OPERATING INSTRUCTIONS

LFP INOX

TDR Level Sensor

SICK
Sensor Intelligence.

en



Described product

LFP Inox

Manufacturer

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Original document

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1 About this document

1.1 Information on the operating instructions

These operating instructions provide important information on how to use sensors from SICK AG.

Prerequisites for safe work are:

- Compliance with all safety notes and handling instructions supplied
- Compliance with local work safety regulations and general safety regulations for sensor fields of application

The operating instructions are intended to be used by qualified personnel and electrical specialists.

Note:

Read these operating instructions carefully before starting any work on the device in order to familiarize yourself with the device and its functions.

The instructions constitute an integral part of the product and are to be stored in the immediate vicinity of the device so they remain accessible to staff at all times. Should the device be passed on to a third party, these operating instructions should be handed over with it.

These operating instructions do not provide information on operating the machine in which the sensor is integrated. For information about this, refer to the operating instructions of the specific machine.

1.2 Scope

These operating instructions explain how to incorporate a sensor into a customer system. Step-by-step instructions are given for all required actions.

These instructions apply to all available device variants of the sensor. For more detailed information on identifying your device type, see “3.1.2 Type code”.

Available device variants are listed on the online product page:

▶ www.sick.com

A number of device variants are used as examples for commissioning, based on the default parameter settings for the relevant device.

Simplified device designation in the document. In the following, the sensor is referred to in simplified form as LFP. except in cases where it is necessary to make a distinction between device variants due to different technical features or functions. In this case the complete type designation (e.g., LFP Inox) is used.

1.3 Explanation of symbols

Warnings and important information in this document are labeled with symbols. The warnings are introduced by signal words that indicate the extent of the danger. These warnings must be observed at all times and care must be taken to avoid accidents, personal injury, and material damage.

DANGER

... indicates a situation of imminent danger, which will lead to a fatality or serious injuries if not prevented.

WARNING

... indicates a potentially dangerous situation, which may lead to a fatality or serious injuries if not prevented.

CAUTION

... indicates a potentially dangerous situation, which may lead to minor/slight injuries if not prevented.

IMPORTANT

... indicates a potentially harmful situation, which may lead to material damage if not prevented.

NOTE

... highlights useful tips and recommendations as well as information for efficient and trouble-free operation.

1.4 Further information

CONFORMITIES AND CERTIFICATES

At www.sick.com you will find declarations of conformity, certificates, and the current operating instructions for the product. To do so, enter the product part number in the search field (part number: see the entry in the “P/N” or “Ident. no.” field on the type label).

Additional information:

- Model-specific online data sheets for device versions with technical data, dimensional drawings, and diagrams
- Dimensional drawings and 3D CAD dimension models in various electronic formats
- Additional publications relating to the sensors described here (e.g., IO-Link)
- Publications about accessories

1.5 Customer service

If you require any technical information, our customer service department will be happy to help. To find your agency, see the final page of this document.

NOTE

Before calling, make a note of all sensor data such as type code, serial number, etc., to ensure faster processing.

2 For your safety

2.1 Intended use

The LFP is designed for both continuous level measurement and discontinuous level measurement in nearly all liquids (a list of possible media can be found in the annex).

The sensor is not affected by changes in the properties of the liquids to be measured. Its hygienic design means the LFP Inox is suitable for universal use in practically all liquids in the food industry.
The LFP can be used in metal containers or bypass systems.
The use at media temperatures of up to 150 °C and up to 180 °C with remote amplifier plus CIP and SIP compatibility mean the device is completely food safe. This has been certified by an EHEDG certificate and FDA conformity.

2.2 Improper use

Any use outside of the stated areas, in particular use outside of the technical specifications and the requirements for intended use, will be deemed to be improper use.

If the sensor is to be used under other conditions or in different environments, the manufacturer's service department may issue an operating license in consultation with the customer and in exceptional cases.

2.3 Limitation of liability

Applicable standards and regulations, the latest technological developments, and our many years of knowledge and experience have all been taken into account when assembling the data and information contained in these operating instructions. The manufacturer accepts no liability for damage caused by:

- Failure to observe the operating instructions
- Improper use
- Use by untrained personnel
- Unauthorized conversions
- Technical modifications
- Use of unauthorized spare parts, wear and tear parts, and accessories

The actual scope of delivery may differ from the features and illustrations shown here where special variants are involved, if optional extras have been ordered, or as a result of the latest technical changes.

2.4 Modifications and conversions



IMPORTANT

Modifications and conversions to the sensor and/or the installation may result in unforeseeable dangers.

Interfering with or modifying the sensor or SICK software will invalidate any warranty claims against SICK AG. This applies in particular to opening the housing, even as part of mounting and electrical installation work.

Before making technical modifications to or expanding the sensor, the prior written approval of the manufacturer must be obtained.

2.5 Requirements for skilled persons and operating personnel



WARNING

Risk of injury due to insufficient training!

Improper handling of the sensor may result in considerable personal injury and material damage.

- All work must only ever be carried out by the stipulated persons.

The operating instructions state the following qualification requirements for the various areas of work:

- **Instructed personnel** have been briefed by the operating entity about the tasks assigned to them and about potential dangers arising from improper action.
- **Skilled personnels** have the specialist training, skills, and experience as well as knowledge of the relevant regulations to be able to perform tasks assigned to them and to recognize and avoid any potential dangers independently.
- **Electricians** have the specialist training, skills, and experience, as well as knowledge of the relevant standards and provisions, to be able to carry out work on electrical systems and to recognize and avoid any potential dangers independently. In Germany, electricians must meet the specifications of the BGV A3 Work Safety Regulations (e.g., Master Electrician). Other relevant regulations applicable in other countries must be observed.

The following qualifications are required for various activities:

Activities	Qualification
Mounting, maintenance	• Basic practical technical training • Knowledge of the current safety regulations in the workplace
Electrical installation, device replacement	• Practical electrical training • Knowledge of current electrical safety regulations • Knowledge of device control and operation in the specific application concerned (e.g., conveying line)
Commissioning, configuration	• Basic knowledge of the control system used • Basic knowledge of the design and setup of the described connections and interfaces • Basic knowledge of data transmission
Operation of the device for the specific application	• Knowledge of device control and operation in the particular application concerned (e.g., bottling system) • Knowledge of the software and hardware environment for the particular application concerned (e.g., bottling system)

2.6 Operational safety and specific hazards

Please observe the safety notes and the warnings listed here and in other sections of these operating instructions to reduce the possibility of risks to health and avoid dangerous situations.

2.7 General safety notes

- Read the operating instructions prior to commissioning.
- These operating instructions are valid for devices with firmware version V4.00 and above.
- The LFP is not a safety component under the EU Machinery Directive.
- Observe national safety and work safety regulations.
- Wiring work and the opening and closing of electrical connections may only be carried out when the power is switched off.
- The radiated power is far lower than that from telecommunication equipment. According to current scientific research, the operation of this device can be classified as safe and non-hazardous.

2.8 Repair

Repair work on the sensor may only be performed by qualified and authorized personnel from SICK AG. Interference with or modifications to the sensor on the part of the customer will invalidate any warranty claims against SICK AG.

3 Product description

3.1 Product identification

3.1.1 Information on the housing

Information for identification of the sensor and its electrical connection are printed on the housing.

3.1.2 Type code

LFP	x	-	x	x	x	M	x	x
1	2		3	4	5	6	7	8

Position	Description
1	**Product group** LFP (level sensors)
2	**Probe length in mm** 0200: 200 mm in increments of 10 mm 4000: 4000 mm
3	**Process connection/probe version** C: G ¾ A / probe rod made from 1.4404, interchangeable, 150 °C, 16 bar D: ¾" NPT / probe rod made from 1.4404, interchangeable, 150 °C, 16 bar G: G ¾ A (connection for hygienic adapter) / probe rod made from 1.4404 N: ¾" NPT / probe rod from 1.4404 P: G ¾ A (connection for pharmaceutical process connection) / probe rod made from 1.4404, Ra ≤ 0.4 µm (verification), 150 °C, 16 bar, 3.1 material certificate, calibration certificate
4	**Housing, display/device connection** 1: Stainless-steel housing with display, cover with sight glass / M12 x 1 male connector, 5-pin 2: Stainless-steel housing with display, solid cover / 5-pin M12 x 1 male connector 3: Stainless-steel housing 3-A compliant with display, solid cover / M12 x 1 male connector, 5-pin 6: Stainless steel housing with display, cover with sight glass; M12x1 male connector, 8-pin 7: Stainless steel housing with display, solid cover; M12x1 male connector, 8-pin A: Stainless steel housing with display, cover with sight glass; 5-pin cable connection B: Stainless steel housing with display, solid cover; 5-pin cable connection C: Stainless steel housing with display, cover with sight glass / 8-pin cable connection D: Stainless steel housing with display, solid cover; 8-pin cable connection
5	**Application type/design** B: remote amplifier; length of cable 1 m C: remote amplifier; length of cable 2 m D: remote amplifier; length of cable 3.3 m N: Standard
6	**Signal output** M: 4 mA ... 20 mA / 0 V ... 10 V switchable

Position	Description
7	**Switching output** B: 1 x PNP + 1 x PNP/NPN C: 1 x PNP + 3 x PNP/NPN
8	**Device type** L: LABS-compatible

Not all variants of the type code can be combined!

3.2 Product characteristics

3.2.1 Device view

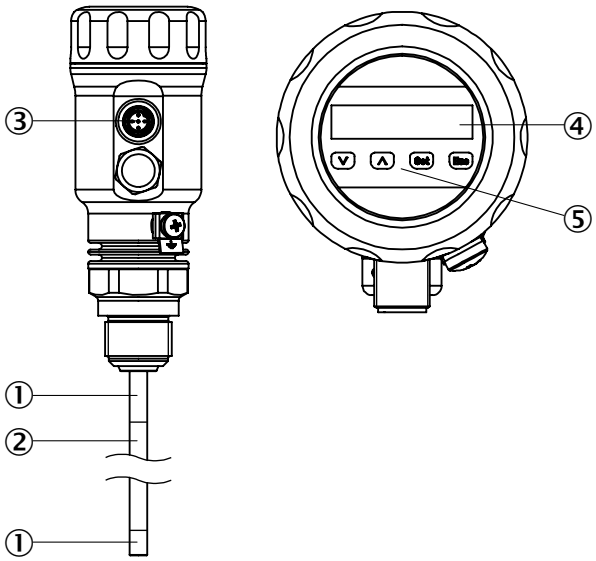


Fig. 1: LFP Inox (standard version)

① Inactive part of the probe

② Probe

③ Electrical connection

④ Display

⑤ Operating buttons

3.2.2 Operating buttons

The sensor is operated using the display and the operating buttons.

For a detailed description of the buttons and their functions, see “8.1 Display and pushbuttons”.

3.3 Product features and functions

3.3.1 Principle of operation

The LFP uses TDR (Time Domain Reflectometry) technology.

This is a process to determine the time-of-flight of electromagnetic waves. A low-energy, electromagnetic pulse is generated in the sensor's electronics, coupled to the rod probe, and conducted along this probe.

If this pulse strikes the surface of the liquid to be measured, a portion of the pulse is reflected there and is conducted back up along the probe path to the electronics, which then calculate the level based on the time difference between the sent and the received pulse.

The sensor can output this level as a continuous measured value (analog output) and can also derive two and/or four freely positionable switching points from it (switching outputs).

IO-Link communication is also available for the switching output (Q1), see "8.1.3 IO-Link".

3.3.2 Fields of application

The innovative TDR technology enables reliable level measurement which is largely application-independent. The LFP is suitable for both continuous level measurement and discontinuous level measurement in nearly all liquids.

The sensor is not affected by changes in the properties of the liquids to be measured.

Its hygienic design, a 3.1 Material Certificate and a calibration certificate means the LFP Inox is suitable for universal use in all liquids in the food industry and pharmaceutical industry.

The LFP can be used in metal containers or bypass systems.

The use at media temperatures of up to 150 °C and up to 180 °C with remote amplifier plus CIP and SIP compatibility mean the device is completely food safe. This has been certified by an EHEDG certificate and FDA conformity.

4 Transport and storage

4.1 Transport

For your own safety, please read and observe the following notes:

IMPORTANT

Damage to the sensor due to improper transport!

- The device must be packaged for transport with protection against shock and damp.
- Recommendation: Use the original packaging as it provides the best protection.
- Transport should be performed by specialist staff only.
- The utmost care and attention is required at all times during unloading and transportation on company premises.
- Note the symbols on the packaging.
- Do not remove packaging until immediately before starting installation work.

4.2 Transport inspection

Immediately upon receipt in incoming goods, check the delivery for completeness and for any damage that may have occurred in transit. In the case of transit damage that is visible externally, proceed as follows:

- Do not accept the delivery or only do so conditionally.
- Note the extent of damage on the transport documents or on the transport company's delivery note.
- File a complaint.

Note:

Complaints regarding defects should be filed as soon as these are detected. Damage claims are only valid before the applicable complaint deadlines.

4.3 Storage

Store the device under the following conditions:

- Recommendation: Use the original packaging.
- Do not store outdoors.
- Store in a dry area that is protected from dust.
- Do not store in an airtight container: this is so that any residual moisture present can escape.
- Do not expose to any aggressive substances.
- Protect from sunlight.
- Avoid mechanical shocks.
- Storage temperature: see "12 Repair".
- Relative humidity: see "12 Repair".
- For storage periods of longer than 3 months, check the general condition of all components and packaging on a regular basis.

5 Mounting

5.1 Installation conditions

The LFP is mounted vertically from above into the container or bypass, using its process connection. The LFP level sensor has a G ¾ or ¾" NPT threaded connection.
A minimum connecting piece diameter in accordance with the figures below must be observed.

The LFP is to be installed in such a way that, after it has been mounted, there is a sufficient distance between it and other tank components (e.g., supply pipes, other measuring devices) as well as the sides and bottom of the container. These minimum distances are also specified in the figures.

The LFP can also be used in a metal immersion pipe or bypass. The installation conditions are shown in the figure on page 17.

Make sure that there is a good metallic connection between the LFP measuring device and the tank/bypass. When operating the sensor, ensure that the ambient temperature is not above or below the limits.

Insulating the sensor housing is not permitted for tanks with hot media.

When positioning the device, ensure that the sensor is not directly exposed to the filling flow.

The sensor housing can be rotated 360°, allowing for the cable connection to be positioned freely.

5.1.1 Installation in a container

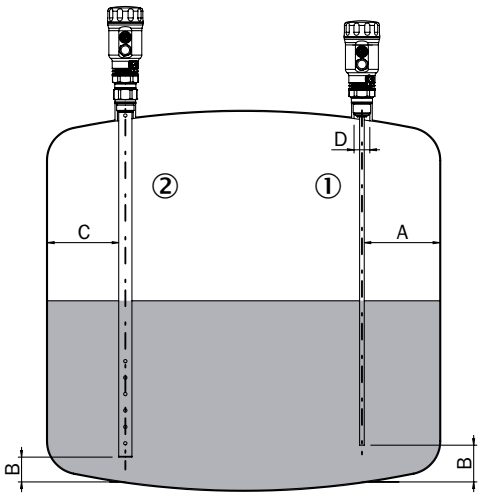


Fig. 2: LFP Inox

① **Rod probe with metallic containers**

Installation in coupling
D ≥ DN 25
Distance container wall/container floor:
A ≥ 50 mm
B ≥ 10 mm
Distance to built-in components in container
≥ 100 mm

② **Coaxial tube in metallic and non-metallic containers**

C = No minimum distance to the container wall and to built-in components needs to be maintained with a coaxial probe.

Smaller separations may be possible depending on the application and medium. It is essential to perform an AutoCal, see “7.1 Quick commissioning (with factory settings)”

In accordance with the 3-A guidelines, the height of the connecting piece should not be greater than the connecting piece diameter. Tank, connecting piece and process connection (on tank) must comply with the guidelines and applicable standards for hygienic design, e.g. surface roughnesses of parts that come into contact with media Ra ≤ 0.8 µm.

Note:

The distances are the same for sensors with remote amplifier.

The drainability of the tank and coupling must not be hindered by installation of the measurement probe.

When installing the measurement probe in a coupling, it must be ensured that the distance between the probe and coupling wall is greater than the length of the coupling (maximum length L <= (D-d)).

In the case of installation in a tank, it must be ensured that the cleaning fitting is positioned in such a way that both the connection and the sensor can be completely wetted and cleaned.

When using hygienic process adapters, the notes in "17 Accessories" must be observed.

5.1.2 Installation in a metal immersion tube or metal bypass

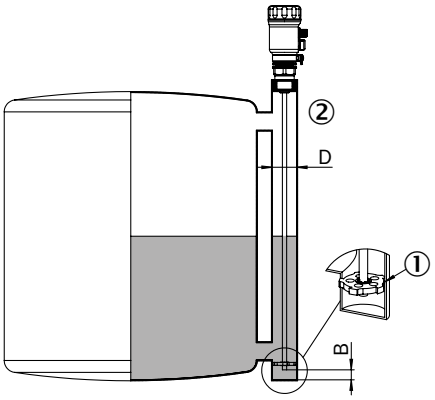


Fig. 3: LFP Inox

① *Centering*

② ***LFP Inox***

D ≥ DN 40

Distance bypass floor / container floor

B ≥ 15 mm

Centering: To prevent contact between the probe and the bypass pipe during vibration, the probe should be centered according to its length and depending on the diameter of the bypass pipe. To do this, it is necessary to insert one or two centering pieces, see "17 Accessories".

Tank welds can affect the measurement accuracy.

5.2 Mounting the coaxial tube

See the operating instructions for the coaxial tube (8015674) at www.sick.com.

5.3 Shortening the probe

If the rod probe is too long for use, it can be shortened to the height of the container. In this case, you should not shorten the probe beyond its minimum length of 100 mm. If the LFP is to be used in a hygienic or pharmaceutical application, then be sure that the roughness of Ra ≤ 0.8 µm or Ra ≤ 0.4 µm is reestablished on the shortened machined surfaces of the rod probe.

5.3.1 Process

Shorten the probe rod to the desired dimension. Set the new probe length in the LFP, see “8.4.7 Configuring the probe length”. Make sure that this correction corresponds to the probe length, because an incorrect value in the Length menu has a direct effect on measurement accuracy and can lead to faults. The probe length L is defined in section “15 Dimensional drawings”.

6 Electrical installation

6.1 Safety

6.1.1 Notes on electrical installation

IMPORTANT

Equipment damage due to incorrect supply voltage!

An incorrect supply voltage may result in damage to the equipment.

- Only operate the device using a protected low voltage and safe electrical insulation as per protection class III.

IMPORTANT

Equipment damage or unpredictable operation due to working with live parts!

Working with live parts may result in unpredictable operation.

- Only carry out wiring work when the power is off.
- Only connect and disconnect electrical connections when the power is off.

- **The electrical installation must only be performed by electrically qualified personnel.**
- **Standard safety requirements must be observed when working on electrical systems!**
- Only switch on the supply voltage for the device when the connection tasks have been completed and the wiring has been thoroughly checked.
- When using extension cables with open ends, ensure that bare wire ends do not come into contact with each other (risk of short-circuit when supply voltage is switched on!). Wires must be properly insulated from each other.
- Wire cross-sections in the supply cable from the user's power system must be designed in accordance with the applicable standards. In Germany, observe the following standards:
  DIN VDE 0100 (Part 430) and DIN VDE 0298 (Part 4) or DIN VDE 0891 (Part 1).
- Circuits connected to the device must be designed as SELV circuits
  (SELV = Safety Extra Low Voltage).
- Protect the device with a separate fuse at the start of the supply circuit.

Notes on layout of data cables:

- Use shielded data cables with twisted-pair wires.
- Implement proper and complete shielding concept.
- To avoid interference, e.g., from switching power supplies, motors, clocked drives, and contactors, always use suitable EMC cables and layouts.
- Do not lay cables over long distances in parallel with voltage supply cables and motor cables in cable ducts.

The IP67 and/or IP69K protection class for the device is only achieved under the following conditions:

- The cable attached to the M12 connection is screwed in place.

If this is not done, the device does not fulfill any specified IP enclosure rating!

6.2 Electrical connection

6.2.1 Overview of the electrical connections

The sensor is connected using a pre-assembled female cable connector with 1 x M12 plug connector (5-pin or 8-pin). With the power switched off, plug the female cable connector into the sensor and screw it tight.

Connect the cable according to its function. After the supply voltage has been applied, the sensor carries out a self-test. Once installed, the sensor is ready for operation on completion of the self-test (< 5 s) and the display shows the current measured value.

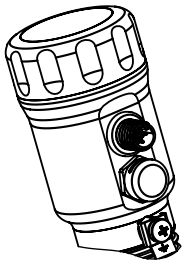


Fig. 4: LFP Inox

6.2.2 Pin assignment, M12 plug connector, 5-pin

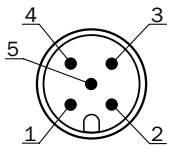


Fig. 5: M12 x 1 plug connector, 5-pin

Contact	Signs	Wire color	Description
1	L+	Brown	Supply voltage
2	Q_A	White	Analog current/voltage output
3	M	Blue	Ground, reference potential for current/voltage output
4	C/ Q_1	Black	Switching output 1, PNP/ IO-Link communication
5	Q_2	Gray	Switching output 2, PNP/NPN

6.2.3 Pin assignment, M12 plug connector, 8-pin

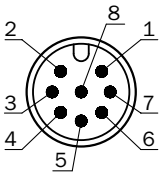


Fig. 6: M12 x 1 plug connector, 8-pin

Contact	Signs	Description
1	L+	Supply voltage
2	Q_2	Switching output 2, PNP/NPN
3	M	Ground, reference potential for current / voltage output
4	C/Q_1	Switching output 1, PNP / IO-Link
5	Q_3	Switching output 3, PNP/NPN
6	Q_4	Switching output 4, PNP/NPN
7	Q_A	Analog current/voltage output
8		No function

The wire colors for 8-pin cables are not uniform. Always note the pin assignment of the sensor.

6.2.4 Pin assignment, cable variant, 5-pin

Contact	Signs	Wire color	Description
1	L+	Brown	Supply voltage
2	Q_A	White	Analog current/voltage output
3	M	Blue	Ground, reference potential for current/voltage output
4	C/Q_1	Black	Switching output 1, PNP / IO-Link
5	Q_2	Gray	Switching output 2, PNP/NPN

6.2.5 Pin assignment, cable variant, 8-pin

Contact	Signs	Wire color	Description
1	L+	White	Supply voltage
2	Q_2	Brown	Switching output 2, PNP/NPN
3	M	Green	Ground, reference potential for current/voltage output
4	C/Q_1	Yellow	Switching output 1, PNP / IO-Link
5	Q_3	Gray	Switching output 3, PNP/NPN
6	Q_4	Pink	Switching output 4, PNP/NPN
7	Q_A	Blue	Analog current/voltage output
8		Red	No function

7 Commissioning

7.1 Quick commissioning (with factory settings)

Quick commissioning is used in applications under reference conditions, see “5 Mounting”.

Where:

- Use in metallic containers or immersion/bypass pipes.
- The liquid to be measured has a DK value of > 5, see “18 Medium list”.

Commissioning

1. Mount the sensor in accordance with the installation conditions, see “5 Mounting”.
2. The container must be empty and/or the level must be at least 200 mm below the end of the probe.
3. Log in to expert mode, see “8.4.1 Expert mode”.
4. After mounting, launch the AutCal menu item.
   - Press and hold the Set pushbutton for at least 3 secs.
   - Use the Set pushbutton to confirm the AutCal menu item and then use it again to confirm the “OK?” confirmation prompt.
   - The AutCal function is confirmed with !CalOK.
5. Configure outputs, see “8.2 Configuring the switching outputs”.

Note:

If the AutCal function was confirmed with !NoSig, relaunch AutCal.

In the event of problems during commissioning, see “11 Troubleshooting”.

7.2 Advanced commissioning

Advanced commissioning is required when quick commissioning is not sufficient or if one of the following situations applies:

- The liquid to be measured has a DK value of < 5, see “18 Medium list”.
- There are extreme ripples on the surface of the liquid.
- There are variations in the installation conditions, see “5 Mounting”.
- If the tank cannot be completely emptied prior to calibration for technical reasons.

Commissioning

1. Mount the sensor as appropriate to the installation conditions, see “5 Mounting”.
2. Log in to expert mode, see “8.4.1 Expert mode”.
3. Select measuring mode.
   - Access the EXPRT-CONFIG-MeasMd menu using the arrow and Set pushbuttons.
   - HiSpd: max. length = 2,005 mm, response time < 400 ms.
   - HiAcc: max. length = 6,005 mm, response time < 2,800 ms, more stable measured values, recommended for liquids with low DK values and where TrsHld is < 70.
4. Teach in static sources of interference in the tank.
   - Static sources of interference in the tank generated by pipes, struts, couplings, or cleaning balls are taught into the system as standard.
   - Access the EXPRT-CONFIG-CalRng menu using the arrow and Set pushbuttons. Where:
     - Teach-in depth starts from the LFP process connection
     - The teach-in depth should cover all interference signals
     - Maximum teach-in depth (recommended) = probe length
     - Set the value range: 95 mm ... 6,005 mm
   - If the tank cannot be emptied completely, the CalRng teach-in depth must be adapted accordingly.
   - The level must be at least 200 mm under the CalRng and/or below the end of the probe.
5. Run the AutCal function.
   - Access the AutCal menu using the arrow and Set pushbuttons.
   - The following applies: The probe must not be covered with liquid in the CalRng set in step 4 (teach-in depth + 200 mm).
   - Use the Set pushbutton to confirm the AutCal menu item and then use it again to confirm the Ok? prompt.
   - The AutCal function is confirmed with !CalOK.
6. Analyze the signal quality.
   - The signal quality can be analyzed when the device is installed, see “8.4.9 Evaluating signal quality”.
   - In the event of problems:
     - Reduce the value in the EXPRT-CONFIG-TrsHld menu.
     - Set parameter to HiAcc in the EXPRT-CONFIG-MeasMd menu.
     - Switch on filters in the Set filters menu.
     - Reduce the parameter in the EXPRT-CONFIG-MaxCol menu.
7. Configure the filter (see section “8.4.2 Filtering measured values”).
8. Run maximum change of level/plausibility check (see section “8.4.2 Filtering measured values”).
9. Configure the outputs (see section “8.2 Configuring the switching outputs”).

Note:

- Use the foam commissioning instructions for applications with foam.
- The sensor automatically quits expert mode after 5 minutes of inactivity on the display.
- Configuration (AutCal) does not take place in the following processes:
  - Changing the probe length
  - Changing the measuring mode
  - Changing the teach-in depth

In the event of problems during commissioning, see “11 Troubleshooting”.

7.3 Foam commissioning (with factory settings)

For use in applications with a significant buildup of foam.

Performing foam calibration

1. Mount the sensor as appropriate to the installation conditions, see “5 Mounting”.
2. Log in to expert mode,, see “8.4.1 Expert mode”.
3. Empty the tank completely.
   - The rod probe must be completely free from medium and foam.
   - Buildup must be removed from the probe.
   - The end of the probe must not be fixed to the bottom of the tank.
4. Select measuring mode.
   - Access the EXPRT-Config-MeasMd menu using the arrow and Set pushbuttons, and configure to HiAcc.
5. Select the mode
   Access the EXPRT-Config-Mode menu using the arrow and Set pushbuttons, and configure to Foam.
6. Perform empty calibration.
   - Access the EXPRT-Foam-CalEmp menu using the arrow and Set pushbuttons.
   - !CalOk: Proceed to step 7.
   - !faild: Make sure the tank is empty and repeat step 6.
7. Fill with medium (without foam) until the probe is covered by at least 200 mm.
   The maximum level must remain 200 mm from the process connection, however.
8. Run EXPRT-Foam-CalMed.
   - !CalOk: Everything worked, proceed to step 9.
   - !faild: Repeat step 8.

   The LFP should now display a valid measured value.
9. Check the foam calibration in EXPRT-INFO-CalSta.
   - FomCal: Foam commissioning was completed successfully.
   - CalMis: Commissioning unsuccessful. Please repeat the process.

Note:

- Measurement deviation may be higher.
- Signal quality 1 and 2 are not counted!
- The sensor automatically quits expert mode after 5 minutes of inactivity on the display.
- Configuration (foam teach) does not take place in the following processes:
  - Changing the probe length
  - Changing the measuring mode
  - Changing the teach-in depth
  - Running AutCal

In the event of problems during commissioning, see “11 Troubleshooting”.

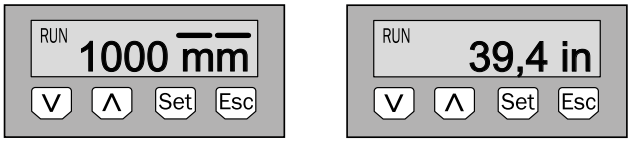
8 Operation

8.1 Display and pushbuttons

All lengths specified in the menu refer to the end of the probe and/or with a configured offset (see “8.4.13 Setting the offset”) to the tank bottom. You can access the menu by pressing the SET pushbutton for at least three seconds.

8.1.1 Variants with two switching outputs

Q1 Q2



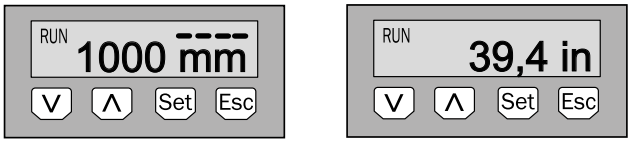
Arrow pushbuttons:	*For navigating in the menu and changing values*
Set pushbutton:	*For saving and confirming*
Esc pushbutton:	*To exit the operating menu one step at a time*

Note:

The status of the switching outputs is indicated in millimeters by bar graphs above the unit symbol. This display is not available when inches are selected as the unit.

8.1.2 Variants with four switching outputs

Q1/2/3/4



Arrow pushbuttons:	*For navigating in the menu and changing values*
Set pushbutton:	*For saving and confirming*
Esc pushbutton:	*To exit the operating menu one step at a time*

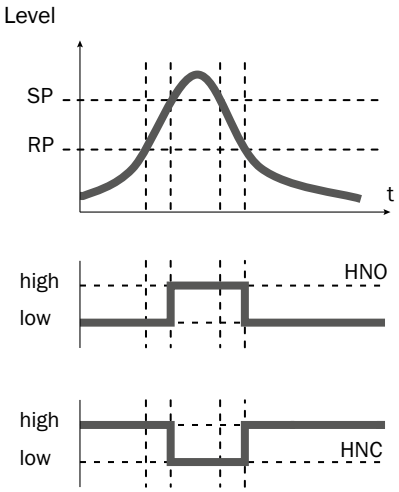
8.1.3 IO-Link

For operation via IO-Link, an IODD file and a description of the available telegram parameters can be downloaded from www.sick.com.

8.2 Configuring the switching outputs

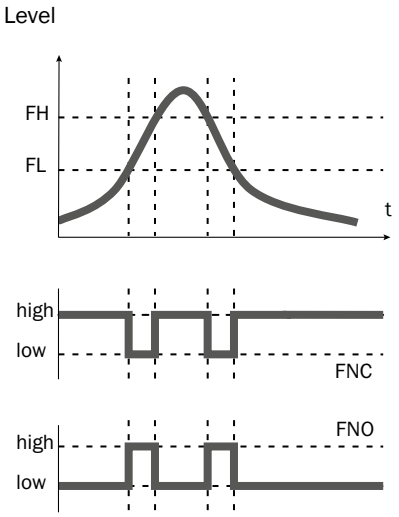
8.2.1 Switching hysteresis and window function

2 or 4 outputs depending on the variant



If the level is fluctuating around the set value (e.g., ripple movement during filling), the hysteresis keeps the switching status of the outputs stable. When the level is increasing, the output switches when the respective switching point (SP) is reached; if the level sinks again, the output switches back only after the reset switching point (RP) has been reached.

2 or 4 outputs depending on the variant



The window function enables monitoring of a defined range. If the level is between window high (FH) and window low (FL), the output will be active (normally open) and/or inactive (normally closed).

The error status of the measuring device reflects the cable break monitoring. During an error status, the measuring device switches to the safe state; i.e., the switching outputs become inactive.
As far as the downstream signal evaluation is concerned, this corresponds to a cable break.

8.2.2 Normally open with configurable hysteresis

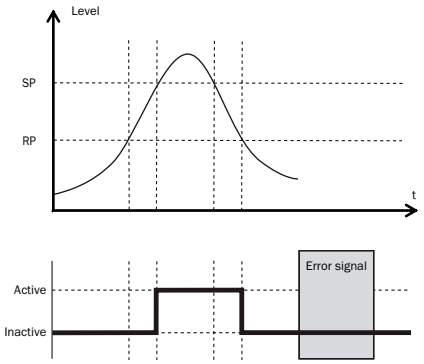
Applications

- Dry run protection
- Empty signal

Parameterization

1. Configure the Qx switching output as normally open.
   - Set the parameter in the QxMENU-OUx menu to Qx_Hno.
2. Set the switching point.
   - Set the value in the QxMENU-SPx menu to level in mm (e.g., 500 mm).
3. Set the reset point.
   - Set the value in the QxMENU-RPx menu to level in mm (e.g., 450 mm).
4. Select the electrical property (NPN/PNP/DRV (push/pull)).
   Select the parameter in the QxMENU-TYPx menu.
   Where:
   - Qx-PNP = Switching output in PNP circuit
   - Qx-NPN = Switching output in NPN circuit
   - Qx-Drv = Switching output in push/pull function

Switching output behavior



Switching output		PNP	NPN	DRV	Error status
Normally open/HNO	Active	U_v	0 V	U_v (PNP switched)	Inactive
	Inactive	0 V [1]	U_v [2]	0 V (NPN switched)	

[1] Pulldown only.

[2] Pullup only.

8.2.3 Normally closed with configurable hysteresis

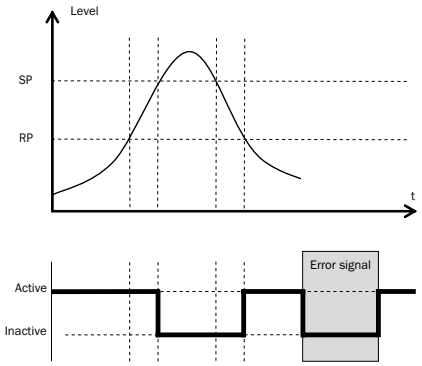
Applications

- Overfill protection
- Full signal

Parameterization

1. Configure the Qx switching output as normally closed.
   - Set the parameter in the QxMENU-OUx menu to Qx_Hnc.
2. Set the switching point.
   - Set the value in the QxMENU-SPx menu to level in mm (e.g., 500 mm).
3. Set the reset point.
   - Set the value in the *QxMENU-RPx* menu to level in mm (e.g., 450 mm).
4. Select the electrical property (NPN/PNP/DRV (push/pull)).
   Select the parameter in the *QxMENU-TYPx* menu.
   Where:
   - Qx-PNP = Switching output in PNP circuit
   - Qx-NPN = Switching output in NPN circuit
   - Qx-Drv = Switching output in push/pull function

Switching output behavior



Switching output		PNP	NPN	DRV	Error status
Normally closed/HNC	Active	U_v	0 V	U_v (PNP switched)	Inactive
	Inactive	0 V[1)]	U_v[2)]	0 V (NPN switched)	

[1)] Pulldown only.

[2)] Pullup only.

8.2.4 Normally open with window function

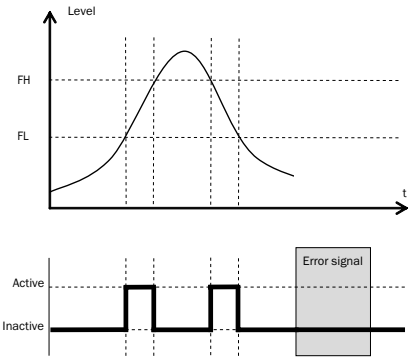
Application

The critical fill level for the application is within the FHx and FLx window thresholds.

Parameterization

1. Configure the Qx switching output as normally open.
   - Set the parameter in the QxMENU-OUx menu to Qx_Fno.
2. Set the switching point.
   - Set the value in the QxMENU-FHx menu to level in mm (e.g., 500 mm).
3. Set the reset point.
   - Set the value in the QxMENU-FLx menu to level in mm (e.g., 400 mm).
4. Select the electrical property (NPN/PNP/DRV (push/pull)).
   Select the parameter in the QxMENU-TYPx menu.
   Where:
   - Qx-PNP = Switching output in PNP circuit
   - Qx-NPN = Switching output in NPN circuit
   - Qx-Drv = Switching output in push/pull function

Switching output behavior



Switching output		PNP	NPN	DRV	Error status
Normally open/FNO	Active	U_v	0 V	U_v (PNP switched)	Inactive
	Inactive	0 V [1]	U_v [2]	0 V (NPN switched)	

[1] Pulldown only.

[2] Pullup only.

8.2.5 Normally closed with window function

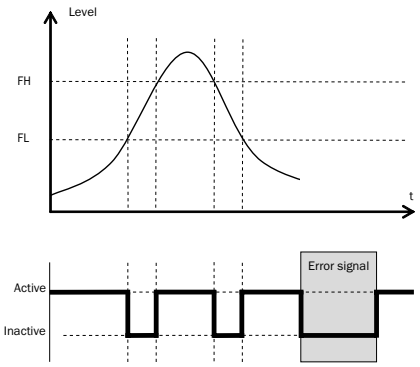
Application

The critical fill level for the application is outside the FHx and FLx window thresholds.

Parameterization

1. Configure the Qx switching output as normally closed.
   - Set the parameter in the QxMENU-OUx menu to Qx_Fnc.
2. Set the switching point.
   - Set the value in the QxMENU-FHx menu to level in mm (e.g., 500 mm).
3. Set the reset point.
   - Set the value in the QxMENU-FLx menu to level in mm (e.g., 400 mm).
4. Select the electrical property (NPN/PNP/DRV (push/pull)).
   Select the parameter in the QxMENU-TYPx menu.
   Where:
   - Qx-PNP = Switching output in PNP circuit
   - Qx-NPN = Switching output in NPN circuit
   - Qx-Drv = Switching output in push/pull function

Switching output behavior



Switching output		PNP	NPN	DRV	Error status
Normally closed/FNC	Active	U_v	0 V	U_v (PNP switched)	Inactive
	Inactive	0 V [1]	U_v [2]	0 V (NPN switched)	

[1] Pulldown only.

[2] Pullup only.

8.2.6 Normally open with error signal

Application

If there is an error message on the LFP, this can be transferred using a switching contact.

Parameterization

1. Configure the Qx switching output as normally open.
   - Set the parameter in the QxMENU-OUx menu to Qx_Eno.
2. Select the electrical property (NPN/PNP/DRV (push/pull)).
   Select the parameter in the QxMENU-TYPx menu.
   Where:
   - Qx-PNP = Switching output in PNP circuit
   - Qx-NPN = Switching output in NPN circuit
   - Qx-Drv = Switching output in push/pull function

8.2.7 Normally closed with error signal

Application

If there is an error message on the LFP, this can be transferred using a switching contact.

Parameterization

1. Configure the Qx switching output as normally closed.
   - Set the parameter in the QxMENU-OUx menu to Qx_Enc.
2. Select the electrical property (NPN/PNP/DRV (push/pull)).
   Select the parameter in the QxMENU-TYPx menu.
   Where:
   - Qx-PNP = Switching output in PNP circuit
   - Qx-NPN = Switching output in NPN circuit
   - Qx-Drv = Switching output in push/pull function

8.3 Configuring the analog output

8.3.1 Automatic signal detection

The LFP can automatically detect which signal is required using the connected output load.

Where:

- 4 mA to 20 mA < 500 ohms at Uv > 15 V
- 4 mA ... 20 mA < 350 Ohm at Uv > 12 V
- 0 V to 10 V > 750 ohms at Uv ≥ 14 V

Parameterization

1. Access the QAMENU-TYP menu using the arrow and Set pushbuttons.
2. Set the QAMENU-TYP menu to Auto?.

Note:

Automatic signal detection is only active when the device is switched on for the first time. After this the function can be activated in the QAMENU-TYP menu with Auto? again.

8.3.2 Current output 4 mA ... 20 mA

Parameterization

1. Set upper limit value (20 mA).
   - Set the value in the QAMENU-QAHIGH menu to level in mm (e.g., 500 mm).
2. Set lower limit value (4 mA).
   - Set the value in the QAMENU-QALOW menu to level in mm (e.g., 10 mm).
3. Invert the signal.
   The analog signal can be inverted in the QAPOL menu.
   Set the parameter in the QxMENU-QAPOL menu to QA-INV.
   - QA-NRM = Analog output signal as configured
   - QA-INV = Analog output signal is inverted; QAHIGH 4 mA and QALOW 20 mA
4. Select electrical signal.
5. Set the parameter in the QxMENU-QATYP menu to 4 mA ... 20 mA.

8.3.3 Voltage output 0 V ... 10 V

Parameterization

1. Set upper limit value (10 V).
   - Set the value in the QAMENU-QAHIGH menu to level in mm (e.g., 500 mm).

2. Set lower limit value (0 V).
   - Set the value in the QAMENU-QALOW menu to level in mm (e.g., 10 mm).
3. Invert the signal.
   The analog signal can be inverted in the QAPOL menu.
   Set the parameter in the QxMENU-QAPOL menu to QA-INV.
   - QA-NRM = Analog output signal as configured
   - QA-INV = Analog output signal is inverted; QAHIGH 0V and QALOW 10V
4. Select electrical signal.
   Set the parameter in the QxMENU-QATYP menu to 0 V ... +10 V.

8.4 Advanced functions

8.4.1 Expert mode

Expert mode must first be set to activate special functions.

Log in to expert mode

1. Access the PASSW menu using the arrow pushbuttons.
2. Enter password 000537 (LFP on the mobile keypad: L=5 / F=3 / P=7).

Expert mode may be locked again if the password is entered incorrectly or if the power supply is disconnected.

8.4.2 Filtering measured values

Activate filtering

Smoothing of the measured value; e.g., in the case of ripples on level surfaces. For fast level changes, the average of the measured values over X seconds is indicated.

▶ Set the parameter in the Filter menu.
The possible values are Off, 400 ms, 600 ms, 1000 ms, 1400 ms, 2 s, 5 s, 10 s.

Maximum change of level (plausibility check)

For applications that cause the level to jump on the LFP due to significant interference. Enter the max. level dynamic value in the application, or the maximum permissible rate of change of the fill level.

1. Log in to expert mode, see “8.4.1 Expert mode”.
2. Reduce the parameter in the EXPRT-CONFIG-MaxCol menu.
   AnySpd (50 cm/s) (default), 10 cm/s, 5 cm/s, 2 cm/s

Note:

- For MeasMd = HiSpd, any max. change rate is possible
- For MeasMd = HiAcc, max. is 10 cm/s

8.4.3 Automatic interference signal limit adjustment

The interference signal limit (TrsHld) can be adjusted automatically in many applications.

Configuration

1. Set the level to 30 %.
2. Log in to expert mode, see “8.4.1 Expert mode”.
3. Run EXPRT-Pulse-AutoTn in the menu.

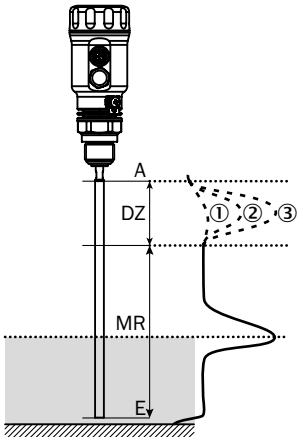
The sensor identifies a suitable value for TrsHld.

Note:

This setting can only be used in Pulse mode.

8.4.4 Blanking interference signals in masked zone

To blank interference signals from the area above the maximum anticipated level, a zone can be masked (dead zone). This zone starts at the process connection and extends to the configured point. If signal values above the set limit value (TrsHld) occur within this area, the sensor goes into the safe state and the sensor signals a !MaskZ error.



MaskTr	①		②		③	
	DZ	MR	DZ	MR	DZ	MR
20 %	x	✓	✓	x	✓	x
100 %	x	✓	x	✓	✓	x
200 %	x	✓	x	✓	x	✓

① No/very poor reflection

② Poor reflection (e.g., splashed water)

③ Strong reflection (e.g., thick layer of ketchup)

DZ Dead zone

MR Active measuring range

x No detection/measurement

✓ Detection/measurement

Parameterization

1. Log in to expert mode, see “8.4.1 Expert mode”.
2. Define the parameter in the EXPRT-Pulse-MaskZn menu.

Note:

This setting can only be used in Pulse mode.

8.4.5 Selecting evaluation process

You can switch between Pulse mode and Foam mode for the evaluation process. Different evaluation algorithms are used depending on the mode selected.

Parameterization

1. Log in to expert mode, see “8.4.1 Expert mode”.
2. Select either Pulse or Foam in the EXPRT-Config-Mode menu.

Where:

- Mode = Pulse: The sensor measures either with or without AutCal.
- Mode = Foam: The sensor measures only with valid CalEmp+CalMed. If there are no valid calibrations, the message CalPls is shown and the sensor goes into the safe state.

Note:

If AutCal is accessed while the sensor is in Foam mode, AutCal is denied with the error message !Denid.

8.4.6 Testing the configuration

Testing outputs

Switching / analog outputs can be simulated. This allows for the wiring and signal values on the connected systems, such as the PLC control, relay, and lamps, to be checked.

Parameterization

Activate the Qx switching output

▶ Set the parameter in the QxMENU-SimQx menu to QxOn.

Further options:

- QxOff = switching output off
- QxNorm = switching output in measuring operation
- QxOn = switching output is active

Note:

The simulation is automatically deactivated if the supply voltage is interrupted.

Activate the QA analog output

▶ Set the parameter in the QAMENU-SimCur or SimVol menu to the desired signal value.

- SimCur for current output
- SimVol for voltage output

Note:

The simulation is automatically deactivated if the supply voltage is interrupted.

Simulating the level

Even if there is no liquid in the container yet, it is possible to select a fill level in the menu in order to test the sensor configuration. When simulating a level value, all outputs on the LFP are set according to the defined configuration. The function should not be selected until a configuration is complete.

Parameterization

▶ Set parameter to the desired fill level as a % in the SimLev menu.

Note:

- The level simulation refers to the probe length and/or container level (probe length + offset) if an offset is configured.
- The simulation is only active when there are no error messages. The simulation is automatically deactivated if the supply voltage is interrupted.

Parameter selection

- SimOff: Off
- Fill level 0 %
- 25 % fill level
- 50 % fill level
- 75 % fill level
- 100 % fill level

8.4.7 Configuring the probe length

1. Log in to expert mode, see “8.4.1 Expert mode”.
2. Access the EXPRT-CONFIG-Length menu using the arrow and Set pushbuttons.
3. Enter the probe length in the Length menu. Please note the defined probe length in section “15 Dimensional drawings”.

Note:

- HiSpd: max. length = 2005 mm, response time < 400 ms
- HiAcc: max. length = 6,005 mm, response time < 2,800 ms

8.4.8 Teaching in static interference signals

Static interference signals in the tank generated by pipes, struts, couplings, or cleaning balls can be taught in. The probe length provides the value for the teach-in depth.

1. Log in to expert mode, see “8.4.1 Expert mode”.
2. Access the EXPRT-Pulse-CalRng menu using the arrow and Set pushbuttons.
3. Set the value range: 95 mm ... 6,005 mm.

Note:

- The value starts from the LFP process connection.
- The value should cover all interference signals.
- Maximum value = probe length – 100 mm.
- The AutCal function should then run, see “7 Commissioning”.
- The CalRng parameter should always match the probe length for LFPs with remote amplifier.

8.4.9 Evaluating signal quality

Parameters describe the quality of the measuring signal.

▶ Log in to expert mode,, see “8.4.1 Expert mode”.

SigQa1

Characteristic for the robustness of the EXPRT-Pulse-TrsHld setting.

Not active in foam mode. The displayed value is only valid if the sensor displays the correct level value.

- Value range: 0 % ... + 100 %
- Good signal: > 40 % (a high pulse reserve is provided with the current TrsHld setting.)

▶ Measures: Reduce EXPRT-Pulse-TrsHld to increase SigQa1.

Note:

- Changing TrsHld will have an impact on SigQa2 and SigQa3.
- If a satisfactory SigQa1 value cannot be achieved by adjusting TrsHld in conjunction with the SigQa values, the installation condition must be checked. Using a coaxial tube improves signal detection, particularly in media with low DK values (e.g., oil).

SigQa2

Characteristic for the robustness of echo pulse detection in relation to interference pulses.

Not active in foam mode. The displayed value is only valid if the sensor displays the correct level value.

- Value range: 0 % ... + 100 %
- Good signal: > 50 %

▶ Actions: Run AutCal; check installation conditions; remove deposits from probe and process connection.

SigQa3

Characteristic for signal noise and electromagnetic interference.

- Value range: 0 % ... + 100 %
- Good signal: > 75 %
- Poor signal: < 50 %

Not active in foam mode. The displayed value is only valid if the sensor displays the correct level value.

- Value range: 0 % ... + 100 %

▶ Actions:

- Increase EXPRT-Config-TrsHld
- EXPRT-Config-MeasMd = HiAcc
- Improve filtering
- Switch on filter
- Reduce EXPRT-Config-MaxCol

8.4.10 Changing the coaxial cable length

- Valid for versions with remote amplifier.
- This setting makes it possible to configure the coaxial cable length between the sensor head and process connection.

Parameterization

Predefined coaxial cable length (1,000 mm, 2,000 mm, or 3,300 mm)

1. Log in to expert mode, see “8.4.1 Expert mode”.
2. Configure the coaxial cable length in the EXPRT-Config-CblLen menu (1,000 mm ... 3,300 mm).

Note:

Only the following configurations are permitted:

	Max. probe length [mm]	
Coaxial cable length [mm]	Foam mode inactive	Foam mode active
1,000	4,000	2,000
2,000	3,000	1,500
3,300	1,000	500

8.4.11 Activating the display lock

To prevent the sensor from manipulation, password protection can be activated for the display.

When the protection is active, the expert password (000537) must be entered before the menu can be accessed.

The menu is only unlocked once the correct password is entered.

Parameterization

1. Log in to expert mode, see “8.4.1 Expert mode”.
2. The protection can be (de)activated via the EXPRT-Config-Lock menu.

Note:

- The user is logged out again after 5 minutes of inactivity.
- When the display is locked, only the configured measured value display (DspVal) can be seen.

8.4.12 Selecting the display unit (millimeter/inch)

This setting makes it possible to display and configure all length measurements in either millimeters or inches.

Parameterization

1. Log in to expert mode, see “8.4.1 Expert mode”.
2. Set the unit in the EXPRT-Config-Unit menu (mm/inch).

8.4.13 Setting the offset

This setting makes it possible to indicate the level value on the display in relation to the tank bottom instead of the end of the probe. The actual container level is then indicated on the display.

Parameterization

1. Log in to expert mode, see “8.4.1 Expert mode”.
2. Set the offset in the EXPRT-Config-Offset menu (0 mm ... +3,000 mm).

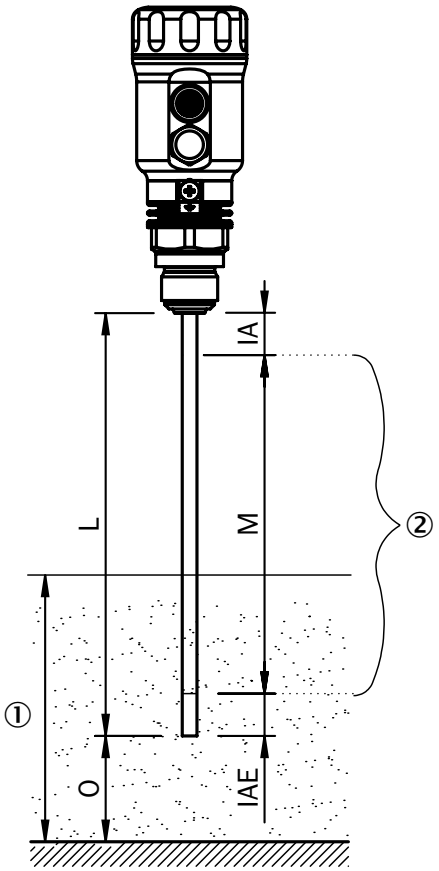


Fig. 7: LFP Inox

① *Level*
② *QALOW/ QAHIGH*
SPx/RPx
FHx/FI x
Can only be set in this zone
O: Offset
L: Probe length
M: Measurement length
IA: Inactive area at process connection
IAE: Inactive area at probe end

Note:

If the offset parameter is changed, the SPx/RPx/FLx/FHx/QALOW/QAHIGH parameters are automatically adjusted.

8.4.14 Resetting the calibration

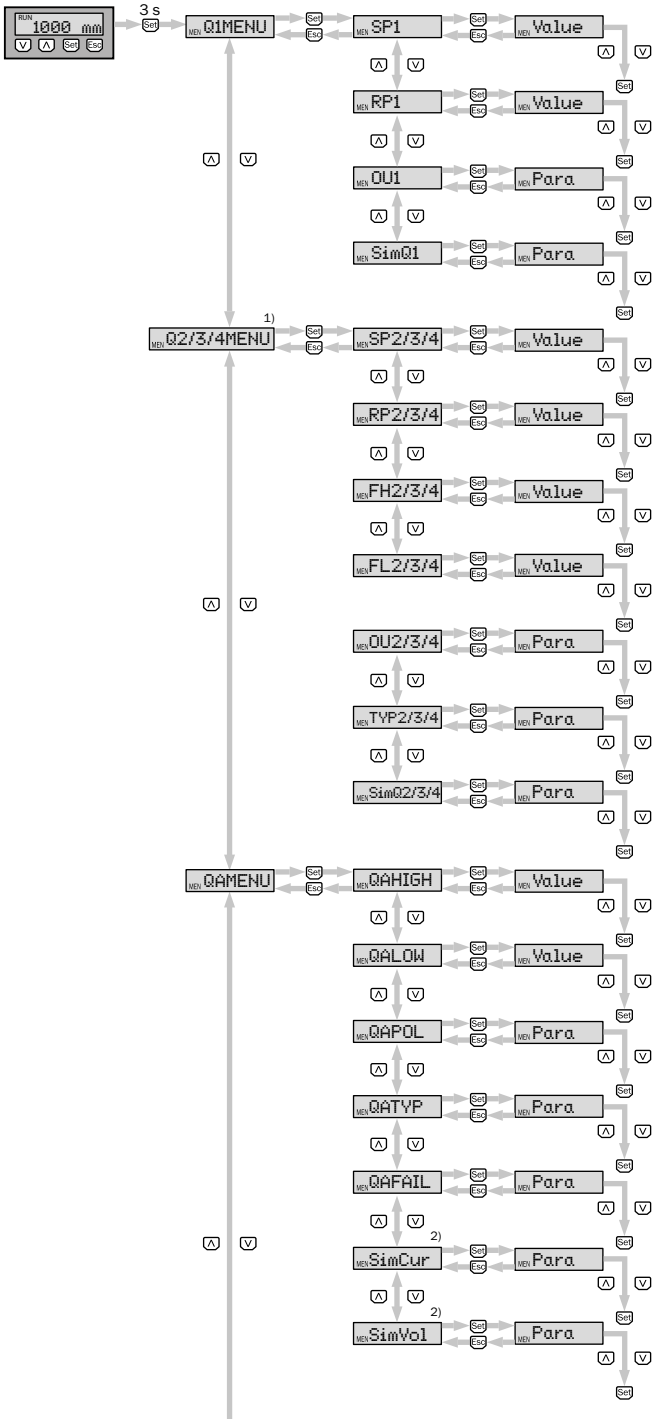
Reset AutCal

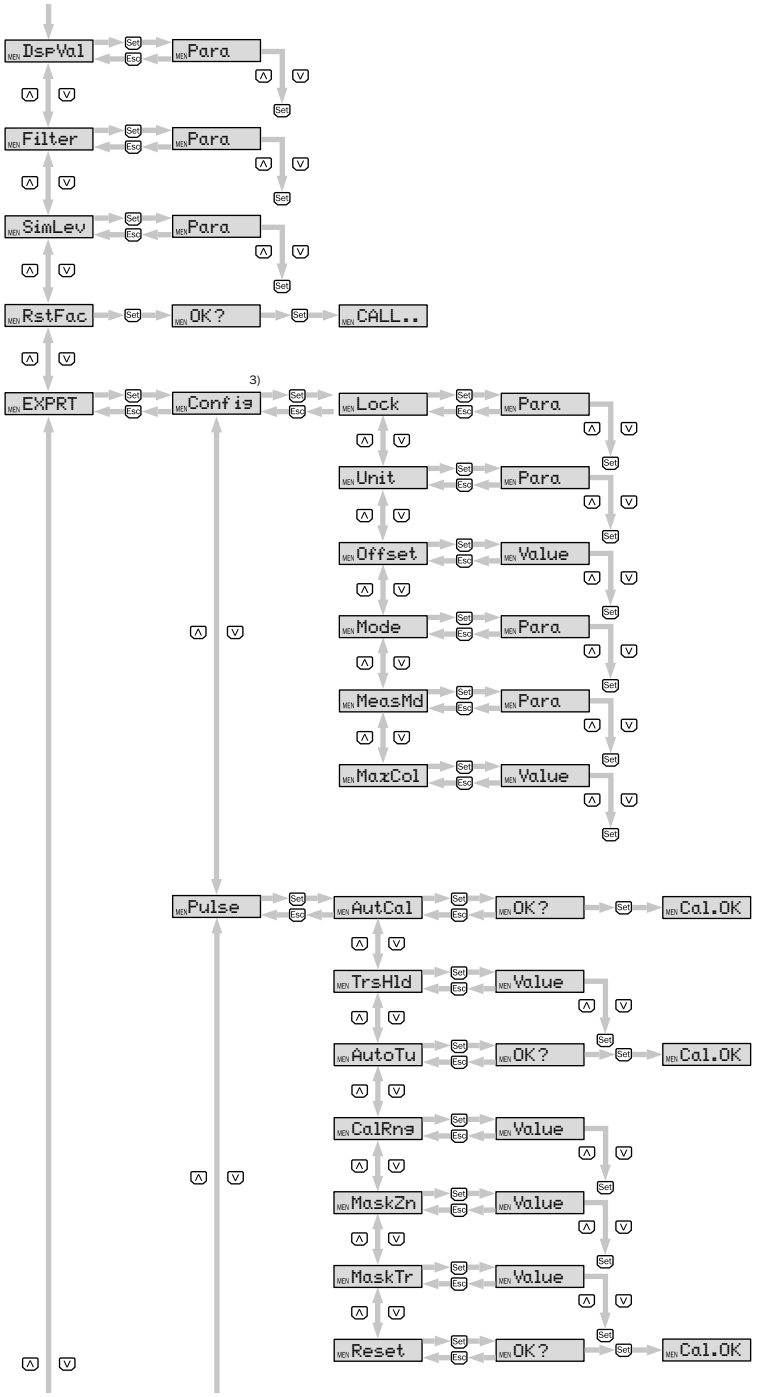
1. Log in to expert mode, see “8.4.1 Expert mode”.
2. Reset AutCal in the EXPRT-Pulse-Reset menu.

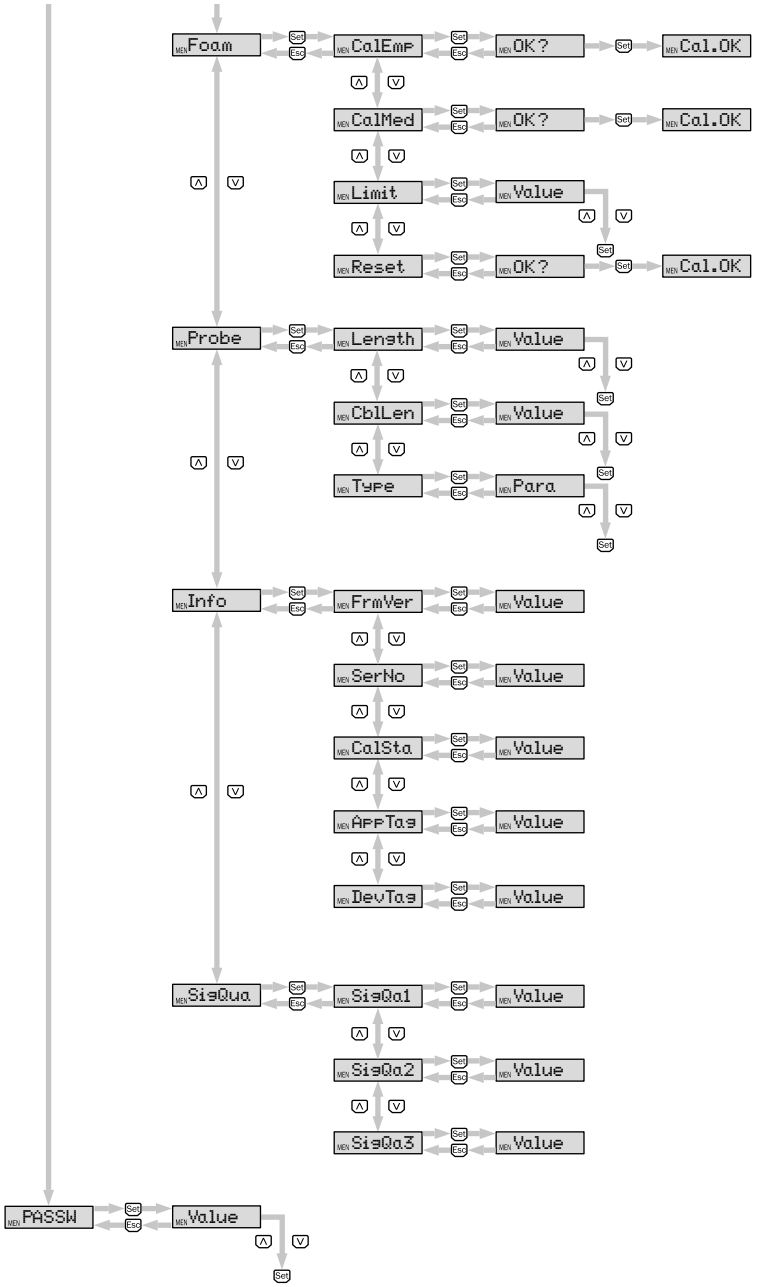
Reset CalEmp+CalMed

1. Log in to expert mode, see “8.4.1 Expert mode”.
2. Reset CalEmp+CalMed in the EXPRT-Foam-Reset menu.

9 Menu overview




MEN DspVal
MEN Filter
MEN SimLev
MEN RstFac
MEN EXPRT
MEN Para
MEN OK?
MEN CALL..
3)
MEN Config
MEN Lock
MEN Unit
MEN Offset
MEN Mode
MEN MeasMd
MEN MaxCol
MEN Value
MEN Pulse
MEN AutCal
MEN Cal.OK
MEN TrsHld
MEN AutoTu
MEN CalRng
MEN MaskZn
MEN MaskTr
MEN Reset
Set
Esc



1) Elements which are displayed depend on the OUx parameter selection

2) Elements which are displayed depend on the QATYP parameter selection.

3) Password-protected measuring range.

Q3 and Q4 are only available for an LFP with four switching outputs.

10 Overview of parameters

Parameter	Description
Q1MENU, Q2MENU, Q3MENU, Q4MENU	See “8.2 Configuring the switching outputs”.
SPx	Switching point, switching output 1 or 2 or 3 or 4 (SPx > RPx). Note: Not displayed if the switching output in the OUx menu is set to error or window.
RPx	Reset switching point, switching output 1 or 2 or 3 or 4. Note: Not displayed if the switching output in the OU2/3/4 menu is set to error or window.
FHx FLx	• Upper threshold (high) window function, switching output 2/3/4 (FHx > FLx) • Lower threshold (low) window function, switching output 2/3/4 Note: Not displayed if the switching output in the OU2/3/4 menu is set to error or hysteresis.
OUx	Switching function, switching output. • Qx-Hno = Hysteresis function, normally open • Qx-Hnc = Hysteresis function, normally closed • Qx-Fno = Window function, normally open (function only available for Q2/3/4) • Qx-Fnc = Window function, normally closed (function only available for Q2/3/4) • Qx-Eno = Error signal, normally open (function only available for Q2/3/4) • Qx-Enc = Error signal, normally closed (function only available for Q2/3/4) If Qx is used as an error signal, SPx/FHx and RPx/FLx are hidden in the menu.
SimQx	See “8.4.6 Testing the configuration”.
TYP2/3/4	• Qx-PNP = Switching output in PNP circuit • Qx-NPN = Switching output in NPN circuit • Qx-Drv = Switching output executed in push/pull function
QAMENU	See “8.3 Configuring the analog output”.
QAHIGH	Input of the fill level in mm for 20 mA / 10 V signal (QAHIGH > QALOW).
QALOW	Input of the fill level in mm for 4 mA / 0 V signal.
QAPOL	The analog output signal can be inverted. • QA-Nrm = Analog output signal as configured • QA-INV = Analog output signal is inverted: QAHIGH 4 mA/0 V and QALOW 20 mA/10 V

Parameter	Description
QATYP	Output signal settings. • 4 mA ... 20 mA • 0 V ... +10 V • Auto V = Qa operated with voltage output of 0 V ... +10 V • Auto A = Qa operated with current output of 4 mA ...20 mA • Auto? = Automatic signal detection based on the existing load resistance During a menu query, either 4 mA ... 20 mA or 0 V ... +10 V is displayed.
QAFAIL	Output behavior as per NE43 in the event of a fault (function only available when current output has been selected under QATYP.) • 3.5 mA = Analog current output is set to 3.5 mA in the event of a fault. • 21.5 mA = Analog current output is set to 21.5 mA in the event of a fault.
SimCur	See “8.4.6 Testing the configuration”.
SimVol	See “8.4.6 Testing the configuration”.
DspVal	Display settings. • Distan = The display shows the distance in mm in relation to the end of the probe. • QaPerc = The display shows the fill level in % in relation to the QA analog output with the corresponding QAHIGH and QALOW thresholds. • QaBarG = The display shows a bar graph in relation to the QA analog output with the corresponding QAHIGH and QALOW thresholds. • QaSign = The display shows the current QA output value in mA or V. • QxSign = The display shows the output states.
Filter	See “8.4.2 Filtering measured values”.
SimLev	See “8.4.6 Testing the configuration”.
RstFac	Reset the set parameters to the factory settings.
EXPRT	See “8.4.1 Expert mode”.
Lock	See “8.4.11 Activating the display lock”.
Unit	See “8.4.12 Selecting the display unit (millimeter/inch)”.
Offset	See “8.4.13 Setting the offset”.
Mode	See “8.4.5 Selecting evaluation process”.
MaxCol	See “8.4.2 Filtering measured values”.
MeasMd	Measuring mode. • HiSpd: max. length = 2,005 mm, response time < 400 ms • HiAcc: max. length = 6,005 mm, response time < 2,800 ms (more stable measured values, recommended for liquids with low DK values and where TrsHld is < 70) • mode-1: not supported, deactivates current AutCal/foam calibration

Parameter	Description
Pulse	See “8.4.5 Selecting evaluation process”.
AutCal	See “7 Commissioning”.
TrsHld	This value describes a factor which determines how strong an echo has to be in order to be recognized by the device. The value range lies between 20 % and 500 %. The default is 100 % in this case. Only shown if password entered. • 20 % = high sensitivity • 100 % = standard • 500 % = low sensitivity
AutoTn	See “8.4.3 Automatic interference signal limit adjustment”.
CalRng	Calibration range/calibration length (calibration range). • Value range: 95 mm ... 6,005 mm Range starting from the process connection in which static interference signals (coupling sections, welds, spray balls, etc.) are hidden during the AutCal process. During the AutCal process, there must not be any medium in the defined area of + 200 mm. See “8.4.8 Teaching in static interference signals” (LFP Inox).
MaskZn	See “8.4.4 Blanking interference signals in masked zone”.
MaskTr	See “8.4.4 Blanking interference signals in masked zone”.
Reset	Resets the value for AutCal.
Foam	See “7.3 Foam commissioning (with factory settings)”.
CalEmp	See “7.3 Foam commissioning (with factory settings)”.
CalMed	See “7.3 Foam commissioning (with factory settings)”.
Limit	Limit between foam and fluid. • Range: 20 % ... 100 % • Factory setting: 90 % • Medium surface: 90 % • Foam surface: < 90 % When measuring the foam surface, it may be necessary to reduce the limit. If the sensor displays a limit value that is too low, it is necessary to reduce the limit.
Reset	Resets the values for CalEmp and CalMed.
Sample	Probe settings.
Length	See “8.4.7 Configuring the probe length”.
CblLen	See “8.4.10 Changing the coaxial cable length”.
Type	Choose either Rod (rod probe) or Rope (cable probe).
Info	Sensor information.
FrmVer	Shows the firmware version.
SerNo	Shows the serial number.
CalSta	Displays the status of the container calibration. • Pulse = AutCal (calibrated), NoCal (not calibrated) • Foam = FomCal (calibrated), CalMis (not calibrated)
AppTag	Measuring point name, can only be written via IO-Link.
DevTag	Device name, can only be written via IO-Link.

Parameter	Description
SigQua	Parameter describes the quality of the measuring signal.
SigQa1	See “8.4.9 Evaluating signal quality”.
SigQa2	See “8.4.9 Evaluating signal quality”.
SigQa3	See “8.4.9 Evaluating signal quality”.
PASSW	See “8.4.1 Expert mode”.

11 Troubleshooting

11.1 Error message on the display

Fault pattern	Cause	Solution
!InvEc & level present	AutCal not executed, source of interference superimposed on medium reflection.	Perform commissioning (See "7.1 Quick commissioning (with factory settings)").
	TrsHld setting is not suitable for the medium.	Perform advanced commissioning (See "7.2 Advanced commissioning").
!InvEc & Tank empty	Probe length configured incorrectly.	Check probe length and compare against configuration in EXPRT-Config-LENGTH.
	Probe not available.	Check probe.
!ATTNT	A parameter was written outside of the valid value range and therefore was adjusted	Rewrite the value in the valid range.
	Another parameter was automatically adjusted due to a dependency (SPx, RPx).	Check the parameter again.
!WRONG	Incorrect password entered.	Enter the correct password.
!NoCal	Information: The AutCal process and/or foam calibration was rejected because the probe length, teach-in depth, or measuring mode was changed.	Repeat commissioning if necessary.
!Denid	AutCal was accessed in the Foam sensor mode.	AutCal is only available in Pulse mode. Perform foam calibration in Foam mode.
CalPls	No valid calibrations for CalEmp and CalMed.	Perform foam calibration.
!CalOk	The teach-in process was successful.	
!NoSig	AutCal failed.	Repeat commissioning.
!faild	Foam-CalEmp or FoamCalMed menu item failed.	Follow the foam commissioning instructions.
!SC-Q1 !SC-Q2 !SC-Q3 !SC-Q4 !SC-Qa	Short circuit at the output.	Remove short circuit.
	Load resistance at the output is too low.	Increase load resistance.
!IOLOf	Supply voltage too low for IO-Link communication.	Increase supply voltage to achieve the desired functionality.
!QaOff	Supply voltage too low for analog output.	Increase supply voltage to achieve the desired functionality.
!QxOff	Supply voltage too low for switching outputs.	Increase supply voltage to achieve the desired functionality.
!QaOvf	The ohmic load at the analog current output Qa is too high.	Reduce the load at Qa.
	The analog current output Qa is not wired.	Connect the load to Qa.
!MaskZ	Interference / pulse exceeds value for MaskTr.	Increase MaskTr or identify and remove source of interference.
!Range	The maximum allowable measuring range was exceeded. Measurement in this configuration is not possible.	Reduce probe length and/or coaxial cable length, see "8.4.10 Changing the coaxial cable length".
!Cable	The coaxial cable is damaged/faulty.	Replace the coaxial cable.
	The coaxial cable length was configured incorrectly.	See "8.4.10 Changing the coaxial cable length".
Display only shows RUN. Otherwise the display is empty.	The Menu-DspVal menu parameter is at QaBarG and the level is below QALOW.	Change QALOW or DspVal.

Fault pattern	Cause	Solution
Display off	Temperature too high.	Reduce the temperature.
	Temperature too low.	Increase the temperature.
	No supply voltage.	Connect sensor correctly.
!Err[xx] !ErM[xx] !ErI[xx] !ErO[xx]	System error.	The device is faulty and needs to be replaced.
NVFail	Memory error.	The device is faulty and needs to be replaced.

11.2 Operating the display

Fault pattern	Cause	Solution
The menu item SPx/ RPx is not displayed.	QxMENU/OUx is not configured to Qx-Hno and/or Qx-Hnc.	Perform configuration of Qx (see “8.2 Configuring the switching outputs”).
The menu item FHx/ FLx is not displayed.	QxMENU/OUx is not configured to Qx-Fno and/or Qx-Fnc.	Perform configuration of Qx (see “8.2 Configuring the switching outputs”).
QAFAIL is not displayed.	The analog output Qa is in voltage mode (QATYP = 0 V ... +10 V).	Perform configuration of Qa (see “8.3 Configuring the analog output”).
SimVol is not displayed.	The analog output Qa is in current mode (QATYP = 4 mA ... 20 mA).	Perform configuration of Qa (see “8.3 Configuring the analog output”).
SimCur is not displayed.	The analog output Qa is in voltage mode (QATYP = 0 V ... +10 V).	Perform configuration of Qa (see “8.3 Configuring the analog output”).
EXPRT-Config-... is not displayed.	Correct password not entered.	See “8.4.1 Expert mode”.
EXPRT-Foam-... is not displayed.	Correct password not entered.	See “8.4.1 Expert mode”.
Lengths are expressed as decimal numbers.	Inch is activated as the display unit.	Perform configuration of units (see “8.4.12 Selecting the display unit (millimeter/ inch)”).
The menu only shows PASSW.	Display lock is activated.	See “8.4.11 Activating the display lock”.

11.3 Outputs

Fault pattern	Cause	Solution
Switching output does not behave as expected	Configuration incorrect.	Perform configuration of the switching output (See "8.2 Configuring the switching outputs").
	An error is pending; the sensor outputs are in the safe state.	Remove the cause of the error.
	Cable break.	Check cable.
Analog output does not behave as expected	Configuration incorrect.	Configure the analog output (See "8.3 Configuring the analog output").
	An error is pending; the sensor outputs are in the safe state.	Remove the cause of the error.
	Cable break.	Check cable.

11.4 Error behavior

Fault pattern	Cause	Solution
After installation, the sensor indicates a high level although the tank is empty.	AutCal not performed.	Perform commissioning (see "7 Commissioning").
When used with a coaxial tube, the sensor indicates a high level even though the tank is empty.	AutCal not performed.	Perform commissioning (see "7 Commissioning").
Level value fluctuates on the display.	Medium surface unsettled.	Activate filtering (see "7.1 Quick commissioning (with factory settings)").
The displayed level value/SPx/RPx/FHx/FLx/QALOW/QAHIGH is greater than the probe length.	An offset was configured for the level value.	Adjust offset (see "8.4.13 Setting the offset").
	Incorrect probe length configured.	Adjust probe length (see "8.4.7 Configuring the probe length").
Level occasionally jumps to a higher value.	Contamination in the vicinity of the process connection.	Clean.
	Spray ball or feed wetting probe with medium above the medium surface.	Observe the installation conditions Configure the MaxCoL plausibility filter (see "8.4.2 Filtering measured values").
	Change in the ambient conditions with respect to the situation during the AutCal process.	Perform commissioning again (See "7 Commissioning").
	Significant buildup of foam.	Perform foam commissioning (See "7.3 Foam commissioning (with factory settings)").
	TrsHld set too low, echo algorithm detecting interference reflections.	Increase TrsHld.
Level occasionally jumps to 0 mm.	TrsHld set too high.	Perform advanced commissioning (See "7 Commissioning").
	Significant buildup of foam.	Perform foam commissioning.
No measurement of low levels for media with low DK values.	Increased inactive range at the end of the probe for media with a low DK.	
Increased measurement inaccuracy.	Use of foam algorithm.	

12 Repair

12.1 Maintenance

The LFP is maintenance-free. We recommend performing the following actions regularly:

- Checking the probe for contamination
- Checking the screw connections and plug connections.

12.2 Return

Rinse off and/or clean removed devices before returning them in order to protect our employees and the environment from dangers posed by residue from measured materials. Faulty devices can only be examined when accompanied by a completed return form. This form includes information about all materials which have come into contact with the device, including those which were used for testing purposes, operation, or cleaning. The return form is available from our website (www.sick.com).

13 Disposal

Dispose of device components and packaging materials in compliance with applicable country-specific waste treatment and disposal regulations for the region of use.

14 Technical data

14.1 Features

Medium	Liquids
Detection type	Point level measurement, continuous
Probe length	200 mm ... 4,000 mm
Adjustable measuring range	95 mm ... 6,005 mm
Process pressure	–1 bar ... +16 bar
Process temperature	–20 °C ... +150 °C
EHEDG certificate	✓
GOST certificate	✓
RoHS certificate	✓
IO-Link	✓
3A approval	✓
UL certificate	✓
3.1 Material certificate	✓
calibration certificate	✓

14.2 Performance

Accuracy[1)]	± 5 mm
Repeatability[1)]	≤ 2 mm
Resolution	1 mm
Response time[3)]	< 400 ms
Dielectric constant	≥ 5 for mono-rod probe ≥ 1.8 with coaxial tube
Conductivity	No limitation
Maximum change of level[4)]	500 mm/s
Inactive area at end of probe[1)]	10 mm

[1)] With water under reference conditions, see “14.7 Measurement accuracy”.
[2)] With parameterized container with water under reference conditions, otherwise 40 mm.
[3)] Depends on measuring mode (high-speed < 400 ms, high accuracy < 2800 ms)
[4)] Depends on configuration (MaxCol - maximum change of level)

14.3 Mechanics/materials

Materials in contact with the media	1.4404 (Ra ≤ 0.8 µm), PEEK
Process connection	G 3/4 (hygienic or pharmaceutical process connectors with adapter for G 3/4, see accessories), 3/4 NPT
Housing material	1.4305
Max. probe load	6 Nm
Enclosure rating	IP67: EN 60529, IP69K: EN 40050
Coaxial cable insulation	FEP
Electrical cable insulation[1)]	PVC

[1)] *Version with electrical cable instead of M12 connection.*

14.4 Reference conditions

Container with diameter	1 m
Minimum distance to built-in components	> 300 mm
Distance from end of probe to tank bottom	> 15 mm
Air humidity	65 % ± 20 %
Temperature	+20 °C ± 5 °C
Pressure	1013 mbar abs. ± 20 mbar
Medium	Water, DK = 80
Centered installation of sensor	✓
Container parameterization carried out	✓

14.5 Ambient conditions

Ambient temperature, operation [1)]	–20 °C ... +60 °C
Ambient temperature, storage	–40 °C ... + 80 °C
Ambient temperature, coaxial cable	–20 °C ... +60 °C

[1)] *According to UL listing: degree of contamination 3 (UL61010-1: 2012-05); air humidity: 80 % at temperatures up to 31 °C; installation height: max. 3,000 m above. sea level; only for indoor applications*

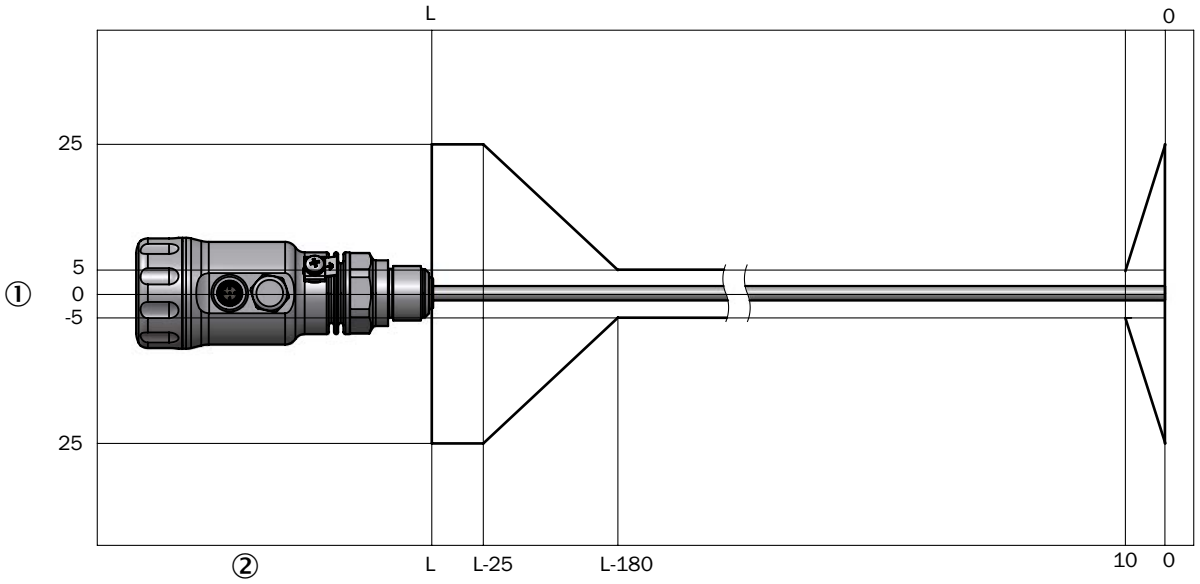
14.6 Electrical connections

Supply voltage	12 V DC ... 30 V DC
Current consumption	≤ 100 mA at 24 V without output load
Initialization time	≤ 5 s
Protection class	III
Connection type	M12 x 1 (5-pin) M12 x 1, 8-pin
Hysteresis	Min. 3 mm, freely configurable
Output signal [1]	4 mA to 20 mA / 0 V to 10 V automatically switchable depending on output load[1] 1 PNP transistor output (Q1) and 1 PNP/NPN transistor output (Q2) switchable, **or** 1 PNP transistor output (Q1) and 3 PNP/NPN transistor outputs (Q2 ... Q4) switchable (depending on type)
Signal voltage HIGH	Uv –2 V
Signal voltage LOW	≤ 2 V
Output current	< 100 mA
Inductive load	< 1 H
Capacitive load	100 nF
Temperature drift	< 0.1 mm/K
Output load	4 mA to 20 mA < 500 ohms at Uv > 15 V 4 mA ... 20 mA < 350 Ohm at Uv > 12 V 0 V to 10 V > 750 ohms at Uv ≥ 14 V
Lower signal level	3,8 mA ... 4 mA
Upper signal level	20 mA ... 20.5 mA
EMC	EN 61326-2-3, 2014/30/EU

[1] All connections are reverse polarity protected. All outputs are overload and short-circuit protected.
[2] Use an energy-limited circuit for voltage supply as per UL61010-1 3rd Ed., Section 9.3

14.7 Measurement accuracy

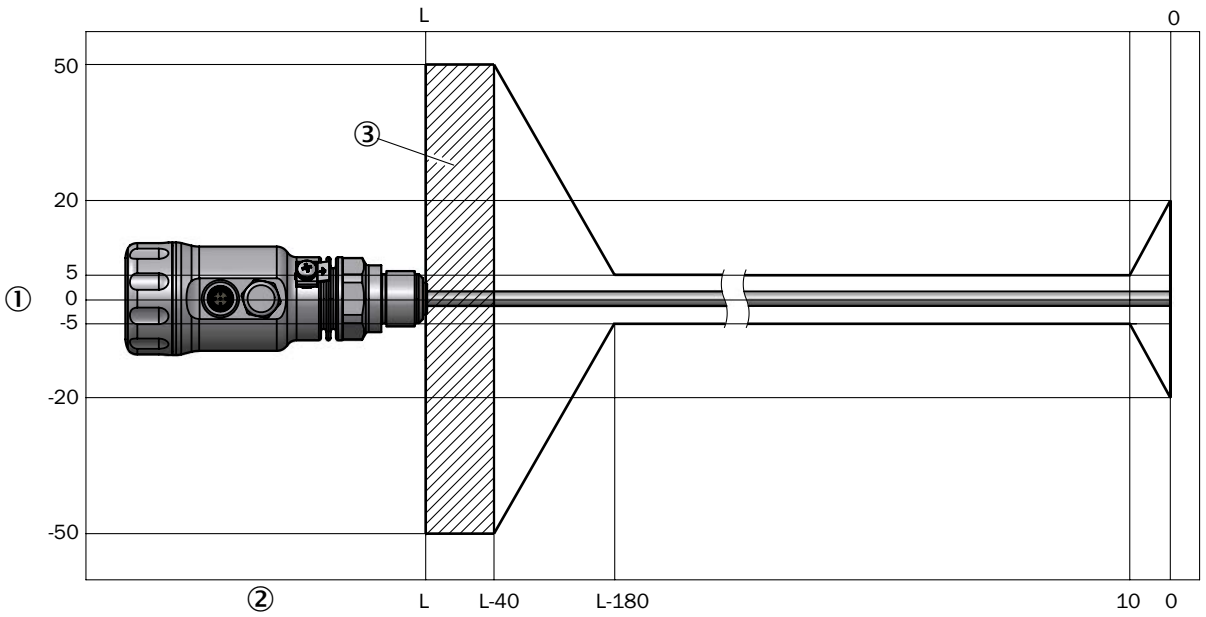
Measurement accuracy with parameterized container



① *Accuracy in mm*

② *Level in mm*

Measurement accuracy without parameterized container



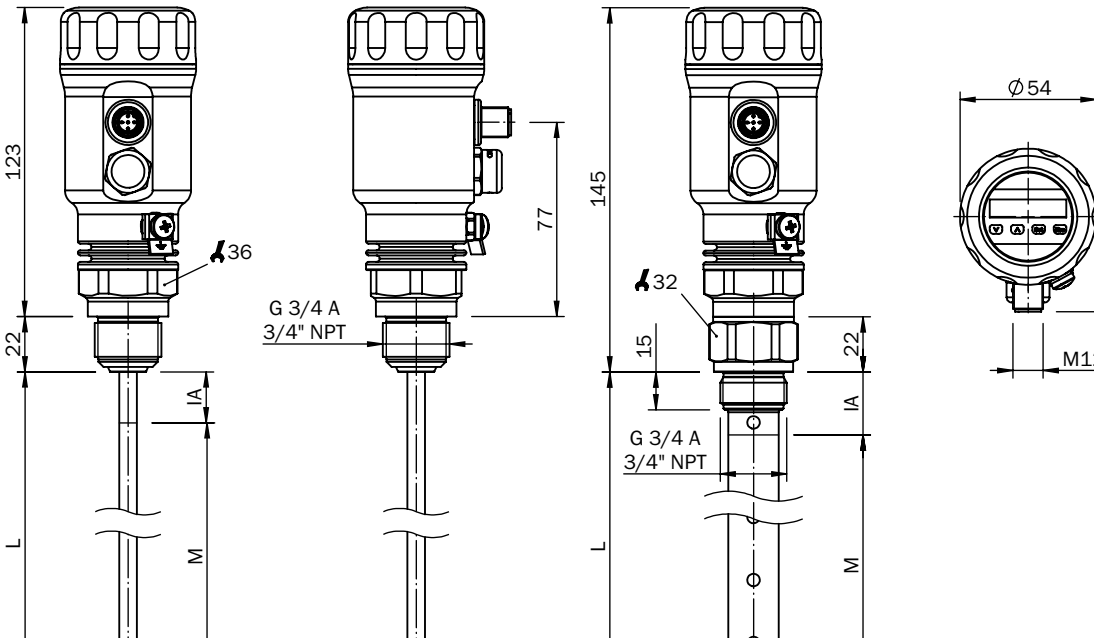
① *Accuracy in mm*

② *Level in mm*

③ *Inactive area*

15 Dimensional drawings

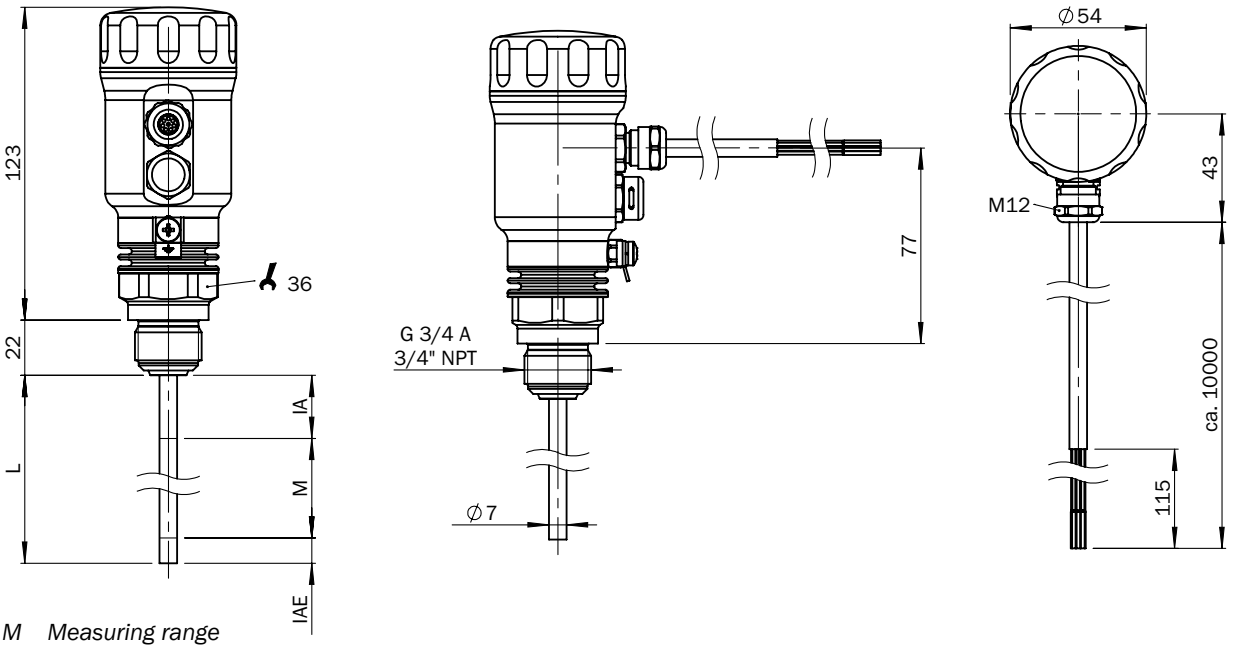
LFP Inox standard version



Rod probe *with coaxial tube*

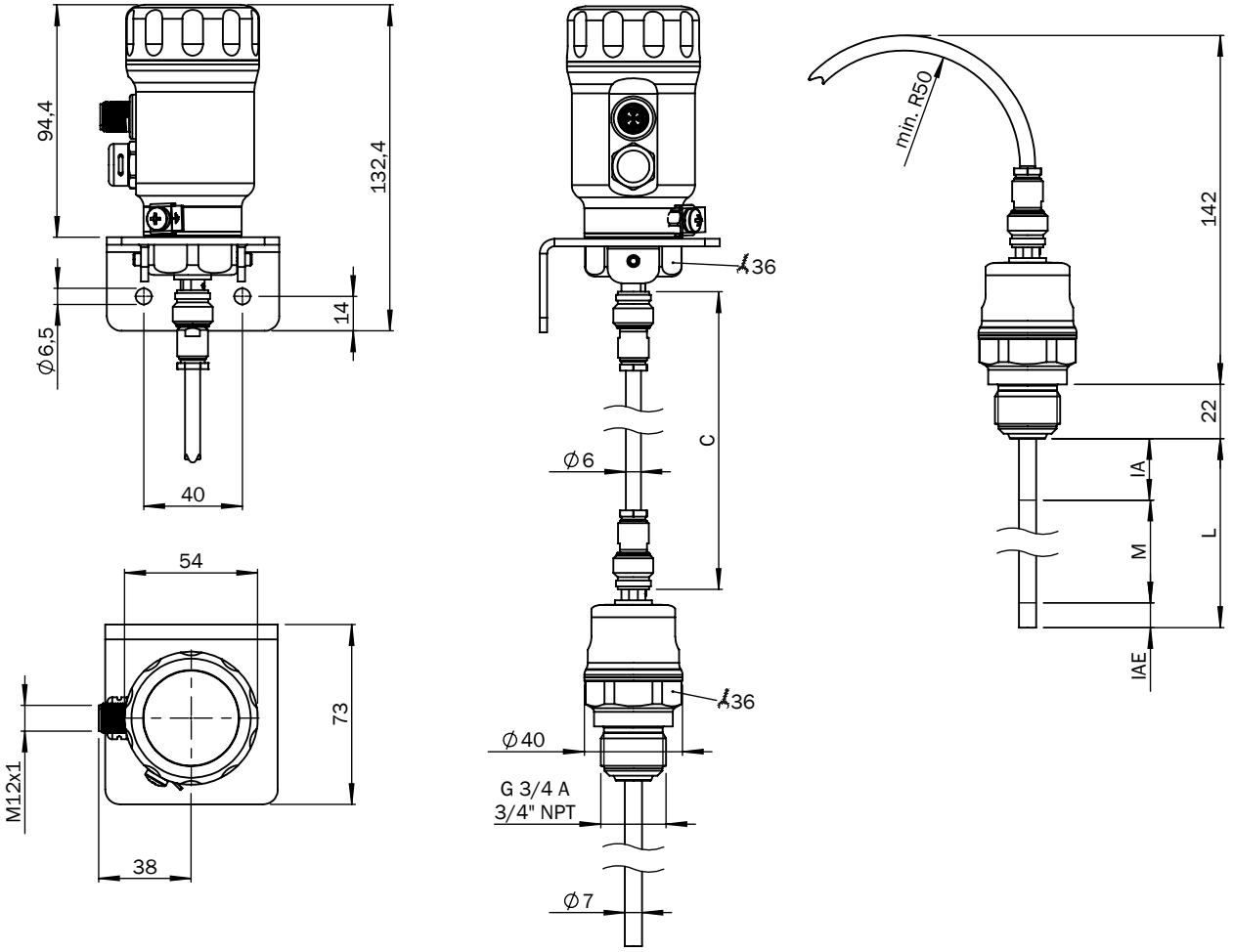
M Measuring range
L Probe length
IA Inactive area at process connection 25 mm
IAE Inactive area at probe end 10 mm

LFP Inox cable version



M Measuring range
L Probe length
IA Inactive area at process connection 25 mm
IAE Inactive area at probe end 10 mm

LFP Inox with remote amplifier



C Length of cable
M Measuring range
L Probe length
IA Inactive area at process connection 20 mm / 40 mm
IAE Inactive area at probe end 10 mm

16 Factory setting

Parameter	Factory setting
SP1	80 % of probe length measured from end of probe
RP1	5 mm below SP1
OU1	Q1_Hno
SP2	For 5-pin versions: 20 % of the probe length measured from the end of the probe For 8-pin versions: 60 % of the probe length measured from the end of the probe
RP2	5 mm below SP2
OU2	Q2_Hno
TYP2	Q2_PNP
SP3	40 % of probe length measured from end of probe
RP3	5 mm below SP3
OU3	Q3_Hno
SP4	20 % of probe length measured from end of probe
RP4	5 mm below SP4
OU4	Q4_Hno
TYP3	Q3_PNP
TYP4	Q4_PNP
QAHigh	50 mm below start of probe
QALOW	10 mm above end of probe
QAPOL	QA_Nrm
QATYP	Auto
QAFAIL	3.5 mA
SimCur	SimOff
SimVol	SimOff
DspVal	Distan
Filter	Off
SimLev	SimOff
TrsHld	100
MaskZn	0 mm
MaskTr	50 %
Mode	Pulse
CalSta	noCal
Probe/Type	Depending on probe type: Rod/Rope
MaxCol	Depending on measuring mode: HiSped = AnySped, HiAcc = 10 cm/s
MeasMd	HiSpd
CalRng	6005 mm
FomSta	Inactive
Limit	90
Offset	0 mm
Unit	mm
Lock	Inactive

17 Accessories

Note:

Hygienic connection adapters may only be screwed on once. The tightening torque for the connection adapter should be at least 20 Nm +/- 5 Nm. Repeated opening can damage the seal and therefore impair the hygienic properties. The available adapters for hygienic and pharmaceutical applications are suitable for the LFP basic device with threaded G ¾ A connection. Process connection seals are to be provided by the customer.

If a leakage is detected at the leakage indication port of the hygienic adapter, the process must be stopped immediately and the sensor must be replaced by new, intact sensor.

Before installing a new sensor, the process connection and the hygiene or pharmaceutical adapter including thread must be cleaned and disinfected using a suitable cleaning agent. We recommend using a neutral cleaning agent with a soft brush that has been rinsed with drinking water and then checked for cleanliness, as well as using a suitable disinfecting solution before installing a new sensor.

An overview of EHEDG-compliant seals can be found in the EHEDG Position Paper: https://www.ehedg.org/guidelines

- Accessories can be found online at: **www.sick.com**

18 Medium list

This medium list provides a guide to the DK values of liquids. Water-based liquids always have a DK value of > 5, which allows LFP to be used easily. For DK values of < 5, a coaxial tube or a metallic immersion tube/bypass is always required.

Substance	DK Value
Acetal (25 °C)	3.8
Acetaldehyde	15
Acetamide (77 °C)	59.2
Acetoacetic acid ethyl ester	15
Acetone	21.5
Acetophenone	18
Acetylacetone	23
Acetyl bromide	16.2
Acetyl chloride	15.9
Acetylene dibromide	7.2
Acetylene tetrabromide	5.6
Aconite acid ester	6.3
Adipic acid	1.8
Aerosile	1
Activated carbon	12
Alum (60 °C)	4.2
Allyl alcohol	20.6
Allyl chloride	8.2
Allyl iodide	6.1
Aluminum bromide (100 °C)	3.4
Aluminum foil	10.8
Aluminum hydroxide	2.5
Aluminum splinters	7.3
Aluminum sulfate	2.6
Formic acid	57.9
Ammonia	15
Ammonia solution (25 %)	31.6
Ammonia salt	4.3
Pentanol	14.8

Substance	DK Value
Amyl amine	4.5
Aniline	7
Anisealdehyde	22.3
Anisole	4.5
Anthracite	3.2
Antimony hydride	1.8
Malic acid diethylester	10
Argon	1.5
Arsine	2.1
Arsole	2.3
Asbestos	10
Ascorbic acid (vitamin C)	2.1
Azelaic acid diethylester	5
Azoxybenzene (36 °C)	5.2
Basalt	2.5
Cotton fiber flour	3.2
Bauxite	2.5
Bentonite	8.1
Benzal chloride	6.9
Benzaldehyde	17.6
Benzil (80 °C)	10
Benzine	2
Benzene	2.3
Benzene, heavy	3.2
Benzyl alcohol	13.5
Benzyl amine	4.6
Benzyl chloride	7
Beer brew	25
Bitumen	2.8

Substance	DK Value
Hydrogen cyanide	158
Bore oil emulsion	25
Bornylacetate	4.6
Bromine	3.1
Butanoic acid	3
Camphene	2.3
Caproic acid (71 °C)	2.6
Caprylic acid	2.5
Carbazole	1.3
Carbonylcyanide	10.7
Cellite	1.6
Cetyl alcohol (60 °C)	3.6
Quinoline	8.8
Chlorine, liquid	2.1
Chloral	6.7
Chlorobenzene	5.7
Chloracetic acid	33.4
Chlorohydrin	31
Chlorinated lime	2.3
Chloroform (trichlormethane)	4.8
Cola essence	17.3
Cream (skin)	19
Cuminaldehyde	10.7
Cyanogen	2.5
Decalin	2.1
Degalan	3.1
Desmodur	10
Diacetone alcohol	18.2
Diamylether	3

Substance	DK Value
Dibenzofuran (100 °C)	3
Dibenzyl (60 °C)	2.5
Diesel fuel	2.1
Diethylamine	3.8
Dimethylether (methyl ether)	5
Diofan	32
Dioxane	2
Diphenyl (75 °C)	2.5
Printing ink	4.6
Ice cream (-20 °C)	16.5
Iron (III) oxide red	1.9
Emulphor	4
Epichlorhydrin	23
Peanuts, dried	3.1
Peanut expeller	2.4
Vinegar	24
Acetic acid	6.2
Cement asbestos	3.2
Ethanol (ethyl alcohol)	16.2
Ether	4
Ethyl acetate	6
Ethylamine	6.9
Ethyl benzoate	6
Ethyl benzene	2.4
Ethylene chlorohydrin	25
Ethylene chloride	10.6
Ethylenediamine	15
Ethylene oxide (-1 °C)	13.9
Ethyl mercaptan	6.9
Fenchone	12.8
Ferrite pellets	21
Ferrosilicone	10

Substance	DK Value
Green vitriol (80 °C)	32.4
Ferrozell	18.3
Fat coal	3.4
Fatty acid (35 °C)	1.7
Fish oil	2.6
Flax pellets	1.4
Meat and bone meal	1.9
Tankage	1.9
Fly ash	3.3
Fluorine	1.5
Fluorbenzene	6.4
Hydrogen fluoride (0 °C)	83.6
Calcium fluoride	2.5
Formamide	109
Furan	3
Furfurol	41.7
Animal feed grist	2.4
Germanium tetrachloride	2.4
Grain grist	3
Gypsum	1.8
Fiber glass powder	1.1
Glass granulate	4
Cullet	2
Glucose (50 °C)	30
Glycerol	13.2
Glycerol water	37
Glycol	37
Glysantin	25
Granuform	4
Guaiacol	11
Guano (phosphate rock)	2.5
Oat	4.9

Substance	DK Value
Urea	2.9
Resin	1.5
Hazelnuts	2
Hot glue (150 °C)	2.3
Heating oil	2.1
Helium	1.1
Heptane	1.9
Heptanal	9.1
Heptanoic acid (71 °C)	2.6
Heptene	2.1
Hexane	1.9
Hexene	2.1
Hexanol	12.5
Hibiscus	2.8
Woodchip	2.3
Charcoal	1.3
Wood swarf	1.5
Splints	1.1
Honey	24
Hydrazine	58
Imidazole, pure (100 °C)	23
Isoamyl acetate	4.8
Isoamyl alcohol	15.6
Isoamyl bromide	6
Isoamyl chloride	6.1
Isoamyl ether	2.8
Isoamyl iodide	5.6
Isobutanoic acid	2.6
Isobutyl alcohol	18.1
Isobutyl amine	4.4
Isobutyl benzene	2.3
Isobutyl bromide	7.2

Substance	DK Value
Isobutyl chloride	6.5
Isobutyl cyanide	18
Isobutyl iodide	6.5
Isobutyl nitrate	11.7
Isobutyl silane	2.5
Isoquinoline	10.7
Isocyanate	6.1
Isoprene	2.1
Isopropanol	18
Isosafrol	3.3
Iodine	11.1
Iodobenzene	4.6
Methyl iodide	7.1
Hydrogen iodide	2.9
Coffee beans	1.5
Cocoa beans	1.8
Caustic potash	3.3
Potash salt	2
Lime	2
Potato starch	1.7
Ceramic compound	17
Ketchup	24
Gravel	2.6
Diatomaceous earth	1.4
Silicic acid	2
Bone fat	2.7
Bonemeal	1.7
Sodium chloride	23
Coal, 15 % moisture	4
Diethyl carbonate	2.8
Coal dust	2.5
Coconut oil (refined)	2.9

Substance	DK Value
Coke	3
Cork powder	1.7
Concentrated feed	3.2
Chalk	2.1
Cresol	11
Cresol resin	18.3
Crystal sugar	2
Fertilizer	4.3
Plastic pellets	1.2
Copper ore	5.6
Nitrous oxide	1.5
Lanolin	4.2
Latex	24
Lauric acid ethyl ester	3.4
Glue	2
Linoleic acid	2.7
Solvent	18
Skimmed milk powder	2.3
Corn	3.6
Corn grist	2.1
Corn starch syrup	18.4
Malt	2.7
Mandelic acid nitrile	18
Marble stones small (2-	2.5
Mice feed	2.3
Flour	2.5
Molasses	31.3
Menthol (42 °C)	4
Mesityl oxide	15
Metal powder	6
Methanol (methyl alcohol)	33
Methyl acetate	8

Substance	DK Value
Methylene bromide	7
Methylene chloride	9
Methylene chloride	9.1
Methylene iodide	5.3
Methyl nitrate	23.5
Methyl cellulose	3
Monochloremethane	9.8
Morpholine	7.3
Naphthenic acid	2.6
Naphthalene	2.5
Sodium carbonate	3
Sodium methylate	1.5
Sodium perborate	2.2
Sodium peroxide	2.7
Sodium sulfate	2.7
Nitrobenzene	35
Nitroethane	29
Nitroglycol	28.3
Nitroglycerin	19.3
Nitro varnish	5.2
Nitromethane	39
Nitrophoska	5.4
Nitrosyl bromide (13 °C)	15.2
Nitrosyl chloride	19
Pasta, milled durum	1.9
Octane	2
Octene	2.1
Octyl bromide	5
Oil	2
Oileic acid	2.5
Water-in-oil emulsion	24.2
Oxalo ethyl acetate	6

Substance	DK Value
Palmitic acid	2.3
Palm tree nuts	2.2
Palm tree nuts	2.8
Palm seed oil	1.8
Paper scraps	1.2
Paraffin	1.6
Paraldehyde	15.1
Pelargon	2.8
Penta borane	21
Penta ethyl chloride	3.8
Penta chlorotoluene	4.8
Pentane	1.8
Pentanal (15 °C)	11.8
Pentene	2
Perchlorate	3.6
Hexachlorobutadiene	2.6
Perlite	1.7
PET powder	1.5
Phenetole	4.2
Phenol	8
Phenol resin	7.4
Phosgene	4.3
Phosphate	4
Phosphorus, liquid	3.9
Phosphorus salt	4
Pinane	2.1
Piperidine	5.8
Polyamide pellets	1.7
Polyethylene	1.2
Polypropylene	1.6
Polyrol	2.8
Polyvinyl acetals	2.8

Substance	DK Value
Popcorn	1.1
Liquid detergent	1.2
Propanal (15 °C)	14.4
Propanol (propyl alcohol)	2.2
Propanoic acid	3.2
Propylamine	3
Propylene, liquid	1.9
Propylene chloride	9
Propylether	3.3
PVC powder, pure	1.3
Pyridine	13.2
Pyrrol	8
Silica sand	2
Quartz stone meal	2.7
Mercury diethyl	2.1
Rapeseed	3.3
Rapeseed grist	2.1
Rice	3
Rye	6
Rye bran	2.2
Beetroot seeds	3.5
Beetroot cuttings	7.3
Soot	18.8
Saccharose solution	20
Sawdust	1.3
Nitric acid (98 %)	19
Hydrochloric acid	5
Salt water	32
Oxygen	1.5
Chamotte	1.8
Foam flakes	1.1
Lard (80 °C)	2.1

Substance	DK Value
Soft soap	32
Chocolate powder	2
Black liquor	32
Sulfur	3.5
Sulfur dioxide (sulfurous acid)	14
Carbon disulfide, pure	2.6
Sulfuric acid	21.9
Sulfuric acid (15 %)	31
Sulfuric acid (97 %)	8.6
Sulfur trioxide	3.1
Hydrogen sulfide	6
Heavy fuel oil	2.2
Soap flakes	9.2
Soap pellets	3.5
Mustard	24
Mustard seeds	3.6
Silicone oil	2.7
Silicone rubber	2.9
Soy flour	4.5
Soy grains	2.9
Sunflower seeds	2
Chaff	1.5
Stearic acid	2.3
Rock salt (0–25 mm)	4.3
Styrene	2.4
Tobacco dust	1.8
Talcum	1.5
Tea powder	2
Tar, raw	4
Terephthalic acid	1.5
White spirit	2
Terpinene	2.7

Substance	DK Value
Terpinolene	2.3
Tetrachloroethylene	2.5
Carbon tetrachloride	2.3
Thomaskali dust	3.4
Thujone (0 °C)	10.8
Meat and bone meal	2.2
Titan tetrachloride	2.8
Toluene	2.4
Clay	2.3
Transformer oil	2.1
Trichloroethylene	3.2
Triethyl aluminum	2.9
Triptane	1.9
Dry yeast	2
Ultrasil	1.4
Undecan	2
Valeric acid	2.7
Viscose	34.5
Wax	1.8
Benzine	2
Water	80.3
Water (360 °C)	10
Water, demineralized	29.3
Water, heavy	78.3
Sodium silicate	16
Hydrogen	1.2
Hydrogen peroxide, pure (0 °C)	84.2

Substance	DK Value
Wine	25
Tartaric acid	35.9
Wheat	4
Wheat starch	2.5
Xylitol	40
Xylene	2.3
Toothpaste	18.3
Cellulose	1.2
Cement	2.2
Zinc oxide	1.5
Zinc powder	4.4
Sugar	1.8
Tinder	12

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