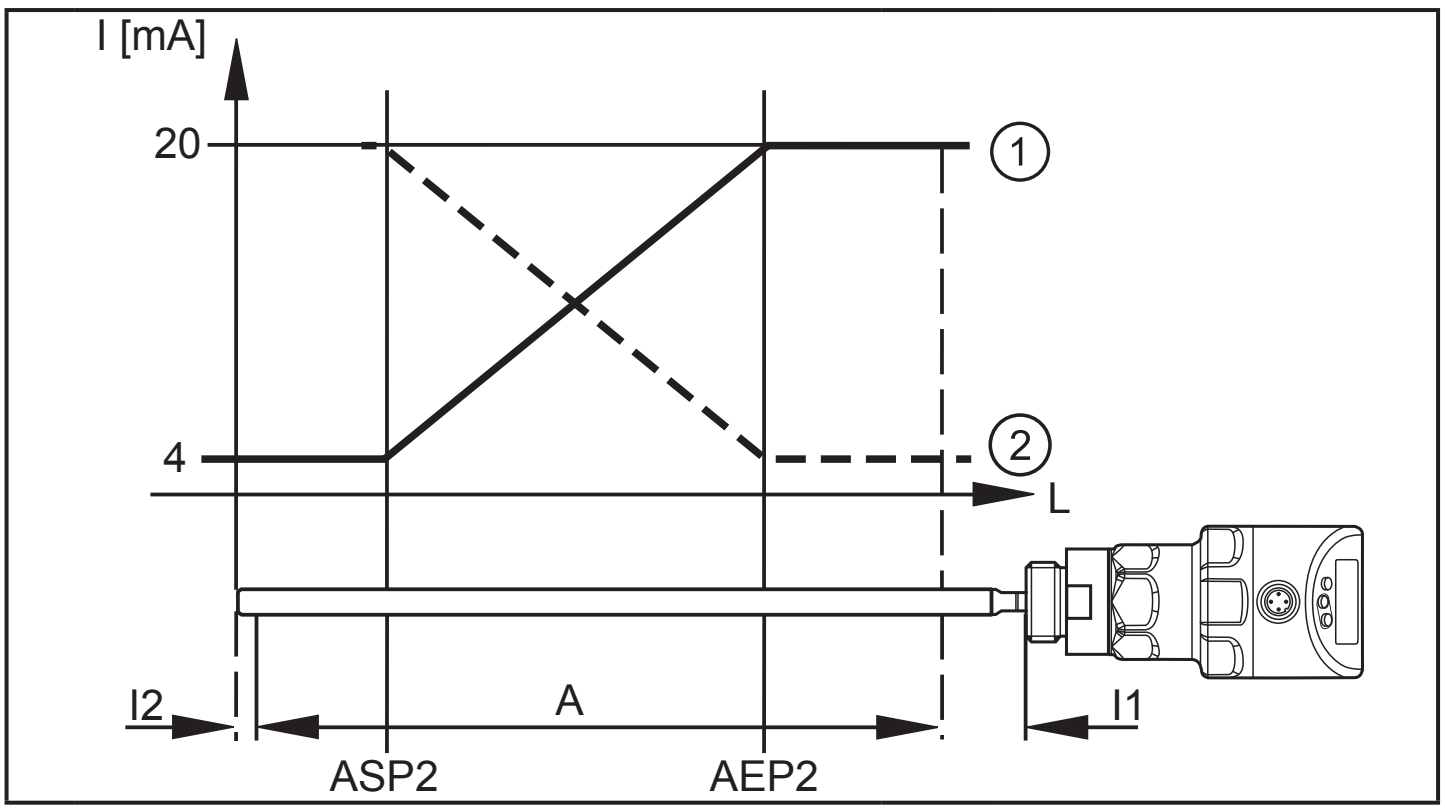
- Analogue end point [ASP2] defines at which measured value the output signal is 20 mA ([ou2] = [I]) or 4 mA ([ou2] = [InEG) (→ 11.4.4).

Minimum distance between [ASP2] and [AEP2] = 20 % of the active zone.

Curve of the analogue signal (factory setting):



Curve of the analogue signal (measuring range scaled):



L: Level
A: Active zone = L - (I1 + I2)
I1: Inactive zone 1
I2: Inactive zone 2 (→ Technical data sheet)

①: [ou2] = I (factory setting)
②: [ou2] = [InEG]
ASP2 Analogue start point
AEP2: Analogue end point

In the set measuring range the output signal is between 4 and 20 mA ([ou2] = [I]) or between 20 and 4 mA ([ou2] = [InEG]).

Additional information of the output signal:

- Level above the measuring range:
  - Output signal 20…20.5 mA at [ou2] = [I]
  - Output signal 4…3.8 mA at [ou2] = [InEG]

- Level below the measuring range:
  - Output signal 4…3.8 mA at [ou2] = [I]
  - Output signal 20…20.5 mA at [ou2] = [InEG]

- In case of a fault, according to the setting [FOUx]:
  - Output signal < 3.6 mA at [FOUx] = [OFF] (factory setting)
  - Output signal > 21 mA at [FOUx] = [on]

Note the tolerances and accuracy limits during the evaluation of the analogue signal (→ Technical data sheet).

6.2.3 Switching functions

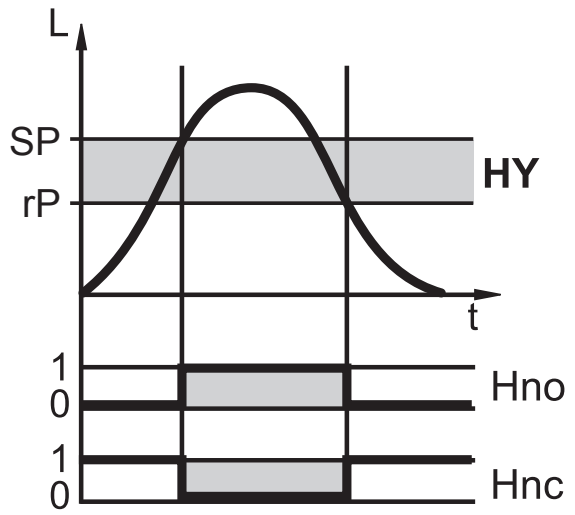
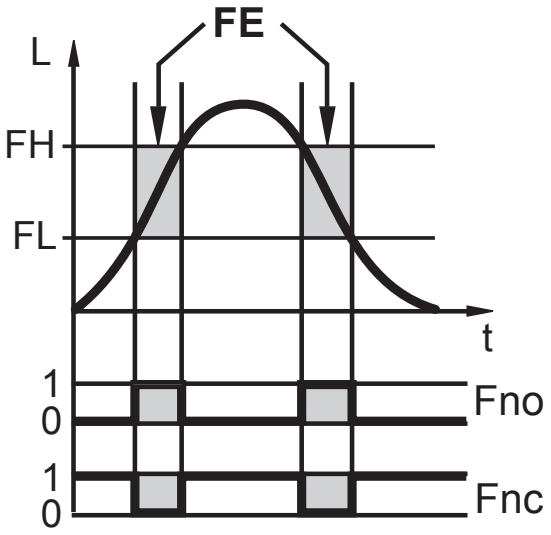
The unit signals via switching output OUT1 or in addition via OUT2 (can be set) that a set limit level has been reached or that the level is below the limit value. The following switching functions can be selected:

- Hysteresis function / normally open (Fig. 5-3): [oux] = [Hno].
- Hysteresis function / normally closed (Fig. 5-3): [oux] = [Hnc].

First the set point (SPx) is set, then the reset point (rPx) with the requested difference.

- Window function / normally open (Fig. 5-4): [oux] = [Fno].
- Window function / normally closed (Fig. 5-4): [oux] = [Fnc].

The width of the window can be set by means of the difference between FHx and FLx. FHx = upper value, FLx = lower value.

Fig. 5-3	Fig. 5-4
	

L: Level
HY: Hysteresis
FE: Window

- For the switching output a switch-off delay of max. 60 s can be set (e.g. for especially long pump cycles).

6.2.4 Damping function

With unsteady level (e.g. turbulence, wave movements...) display and output response may be damped. During damping the determined level values are "smoothed" by means of a mean filter; the result is a steady curve. The damping constant T*)) can be set by means of the parameter [dAP] (→ 11.4.10).

*) T indicates after what time 63 % of the final value are reached in the event of a sudden jump. After 5 T almost 100 % have been reached.

6.2.5 Defined state in case of a fault

- In case of a fault a state can be defined for each output.
- If a fault is detected or if the signal quality is below a minimum value, the outputs change into a safe state according to NAMUR recommendation (NE43). For this case the response of the outputs can be set via the parameters [FOU1], [FOU2] (→ 11.4.8).
- Temporary loss of signal caused e.g. by turbulence or foam formation can be suppressed by a delay time (→ 11.4.11 [dFo]). During the delay time the last measured value is frozen. If the measured signal is received again in sufficient strength within the delay time, the unit continues to work in normal operation. If,

however, it is not received again in sufficient strength within the delay time, the outputs change into the defined state.

6.2.6 IO-Link

General information

This unit has an IO-Link communication interface which requires an IO-Link-capable module (IO-Link master) for operation.

The IO-Link interface enables direct access to the process and diagnostic data and provides the possibility to set the parameters of the unit during operation. In addition communication is possible via a point-to-point connection with a USB adapter cable.
Further information about IO-Link is available at www.ifm.com/gb/io-link.

Device-specific information

You will find the IODDs necessary for the configuration of the IO-Link unit and detailed information about process data structure, diagnostic information and parameter addresses at www.ifm.com/gb/io-link.

Parameter setting tools

You will find all necessary information about the required IO-Link hardware and software at www.ifm.com/gb/io-link.

6.2.7 Simulation functions

Various levels and errors can be simulated for set-up, maintenance or interference restriction. The duration of the simulation can be selected (1 min...1 h). The simulation can be started manually and runs until it is stopped manually or the set time elapses. During the simulation the outputs respond according to the simulated process values (→ 11.7...→ 11.7.3).

7 Mounting

7.1 Installation location / environment

- Vertical installation from the top is preferred.

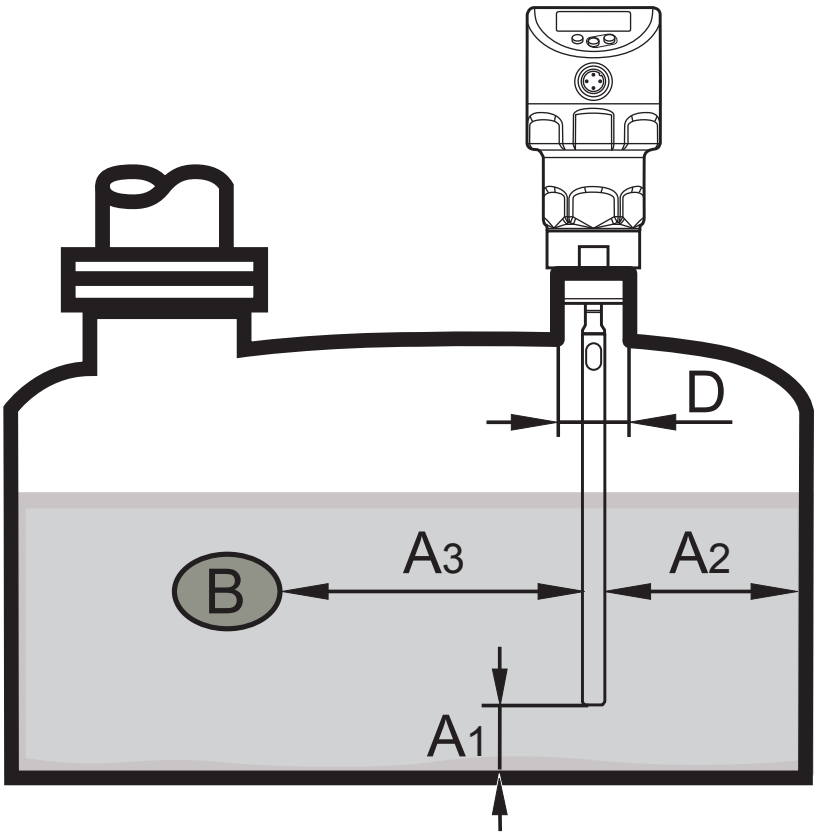
7.1.1 Unit with single probe

- Installation preferably in closed, metal tanks or bypass pipes.
- For installation in open tanks (→ 7.4.1) or plastic tanks (→ 7.4.2).

Installation distances:

▶ Observe the notes on tank adjustment (→ 7.1.2).

- Installation in connection pieces possible.
  ▶ Note min. connection piece diameter D according to the figure / table below.
- The rod must adhere to the following min. distances to the tank wall, objects (B) in the tank and at the tank bottom:



Installation distances with adjustment	Installation distances without adjustment
A1: 10 mm	A1: 10 mm
A2: 20 mm	A2: 50 mm
A3: 20 mm	A3: 50 mm
D: ≥ DN 30	D: No connection piece allowed

- With intensely agitated medium (flow, agitator ...) or heavy soiling:

  ▶ Adhere to increased minimum distances to avoid that the rod gets into contact with the tank wall or structures in the tank.

Reference values:

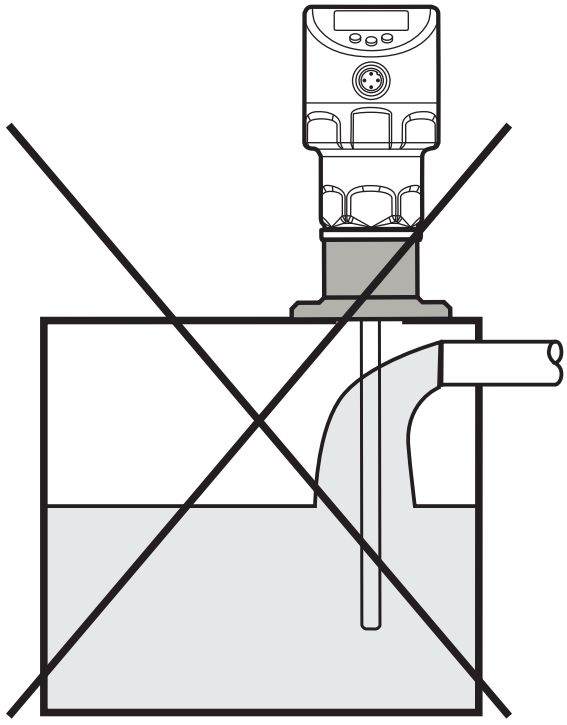
Probe length	Distance to the tank wall or structures in the tank
700...1000 mm	Increase by 40 mm
1000...2000 mm	Increase by 120 mm

- For applications with viscous or intensely flowing media and / or with agitators in which the probe is exposed to continuous and heavy mechanical load the probe has to be fixed at the lower end and be electrically conductive. Fixing at the tank bottom is possible by means of a sleeve or similar devices.

  ▶ The function has to be ensured by carrying out an application test.

- Do not install the unit in the immediate vicinity of a fill opening (Fig. 6-1).

Fig. 6-1



Heavy foam formation and turbulence may lead to incorrect measurements.

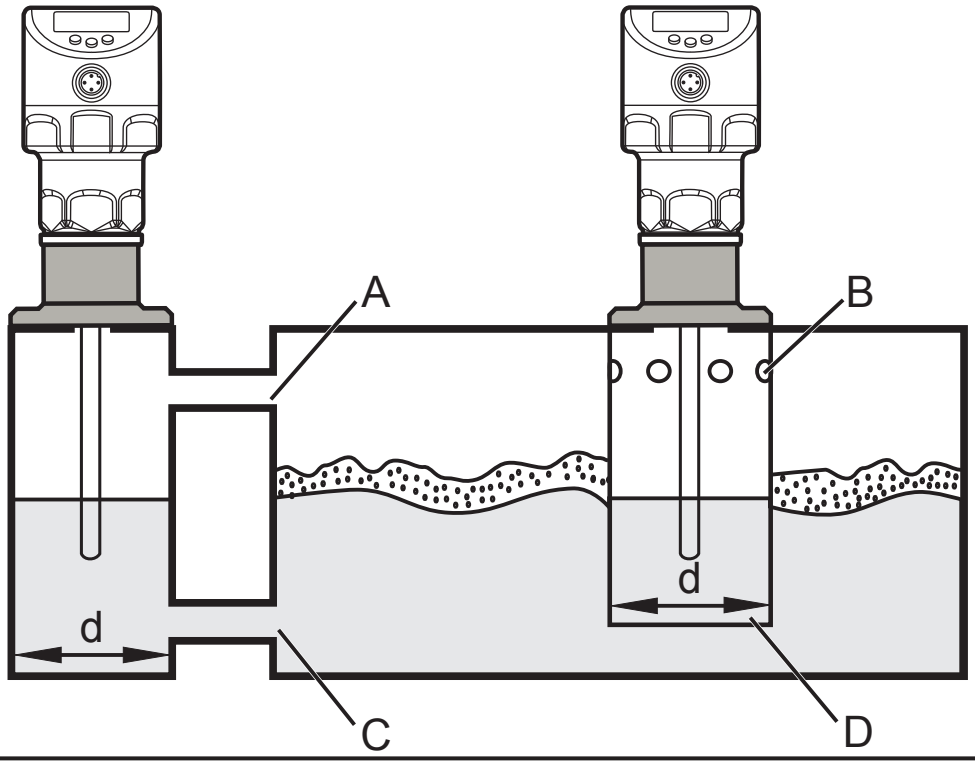
To avoid this

▶ Install the sensor in a steady area.

Example how to create a steady area:

- Installation in metal bypass or metal still pipe (fig. 6-2)
- Separation of the installation location by metal sheets / perforated sheets (without figure)

Fig. 6-2



Min. diameter of the bypass and still pipe:

Installation	with adjustment	without adjustment
Diameter	≥ DN 30	≥ DN 250

The upper access to the steady area (A, B) has to be above the max. level. The lower access (C, D) or the area with perforated sheet has to be below the min. level. This ensures that neither foam nor turbulence impact the sensor zone. When perforated sheets or the like are used, soiling (e.g. by solids in the medium) can also be avoided.

With increased foam formation the setting [MEdI] = [MId] is recommended (→ 11.2.3).

Depending on the operating conditions and the mechanical structure of the bypass or still pipe such as rod does not run centred, flow routes rod to the tank wall, soiling, ... the use of centring pieces is recommended.

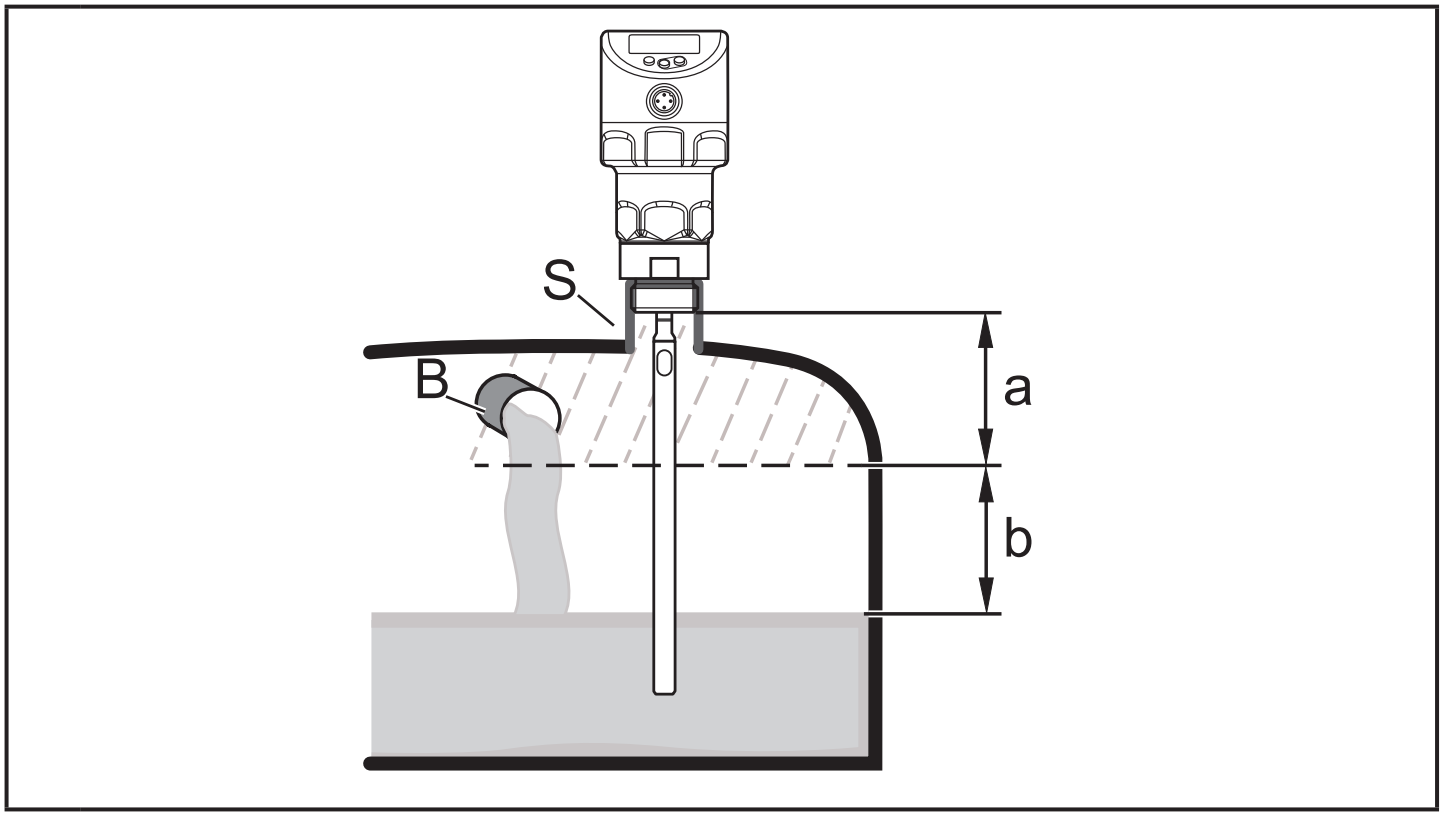
▶ If required, provide for one or several centring pieces between the rod and the pipe.

7.1.2 Notes on the tank adjustment

To improve the signal quality a tank adjustment can be made (→ 11.2.4). For the tank adjustment it is necessary to enter an "adjustment distance" first. Within this distance, starting with the process connection, the interfering reflections are compensated.

▶ Select an adjustment distance size (a) so that the connection piece (S) and structures in the tanks (B) are completely detected.

▶ Observe safety distances (b) to the level or the rod end b ≥ 250 mm.



a: Adjustment distance (min.10 mm; max: L - 250 mm)
b: Safety distance to the level or the rod ends: b ≥ 250 mm
S: Connection piece
B: Structures in the tank

- Carry out a tank adjustment with empty tank, if possible, to cover any possible interfering sources. In this case:

  ▶ Select the max. adjustment distance (L - 250 mm).

- For probe lengths L < 250 mm no tank adjustment is possible. In this case:

  ▶ Keep to the indicated installation distances → 7.1.1.

- With probe lengths L > 250 mm:

  ▶ The level or the rod end have to be min. 250 mm below the adjustment distance.

- With too small distance:

  ▶ Lower the level or observe the installation distances (→ 7.1.1).

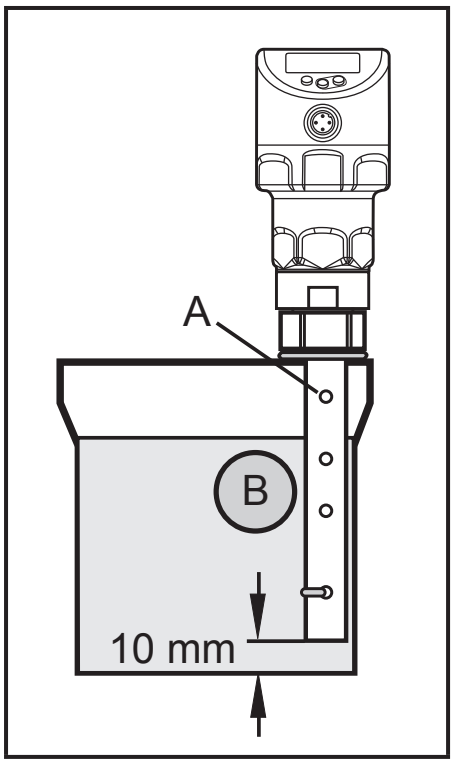
A tank adjustment can help improve the signal quality and ensures a higher excess gain in difficult application conditions (foam, turbulence etc.). In addition, a tank adjustment provides application reliability.

In the event of high interference, the unit rejects tank adjustment, error message: [FAIL]. In such cases:

▶ Check the installation conditions; increase the installation distance / pipe diameter.

7.1.3 Unit with coaxial probe

- No minimum distances to the tank wall and the baffles (B) are required.
- Minimum distance to the bottom of the tank: 10 mm.
- The vent hole (A) must not be covered by mounting elements or similar.
- Do not install the unit in the immediate vicinity of a fill opening. No water jets must enter into the holes of the coaxial pipe.



- Note in case of foam formation: the vent of the coaxial pipe must be above the maximum level. The lower edge of the coaxial pipe must be below the minimum level.

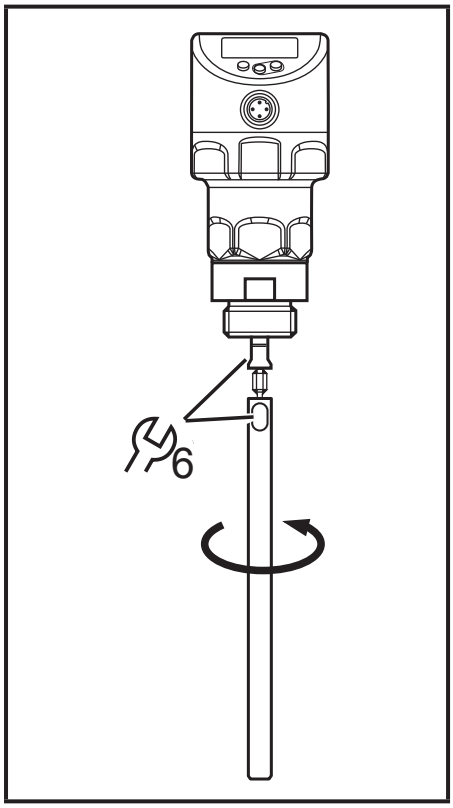
7.2 Installation of the probe

The probe is not supplied. It has to be ordered separately (→ 3 Items supplied).

7.2.1 Installation of the rod

Fixing of the rod:

▶ Screw the rod to the unit and tighten it.



Recommended tightening torque: 4 Nm.

For ease of installation and removal the rod connection can be rotated without restriction. Even if rotated several times there is no risk of damage to the unit. In case of high mechanical stress (strong vibration, moving viscous media) it may be necessary to secure the screw connection, e.g. by a screw retaining compound.

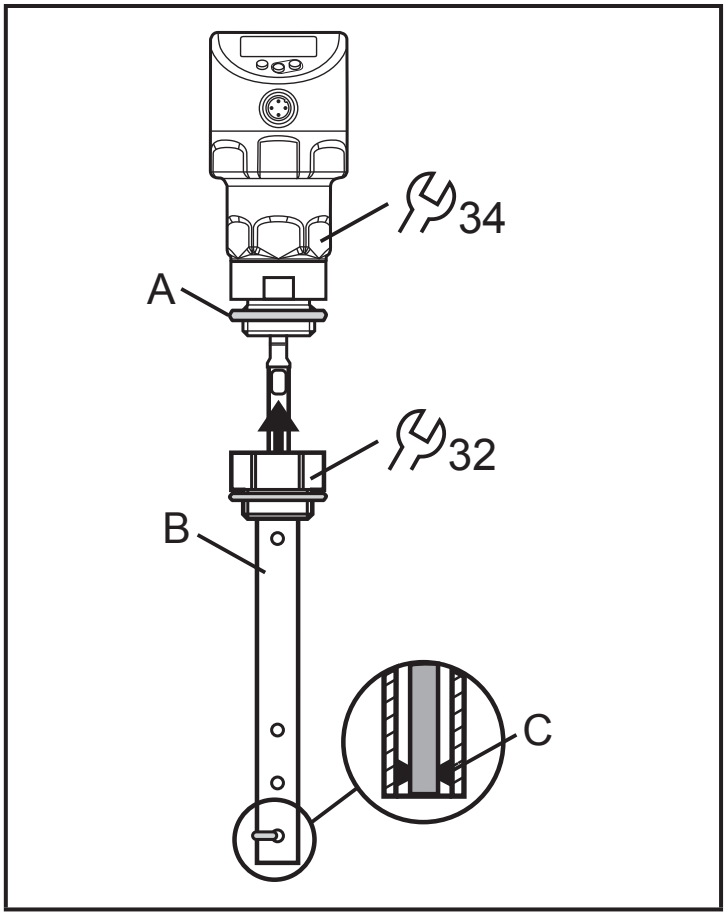
Substances such as screw retaining compounds may migrate into the medium.
Make sure that they are harmless.

7.2.2 Installation of the coaxial pipe

This subchapter is only relevant if the unit is to be operated with a coaxial probe.

The coaxial pipe and the rod must be of the same end length. The coaxial pipe can be shortened (→ 7.3.2).

- ▶ Screw the rod to the unit and tighten it. Recommended tightening torque: 4 Nm.
- ▶ Slide the supplied flat seal (A) onto the thread. The elastomer seal may remain on the unit.
- ▶ Slide the coaxial pipe (B) onto the rod. Carefully centre it and carefully move the rod through the centring piece (C) (for lengths > 140 cm through both centring pieces) of the coaxial pipe. Do not damage the centring pieces.
- ▶ Screw onto the sensor thread and tighten.



7.3 Shortening of the probe, determination of the probe length

7.3.1 Shortening of the rod

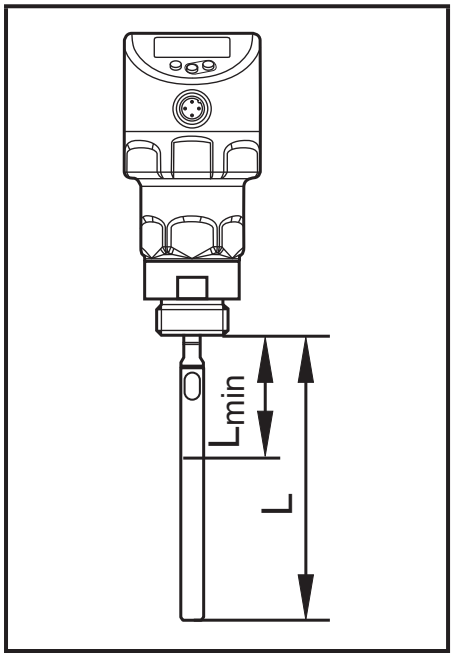
The rod can be shortened to adapt the probe to different tank heights.

Ensure that the probe length is not below the minimum permissible probe length of 150 mm (L_{min}). The unit does not support probe lengths below 150 mm. If shorter probes are used, malfunction can occur.

For probe lengths < 250 mm no tank adjustment is possible (→ 7.1.2 Notes on the tank adjustment).

Proceed as follows:

- ▶ Screw the rod to the unit.
- ▶ Mark the desired length (L) on the rod. The reference point is the lower edge of the process connection.
- ▶ Remove the rod from the unit.
- ▶ Shorten the rod.
- ▶ Remove all burrs and sharp edges.



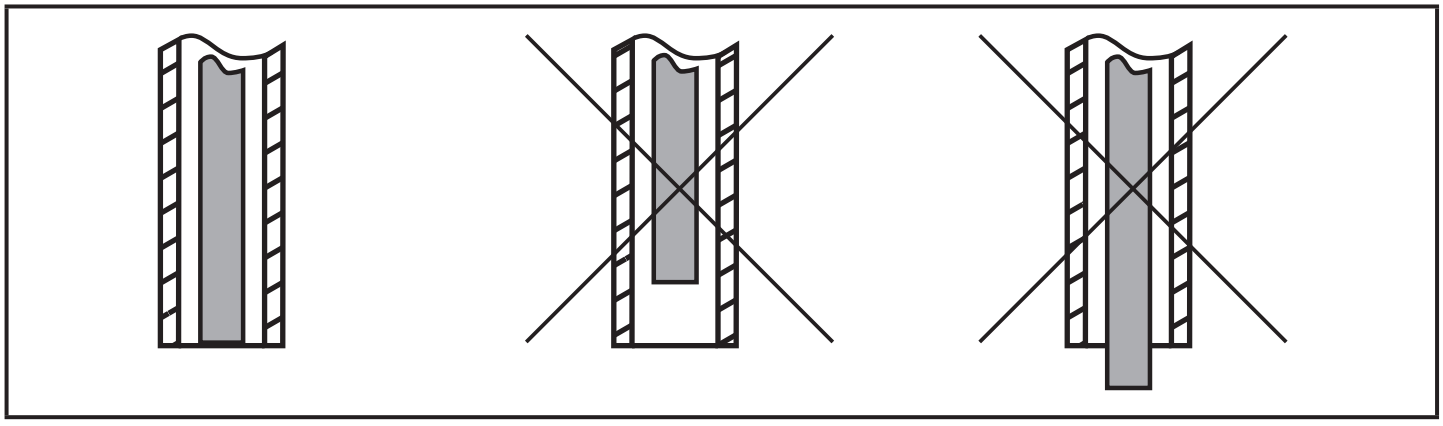
- ▶ Screw the rod to the unit again and tighten it. Recommended tightening torque: 4 Nm.
- ▶ Precisely measure the probe length L, note the value. It is needed for parameter setting of the unit.

In case of high mechanical stress (strong vibration, moving viscous media) it may be necessary to secure the screw connection, e.g. by a screw retaining compound.

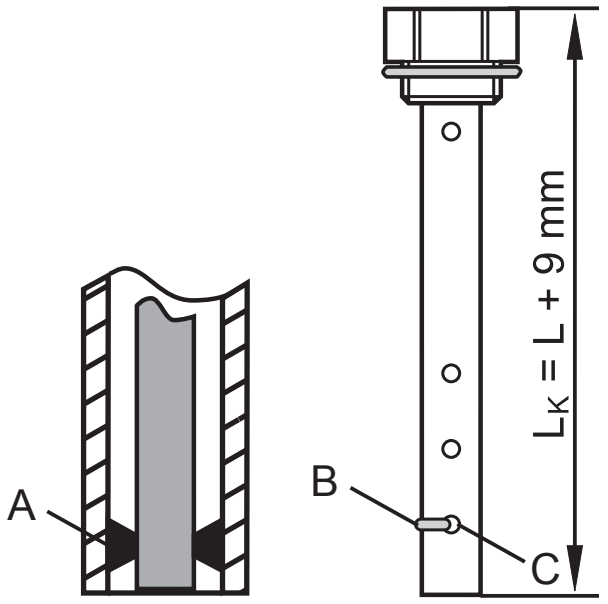
Substances such as screw retaining compounds may migrate into the medium.
Make sure that they are harmless.

7.3.2 Shortening of the coaxial pipe

The coaxial pipe and the rod must be of the same end length:



- ▶ Remove fastening bracket and centring piece (A, B).
- ▶ Shorten the coaxial pipe to the requested length: L_K = L + 9 mm.
- ▶ After shortening, at least one hole (C) for insertion of the fixing bracket has to be left.
- ▶ Remove all burrs and sharp edges.
- ▶ Insert centring piece (A) at the lower end of the pipe and attach it using the fixing bracket (B) at the lower hole (C).



L_K = length of the coaxial pipe
L = length of the rod from the lower edge of the process connection

7.4 Installation of the unit with single probe

Before installing and removing the unit: Make sure that no pressure is applied to the system and that there is no medium in the tank that could leak. Also always note the potential dangers related to extreme machine and medium temperatures.

For installation in closed metal tanks, the tank lid serves as a launching plate) (→ 5.1).

Options are as follows:

- Screw into a G¾ process connection directly in the tank lid (for tanks with thick walls).
- Installation in the tank lid using a flange plate (for tanks with thin walls).

During installation of the process connection on the tank side observe the subsequent orientation of the housing (display orientation, cable outlet). The sensor housing cannot be rotated with respect to the internal thread. Subsequent alignment of the sensor housing is therefore not possible.

Furthermore, installation in open tanks (→ 7.4.1) and plastic tanks is possible (→ 7.4.2).

Installation to G¾ flange

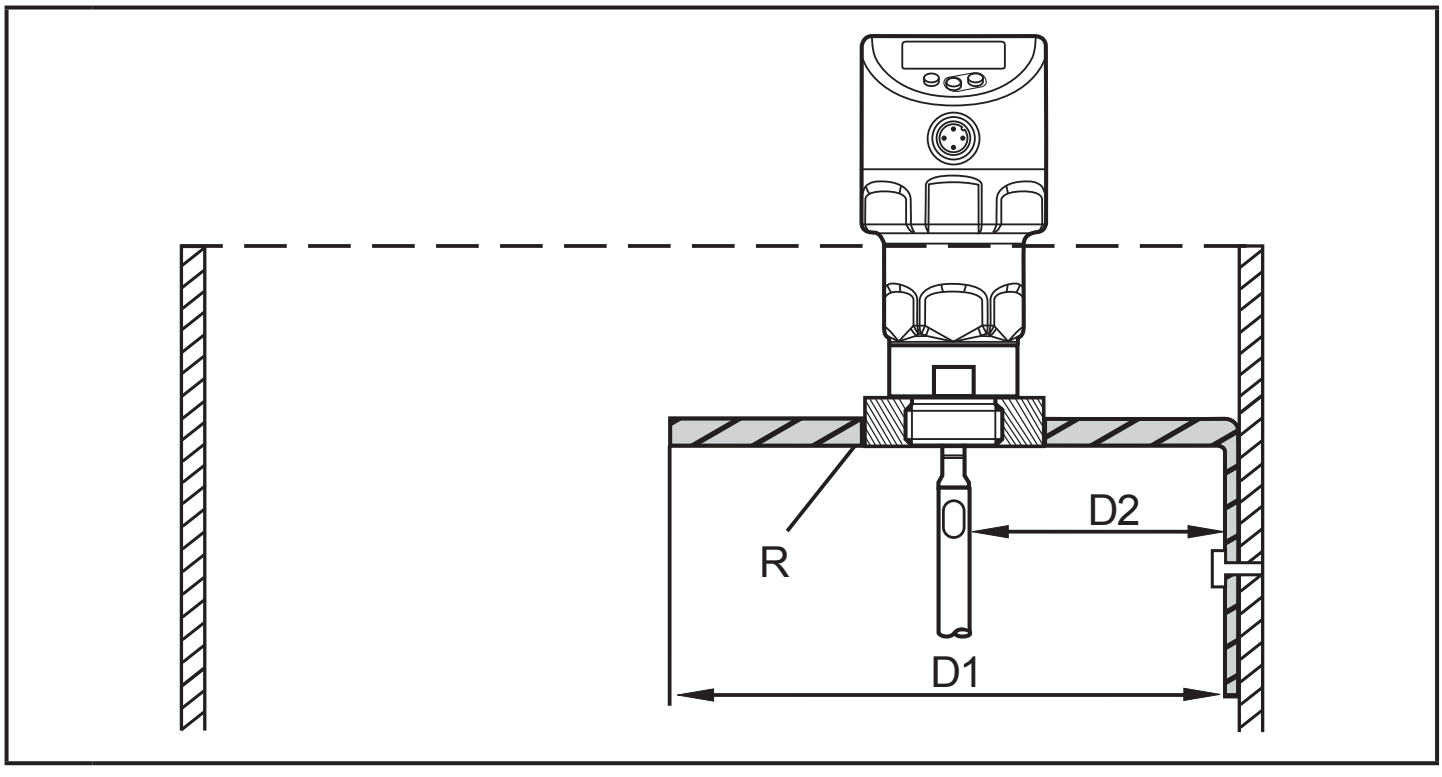
The sealing ring on the sensor is used as process seal.

The upper sealing area on the process connection must be flush with the tapped hole.

- ▶ Grease the sensor thread with a suitable paste.
- ▶ Insert the unit into the process connection.
- ▶ Tighten it using a spanner. Tightening torque: 35 Nm.

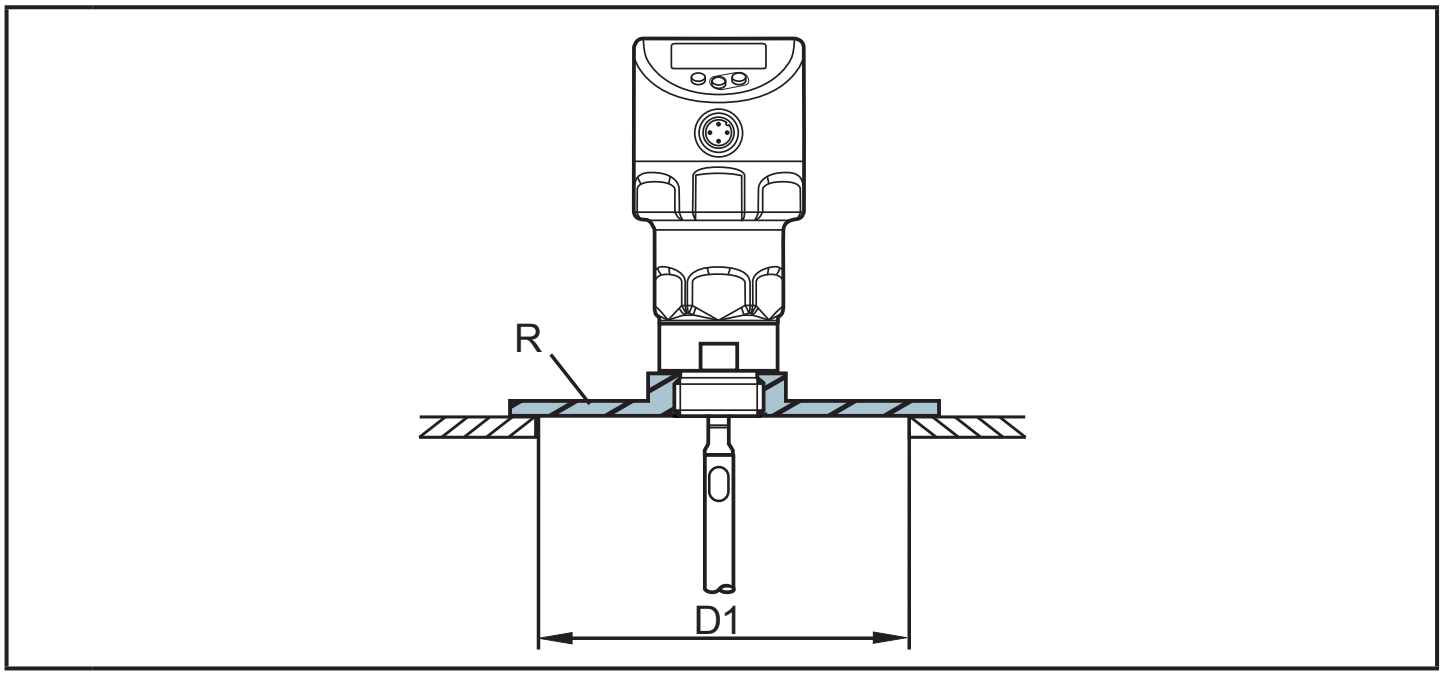
7.4.1 Installation in open tanks

- ▶ For installation in open tanks, use a metal fixture to install the unit. It serves as a launching plate (R); minimum size: 150 x 150 mm for a square fixture, 150 mm diameter for a circular fixture.
- ▶ If possible, mount the unit in the middle of the fixture. The distance D2 must not be below the indicated min. distances (→ 7.1).



D1: Min. 150 mm.
D2: Note the required min. distances → 7.1.
R: Launching plate

7.4.2 Installation in plastic tanks



D1: Min. 150 mm. Note the required min. distances → 7.1.
R: Launching plate

To enable sufficient transfer of the measured signal, note in case of installation in plastic tanks or metal tanks with plastic lid:

▶ The plastic lid must be provided with a drill hole with a minimum diameter of 150 mm.

▶ For installation of the unit, a metal flange plate (= launching plate R) must be used which sufficiently covers the drill hole.

When installed in plastic tanks, there may be deterioration caused by electromagnetic interference. Corrective measures:

- Apply a metal foil to the outside of the tank.
- Apply a shielding screen between the level sensor and other electronic units.
- Operation with coaxial probe efficiently protects the unit from electromagnetic interference. Please note the restrictions regarding the application area (→ 5.2).

7.5 Installation of the unit with coaxial probe

▶ Seal the process connection:

- For coaxial pipes with G¾ process connection:
  Slide the supplied seal onto the thread of the coaxial pipe.

- For coaxial pipes with ¾" NPT process connection: Apply a suitable sealing material (e.g. PTFE tape).

▶ Screw the unit with the coaxial pipe into the tank and tighten it.

8 Electrical connection

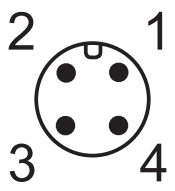
The unit must be connected by a qualified electrician.
The national and international regulations for the installation of electrical equipment must be adhered to.

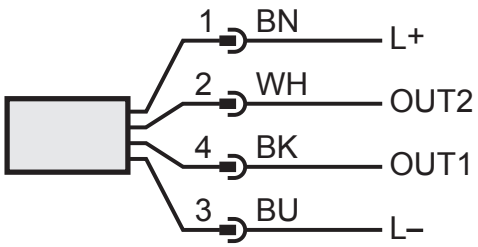
Voltage supply according to EN 50178, SELV, PELV.

▶ Disconnect power.

▶ Connect the unit as follows:

Core colours	
BK	black
BN	brown
BU	blue
WH	white





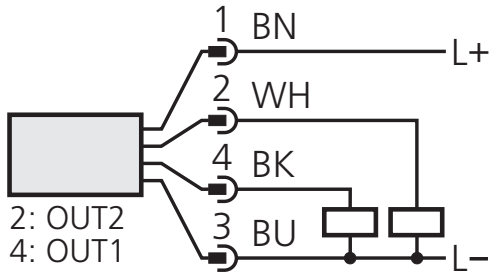
OUT1: switching output or IO-Link

OUT2: analogue output (factory setting) or switching output

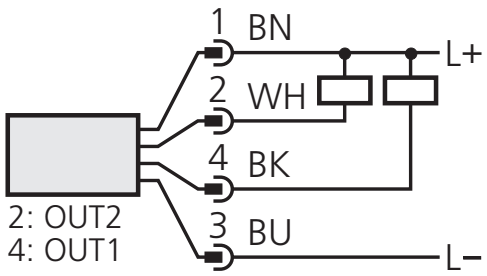
Colours to DIN EN 60947-5-2

Example circuits

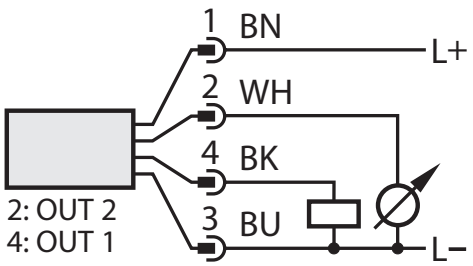
2 x positive switching



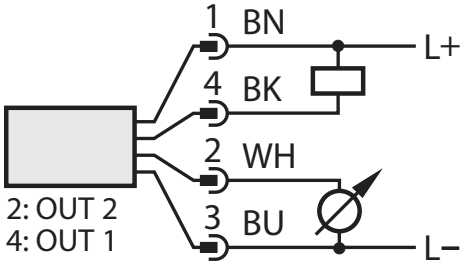
2 x negative switching



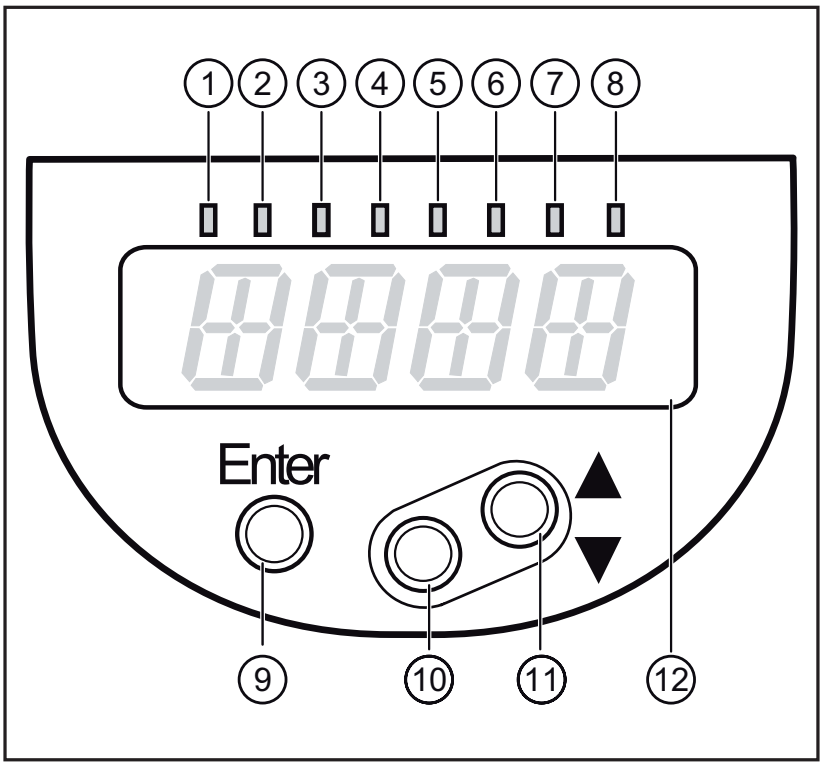
1 x positive switching / 1 x analogue



1 x negative switching / 1 x analogue



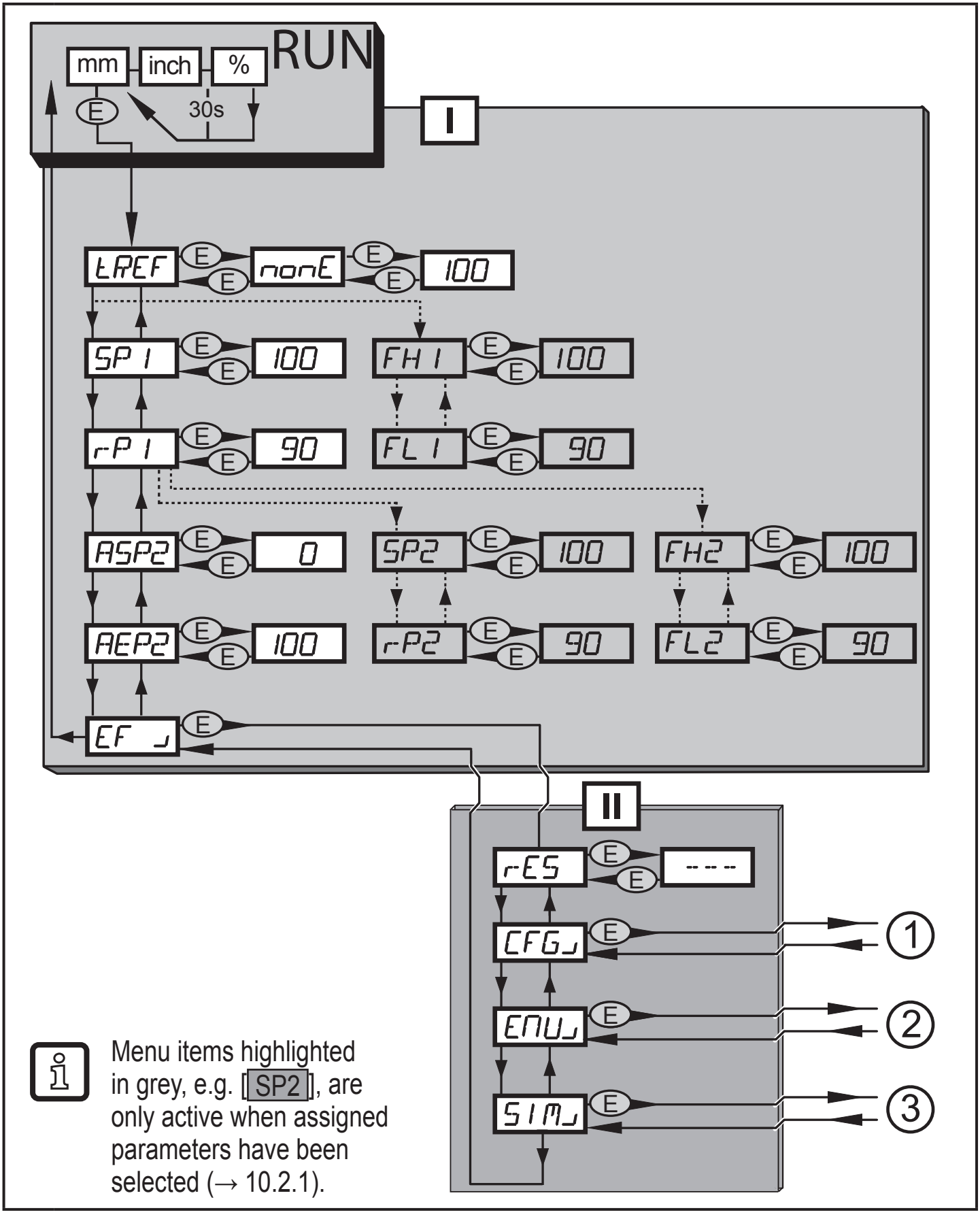
9 Operating and display elements



1 to 8: Indicator LEDs	
LEDS 1 - 3	Selected unit of measurement
LEDS 4 - 6	Not used
LED 7	Switching status OUT2 (lights when output 2 is switched).
LED 8	Switching status OUT1 (lights when output 1 is switched).
9: [Enter] button	
- Open the user menu, edit and confirm the parameter values.	
10 to 11: Arrow keys up [▲] and down [▼]	
- Setting of the parameter values (scrolling by holding pressed; incremental by pressing once).	
12: Alphanumeric display, 4 digits	
- Display of the current level. - Indication of the parameters and parameter values.	

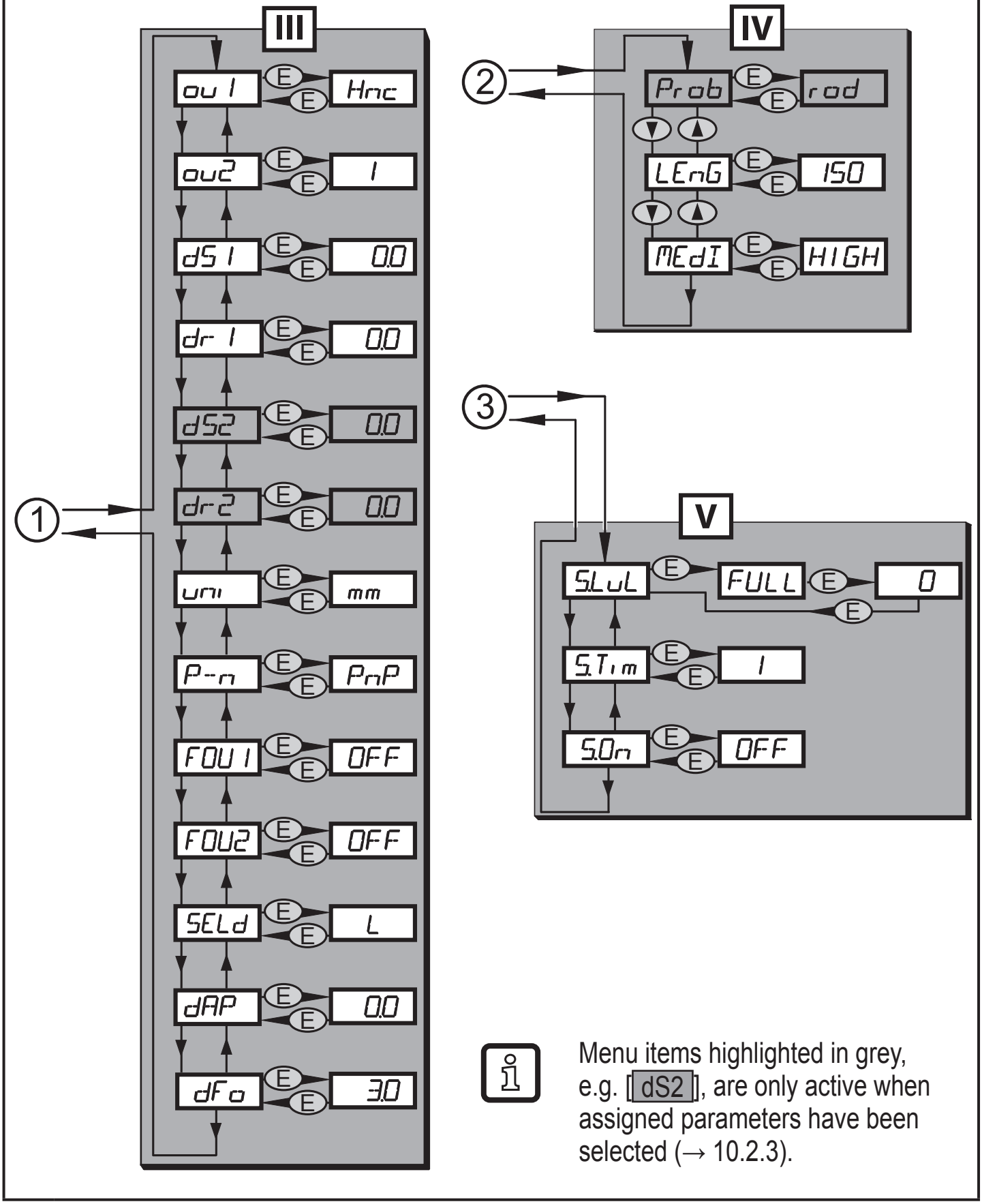
10 Menu

10.1 Menu structure



I: Main menu (→ 10.2.1)

II: EF level (→ 10.2.2)



Menu items highlighted in grey, e.g. [dS2], are only active when assigned parameters have been selected (→ 10.2.3).

III : CFG level (→ 10.2.3)
IV: ENV level (→ 10.2.4)
V: SIM level (→ 10.2.5)

10.2 Explanation of the menu

10.2.1 Main menu [l]

tREF	Carry out tank adjustment.
SP1 / rP1	Upper / lower limit value for the level at which OUT1 switches.
FH1 / FL1*	Upper / lower limit for the acceptable range (monitored by OUT1).
ASP2	Analogue start point for level: Measured value at which the analogue start value is provided. The analogue start point is set with parameter [ou2].
AEP2	Analogue end point for level: Measured value at which the analogue end value is provided. The analogue end value is set with parameter [ou2].
SP2 / rP2**	Upper / lower limit value for the level at which OUT2 switches.
FH2 / FL2*	Upper / lower limit for the acceptable range (monitored by OUT2).
EF ⌟	Extended functions / opening of menu level 2.
* Menu point only visible when window function is selected ([ou.] = [F..]). ** Menu item only visible with selection OUT2 = binary output ([ou2] = [H..]).	

10.2.2 EF level (extended functions) [ll]

rES	Restore the factory setting (all parameters incl. tank adjustment)
CFG⌟	Open the submenu CFG (configuration)
ENV⌟	Open the submenu ENV (environment parameter)
SIM⌟	Open the submenu SIM (simulation)

10.2.3 CFG level (configuration) [III]

ou1	Output function for OUT1: • switching signal for level limit value. Hysteresis or window function, normally closed or normally open
ou2	Output function for OUT2: • analogue signal for current level, 4…20 mA or 20…4 mA or • switching signal for level limit value. Hysteresis or window function, normally closed or normally open
dS1	Switching delay for OUT1
dr1	Switch-off delay for OUT1
dS2*	Switching delay for OUT2
dr2*	Switch-off delay for OUT2
uni	Unit of measurement (mm or inch)
P_n	Switching logic for the outputs (pnp or npn)
FOU1	Response of OUT1 in case of a fault
FOU2	Response of OUT2 in case of a fault
SELD	Type of indication
dAP	Damping of the measured signal (mean filter)
dFo	Delay time for the outputs to pass into the state defined with [FOUx]; only effective in case of a fault.
* Menu item only visible with hysteresis or window function ([ou2] = [H..] or [°F..]).	

10.2.4 EN level (environment) [IV]

Prob*	Type of probe used (single probe or coaxial probe)
LEnG	Probe length
MEdI	Medium to be detected
* Prob only visible with MEdI = HIGH or MId.	

10.2.5 SIM level (simulation) [V]

S.LvL	Simulation of a level / an error state
S.Tim	Simulation time 1…60 min
S.On	Simulation start/stop

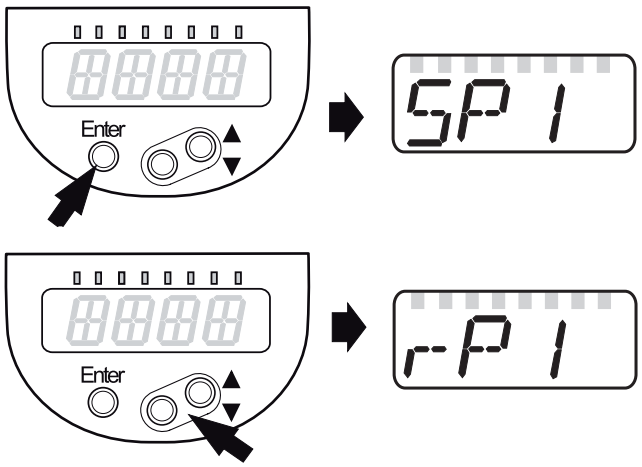
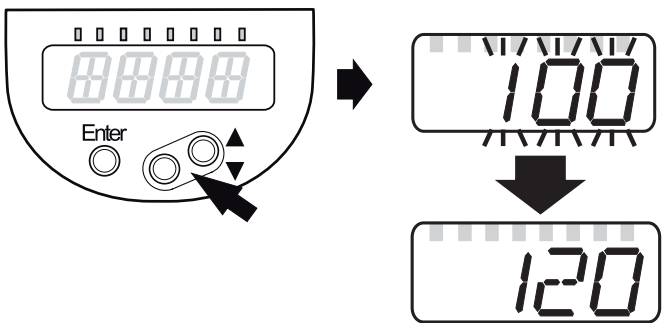
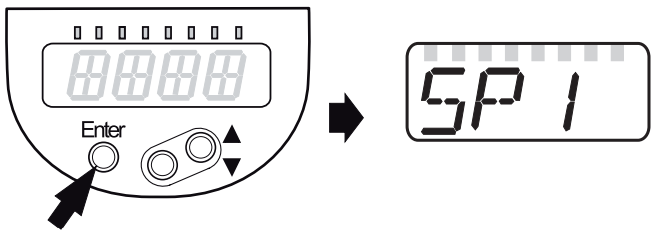
11 Parameter setting

During parameter setting the unit remains in the operating mode. It continues to monitor with the existing parameters until the parameter setting has been completed.

11.1 Parameter setting in general

3 steps must be taken for each parameter setting:

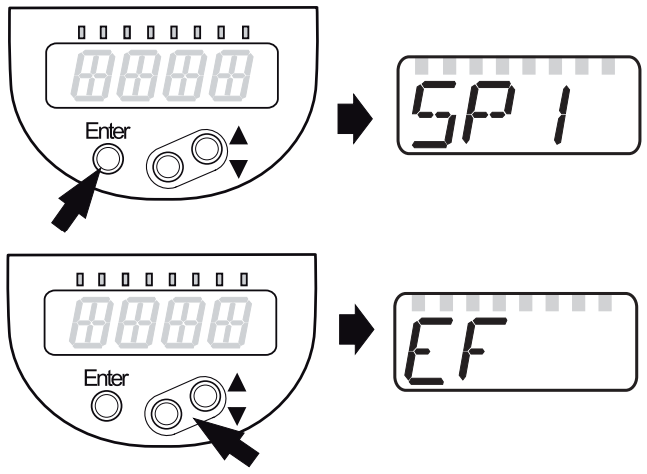
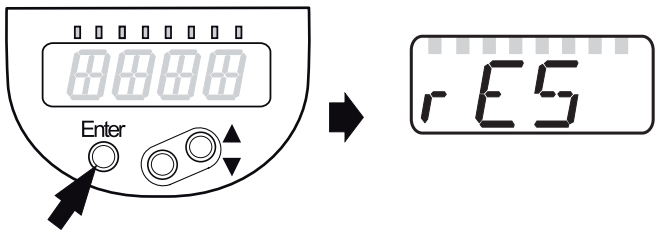
<table>
<tr><td>1</td><td>Select the parameter
▶ Press [Enter] to get to the menu.

▶ Press [▲] or [▼] until the required parameter is displayed.</td><td> 
</td></tr>
<tr><td rowspan="2">2</td><td>Set the parameter value
▶ Press [Enter] to edit the selected parameter.
▶ Press [▲] or [▼] for min. 1 s.
> After 1 s: Setting value is changed: incrementally by pressing the button once or continuously by keeping the button pressed.</td><td> 
</td></tr>
<tr><td colspan="2">Numerical values are incremented continuously with [▲] or decremented with [▼].</td></tr>
<tr><td>3</td><td>Acknowledge parameter value
▶ Briefly press [Enter].
> The parameter is displayed again. The new setting value is saved.</td><td> 
</td></tr>
<tr><td colspan="3">Set other parameters
▶ Press [▲] or [▼] until the required parameter is displayed.</td></tr>
<tr><td colspan="3">Finish parameter setting
▶ Press [▲] or [▼] several times until the current measured value is displayed or wait for 30 s.
> The unit returns to the process value display.</td></tr>
</table>

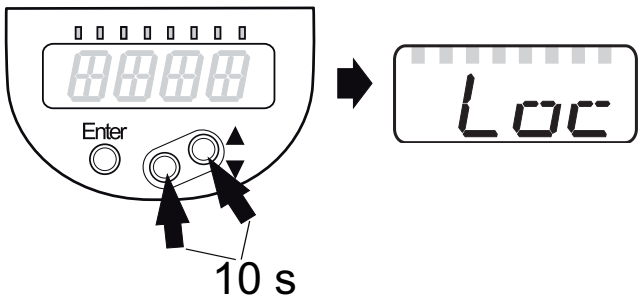
If [C.Loc] is displayed when an attempt is made to modify a parameter value, a parameter setting process is active via IO-Link (temporary locking).

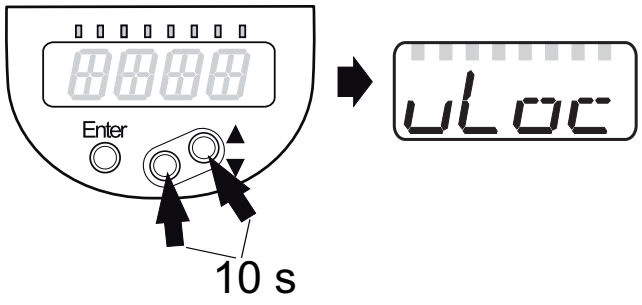
If [S.Loc] is displayed, the sensor is permanently locked via software. This locking can only be removed with a parameter setting software.

- Change from menu level 1 to menu level 2:

▶ Press [Enter] to get to the menu. ▶ Press [▲] or [▼] until [EF] is displayed.	
▶ Press [Enter]. > The first parameter of the submenu is displayed (here: [rES]).	

- Locking / unlocking
  The unit can be locked electronically to prevent unintentional settings.

▶ Make sure that the unit is in the normal operating mode. ▶ Press[▲] + [▼] simultaneously for 10 s. > [Loc] is displayed.	
During operation: [Loc] is briefly displayed if you try to change parameter values.	

For unlocking: ► Press[▲] + [▼] simultaneously for 10 s. > [uLoc] is displayed.	

On delivery: not locked.

- Timeout:

If no button is pressed for 30 s during parameter setting, the unit returns to the operating mode with unchanged values.

UK

11.2 First set-up (unit with factory setting)

On delivery of the unit, you must first enter the basic settings. The complete parameter setting menu cannot be accessed before this.

Malfunctions may occur if wrong basic settings are entered.

11.2.1 Enter the type of probe used

► Apply operating voltage. > The initial display ≡≡≡≡ is shown. ► Select [Prob] and set the value: ► Press [Enter]. > [nonE] is displayed. ► Press [▲] or [▼] for min. 1 s and set the value: [rod] = single probe, for the detection of plastic granulates: - water and hydrous media. [COAX] = coaxial probe, for the detection of: - oils and oil-based media. - water and hydrous media. The detection of water and water-based media is possible with the single probe as well as with the coaxial probe. The detection of oils and oil-based media is only possible with the coaxial probe.	Prob

11.2.2 Enter probe length

▶ Select [LEnG]. ▶ Press [Enter]. > [nonE] is displayed. ▶ Press [▲] or [▼] for min. 1 s. > After 1 s the unit automatically displays the detected probe length (preset function). ▶ Correct the probe length, if necessary, with [▲] or [▼]. incrementally by pressing the button once or continuously by keeping the button pressed. Enter the probe length in mm. ▶ Briefly press [Enter].	

- Automatic probe length detection is only possible with empty tank and sufficiently large launching plate.
- Manual determination of the probe length → 7.3.

11.2.3 Set to the medium

▶ Select [MEdI] and set:	
[HIGH] = For water and water-based media. Operating mode is optimised for suppression of deposits on the rod.	
[MId] = For water-based media and media with a medium DC value (DC = dielectric constant), e.g. water-in-oil emulsions. Operating mode optimised for the detection of media with increased foam formation.	
[LOW] = For oils and oil-based media.	
Note: In case of doubt carry out an application test to ensure the setting best suited for the medium.	

Then the unit changes to the operating mode.

If required (e.g. when mounted in a connection piece) carry out a tank adjustment (parameter [tREF]) and set parameters to adapt to the application.

11.2.4 Carry out tank adjustment

- ▶ Observe notes (→ 7.1.2).
- ▶ Select [tREF].
- ▶ Press [Enter].
- > [nonE] or the value stored by the last tank adjustment (distance value) is displayed.
- ▶ Press [▲] or [▼] for min. 1 s.
- > The adjustment distance is displayed (default value: 10 mm).
- ▶ Correct the value, if necessary, with [▲] or [▼]. incrementally by pressing the button once or continuously by keeping the button pressed.
- ▶ Briefly press [Enter].
- > [donE] is displayed.
- ▶ Briefly press [Enter] again.
- > The unit reboots and then returns to the operating mode.

11.3 Configure display (optional)

- ▶ Select [uni] and set the unit of measurement: [mm], [inch]. Factory setting: mm.
- ▶ Select [SELd] and set type of indication:

[L] =	The level is indicated in mm or inch.
[%] =	The level is indicated in percent of the measuring range / scaled measuring range.
	The level in percent depends on the parameters:
	[ASP2]: set value corresponds to 0 %
	[AEP2]: set value corresponds to 100 %
	These parameters can only be set via an IO-Link device tool if the parameter [ou2] is set to [I] or [InEG].
[OFF] =	The display is switched off in the operating mode. When one of the buttons is pressed, the current measured value is displayed for 30 s. The indicator LEDs remain active even if the display is deactivated.

11.4 Set output signals

11.4.1 Set the output function for OUT1

▶ Select [ou1] and set the switching function: [Hno] = hysteresis function / normally open [Hnc] = hysteresis function / normally closed [Fno] = window function / normally open [Fnc] = window function / normally closed **Note:** If the upper switch point is used as an overflow protection, the setting ou1 = Hnc (NC function) is recommended. The principle of normally closed operation ensures that wire break or cable break is also detected.	

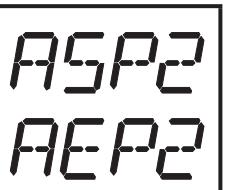
11.4.2 Set the output function for OUT2

▶ Select [ou2] and set the switching function: [I] = current output 4...20 mA [InEG] = current output 20...4 mA [Hno] = hysteresis function / normally open [Hnc] = hysteresis function / normally closed [Fno] = window function / normally open [Fnc] = window function / normally closed **Note:** If the upper switch point is used as an overflow protection, the setting ou2 = Hnc (NC function) is recommended. The principle of normally closed operation ensures that wire break or cable break is also detected.	

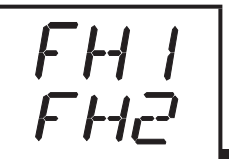
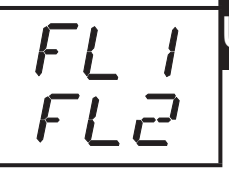
11.4.3 Set the switching limits (hysteresis function)

▶ Make sure that the function [Hno] or [Hnc] is set for [oux]. **Note:** [I] is preset by the factory for [ou2], in this case SP/rP are not available. ▶ Select [SPx] and set the value at which the output is set.	
▶ Select [rPx] and set the value at which the output resets. rPx is always smaller than SPx. The unit only accepts values which are lower than the value for SPx.	

11.4.4 Scale the analogue signal

▶ Select [ASP2] and set the analogue start point (→ 6.2.2 Analogue function) ▶ Select [AEP2] and set the analogue end point (→ 6.2.2 Analogue function)	

11.4.5 Set the switching limits (window function)

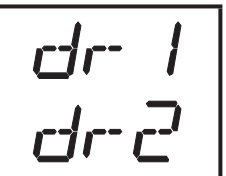
▶ Make sure that for [oux] the function [Fno] or [Fnc] is set. ▶ Select [FHx] and set the upper limit of the acceptable range.	
▶ Select [FLx] and set the lower limit of the acceptable range. FLx is always lower than FHx. The unit only accepts values which are lower than the value for FHx.	

UK

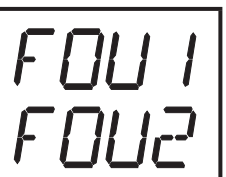
11.4.6 Set the switching delays for switching outputs

▶ Select [dSx] and set the value between 0 and 60 s. At 0.0 (= factory setting) the delay time is not active. The switch-off delay is only active if the hysteresis or window function has been set as switching function (oux = H.. or F..).	

11.4.7 Set the switch-off delay for switching outputs

▶ Select [drx] and set the value between 0 and 60 s. At 0.0 (= factory setting) the delay time is not active. The switch-off delay is only active if the hysteresis or window function has been set as switching function (oux = H.. or F..).	

11.4.8 Response of the outputs in case of a fault

▶ Select [FOU1] / [FOU2] and set the value: - [On] = output switches ON in case of a fault. Analogue output switches to a value > 21 mA in case of a fault. - [OFF] = switching output switches OFF in case of a fault. Analogue output switches to a value > 3.6 mA in case of a fault. Factory setting: [FOU1] and [FOU2] = [OFF]. Faults, e.g.: defective hardware, too low a signal quality. Overflow is not considered to be a fault!	

11.4.9 Set output logic for the switching outputs

▶ Select [P-n] and set [PnP] or [nPn].	

11.4.10 Set damping for the measured signal

▶ Select [dAP] and set a damping constant T in seconds; setting range 0.0...60.0 s (→ 6.2.4).	dAP

11.4.11 Set the delay time in case of a fault

▶ Select [dFo] and set a value between 0...10.0 s. Factory setting: [dFo] = [3.0]. The time delay is only effective in case of a fault. Mind the dynamics of your application. In case of fast level changes it is recommended to adapt the value step by step (→ 6.2.5).	dFo

11.5 Reset all parameters to factory setting

▶ Select [rES]. ▶ Press [Enter] until [rES] is aligned right. ▶ Press and hold [▲] or [▼] until [----] is displayed. ▶ Briefly press [Enter]. > The unit reboots and the factory settings are restored. **Note:** On delivery the unit is not operational. First, the first set-up must be made (→ 11.2).	rES

11.6 Change basic settings

Required after a factory reset [rES] and after changes to the probe or to the application area.

11.6.1 Change the type of probe used

▶ Select [Prob]. ▶ Press [Enter]. ▶ Press [▲] or [▼] for min. 1 s and set the value: [rod] = single probe, for the detection of plastic granulates: - water and hydrous media. [COAX] = coaxial probe, for the detection of: - oils and oil-based media. - water and hydrous media. The detection of water and water-based media is possible with the single probe as well as with the coaxial probe. The detection of oils and oil-based media is only possible with the coaxial probe and with the setting [MEdI] = [LOW]. **Note:** Parameter [Prob] is only visible with [MEdI] = [LOW] or [MId]	Prob

11.6.2 Re-enter the probe length

▶ Select [LEnG]. ▶ Measure the probe length L to a precision of ± 2 mm (± 0.1 inch). Determination of the probe length → 7.3. ▶ Round up the measured value (step increment 5 mm / 0.2 inch). ▶ Select [LEnG] and set the value (setting range: 150... 2000 mm / 6.0...78.8 inch). **Note:** After changing the probe length, the values for the switching limits must also be reviewed / re-entered.	LEnG

After changing the probe length, a tank adjustment already made is deleted / reset to factory setting.

With the factory setting the unit may not be operational, e.g. if the installation instructions are not adhered to.

In this case:

▶ Carry out tank adjustment → 11.2.4.

For probe lengths < 250 mm no tank adjustment is possible.
In this case:

▶ Adhere to the installation instructions (→ 7.1.1).

11.6.3 Set to another medium

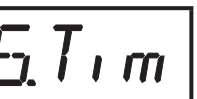
▶ Select [MEdI] and set: [HIGH] = For water and water-based media. Operating mode is optimised for suppression of deposits on the rod. [MId] = For water-based media and media with a medium DC value (DC = dielectric constant), e.g. water-in-oil emulsions. Operating mode optimised for the detection of media with increased foam formation. [LOW] For oils and oil-based media. **Note:** In case of doubt carry out an application test to ensure the setting best suited for the medium.	MEdI

11.7 Simulation

11.7.1 Set simulation value

▶ Select [S.LvL]. ▶ Set the process value to be simulated: [Numeric value] = level in mm / inch (depending on the basic setting) [FULL] = full state [SEnS] = weak measured signal [Err] = electronic fault found [EPTY] = empty state	

11.7.2 Set simulation time

▶ Select [S.Tim]. ▶ Set time span for simulation. Setting range: 1, 2, 3, 4, 5, 10, 15, 20, 30, 45, 60 min. Factory setting: 3 min.	

11.7.3 Switch simulation on / off

▶ Select [S.On] and set: [OFF] = simulation off [On] = simulation on ▶ Press [Enter] to start the simulation.	

Simulation active until [Enter] is pressed again or the time set via [S.Tim] elapses. During the simulation [SIM] is displayed every 3 s. When the simulation has ended, [S.On] is displayed.
The outputs react according to the simulated process values.

If the simulation is started via IO-Link, it can also only be finished via IO-Link. During the attempt to end the simulation via the operating keys, C.Loc is displayed.

12 Operation

When the supply voltage has been applied, the unit is in the operating mode. It carries out its measurement and evaluation functions and generates output signals according to the set parameters.

▶ Check whether the unit operates correctly.

12.1 Operating indicators

Numerical value + LED 1	Current level in mm.
Numerical value + LED 2	Current level in inch.
Numerical value + LED 3	Current level in % of the final value of the scaled measuring range.
LED 7 / LED 8	Switching status OUT2 / OUT1.
[----]	Level below the active zone.
[FULL] + numerical value alternately	Level has reached or exceeded the maximum measuring range (= overflow warning).
---- continuous	Initialisation phase after power on.
≡≡≡≡	On delivery the unit is not operational. Basic settings required (→ 10.2).
[Sim] + XXX alternately	Simulation active. XXX = state to be simulated (→ 11.7.1).
[Loc]	Unit locked via operating keys; parameter setting impossible. For unlocking press the two setting buttons for 10 s.
[uLoc]	Unit is unlocked / parameter setting is possible again.
[C.Loc]	The unit is temporarily locked. Parameter setting via IO-Link active.
[S.Loc]	Unit is permanently locked via software. This locking can only be removed with a parameter setting software.

12.2 Reading the set parameters

▶ Briefly press [Enter] to open the menu.

▶ [▲] or [▼] scrolls through the parameters.

▶ Briefly press [Enter] to indicate the corresponding parameter value for about 30 s. Then the unit returns to the operating mode.

12.3 Change the display unit in the operating mode

(= switching between length indication (mm / inch) and percentage).

▶ Briefly press [▲] or [▼] in the operating mode.

> The selected unit is displayed for 30 s, the corresponding LED is lit. With each push of the button the display type is changed.

12.4 Error indications

	Possible cause	Recommended measures
[Err]	Fault in the electronics.	Replace the unit.
[nPrb]	Probe detached from the unit; possibly incorrect setting of the probe length.	Check whether the probe is still attached to the unit. Check the parameter [LEnG].
[SEnS]	Measurement disturbed by foam formation or strong turbulence.	• Install the unit in a still pipe or bypass (→ 7.1). • Set or increment [dFo] (→ 11.4.11).
	Measurement disturbed by separation layers (e.g. oil layer on water).	Remove the oil layer by suction, stir the medium, verify the composition.
	Rod or process connection soiled.	Clean the rod and the process connection.
	Installation conditions were not adhered to.	Observe the notes in "Installation" (→ 7). Carrry out or repeat a tank adjustment (→ 7.1.2).
	Probe length or sensitivity (setting to the medium) is incorrect.	Correct the settings (→ 11.6), then carry out tank adjustment, if necessary (→ 7.1.2).
[FAIL]	Tank adjustment failed. Rod length too short, adjustment not possible (→ 7.1.2).	Repeat adjustment; if necessary, check installation conditions.
[SCx] + LED 8 [SCx] + LED 9	Flashing: short circuit in switching output OUT1 or OUT2.	Remove the short circuit.
[SC] + LED 8 + LED 9	Flashing: short circuit in both switching outputs	Remove the short circuit.
[PArA]	Faulty data set	Reset to factory settings (→ 11.5).

12.5 Output response in different operating states

	OUT1	OUT2*
Initialisation	OFF	OFF
Normal operation	According to the level and [ou1] setting	According to the level (4...20 mA)
Fault	OFF for FOU1 = OFF; ON for FOU1 = on	< 3.6 mA at FOU2 = OFF > 20 mA at FOU2 = on
* If the analogue function [ou2] = [I] has been selected.		

13 Technical data

Technical data and scale drawing at www.ifm.com → New search → Enter the article number.

Setting ranges

LEnG	mm	inch
Setting range	150...2000	6.0...78.8
Step increment	5	0.2

The setting ranges for the switching limits (SPx, rPx, FHx, FLx) depend on the probe length (L). In general the following applies:

	mm		inch	
	min	max	min	max
SPx / FHx	15 (35)	L - 30	0.6 (1.4)	L - 1.2
rPx / FLx	10 (30)	L - 35	0.4 (1.2)	L - 1.4
Step increment	1		0.05	
Note: The values in brackets apply to the setting [MEdI] = [LOW] (→ 11.2.3)				

- rPx (FLx) is always smaller than SPx / FHx. If SPx / FHx is shifted, rPx / FLx also shifts provided that the lower end of the setting range is not reached. Always set SPx / FHx first, then rPx / FLx.

The setting ranges for analogue start point (ASP2) and analogue end point (AEP2) depend on the probe length (L). In general the following applies:

	mm		inch	
	min	max	min	max
ASP2	0	---	0	---
AEP2	---	L - 30	---	L - 1.2
Step increment	1		0.05	

- Minimum distance between [ASP2] and [AEP2] = 20 % of the active zone.

14 Maintenance / Transport

- ▶ Keep the process connection free of deposits and foreign bodies.
- ▶ In case of heavy soiling: Clean process connection and probe.

For cleaning purposes the unit can be removed from the adapter and the probe can be screwed off the unit.

In case of longer operation separation layers can form in the medium (e.g. oil on water). This applies especially to still pipes or bypasses:

- ▶ Remove separation layers at regular intervals (remove by suction or ensure mixing). Check composition.
- ▶ Ensure that the vent hole (at the upper end of the coaxial pipe) remains free.
- ▶ Keep the interior of the coaxial pipe free from foreign bodies and soiling.

When the medium is changed, it may also be necessary to adapt the unit settings (→ 11.2.3 Setting to the medium).

- ▶ It is not possible to repair the unit.
- ▶ After use dispose of the unit in an environmentally friendly way in accordance with the applicable national regulations.
- ▶ In case of returns ensure that the unit is free from soiling, especially of dangerous and toxic substances.

14.1 Transport

- ▶ For transport only use appropriate packaging to avoid damage of the unit.

When the unit is installed in a plant and transported with the plant:

- ▶ Protect the plant and the unit against shock and vibration. Protect the rod against deflections and vibrations. If necessary, fix at several points to prevent movement of unstable areas.

15 Factory setting

	Factory setting	User setting
SP1	50% VMR*	
rP1	5 mm below SP1	
ASP2	0% VMR*	
AEP2	100% VMR*	
tREF	nonE	
dS1	0.0	
dr1	0.0	
ou1	Hno	
ou2	I	
uni	mm	
P-n	PnP	
FOU1	OFF	
FOU2	OFF	
SELd	L	
dAP	0.0	
dFo	3.0	
Prob	nonE	
LEnG	nonE	
MEdI	nonE	
S.LVL	50 % LEnG	
S.Tim	3	
S.On	OFF	

* VMR = final value of the measuring range = LEnG value minus 30 (in millimetres).
When the LEnG value is entered, the program calculates the basic setting.

More information at www.ifm.com