

Level meter LEVEL-EX

Operating Instructions

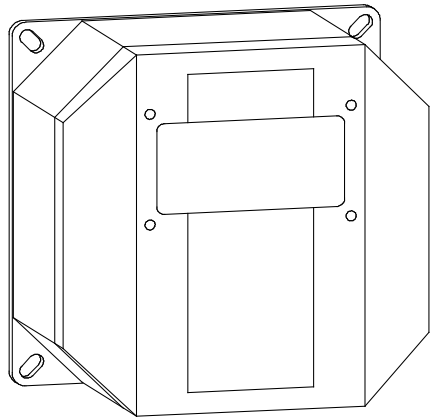
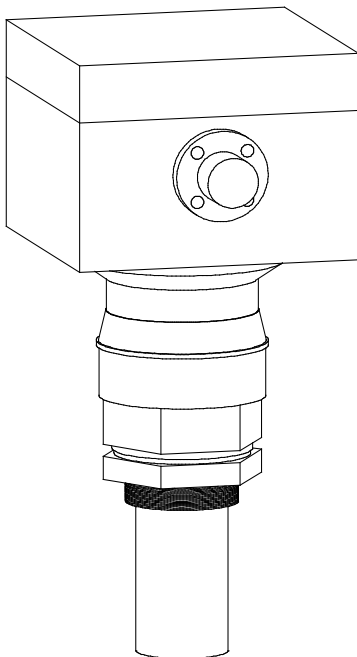


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1 Introduction

1.1 Intended use

The LEVEL-EX is a compact level meter. It is used for continuous level measurements in silos, bunkers and tanks. The level meter is a reliable state-of-the-art construction and complies with the relevant specifications and EC directives. However, if it is used incorrectly or not as intended, the devices may cause application-related hazardous situations, e.g. product overflow as a result of incorrect installation or setting.

Installation, electrical connection, commissioning, operation and maintenance of the measuring equipment must, therefore, only be undertaken by trained specialists who have been authorized for this purpose by the plant operator. The specialist must have read and understood these Operating Instructions and follow the instructions they contain.

Changes and repairs may only be undertaken on the device if the Operating Instructions expressly permit them.

1.2 Notes on safety

In order to highlight safety-related processes, we have laid down the following safety instructions where each piece of information is identified by a corresponding pictogram:

NOTICE

A note highlights actions or procedures which, if not performed correctly, may indirectly affect operation or may lead to an device response which is not planned.

WARNING

Warning highlights actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the device.

1.3 Certification

The level meter LEVEL-EX corresponds to the harmonized European Standards EN 60079-0 and EN 60079-11 as well as the European directive 2014/34/EU (ATEX).

The LEVEL-EX is approved in all variants with the EC Type-Examination Certificate No. KDB 09ATEX146. It is marked with I M2 Ex ia I.

The device LEVEL-EX-AA1B is also part of our measuring system SYMEX-L (EC-Type Examination Certificate No. BVS 05 ATEX E 076 X), in this case the device is additionally marked with I M2 SYST EEx ib I.

1.4 Table of versions

1.4.1 Evaluation and display unit LEVEL-EX-A

Pos.1	Electrical connection:	
	A	2x Cable gland
	B	1x PROMOS connector type BN 4160 + 1x Cable gland
	C	1x Machaczek connector type ME2A10 + 1x Cable gland
	D	1x Souriau connector type 845, size 1 + 1x Cable gland
	E	1x Souriau connector type 845, size 2 + 1x Cable gland
	F	1x Hydrostar connector type SKK24 + 1x Cable gland
	G	1x Hirschmann connector type G4 + 1x Cable gland
	H	1x Circular connector M12 + 1x Cable gland
	J	1x Hydrostar connector type SKK45 + 1x Cable gland
	Y	Special version, to be specified
Pos.2	Output signal:	
	1	Frequency 5 – 15 Hz + Optocoupler output for limit and alarm
	3	Current 4 – 20 mA + Optocoupler output for limit and alarm
	9	Special version, to be specified
Pos.3	Potential separation:	
	A	Output not potential-separated
	B	Output potential-separated
	Y	Special version, to be specified
Pos. 4	Mechanical version:	
	1	Standard
	9	Special version, to be specified
Pos. 5	Special equipment:	
	A	Standard
	Y	Special version, to be specified

Evaluation and display unit

LEVEL - EX - A complete order code

1.4.2 Transducer LEVEL-EX-S

Pos.1	Device version:	
	1	Ultrasonic
	9	Special version, to be specified
Pos.2	Measuring range:	
	A	Max. 2.0 m (Solids) or 5.0 m (Liquids)
	B	Max. 3.5 m (Solids) or 8.0 m (Liquids)
	D	Max. 10.0 m (Solids) or 20.0 m (Liquids)
	Y	Special version, to be specified
Pos.3	Mechanical version:	
	1	Standard
	9	Special version, to be specified
Pos. 4	Special equipment:	
	A	Standard
	Y	Special version, to be specified

Transducer

LEVEL - EX - S complete order code

NOTICE

The connection cable type VLH (max. 100 m) is not a part of the package and has to be ordered separately!

The following pre-fabricated connection cables are available (other lengths on request):

- VLH-005 (5 m)
- VLH-010 (10 m)
- VLH-020 (20 m)
- VLH-050 (50 m)
- VLH-100 (100 m)

NOTICE

Please select the used transducer LEVEL-EX-S at the evaluation and display unit before start of operation, you can find further information in chapter 6 "Commissioning".

1.5 Measuring principle

The level meter LEVEL-EX is a "downward-looking" measuring system, operating based on the time-of-flight method. It measures the distance from the reference point (**A**) to the product surface. Ultrasonic pulses are emitted, reflected by the product surface and received again by the transducer. The distance (**D**) is proportional to the time of flight of the impulse.

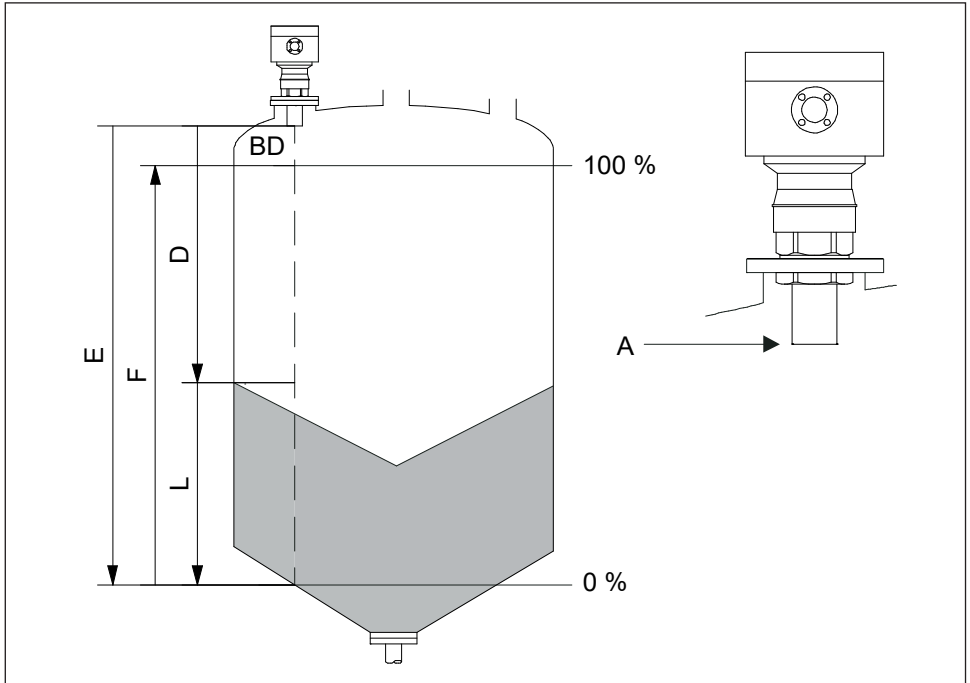


Figure 1: Measuring principle

Based on the entered values for the empty adjustment (**E** = distance from the lower edge of the sensor to the lowest measuring point) and the full adjustment (**F** = distance from the lowest measuring point to the highest measuring point), the level (**L**) is determined.

NOTICE

- Level echoes within the blocking distance can not be detected by the level meter. Make sure that the maximum level of the measurement will never run into the blocking distance (**BD**).
- Blocking distance depending on device type → Page 51

1.6 Measuring conditions

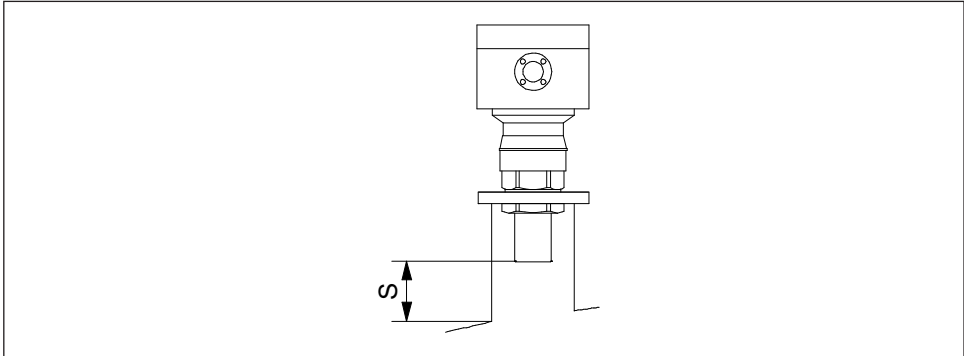


Figure 2: Nozzle mounting

Please take notice of the following measuring conditions:

- The zero point of the measuring range is where the beam meets the vessel bottom. Levels below this point cannot be detected, especially with conical outlets.
- The maximum lengths (**S**) for nozzle mounting are:
 DN50 / 2": 15 mm; DN80 / 3": 175 mm; DN100 / 4": 235 mm; DN150 / 6": 335 mm;
 DN200 / 8": 335 mm; DN250 / 10": 335 mm; DN300 / 12": 335 mm

NOTICE

The maximum sampling rate of the device is 2 Hz. Please take notice of this value when setting the measuring range (full calibration).

1.7 Installation conditions

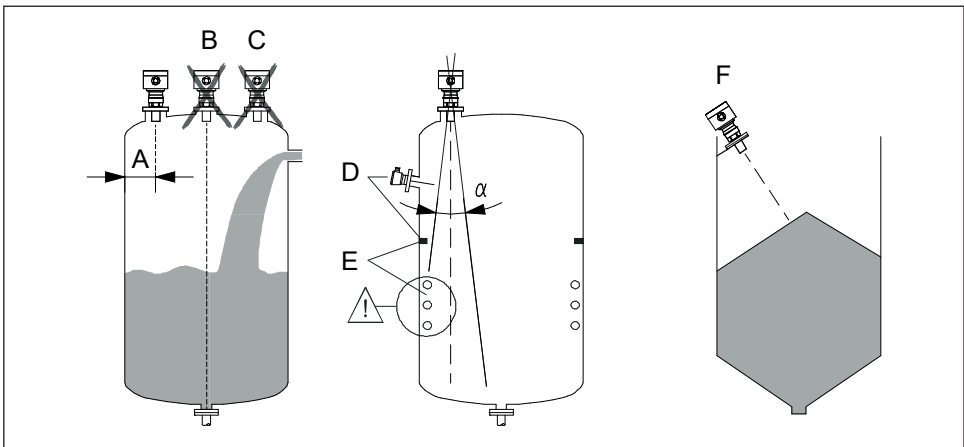


Figure 3: Installation conditions

Please take notice of the following installation conditions:

- Do not install the transducer in the middle of the tank, silo or bunker (**B**). We recommend leaving a distance between the transducer and the wall measuring 1/3 of the tank, silo or bunker radius (**A**).
- Avoid measurements through the filling curtain (**C**).
- Make sure that equipment such as limit switches, temperature sensors, etc. are not located within the emitting angle $\alpha = 11^\circ$ (**D**). In particular, symmetrical equipment (**E**) can influence measurement.
- Align the transducer so that it is vertical to the product surface (**F**).
- Never install two ultrasonic measuring devices in a tank, silo or bunker, as the two signals may affect each other.

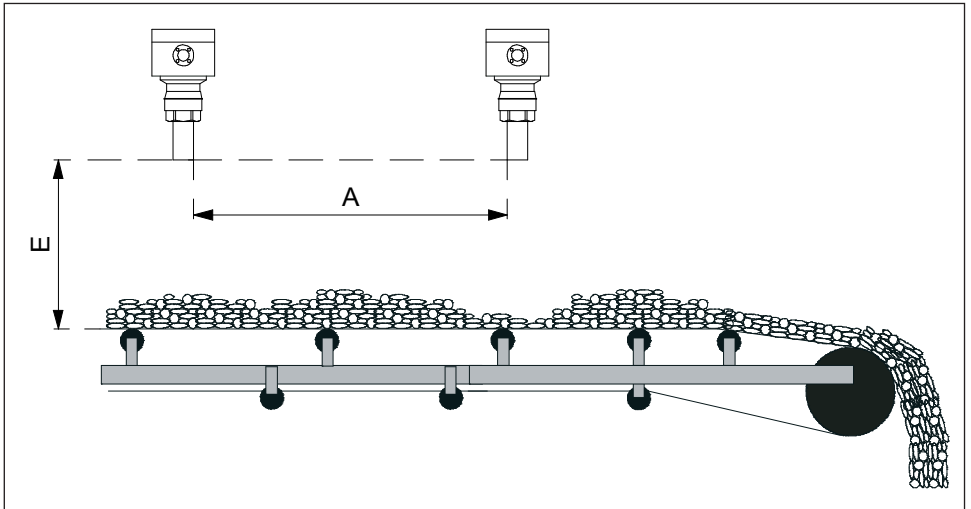


Figure 4: Conveyor belt measurement

NOTICE

If you select the process condition "conveyor belt" and use more than one level meter, we recommend a minimum distance (**A**) between the transducers of twice the LEVEL-EX-S to belt distance (**E**).

1.8 Installation

There are three possible ways to install the transducer LEVEL-EX-S.

NOTICE

For the LEVEL-EX-S1D* only the mounting via the fastening of the housing (see 1.8.1) is possible.

1.8.1 Mounting the housing

In this way the housing will be fixed by four suitable M6 bolts.

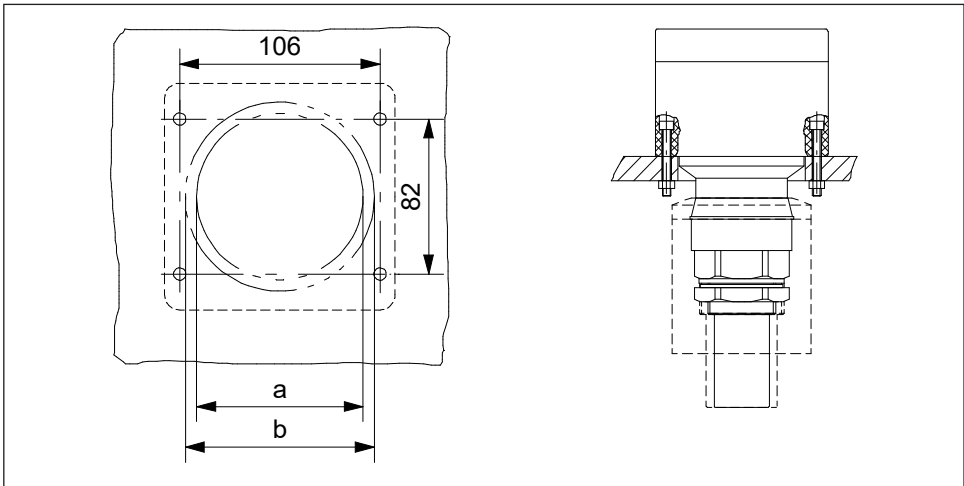


Figure 5: Mounting the housing

- a Min. 90 mm (LEVEL-EX-S1A*'-S1B*)
- b Min. 100 mm (LEVEL-EX-S1D*)

1.8.2 Mounting by the transducer thread

In this way the housing will be fixed by the thread.

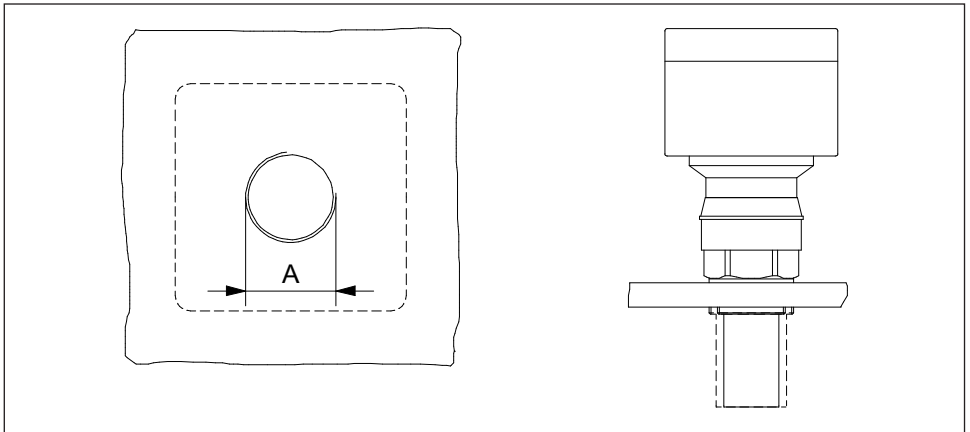


Figure 6: Mounting by the transducer thread

A G 1½ (LEVEL-EX-S1A*) or G 2 (LEVEL-EX-S1B*)

1.8.3 Mounting by the transducer thread and the counter nut

In this way the housing will be passed through a hole and fixed by the thread and the counter nut.

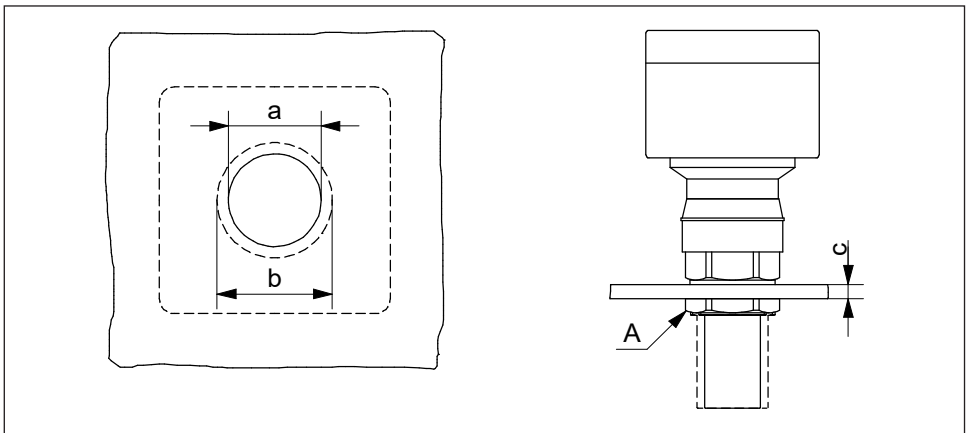


Figure 7: Mounting by the transducer thread and the counter nut

a Min. 49 mm (LEVEL-EX-S1A*)

b Min. 61 mm (LEVEL-EX-S1B*)

c Max. 10 mm

A Counter nut: Wrench size 60 (LEVEL-EX-S1A*) or 70 (LEVEL-EX-S1B*)

2 Electrical connection

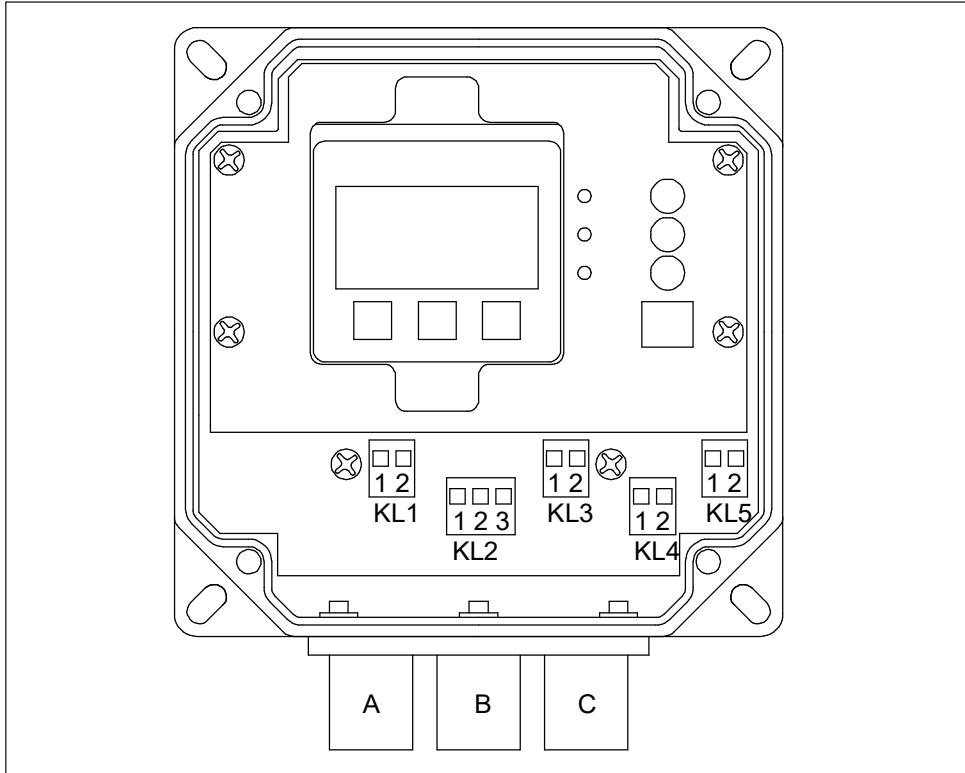


Figure 8: Electrical connections of LEVEL-EX-A*

The electrical connection is made by connection terminals and cable glands or connectors including one cable gland:

- A. Connector 1: Electrical connection with the transducer LEVEL-EX-S* (connection cable type VLH-***)
- B. Cable gland (LEVEL-EX-AA*) or connector 2 (all versions without LEVEL-EX-AA*)
- C. Cable gland (all versions)

Please refer to the chapter "Technical data" for further information about the cable gland(s).

2.1 Signal outputs

2.1.1 Optocoupler outputs

Terminal	Assignment
KL3.1	Alarm output: Collector (C)
KL3.2	Alarm output: Emitter (E)
KL4.1	Limit output: Collector (C)
KL4.2	Limit output: Emitter (E)

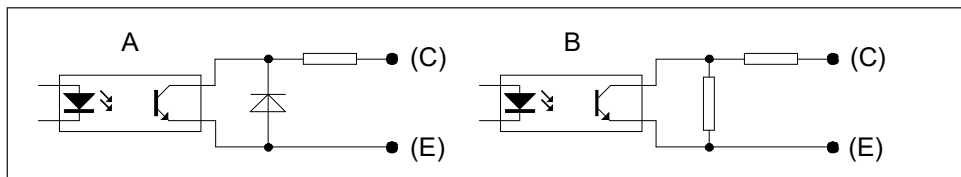


Figure 9: Optocoupler outputs

- A LEVEL-EX-A* (without LEVEL-EX-AB)
- B LEVEL-EX-AB

2.1.2 Frequency outputs

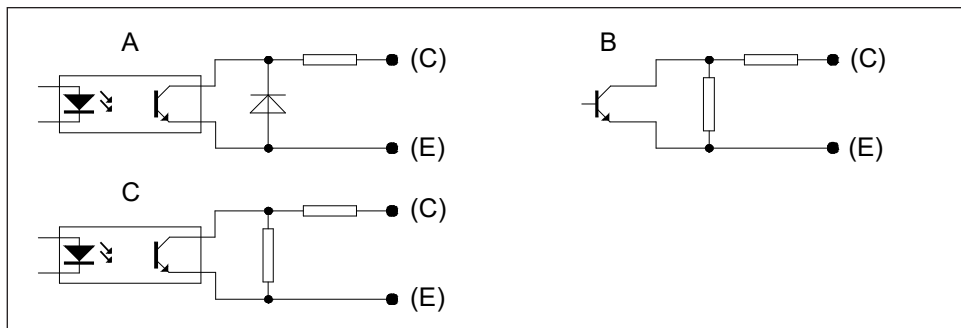


Figure 10: Frequency outputs

- A LEVEL-EX-A*1* (without LEVEL-EX-AB1*)
- B LEVEL-EX-AB1A
- C LEVEL-EX-AB1B

2.1.3 Current output

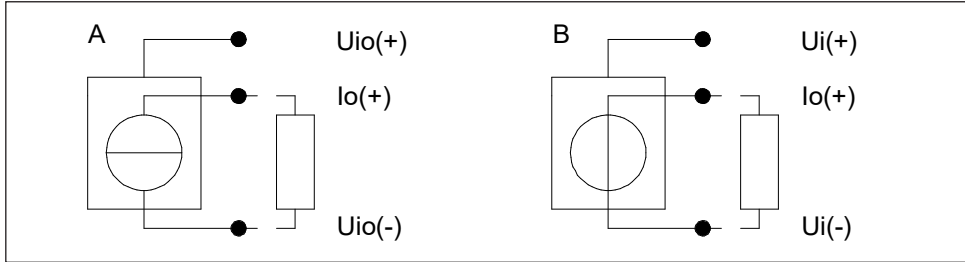


Figure 11: Current outputs

A LEVEL-EX-A*3B*

B LEVEL-EX-A*3A*

2.2 LEVEL-EX-AA****

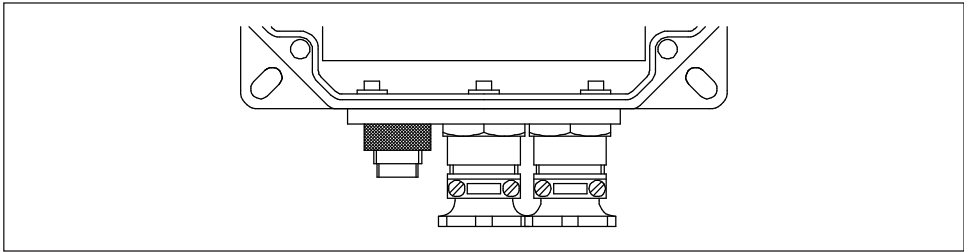


Figure 12: Electrical connection LEVEL-EX-AA****

2.2.1 LEVEL-EX-AA1B**

Terminal	Assignment
KL1.1	Power supply U_i (+)
KL1.2	Power supply U_i (-)
KL5.1	Frequency output: Collector
KL5.2	Frequency output: Emitter

2.2.2 LEVEL-EX-AA3A**

Terminal	Assignment
KL2.1	Power supply U_i (+)
KL2.2	Power supply U_i (-)
KL2.3	Current output I_o (+)

2.2.3 LEVEL-EX-AA3B**

Terminal	Assignment
KL1.1	Power supply U_i (+)
KL1.2	Power supply U_i (-)
KL2.1	Power supply Current output U_{io} (+)
KL2.2	Power supply Current output U_{io} (-)
KL2.3	Current output I_o (+)

2.3 LEVEL-EX-AB****

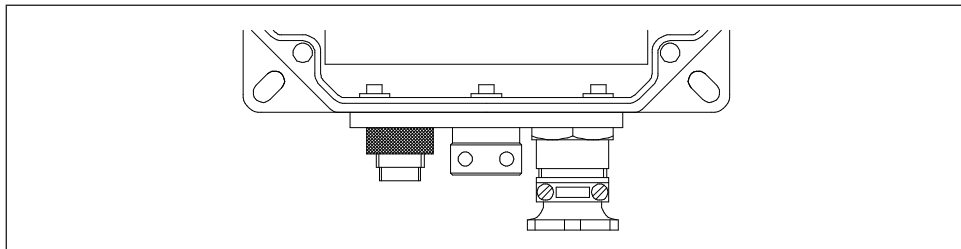


Figure 13: Electrical connection LEVEL-EX-AB****

2.3.1 LEVEL-EX-AB1A**

Terminal	Connector 2	Assignment
KL1.1	Pin 7	Power supply U_i (+)
KL1.2	Pin 5	Power supply U_i (-)
KL5.1	Pin 4	Frequency output: Collector
KL5.2	Pin 5	Frequency output: Emitter

2.3.2 LEVEL-EX-AB1B**

Terminal	Connector 2	Assignment
KL1.1	—	Power supply U_i (+)
KL1.2	—	Power supply U_i (-)
KL5.1	Pin 4	Frequency output: Collector
KL5.2	Pin 5	Frequency output: Emitter

2.3.3 LEVEL-EX-AB3A**

Terminal	Connector 2	Assignment
KL1.1	Pin 7	Power supply U_i (+)
KL1.2	Pin 5	Power supply U_i (-)
KL2.1	Pin 7	Power supply current output U_{io} (+)
KL2.2	Pin 5	Power supply current output U_{io} (-)
KL2.3	Pin 4	Current output I_o (+)

2.3.4 LEVEL-EX-AB3B**

Terminal	Connector 2	Assignment
KL1.1	—	Power supply U_i (+)
KL1.2	—	Power supply U_i (-)
KL2.1	Pin 7	Power supply current output U_{io} (+)
KL2.2	Pin 5	Power supply current output U_{io} (-)
KL2.3	Pin 4	Current output I_o (+)

2.4 LEVEL-EX-AC****

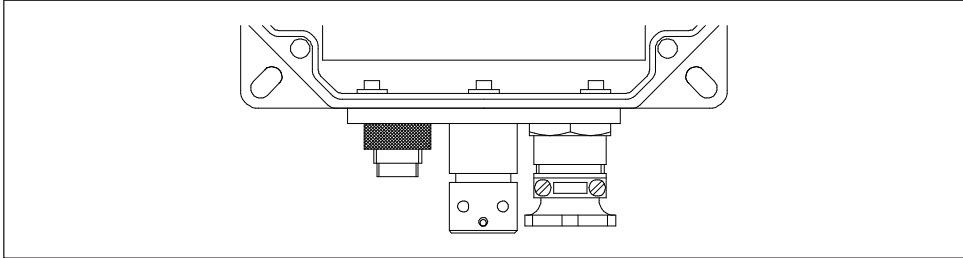


Figure 14: Electrical connection LEVEL-EX-AC****

2.4.1 LEVEL-EX-AC1A**

Terminal	Connector 2	Assignment
KL1.1	Pin 3	Power supply U_i (+)
KL1.2	Pin 4	Power supply U_i (-)
KL5.1	Pin 1	Frequency output: Collector
KL5.2	Pin 2	Frequency output: Emitter

2.4.2 LEVEL-EX-AC1B**

Terminal	Connector 2	Assignment
KL1.1	—	Power supply U_i (+)
KL1.2	—	Power supply U_i (-)
KL5.1	Pin 1	Frequency output: Collector
KL5.2	Pin 2	Frequency output: Emitter

2.4.3 LEVEL-EX-AC3A**

Terminal	Connector 2	Assignment
KL1.1	Pin 3	Power supply U_i (+)
KL1.2	Pin 4	Power supply U_i (-)
KL2.1	Pin 5	Power supply current output U_{io} (+)
KL2.2	Pin 6	Power supply current output U_{io} (-)
KL2.3	Pin 1	Current output I_o (+)

2.4.4 LEVEL-EX-AC3B**

Terminal	Connector 2	Assignment
KL1.1	—	Power supply U_i (+)
KL1.2	—	Power supply U_i (-)
KL2.1	Pin 5	Power supply current output U_{io} (+)
KL2.2	Pin 6	Power supply current output U_{io} (-)
KL2.3	Pin 1	Current output I_o (+)

2.5 LEVEL-EX-AD****

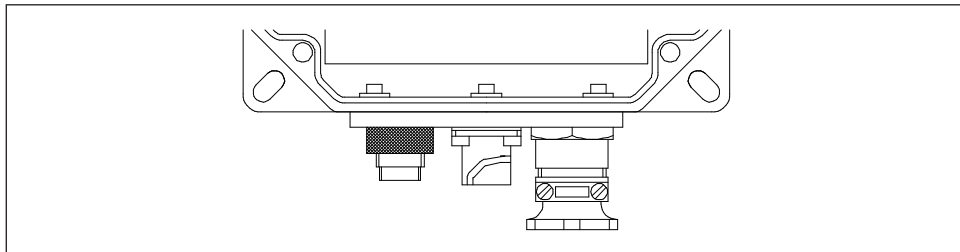


Figure 15: Electrical connection LEVEL-EX-AD****

2.5.1 LEVEL-EX-AD1A**

Terminal	Connector 2	Assignment
KL1.1	Pin 1	Power supply U_i (+)
KL1.2	Pin 2	Power supply U_i (-)
KL5.1	Pin 3	Frequency output: Collector
KL5.2	Pin 2	Frequency output: Emitter

2.5.2 LEVEL-EX-AD1B**

Terminal	Connector 2	Assignment
KL1.1	—	Power supply U_i (+)
KL1.2	—	Power supply U_i (-)
KL5.1	Pin 3	Frequency output: Collector
KL5.2	Pin 2	Frequency output: Emitter

2.5.3 LEVEL-EX-AD3A**

Terminal	Connector 2	Assignment
KL1.1	Pin 1	Power supply U_i (+)
KL1.2	Pin 2	Power supply U_i (-)
KL2.1	Pin 1	Power supply current output U_{io} (+)
KL2.2	Pin 2	Power supply current output U_{io} (-)
KL2.3	Pin 3	Current output I_o (+)

2.5.4 LEVEL-EX-AD3B**

Terminal	Connector 2	Assignment
KL1.1	—	Power supply U_i (+)
KL1.2	—	Power supply U_i (-)
KL2.1	Pin 1	Power supply current output U_{io} (+)
KL2.2	Pin 2	Power supply current output U_{io} (-)
KL2.3	Pin 3	Current output I_o (+)

2.6 LEVEL-EX-AE****

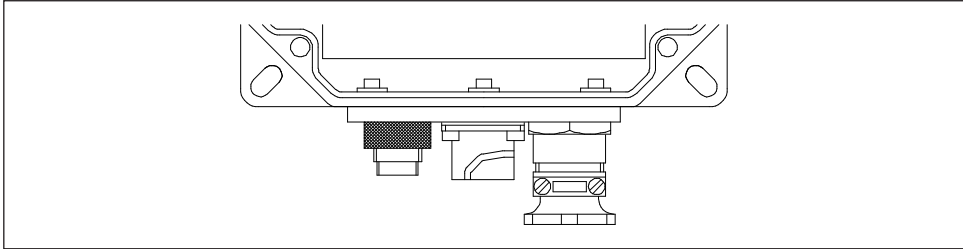


Figure 16: Electrical connection LEVEL-EX-AE****

2.6.1 LEVEL-EX-AE1A**

Terminal	Connector 2	Assignment
KL1.1	Pin 1	Power supply U_i (+)
KL1.2	Pin 2	Power supply U_i (-)
KL5.1	Pin 3	Frequency output: Collector
KL5.2	Pin 4	Frequency output: Emitter

2.6.2 LEVEL-EX-AE1B**

Terminal	Connector 2	Assignment
KL1.1	—	Power supply U_i (+)
KL1.2	—	Power supply U_i (-)
KL5.1	Pin 3	Frequency output: Collector
KL5.2	Pin 4	Frequency output: Emitter

2.6.3 LEVEL-EX-AE3A**

Terminal	Connector 2	Assignment
KL1.1	Pin 1	Power supply U_i (+)
KL1.2	Pin 2	Power supply U_i (-)
KL2.1	Pin 3	Power supply current output U_{io} (+)
KL2.2	Pin 4	Power supply current output U_{io} (-)
KL2.3	Pin 5	Current output I_o (+)

2.6.4 LEVEL-EX-AE3B**

Terminal	Connector 2	Assignment
KL1.1	—	Power supply U_i (+)
KL1.2	—	Power supply U_i (-)
KL2.1	Pin 3	Power supply current output U_{io} (+)
KL2.2	Pin 4	Power supply current output U_{io} (-)
KL2.3	Pin 5	Current output I_o (+)

2.7 LEVEL-EX-AF****

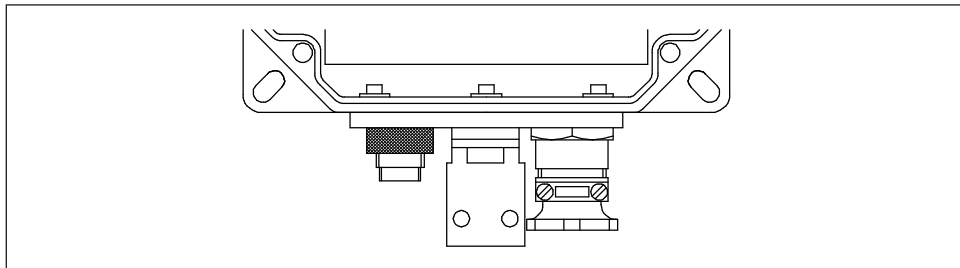


Figure 17: Electrical connection LEVEL-EX-AF****

2.7.1 LEVEL-EX-AF1A**

Terminal	Connector 2	Assignment
KL1.1	Pin 1	Power supply U_i (+)
KL1.2	Pin 2	Power supply U_i (-)
KL5.1	Pin 3	Frequency output: Collector
KL5.2	Pin 4	Frequency output: Emitter

2.7.2 LEVEL-EX-AF1B**

Terminal	Connector 2	Assignment
KL1.1	—	Power supply U_i (+)
KL1.2	—	Power supply U_i (-)
KL5.1	Pin 3	Frequency output: Collector
KL5.2	Pin 4	Frequency output: Emitter

2.7.3 LEVEL-EX-AF3A**

Terminal	Connector 2	Assignment
KL1.1	Pin 1	Power supply U_i (+)
KL1.2	Pin 2	Power supply U_i (-)
KL2.1	Pin 1	Power supply current output U_{io} (+)
KL2.2	Pin 2	Power supply current output U_{io} (-)
KL2.3	Pin 3	Current output I_o (+)

2.7.4 LEVEL-EX-AF3B**

Terminal	Connector 2	Assignment
KL1.1	—	Power supply U_i (+)
KL1.2	—	Power supply U_i (-)
KL2.1	Pin 1	Power supply current output U_{io} (+)
KL2.2	Pin 2	Power supply current output U_{io} (-)
KL2.3	Pin 3	Current output I_o (+)

2.8 LEVEL-EX-AG****

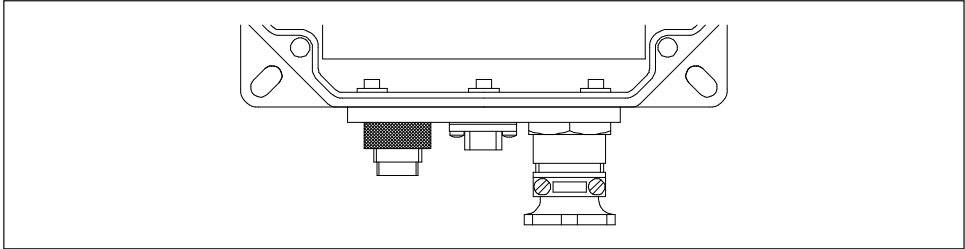


Figure 18: Electrical connection LEVEL-EX-AG****

2.8.1 LEVEL-EX-AG1A**

Terminal	Connector 2	Assignment
KL1.1	Pin 3	Power supply U_i (+)
KL1.2	Pin 4	Power supply U_i (-)
KL5.1	Pin 1	Frequency output: Collector
KL5.2	Pin 2	Frequency output: Emitter

2.8.2 LEVEL-EX-AG1B**

Terminal	Connector 2	Assignment
KL1.1	—	Power supply U_i (+)
KL1.2	—	Power supply U_i (-)
KL5.1	Pin 1	Frequency output: Collector
KL5.2	Pin 2	Frequency output: Emitter

2.8.3 LEVEL-EX-AG3A**

Terminal	Connector 2	Assignment
KL1.1	Pin 3	Power supply U_i (+)
KL1.2	Pin 4	Power supply U_i (-)
KL2.1	Pin 3	Power supply current output U_{io} (+)
KL2.2	Pin 4	Power supply current output U_{io} (-)
KL2.3	Pin 1	Current output I_o (+)

2.8.4 LEVEL-EX-AG3B**

Terminal	Connector 2	Assignment
KL1.1	—	Power supply U_i (+)
KL1.2	—	Power supply U_i (-)
KL2.1	Pin 3	Power supply current output U_{io} (+)
KL2.2	Pin 4	Power supply current output U_{io} (-)
KL2.3	Pin 1	Current output I_o (+)

2.9 LEVEL-EX-AH****

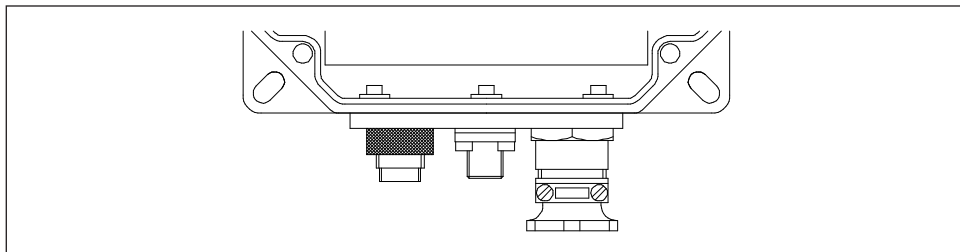


Figure 19: Electrical connection LEVEL-EX-AH****

2.9.1 LEVEL-EX-AH1A**

Terminal	Connector 2	Assignment
KL1.1	Pin 1	Power supply U_i (+)
KL1.2	Pin 2	Power supply U_i (-)
KL5.1	Pin 3	Frequency output: Collector
KL5.2	Pin 4	Frequency output: Emitter

2.9.2 LEVEL-EX-AH1B**

Terminal	Connector 2	Assignment
KL1.1	—	Power supply U_i (+)
KL1.2	—	Power supply U_i (-)
KL5.1	Pin 3	Frequency output: Collector
KL5.2	Pin 4	Frequency output: Emitter

2.9.3 LEVEL-EX-AH3A**

Terminal	Connector 2	Assignment
KL1.1	Pin 1	Power supply U_i (+)
KL1.2	Pin 2	Power supply U_i (-)
KL2.1	Pin 3	Power supply current output U_{io} (+)
KL2.2	Pin 4	Power supply current output U_{io} (-)
KL2.3	Pin 5	Current output I_o (+)

2.9.4 LEVEL-EX-AH3B**

Terminal	Connector 2	Assignment
KL1.1	—	Power supply U_i (+)
KL1.2	—	Power supply U_i (-)
KL2.1	Pin 3	Power supply current output U_{io} (+)
KL2.2	Pin 4	Power supply current output U_{io} (-)
KL2.3	Pin 5	Current output I_o (+)

2.10 LEVEL-EX-AJ****

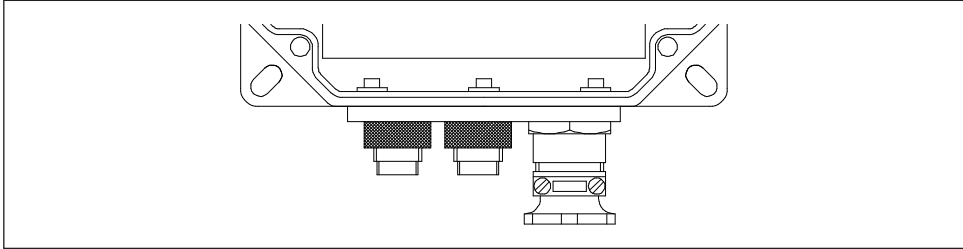


Figure 20: Electrical connection LEVEL-EX-AJ****

2.10.1 LEVEL-EX-AJ1A**

Terminal	Connector 2	Assignment
KL1.1	Pin 1	Power supply U_i (+)
KL1.2	Pin 2	Power supply U_i (-)
KL5.1	Pin 3	Frequency output: Collector
KL5.2	Pin 4	Frequency output: Emitter

2.10.2 LEVEL-EX-AJ1B**

Terminal	Connector 2	Assignment
KL1.1	—	Power supply U_i (+)
KL1.2	—	Power supply U_i (-)
KL5.1	Pin 3	Frequency output: Collector
KL5.2	Pin 4	Frequency output: Emitter

2.10.3 LEVEL-EX-AJ3A**

Terminal	Connector 2	Assignment
KL1.1	Pin 1	Power supply U_i (+)
KL1.2	Pin 2	Power supply U_i (-)
KL2.1	Pin 1	Power supply current output U_{io} (+)
KL2.2	Pin 2	Power supply current output U_{io} (-)
KL2.3	Pin 3	Current output I_o (+)

2.10.4 LEVEL-EX-AJ3B**

Terminal	Connector 2	Assignment
KL1.1	—	Power supply U_i (+)
KL1.2	—	Power supply U_i (-)
KL2.1	Pin 1	Power supply current output U_{io} (+)
KL2.2	Pin 2	Power supply current output U_{io} (-)
KL2.3	Pin 3	Current output I_o (+)

3 Outputs

There are three selectable outputs (see order code):

- Frequency 5 ... 15 Hz
- Current 4 ... 20 mA

There is an additional optocoupler output (potential-free) on every device.

3.1 Analogue output

The level meter LEVEL-EX was designed for the international market, where you mostly find the 4 ... 20 mA current output. Therefore all software parameters are mapped for this output.

NOTICE

For mining we designed an additional frequency output (5 ... 15 Hz, LEVEL-EX-A*1B**). If you enter analogue values (e.g. simulation value), you will need to convert these values.

The converting is necessary for the following functions:

- Function group safety settings:
 - output on alarm (010) and output on alarm (011)
- Function group output:
 - fixed current (064), output current (067), 4 mA value (068) and 20 mA value (069)

3.1.1 Frequency output

It applies: 4 ... 20 mA = 5 ... 15 Hz

You can convert the frequency value with the following formula:

Frequency value [Hz] = (current value [mA] × 0.625) + 2.5

The following table shows you some pairs of values in 1 mA steps:

Current in mA	4	5	6	7	8	9	10	11	12
Frequency in Hz	5,0	5,6	6,3	6,9	7,5	8,1	8,8	9,4	10,0
Current in mA	13	14	15	16	17	18	19	20	
Frequency in Hz	10,6	11,3	11,9	12,5	13,1	13,8	14,4	15,0	

You can find information about the device reaction on alarm (current ≤ 3.6 mA or current = 22 mA) in chapter 5.2.

3.1.2 Current output

For the current output you don't need any conversion, you can find more information in chapter 5.6.

3.2 Alarm output

The alarm output (potential-free optocoupler) will switch in one of the following conditions:

1. The power supply is too low ($U_i < U_{min}$), you can find detailed information about the minimal supply voltages in chapter 9.
2. The analogue output (frequency, current or voltage) is lower than the lower limit value (see chapter 5.2.1 "Output on alarm")

NOTICE

You can't separate the meaning of the alarm, if both alarm conditions will be active. As soon as one or both alarms are active, the output switches.

3.3 Limit output

The limit output (potential-free optocoupler) switches depending on the setting of switch S1 upon over- or under-run of the selected limit value.

NOTICE

You can find further information about the limit function in chapter 4.2.1.

4 Operation

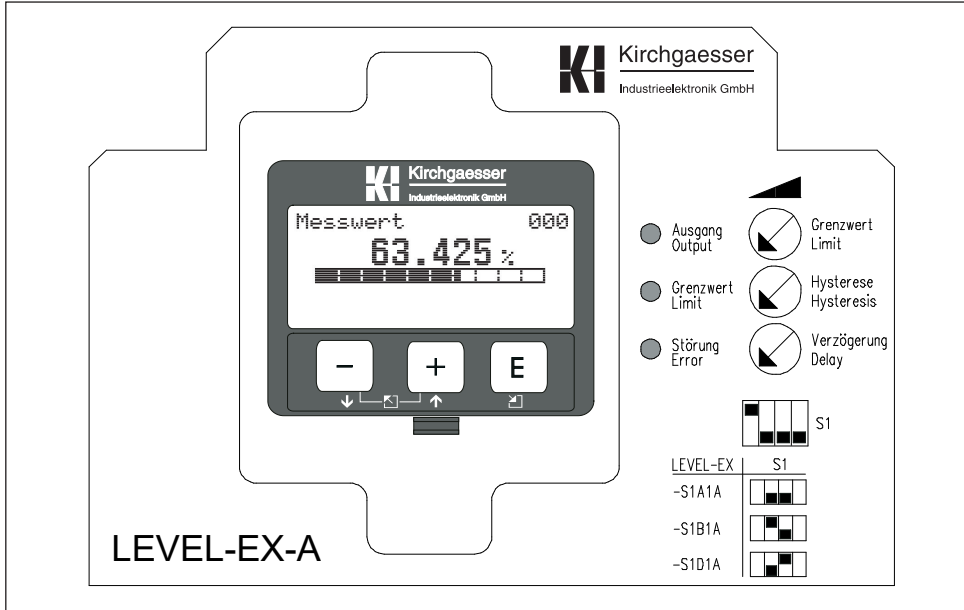


Figure 21: Display and control elements

The basic settings like empty and full calibration will be entered and displayed by the small removable LC operating and display module. All other settings for the signal output will be entered by the potentiometers and the switch S1.

4.1 Operating and display module

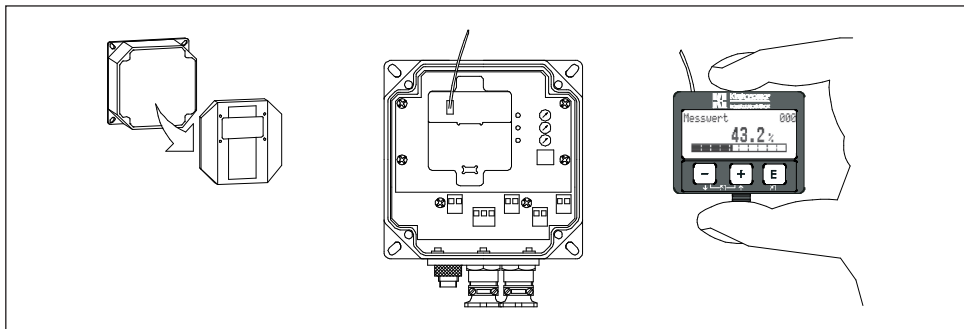


Figure 22: Removing the display and control module

WARNING

Take notice of the connection cable of the operating and display module, the cable should not be damaged.

4.1.1 General structure of operating menu

The operating menu consists of two levels:

- Function groups (00, 01, ..., 0D):
The individual possible ways of operating the device are divided roughly into function groups. Function groups available are e.g. "basic setup", "safety settings" and "temperature".
- Functions (001, 002, ..., 0D9):
Each function group consists of one or more functions. The actual operating and/or setting of parameters for the device takes place in the functions. Numerical values can be entered here and parameters selected and saved. Functions available from the "basic setup" (00) function group are e.g. "tank shape" (002), "medium property" (003) and "process cond." (004).

If e.g. the medium properties change, the following procedure applies:

1. Select the function group "basic setup" (00)
2. Select the function "medium property" (003) and enter the new value

4.1.2 Display appearance

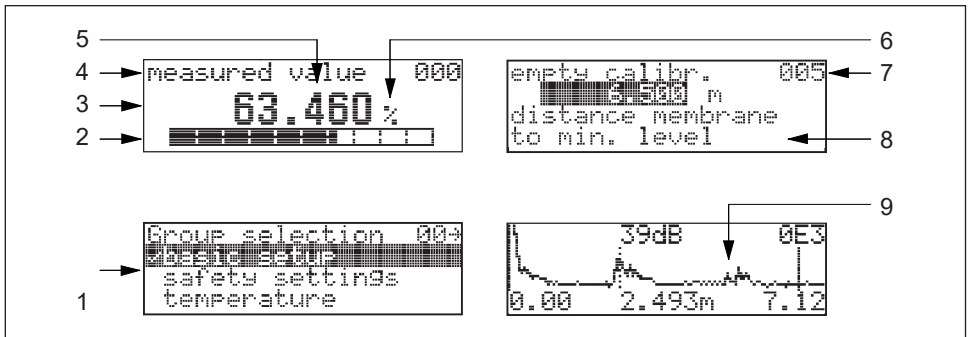


Figure 23: Display elements



- 1 Selection list (here: basic setup 00)
- 2 Bargraph (only in measured value display)
- 3 Symbol
- 4 Label of the current function (here: measured value 000)
- 5 Measured value
- 6 Unit of the measured value
- 7 Number of the function
- 8 Help texts
- 9 Envelope display mode

You have a four lines LC-display with 20 characters each line. The display contrast is adjustable through key combination (see next page).

The bargraph (corresponds to the output) is segmented in 10 bars. Each completely filled bar represents a change of 10 % of the adjusted span.

















4.1.3 Display symbols

The following table describes the symbols used in the display:

Symbol	Meaning
	Alarm symbol: The alarm symbol is shown when the device is in an alarm status (error status). If the symbol is flashing, a fault has occurred.
	Lock symbol: The lock symbol appears when the instrument is locked, i.e. if no input is possible.

4.1.4 Function of the keys

The following table describes the function(s) of the keys:

Key(s)	Meaning
 / 	- Upwards navigation in the selection list - Edit the numerical values within a function
 / 	- Downwards navigation in the selection list - Edit the numerical values within a function
 +  / 	Navigation to the left within a function group
	- Navigation to the right within a function group - Confirmation
 +  /  + 	Contrast settings of the LC-display: -  and  increments the contrast -  and  decrements the contrast

4.1.5 Function codes

The first two digits indicate the function group:

- basic setup (00)
- safety settings (01)

...

The third digit numbers the individual functions within the function groups:

- basic setup (00) → - tank shape (002)
- medium property (003)
- process cond. (004)

...

4.1.6 Operation

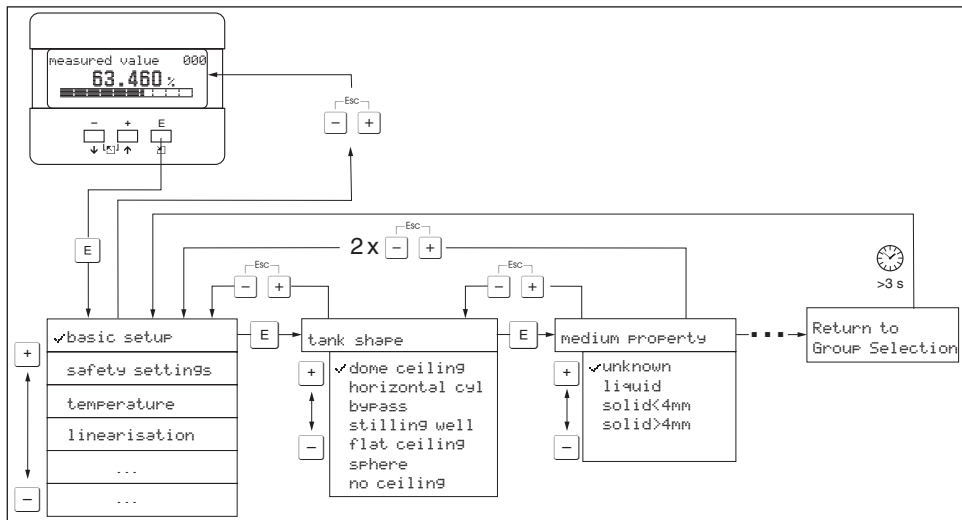


Figure 24: Functionality of the operation

1. Change from measured value display to group selection by pressing **E**.
2. Press **-** or **+** to select the required function group and confirm by pressing **E**. The active selection is marked by a ✓ in front of the menu text.
3. Activate edit mode with **+** or **-**.

Selection menus:

- a. Select the required parameter in selected function with **-** or **+**.
- b. **E** confirms selection; ✓ appears in front of the selected parameter.
- c. **E** confirms the edited value; system quits edit mode.
- d. **+** and **-** (= **↔**) interrupts selection; system quits edit mode.

Typing in numerals and text:

- a. Press **+** or **-** to edit the first character of the numeral / text.
 - b. **E** positions the cursor at the next character; continue with a. until you have completed your input.
 - c. If a **↓** symbol appears at the cursor, press **E** to accept the value entered; system quits edit mode.
 - d. If a **←** symbol appears at the cursor, press **E** to return to the previous character (e.g. for correction of entries).
 - e. **+** and **-** (= **↔**) interrupts selection; system quits edit mode.
4. Press **E** to select the next function.
 5. Press **+** and **-** (= **↔**) once; return to previous function.
Press **+** and **-** (= **↔**) twice; return to group selection.
 6. Press **+** and **-** (= **↔**) to return to measured value display.

4.2 Potentiometers and DIP switch



You can select the behavior of the signal output with the potentiometers and the DIP switch S1.

4.2.1 Limit

You can adjust the limit function with the potentiometer "Limit" (in the range of approx. 10 to 100 %). The following steps will help you to select the favoured value:

1. Switch on the simulation:
 - Function group 06 "output" → select "simulation" in function 065
 - Select for example "sim. current"
2. Enter simulation value:
 - Function group 06 "output" → select "simulation value" in function 066
 - Enter simulation value (4 ... 20 mA) of the corresponding limit value
Example: Limit = 50 % → simulation value = 12 mA
3. Rotate the potentiometer clockwise until the green LED "Limit" flashes on. A limit of 50 % is now select, the limit output (optocoupler) is active.

With the help of the DIP switch S1 you can select, if the limit output (optocoupler) is active on limit higher or lower than the measuring value:

DIP switch S1	Limit condition	Limit output	LED
	Limit < measuring value	not active	●
	Limit > measuring value	active	☀
	Limit < measuring value	active	☀
	Limit > measuring value	not active	●

NOTICE

Don't forget to switch off the simulation after the limit is set!

4.2.2 Hysteresis

You can adjust the hysteresis with the potentiometer "Hysteresis" in the range of 1 % (left stop) to 10 % (right stop).

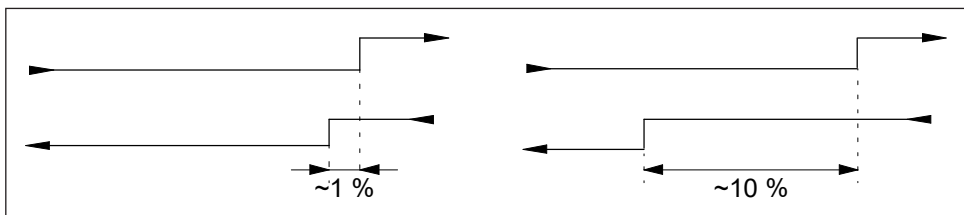


Figure 25: Hysteresis settings

4.2.3 Delay

You can adjust the delay time (t) with the potentiometer "Delay" in the range of 0 s (delay time off, left stop) to approx. 20 s (right stop).

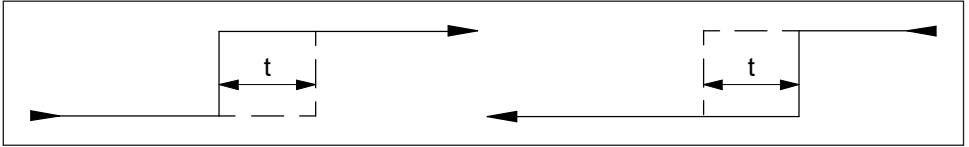


Figure 26: Delay settings

NOTICE

This delay time is only for the limit and alarm outputs. After an event (alarm or limit) occurs and the delay time expired, the appropriate output puts through.

4.2.4 Transducer selection

Please select the used transducer LEVEL-EX-S with the S1 switch before start of operation.

	LEVEL-EX-S1A1A	LEVEL-EX-S1B1A	LEVEL-EX-S1D1A
S1			

4.3 LEDs

Additional to the operating and display module there are three LEDs to show you the following conditions:

- Green LED "Output": Only on the device with frequency output this LED flashes in the frequency of the output (5 ... 15 Hz).
- Yellow LED "Limit": This LED lights up if the limit output puts through, for details please refer to chapter 4.2.1.
- Red LED "Error": This LED lights up if one of the following conditions occurs:
 1. The power supply is too low ($U_i < U_{i,min}$). The device is still working, but the measurements may be faulty.
 2. The analogue output (frequency, current or voltage) is lower than the limit value (see function "output on alarm" (010), selection "MIN($\leq 3.6mA$)", for details please refer to chapter 5.2).

⚠ WARNING

Please take notice of the required power supply, for details please refer to chapter 9 "Technical data".

5 Description of device functions

Please refer to the appendix for an overview of all functions of the device.

⚠ WARNING

All functions which are not explained in this chapter and the functions of the function group "Service" are only used for factory tests and shall not be changed.

5.1 Function group "basic setup" (00)

```

Group selection 000
basic setup
safety settings
temperature
  
```

5.1.1 Function "measured value" (000)

```

measured value 000
63.460%
  
```

This function displays the current measured value in the selected unit (see function "customer unit" (042)). The number of digits after decimal point can be selected in the function "no. of decimals" (095).

5.1.2 Function "tank shape" (002)

```

tank shape 002
dome ceiling
horizontal cyl
bypass
  
```

This function is used to select the tank shape:

The following options are available:

- **dome ceiling** (factory setting)
- **horizontal cyl.**
- **bypass**
- **stilling well**
- **flat ceiling**
- **sphere**
- **open levels**

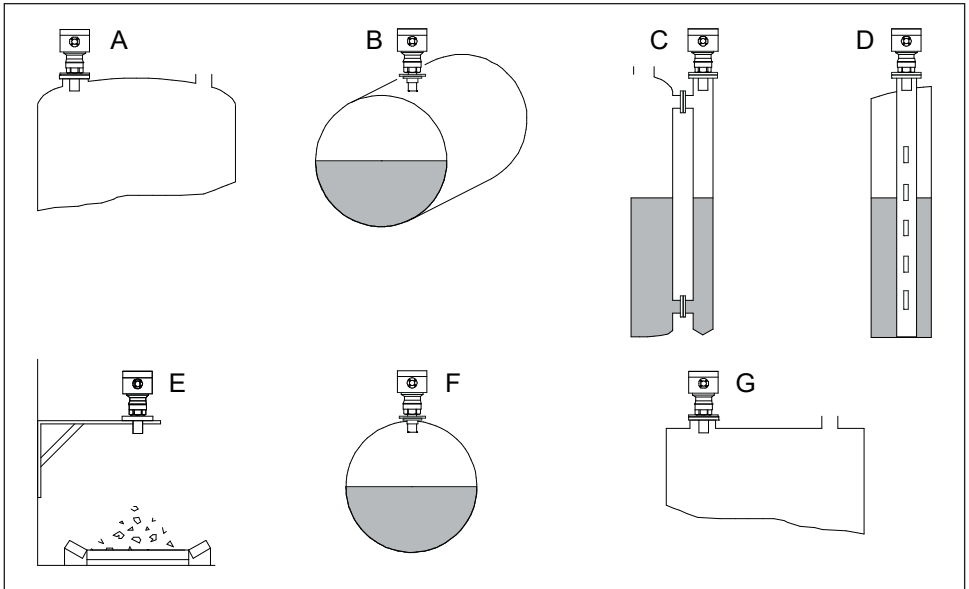


Figure 27: Tank shapes

- A Dome ceiling
- B Horizontal cyl.
- C Bypass
- D Stilling well
- E Open levels and conveyor belts
- F Sphere
- G Flat ceiling

5.1.3 Function "medium property" (003)

```

medium Property 003
unknown
liquid
solid<4mm
    
```

This function is used to set the medium properties.

The following options are available:

- **unknown** (factory setting)
- **liquid**
- **solids, grain size < 4 mm** (fine)
- **solids, grain size > 4 mm** (coarse)

5.1.4 Function "process condition" (004)

```

Process cond. 004
standard
calm surface
turb. surface
    
```

This function is used to select the process conditions.

The following options are available:

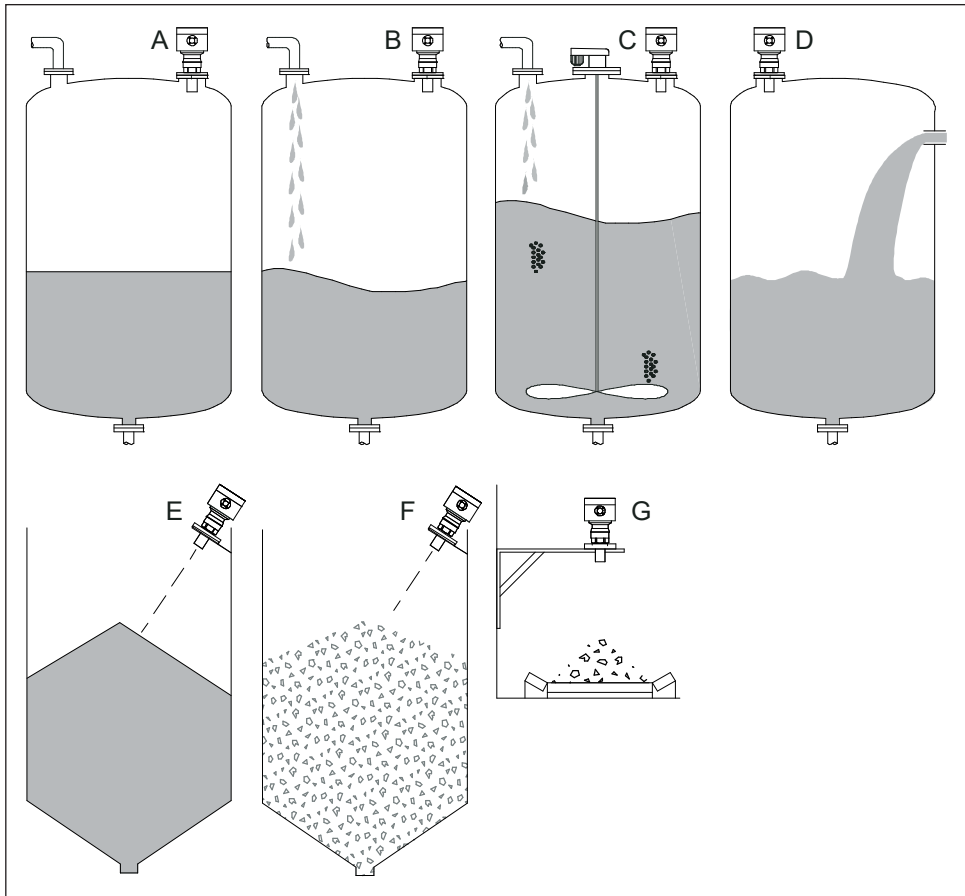


Figure 28: Process conditions

- A *Calm surface*
- B *Turb. surface*
- C *Add. agitator*
- D *Fast change*
- E *Standard solid*
- F *Solid dusty*
- G *Conveyor belt*

- **standard liquid** (default): For all fluid applications which do not fit in any of the following groups. The filters and output damping are set to average values.
- **calm surface** (A): Storage tanks with immersion tube or bottom filling. The averaging filters and output damping are set to large values.
- **turb. surface** (B): Storage / accumulation tanks with uneven surface due to free filling, mixing nozzles or small bottom stirrers. Special filters for stabilizing the input signal are activated.

- **add. agitator (C)**: Moving surfaces (poss. with vortex formation) due to agitators. Special filters for stabilizing the input signal are set to large values.
- **fast change (D)**: Rapid level change, particularly in small tanks. The averaging filters are set to small values.
- **standard solid (E)**: For all bulk solids applications which do not fit in any of the following groups. The filter and output damping are set to average values.
- **solid dusty (F)**: Dusty bulk solids. The filters are set to detect even relatively weak signals.
- **conveyor belt (G)**: Bulk solids with rapid level change. The averaging filters are set to small values.
- **test: no filter**: All the filters can be switched off for purposes of service and diagnosis. All filters off.

5.1.5 Function "empty calibration" (005)

```

empty calibr.      005
██████████ 5.500 m
distance membrane
to min. level
  
```

This function is used to enter the distance from the lower edge (reference point) of the LEVEL-EX-S to the minimum level (= zero).

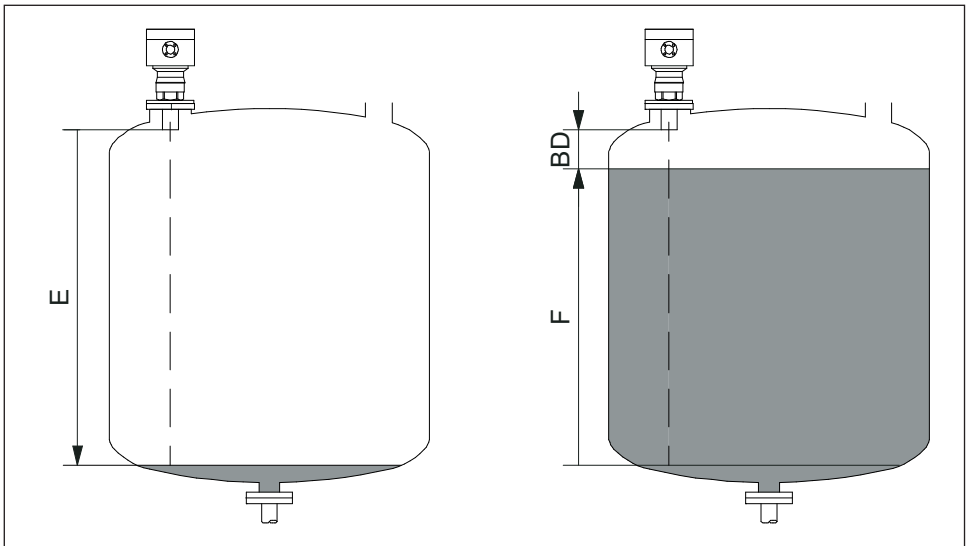


Figure 29: Full and empty calibration

E Empty calibration (function 005)

F Full calibration (function 006)

BD Blocking distance (depends on the type of device, see chapter 1.5)

⚠ WARNING

For dish bottoms or conical outlets, the zero point should be no lower than the point at which the ultrasonic beam hits the bottom of the tank.

5.1.6 Function "full calibration" (006)

```
full calibr. 006
██████████ 4.750 m
span
max: empty - BD
```

This function is used to enter the distance from the minimum level to the maximum level (= span).

After basic calibration, enter a safety distance (SD) in the "safety distance" (015) function. If the level is within this safety distance, the device signals a warning or an alarm, depending on your selection in the "in safety distance" (016) function.

⚠ WARNING

The maximum level must not project into the blocking distance (BD). If the blocking distance is compromised, it may cause device malfunction. Refer to chapter 5.5.10 for further information about the blocking distance.

5.1.7 Function "distance/measuring value" (008)

```
dist./meas.value 008
dist. 2.463 m
meas.v. 63.422 %
```

The distance measured from the lower edge of the LEVEL-EX-S to the product surface and the level calculated with the aid of the empty calibration are displayed.

Check whether the values correspond to the actual level or the actual distance.

The following cases can occur:

- Distance correct, level correct → continue with function "check distance" (051)
- Distance correct, level incorrect → Check "empty calibr." (005)
- Distance incorrect, level incorrect → continue with function "check distance" (051)

5.2 Function group "safety settings" (01)

```
Group selection 01
safety settings
temperature
linearisation
```

5.2.1 Function "output on alarm" (010)

```
output on alarm 010
MIN (<=3.6mA)
✓MAX (22mA)
hold
```

This function is used to select the reaction of the device on an alarm.

If the device is in alarm state, the output changes as follows:

- **MIN(<=3.6mA)**
 - Current output: 3.6 mA
 - Frequency output: In this special case the output switches to 4 Hz (at $I < 4$ mA).
- **MAX(22mA)** (factory setting)
 - Current output: 22 mA
 - Frequency output: In this special case the output switches to 16 Hz (at $I > 20$ mA).
- **hold**
 - The last measured value is held.
- **user specific**
 - The output is set to the value configured in "output on alarm" (011).

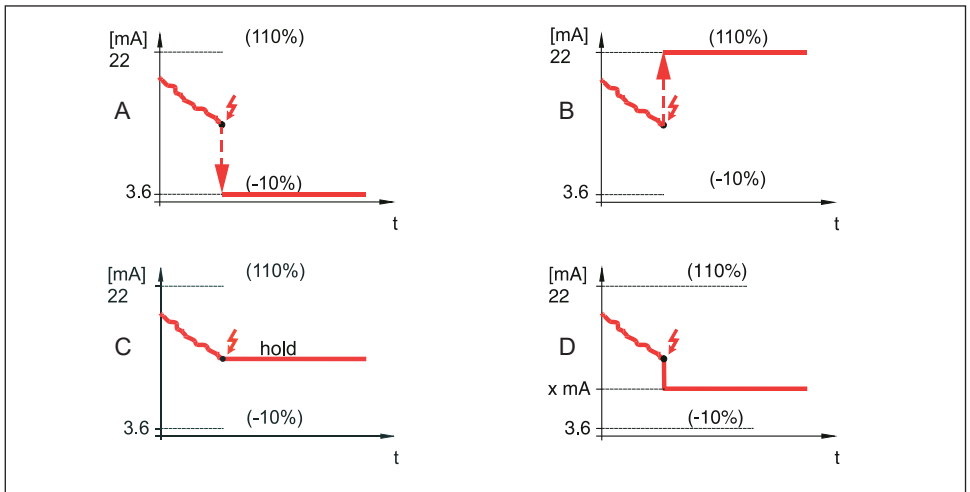


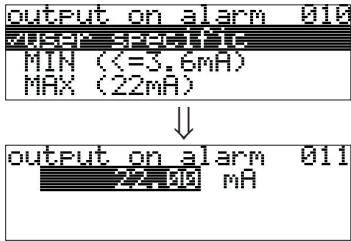
Figure 30: Output on alarm

- A MIN(<=3.6mA)
- B MAX(22mA)
- C Hold
- D User specific

NOTICE

Using device versions with frequency output (LEVEL-EX-A*1*), you will need to convert these values. Please refer to chapter 3 for details.

5.2.2 Function "output on alarm" (011)



The current (in mA) which will be output in case of an alarm.

This function is active when you selected "user specific" in the "output on alarm" (010) function.

NOTICE

Using device versions with frequency output (LEVEL-EX-A*1*), you will need to convert these values. Please refer to chapter 3 for details.

5.2.3 Function "output echo loss" (012)



Use this function to set the output response on echo loss.

The following options are available:

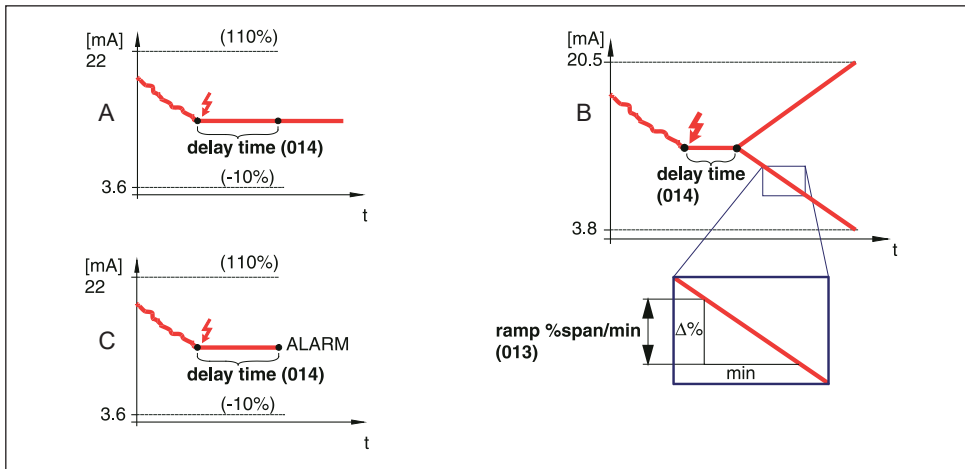


Figure 31: Output echo loss

- A Alarm
- B Ramp %span/min
- C Hold

- **alarm**

On echo loss, the instrument switches to alarm state after an adjustable "delay time" (014). The output response depends on the configuration set in "output on alarm" (010).

- **hold** (factory setting)

On echo loss, a warning is generated after a definable "delay time" (014). Output is held.

- **ramp %/min**

On echo loss, a warning is generated after a definable "delay time" (014). The output is changed towards 0% or 100% depending on the slope defined in "ramp %span/min" (013).

5.2.4 Function "ramp %span/min" (013)

```

outp. echo loss 012
  ramp %/min
  alarm
  hold
  
```

Ramp slope which defines the output value on echo loss. This value is used if "ramp %/min" is selected in "outp. echo loss" (012) function. The slope is given in % of the measuring range per minute.



```

ramp %span/min 013
  0.000 %/min
  
```

5.2.5 Function "delay time" (014)

```

delay time 014
  30 s
in case of echo loss
max. 4000 sec.
  
```

Use this function to enter the delay time after which a warning is generated on echo loss, or after which the device switches to alarm state.

Range: 0 ... 4000 s (default: 30 s)

5.2.6 Function "safety distance" (015)

```

Sicherheitsabst. 015
  0.100 m
ab Blockdistanz
  
```

Use this function to enter the size of the safety distance here.

A configurable safety distance is placed before the "blocking dist." (059) (see chapter 5.5.10 for details). This distance warns you that any further level increase would make the measurement invalid, because the blocking distance would be compromised.

Default: 0,1 m

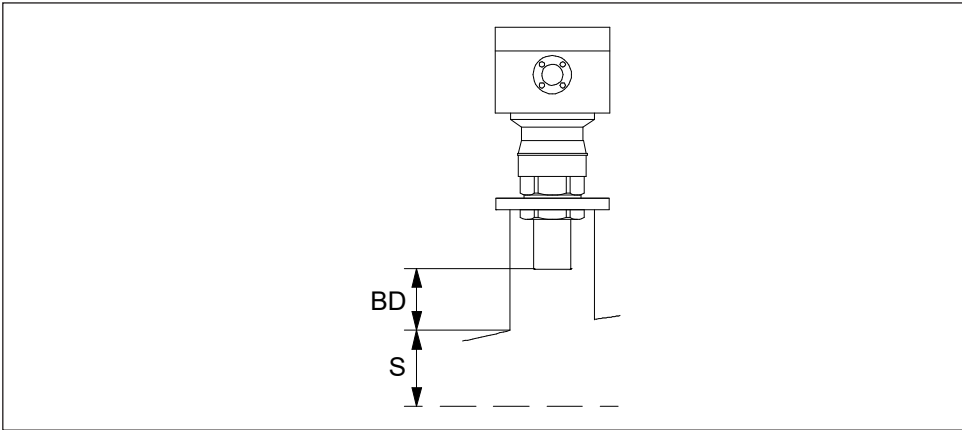


Figure 32: Safety distance

BD Blocking distance (function 059)

S Safety distance

5.2.7 Function "in safety dist." (016)

```
in safety dist. 016
warning
self holding
alarm
```

This function defines the response when the level enters the safety distance.

The following options are available:

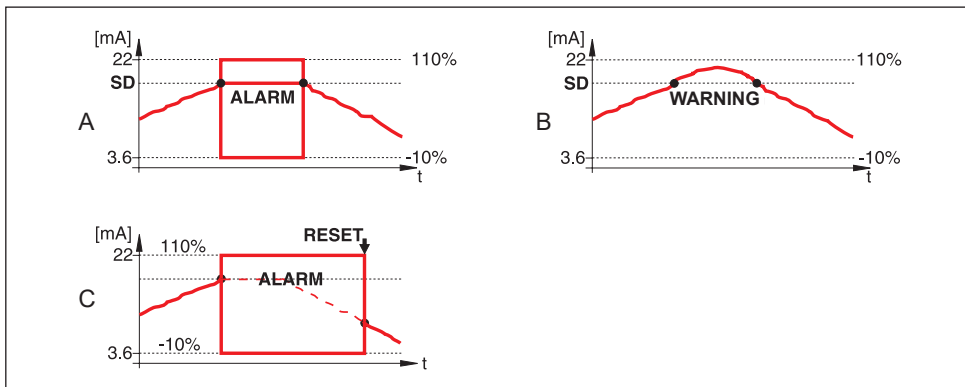


Figure 33: In safety distance

A Alarm

B Warning

C Self holding

- **alarm**

The device enters the defined alarm state ("output on alarm" (011)). The alarm message E651 "level in safety distance - risk of overspill" is displayed. If the level drops out of the safety distance, the alarm warning disappears and the device starts to measure again.

- **warning** (factory setting)

The device displays a warning E651 "level in safety distance - risk of overspill", but continues to measure. If the level leaves the safety distance, the warning disappears.

- **self holding**

The device switches to defined alarm state ("output on alarm" (011)). The alarm message E651 "level in safety distance - risk of overspill" is displayed. If the level leaves the safety distance, the measurement continues only after a reset of the self holding (function "ackn. alarm" (017)).

5.2.8 Function "ackn. alarm" (017)

```
ackn. alarm      017
no
yes
```

This function acknowledges an alarm in case of "self holding".

The following options are available:

- **no** (factory setting): The alarm is not acknowledged.
- **yes**: Acknowledgement takes place.

5.3 Function group "temperature" (03)

```
Group selection  03
temperature
linearisation
extended calibr.
```

5.3.1 Function "measured temp." (030)

```
measured temp.  030
72.9 F
```

In this function the temperature at the transducer is displayed. The temperature unit is determined by the function "temperature unit" (0C6).

5.3.2 Function "max. temp. limit" (031)

```
max. temp. limit 031
176.0 F
```

In this function the maximum permitted temperature of the transducer LEVEL-EX-S is displayed. The temperature unit is determined by the function "temperature unit" (0C6).

WARNING

If this temperature is exceeded, the LEVEL-EX-S may become damaged.

5.3.3 Function "max. meas. temp" (032)

```
Max. meas. temp 032
76.2 F
```

In this function the maximum temperature, which has ever been measured at the transducer, is displayed. The temperature unit is determined by the function "temperature unit" (0C6).

This function is not influenced by a reset of the parameters.

5.3.4 Function "react. high temp" (033)

```
react. high temp 033
warning
```

In this function you determine, how the device will react if the maximum permitted temperature of the transducer LEVEL-EX-S is exceeded.

The following options are available:

- **warning** (factory setting)

The device continues measuring, an error message is displayed.

- **alarm**

The output adopts the value defined in the function "output on alarm" (010), additionally an error message is displayed.

5.3.5 Function "defect temp sens" (034)

```
defect temp sens 034
warning
```

In this function you determine, how the device will react, if the maximum permitted temperature of the transducer LEVEL-EX-S is exceeded.

The following options are available:

- **warning**

The device continues measuring, an error message is displayed.

- **alarm** (factory setting)

The output adopts the value defined in the function "output on alarm" (010), additionally an error message is displayed.

5.4 Function group "linearization" (04)

```
Group selection 04
<linearisation
extended calibr.
output
```

5.4.1 Function "level/ullage" (040)

```
level/ullage 040
<level CU
level DU
ullage CU
```

In this function you can select the displayed value in the function "measured value" (000):

The following options are available:

- **level CU** (factory setting)

Level in customer units. The measured value can be linearized. The "linearization" (041) default value is set to a linear 0 ... 100 %.

- **level DU**
Level in the selected "distance unit" (0C5).
- **ullage CU**
Ullage in customer units. The value can be linearized. The "linearization" (041) default value is set to a linear 0 ... 100 %.
- **ullage DU**
Ullage in the selected "distance unit" (0C5).

5.4.2 Function "linearization" (041)



Linearization defines the ratio of level to container volume or product weight and allows a measurement in customer units, e.g. metres, hectoliters etc.

The measured value in (000) is then displayed in the selected unit.

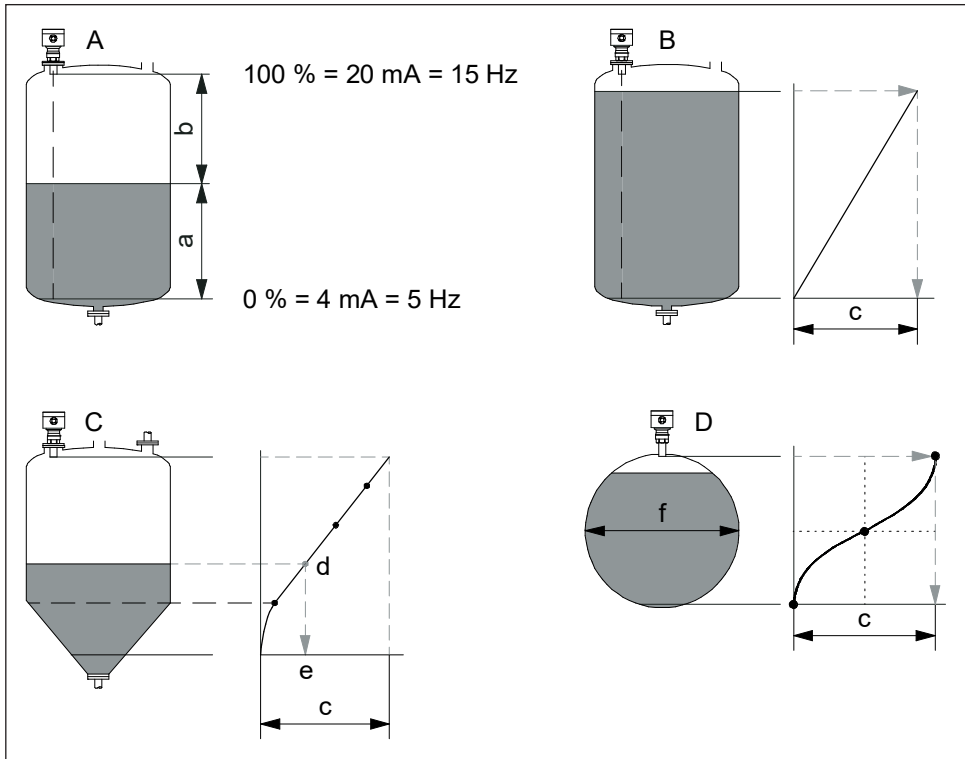


Figure 34: Linearization of the measured value

- A Level/ullage
- B Linear
- C Manual
- D Horizontal cyl.
- a Level
- b Ullage
- c Max. scale (Function 046)
- d Level
- e Measured value in customer unit (Function 042)
- f Vessel diameter (Function 047)

The following options are available:

- **linear** (factory setting)

The tank is linear e.g. a cylindrical vertical tank. You can measure in customer units by entering a maximum volume/weight. You can select the "customer unit" (042). Define the volume value corresponding to the calibration in "max. scale" (046). This value corresponds to an output of 100 %.

- **table on**

An entered linearization table only becomes effective when activated.

- **semi-automatic**

The tank is filled in stages when the linearization curve is entered semi-automatically. The device automatically detects the level and the corresponding volume/weight has to be entered. The procedure is similar to manual table entry, where the level value for each table point is given automatically by the device.

NOTICE

If the tank is emptied (out liters), pay attention to the following points:

- The number of points must be known in advance.
- The first table number = (32 - number of points).
- Entries in "Tab. no." (043) are made in reverse order (last entry = 1).

- **horizontal cyl.**

The volume, mass etc. are calculated automatically in cylindrical horizontal tanks by entering the "diameter vessel" (047), the "customer unit" (042) and the "max. scale" (046). The "max. scale" (046) corresponds to an output of 100 %.

- **manual**

If the level is not proportional to the volume or weight within the set measuring range, you can enter a linearization table in order to measure in customer units. Each point in the table is described by a value pair: level (d) and, for example, volume (e). The last value pair defines the 100 % output.

NOTICE

The requirements are as follows:

- The 32 (max.) value pairs for the linearization curve points are known.
- The level values must be given in ascending order. The curve is monotonously increasing.
- The level heights for the first and last points on the linearization curve correspond to empty and full calibration respectively.
- The linearization takes place in the basic setup unit ("distance unit" (0C5)).

- **clear table**

Before making entries into the linearization table, any existing tables must be deleted. The linearization mode automatically switches to linear.

The linearization is entered as follows:

```
linearisation 041
<manual
semi-automatic
table on
```



```
linearisation 043
Tab.no. 1
Level 0.000m
Volume 0.000%
```

Select the table point (1 ... 32)



```
linearisation 044
Tab.no. 1
Level 0.000m
Volume 0.000%
```

Enter the level belonging to the point



```
linearisation 045
Tab.no. 1
Level 0.000m
Volume 0.000%
```

Enter the corresponding volume



```
next point 045
<yes
no
```

Enter a further table point?



```
linearisation 043
Tab.no. 2
Level 0.000m
Volume 0.000%
```

Next table point

NOTICE

- After making entries into the table, activate it with "table on". The 100% value is defined by the last point in the table.
- Before confirming 0.00 m as the level or 0.00% as the volume, activate the edit mode with or .
- A linearization table can be deactivated by selecting "linear" or "horizontal cyl" (or the "level/ullage" (040) function = "level DU", "ullage DU"). It is not deleted and can be reactivated at any time by selecting "table on".

5.4.3 Function "customer unit" (042)

```
customer unit 042
<h1
```

You can select the customer unit with this function.

The following options are available:

- Percent (%) (factory setting)
- Volume: l, hl, m³, dm³, cm³, ft³, usgal, i gal
- Weight: kg, t, lb, ton
- Length: m, ft, mm, inch

NOTICE

The units of the parameters "measured value" (000), "input volume" (045), "max. scale" (046) and "simulation value" (066) are changed automatically.

5.4.4 Function "table no." (043)

```
linearisation 043
Tab.no. 1
Level 0.000m
Volume 0.000%
```

Position of the value pair in the linearization table.

5.4.5 Function "input level" (044)

```
linearisation 044
Tab.no. 1
Level 0.000m
Volume 0.000%
```

You can enter the level for each point of the linearization curve with this function. When the linearization curve is entered semi-automatically, the device detects the level automatically.

5.4.6 Function "input volume" (045)

```
linearisation 045
Tab.no. 1
Level 0.000m
Volume 0.000%
```

Specify the volume for each point of the linearization curve with this function (depending on the "customer unit" (042)).

5.4.7 Function "max. scale" (046)

```
max. scale 046
100.000 %
```

You can enter the end value of the measuring range with this function. This input is necessary if you selected "linear" or "horizontal cyl" in the "linearization" (041) function.

5.4.8 Function "horizontal cyl" (047)

```
linearisation 041
horizontal cyl
manual
semi-automatic
```

Enter the tank diameter with this function. This entry is necessary if you selected "horizontal cyl" in the "linearization" (041) function.

↓

```
diameter vessel 047
9.000 m
```

5.5 Function group "extended calibr." (05)

```

Group selection 05
<extended calibr.
output
display

```

In this function group you can adjust further settings for the calibration of the level meter LEVEL-EX.

5.5.1 Function "selection" (050)

```

selection 050
<common
mapping
extended map.

```

Select the functions of the extended calibration:

- common with the functions
 - "echo quality" (056)
 - "offset" (057)
 - "output damping" (058)
 - "blocking distance" (059)
- mapping with the functions
 - "check distance" (051)
 - "range of mapping" (052)
 - "start mapping" (053)
- extended map with the function
 - "pres. map. dist." (054)
 - "cust. tank map" (055)

5.5.2 Function "check distance" (051)

```

check distance 051
<dist. unknown
manual
distance = ok

```

This function triggers the mapping of interference echoes. To do so, the measured distance must be compared with the actual distance to the product surface.

The following options are available for selection:

- **distance = ok**
Mapping is carried out up to the currently measured echo. The range to be suppressed is suggested in the "range of mapping" (052) function. Anyway, it is wise to carry out a mapping even in this case.
- **dist. too small**
At the moment, an interference is being evaluated, Therefore, a mapping is carried out including the presently measured echoes. The range to be suppressed is suggested in the "range of mapping" (052) function.
- **dist. too big**
This error cannot be remedied by interference echo mapping. Check the application parameters (002) to (005).
- **dist. unknown** (factory setting)
If the actual distance is not known, no mapping can be carried out.
- **manual**
A mapping is also possible by manual entry of the range to be suppressed. This entry is made in the "range of mapping" (052) function.

⚠ WARNING

- The range of mapping must end 0.5 m (20") before the echo of the actual level. For an empty tank, do not enter E, but E – 0.5 m (20").
- If a mapping already exists, it is overwritten up to the distance specified in "range of mapping" (052). Beyond this value the existing mapping remains unchanged.

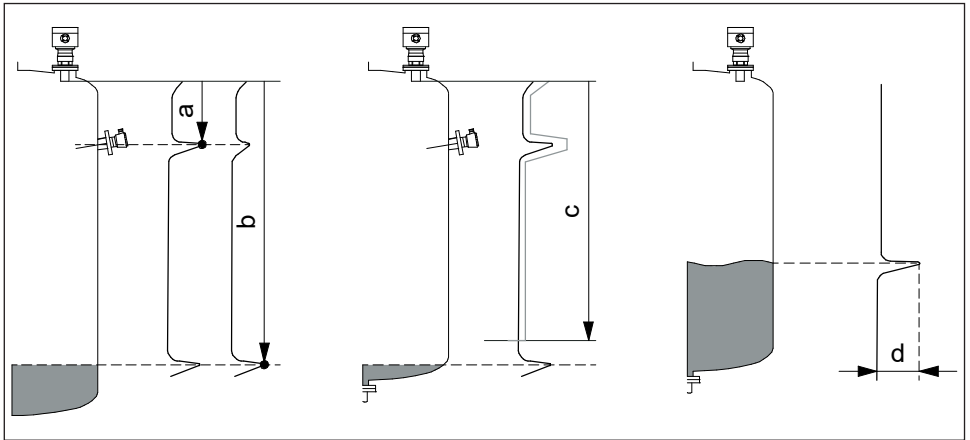


Figure 35: Mapping and echo quality

- a Distance too small
- b Distance ok
- c Current mapping distance (function 054)
- d Echo quality (function 056)

5.5.3 Function "range of mapping" (052)

```
range of mapping 052
  0.000 m
input of
mapping range
```

This function displays the suggested range of mapping. The reference point is always the lower edge of the transducer LEVEL-EX-S.

This value can be edited by the operator. For manual mapping, the default value is: 0 m.

5.5.4 Function "start mapping" (053)

```
start mapping 053
  off
on
```

This function is used to start the interference echo mapping up to the distance given in "range of mapping" (052).

The following options are available:

- **off** (default): No mapping is carried out.
- **on**: Mapping is started

⚠ WARNING

- No mapping is performed as long as the device is in alarm condition. While mapping is being performed, the display shows the message "mapping in progress".
- You need to delete a existing mapping before you start a new mapping (see function 055).

5.5.5 Function "pres. map dist." (054)

```
pres. map dist. 054
0.000 m
```

Displays the distance up to which a mapping has been recorded . A value of 0 indicates that no mapping was recorded so far.

5.5.6 Function "cust. tank map" (055)

```
cust. tank map 055
<inactive
active
reset
```

This function displays the evaluation mode using the customer tank map.

The following options are available:

- **inactive** (factory setting)
No tank mapping has been recorded, or map is switched off. Evaluation is only done using FAC (see chapter 5.7)
- **active**
Evaluation is using the customer tank map.
- **reset**
Deletes the complete tank map.

5.5.7 Function "echo quality" (056)

```
echo quality 056
19 dB
```

The echo quality is the benchmark for measurement reliability.

It describes the amount of reflected energy and depends primarily on the following conditions:

- Surface characteristics (waves, foam etc.)
- Distance between transducer LEVEL-EX-S and product

NOTICE

Low values increase the probability that the echo is lost through a change in measurement conditions, e.g. turbulent surface, foam, large measuring distance.

5.5.8 Function "offset" (057)

```
offset 057
0.000 m
will be added to the
measured level
```

This function corrects the measured level by a constant value. The entered value is added to the measured level.

5.5.9 Function "output damping" (058)

```
output damping 058
5.0 s
```

Influences the time an output requires to react to a sudden level jump (63% of steady state). A high value attenuates, for example, the influences of rapid changes on the measured variable.

Range: 0 ... 255 s (Default: depends on the selected application parameters)

NOTICE

The minimum response time of the LEVEL-EX is 0.5 s. This response time cannot be reduced by switching off the output damping (058 = 0).

5.5.10 Function "blocking distance" (059)

```
blocking dist. 059
5 [██████████] 0.250 m
BD=blocking dist.
```

In this function the blocking distance is displayed. Level echoes within the blocking distance can not be detected by the device.

The blocking distance value, which depends on the device type, is defined as follows:

- LEVEL-EX-S1A1A: 0.25 m
- LEVEL-EX-S1B1A: 0.35 m
- LEVEL-EX-S1D1A: 0.50 m

⚠ WARNING

Make sure that the maximum level will never run into the blocking distance.

5.6 Function group "output" (06)

```
Group selection 063
</output
display
diagnostics
```

5.6.1 Function "low output limit" (062)

```
low output limit 062
</on
off
```

The output of negative level values can be suppressed with this function.

The following options are available:

- **off** (default setting)
Minimum output: 3.8 mA (and converted values respectively, see chapter 3)
- **on**
Minimum output: 4 mA (and converted values respectively, see chapter 3)

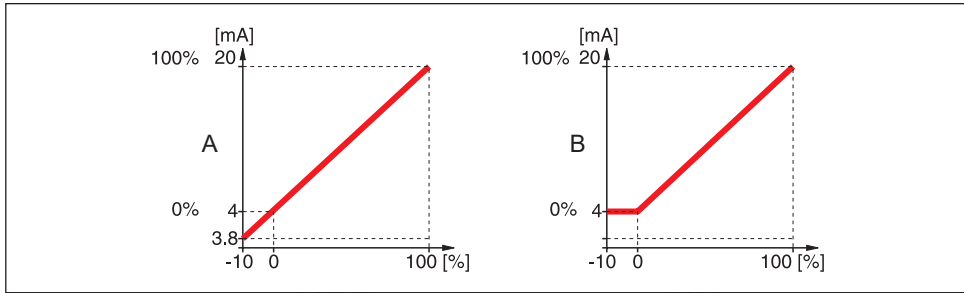


Figure 36: Low output limit

A Off
B On

5.6.2 Function "curr.output mode" (063)

```
curr.output mode 063
standard
curr.turn down
fixed current
```

In this function you specify the mode of the current output.

The following options are available:

- **standard** (factory setting)
The total measuring range of 0 ... 100 % will be mapped to the output interval (4...20 mA).
- **curr. turn down**
Only a part of the measuring range will be mapped to the output interval (4 ... 20 mA). Use the functions "4mA-value" (068) and "20mA-value" (069) to define the concerning range.
- **fixed current**
The current is fixed. The value of the current is defined in the "fixed cur. value" (064) function.

NOTICE

You may use the "fixed current" option only for tests and not for real measuring!

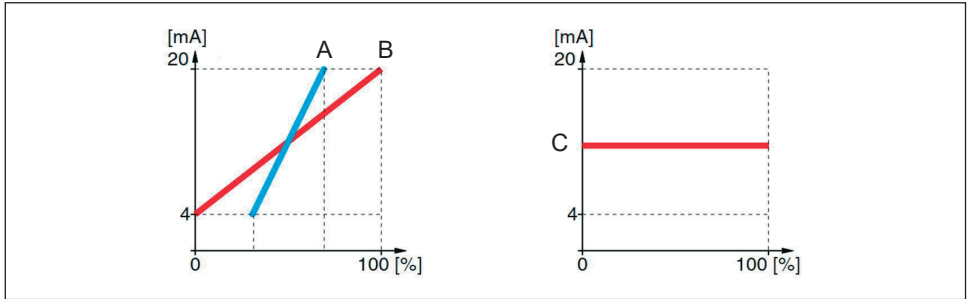


Figure 37: Current output modes

- A Curr. turn down
- B Standard
- C Fixed current

5.6.3 Function "fixed cur. value" (064)

```
fixed cur. value 064
  4.00 mA
```

Set the fixed current value with this function. This entry is necessary when you have switched on the "fixed current" (063) function.

Range: 3.8 ... 20.5 mA

5.6.4 Function "simulation" (065)

```
simulation 065
  /sim. off
  sim. level
  sim. volume
```

If necessary, linearization, the output signal and the current output can be tested with the simulation function.

The following options are available:

- **sim. off** (factory setting)
Simulation is switched off.
- **sim. level**
Enter the level value in "simulation value" (066). The functions "measured value" (000), "measured level" (0A6) and "output current" (067) follow the entered values.
- **sim. volume**
Enter the volume value in "simulation value" (066). The functions "measured value" (000) and "output current" (067) follow the entered values.
- **sim. current**
Enter the current value in "simulation value" (066). The function "output current" (067) follows the entered values.

5.6.5 Function "simulation value" (066)

```
simulation value 066
 23.16 %
```

In this function you can enter a simulation value depending on the "simulation" (065) function:

The following options are available:

- **level** (depending on "distance unit" (0C5))
- **volume** (depending on "customer unit" (042))
- **current**

5.6.6 Function "output current" (067)

```
output current 067
 4.00 mA
```

This function displays the output current in mA (see chapter 3 for converted values).

5.6.7 Function "4mA value" (068)

```
4mA value 068
 10.00 %
```

In this function you can specify the level (or volume, weight, flow resp.), at which the output current should be 4 mA.

This value will be used if you choose the option "curr. turn down" in the "curr. output mode" (063) function.

5.6.8 Function "20mA value" (069)

```
20mA value 069
 20.00 %
```

In this function you can specify the level (or volume, weight, flow resp.), at which the output current should be 20 mA.

This value will be used if you choose the option "curr. turn down" in the "curr. output mode" (063) function.

5.7 Function group "envelope curve" (0E)

```
Group selection 0E3
envelope curve
display
diagnostics
```

5.7.1 Function "plot settings" (0E1)

```
Plot settings 0E1
envelope curve
env.curve+PAC
env.curve+cust.map
```

In this function you can select which information is displayed in the LCD.

The following options are available:

- **envelope curve** (factory setting)

Depending on the setting in "recording curve" (0E2), the device reads the envelope curve as a single curve or cyclic. You can see the following details from the displayed curve.

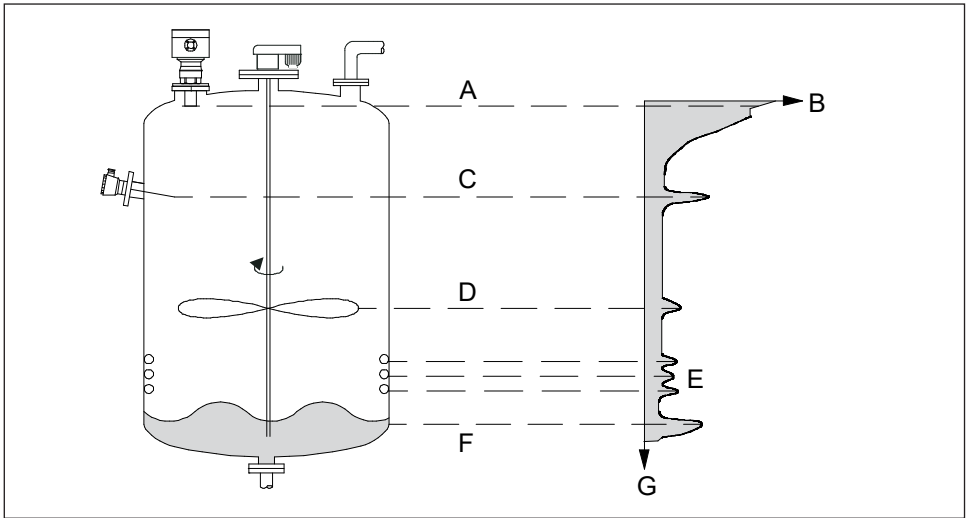


Figure 38: Envelope curve

- A Sending pulse with reverberation time
- B Amplitude
- C Interference echo caused by installations
- D Interference echo caused by agitator
- E Interference echo caused by installations
- F Level echo
- G Time-of-flight

- **env.curve+cust.map**

It may be required to map interference reflections inside the tank. This map is preferably done with an empty tank. This way, all eventual interference reflections caused by installations in the tank are detected and stored in memory. Only significant echoes will then exceed the tank map and be evaluated. The mapping can also be performed up to the level or a defined distance, even if the tank is not empty. However, if the level drops below the mapping distance, additional reflections can interfere with the measurement.

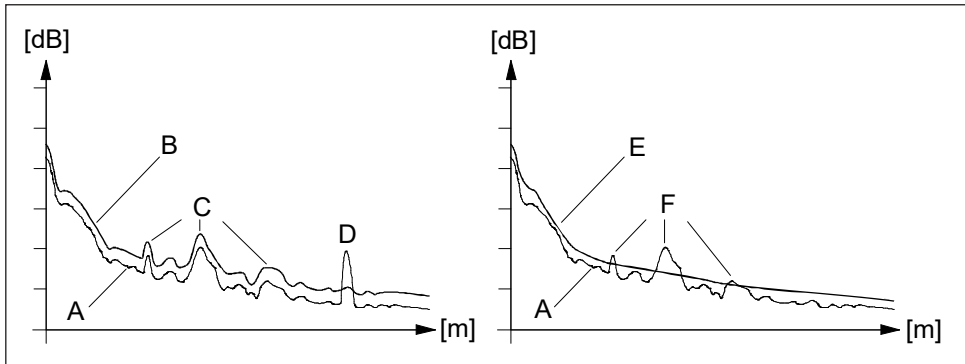


Figure 39: Envelope curve with customer map and FAC

- A Envelope curve with reflections/echoes
- B Customer map
- C Interference echoes
- D Level echo
- E Curve of FAC (Floating Average Curve)
- F Echoes; the echo with the greatest distance to the FAC will be evaluated

• env.curve + FAC

The FAC is similar to the tank map, but automatically adapts itself to changing interference echoes in the tank, i.e. caused by buildup and turbulences. The FAC only covers small interference reflections, all signals below this curve are ignored. The echo signal with the greatest distance to the FAC will be evaluated. The FAC is not only recorded once, but newly calculated with every envelope curve. Thus, it continuously adapts itself to the conditions in the tank.

5.7.2 Function "recording curve" (0E2)



This function defines whether the envelope curve is read.

The following options are available:

- **single curve** (factory setting)
- **cyclic**

NOTICE

If the cyclical envelope curve is active in the display, the measured value is refreshed in a slower cycle time. It is therefore recommended to exit the envelope curve display after optimizing the measuring point.

5.7.3 Function "envelope curve display" (0E3)

The envelope curve is displayed in this function. You can use it to obtain the following informations:

- Envelope curve without customer map (figure left)
- Envelope curve with customer map (figure right)

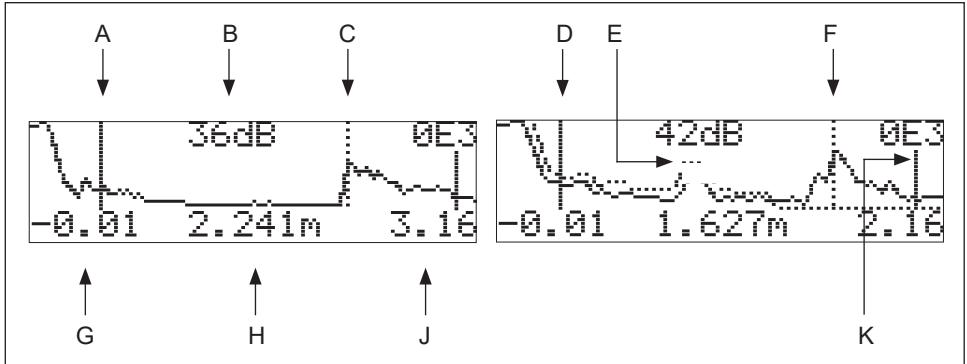


Figure 40: Envelope curve with/without customer map

- A Full calibration
- B Quality of evaluated echo
- C Evaluated echo is marked
- D Customer map
- E Interference echo
- F Level echo
- G Minimum distance of the plot
- H Distance of evaluated echo
- J Maximum distance of the plot
- K Empty calibration

- Navigation in the envelope curve display
Using navigation, the envelope curve can be scaled horizontally and vertically and shifted to the left or the right. The active navigation mode is indicated by a symbol in the top left hand corner of the display.

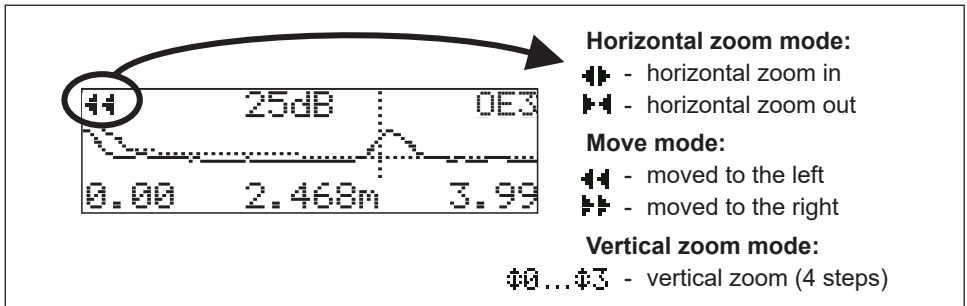


Figure 41: Navigation in the envelope curve display

- Horizontal zoom mode

Firstly, go into the envelope curve display. Then press \square or \square to switch to the envelope curve navigation. You are then in horizontal zoom mode. Either \leftarrow or \rightarrow is displayed. Now you have the following options:

- \square increases the horizontal scale
- \square reduces the horizontal scale

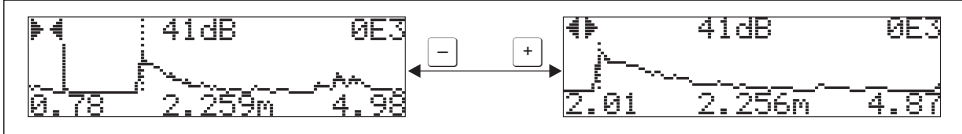


Figure 42: Horizontal zoom mode

- Move mode

Then press \square to switch to move mode. Either \leftarrow or \rightarrow is displayed. Now you have the following options:

- \square shifts the curve to the right
- \square shifts the curve to the left

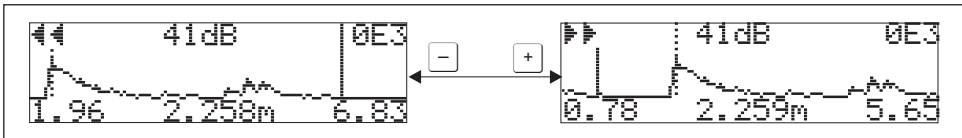


Figure 43: Move mode

- Vertical zoom mode

Press \square once more to switch to vertical zoom mode. $\Phi 1$ is displayed. Now you have the following options:

- \square increases the vertical scale
- \square reduces the vertical scale

The display icon shows you the current zoom factor ($\Phi 0$ to $\Phi 3$).

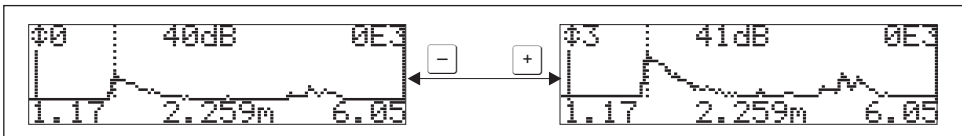


Figure 44: Vertical zoom mode

- Exiting the navigation

Press \square again to run through the different modes of the envelope curve navigation.

Press \square and \square to exit the navigation. The set increases and shifts are retained. Only

when you reactivate the "recording curve" (0E2) function the device LEVEL-EX uses the standard display again.

5.8 Function group "display" (09)

```

Group selection 09
✓display
diagnostics
system parameters
  
```

5.8.1 Function "language" (092)

```

language 092
✓English
Deutsch
Français
  
```

This function is used to select the language of the device.

The following options are available:

- **English** (factory setting)
- **Deutsch**
- **Français**
- **Español**
- **Italiano**
- **Nederlands**

5.8.2 Function "back to home" (093)

```

back to home 093
9999 s
  
```

If no entry is made using the display during the specified time period, the display returns to the measured value display. 9999 s means that there is no return.

5.8.3 Function "format display" (094)

```

format display 094
✓decimal
ft-in-1/16"
  
```

This function is used to select the display format.

The following options are available:

- **decimal** (factory setting)
The measured value is given in decimal form in the display (e.g. 10.70%).
- **ft-in-1/16"**
The measured value is given in the display in this format (e.g. 5'05-14/16"). This option is only possible for "distance unit" (0C5) - "ft" and "in".

5.8.4 Function "no. of decimals" (095)

```

no. of decimals 095
x.xx
x.xxx
x
  
```

This function is used to select the number of decimals.

The following options are available:

- **x**
- **x.x**
- **x.xx** (factory setting)
- **x.xxx**

5.8.5 Function "sep. character" (096)



This function is used to select the separator.

The following options are available:

- . (factory setting): The decimal place is separated by a point.
- , The decimal place is separated by a comma.

5.8.6 Function "display test" (097)



This function is used to test the LCD. All display pixels are switched on for approx. 3 s. If the whole LCD is dark, it is working correctly.

5.9 Function group "diagnostics" (0A)




In the "diagnostics" function group, you can display and confirm error messages.


Errors that occur during commissioning or measuring are displayed immediately on the local display. If two or more system or process errors occur, the error with the highest priority is the one shown on the display.

The measuring system distinguishes between two types of error:


• A (alarm)

The device goes into a defined alarm condition, for example output current = 22 mA (or converted analog value, see chapters 3 and 4.2.1) when "MAX(22mA)" is selected in function "Output on alarm" (011), an error message is displayed. The error symbol  appears permanently on the display.



• W (warning)

Device continues measuring, error message is displayed. Indicated by a flashing  symbol.

• E (alarm or warning)

Configurable (e.g. loss of echo, level within the safety dist.). Indicated by a constant or flashing  symbol.

Error messages appear as four lines of plain text on the display. In addition, a unique error code is also output. A description of all error codes is given in chapter 7 "trouble-shooting".

- The "diagnostics" (0A) function group can display current errors as well as the last errors that occurred.
- If several current errors occur, use  or  to page through the error messages.
- The last occurring error can be deleted in the "diagnostics" (0A) function group with the function "clear last error" (0A2).

5.9.1 Function "present error" (0A0)

```
present error      0A0
linearisation ch1
not complete,
not usable        A671
```

The present error is shown using this function.

5.9.2 Function "previous error" (0A1)

```
previous error    0A1
simulation ch. 1
on
                W621
```

The last error presented is shown with this function.

5.9.3 Function "clear last error" (0A2)

```
clear last error 0A2
keep
erase
```

Use this function to clear the last displayed error.

The following options are available:

- **keep** (factory setting): The last displayed error will not be deleted.
- **erase**: The last displayed error will be deleted.

5.9.4 Function "reset" (0A3)

```
reset            0A3
[ ]
for reset code
see manual
```

A reset sets the instrument back to the factory settings.

WARNING

This can lead to an impairment of the measurement. Generally, you should perform a basic setup again following a reset.

A reset is only necessary, if the device:

- no longer functions
- must be moved from one measuring point to another
- is being de-installed/put into storage/installed

Enter the value "333" to generate a reset.

This reset is recommended whenever a device with an unknown 'history' is to be used in an application:

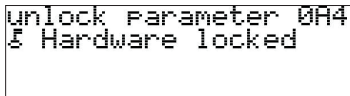
- The device is reset to the default values.
- The customer specific tank map is not deleted.
- A linearization is switched to "linear" although the table values are retained. The table can be reactivated in the "linearization" (04) function group.

List of functions that are affected by a reset:

- tank shape (002)
- empty calibr. (005)
- full calibr. (006)
- output on alarm (010)
- output on alarm (011)
- outp. echo loss (012)
- ramp %span/min (013)
- delay time (014)
- safety distance (015)
- in safety dist. (016)
- level/ullage (040)
- linearization (041)
- customer unit (042)
- diameter vessel (047)
- range of mapping (052)
- pres. map dist. (054)
- offset (057)
- low output limit (062)
- curr. output mode (063)
- fixed cur. value (064)
- simulation (065)
- simulation value (066)
- format display (094)
- distance unit (0C5)

A reset of the customer specific tank map is possible in "cust. tank map" (055) function.

5.9.5 Function "unlock parameter" (0A4)




```
unlock parameter 0A4
Hardware locked
```





Set-up can be locked and unlocked with this function.

The LEVEL-EX can be protected in two ways against unauthorized changing of device data, numerical values or factory settings:

1. Software lock:

A value <> 100 (e.g. 99) must be entered in "unlock parameter" (0A4) in the "diagnostics" (0A) function group. The lock is shown on the display by the  symbol and can be released again via the display. By entering the unlock parameter 100 the device is released for operation.

2. Hardware lock:

The device is locked by pressing the  +  +  keys at the same time. The lock is shown on the display by the  symbol and can only be unlocked again via the display by pressing the three keys at the same time again. It is not possible to unlock the hardware by a software unlock.

All parameters can be displayed even if the device is locked.

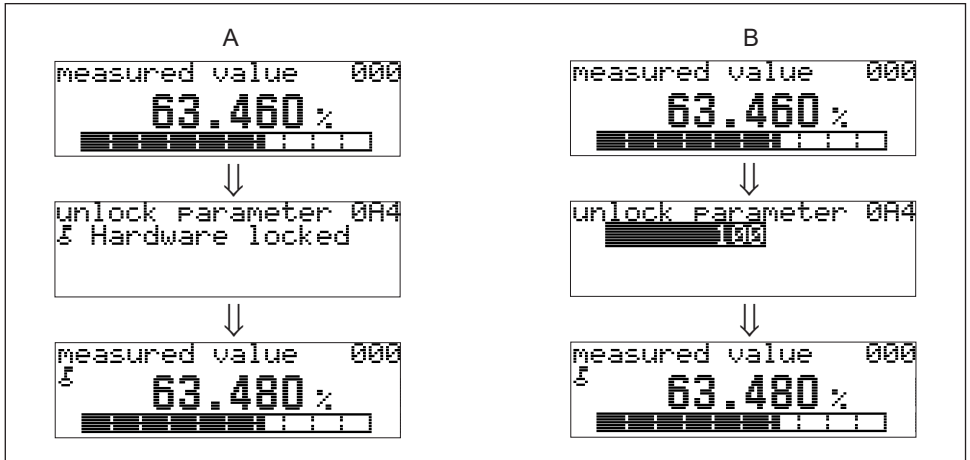


Figure 45: Unlock examples

- A Hardware unlock
- B Software unlock

5.9.6 Function "measured dist." (0A5)

```
measured dist. 0A5
  2.463 m
```

This function shows the measured distance in the selected "distance unit" (0C5).

5.9.7 Function "measured level" (0A6)

```
measured level 0A6
  2.541 m
```

This function shows the level in the selected "distance unit" (0C5). This value is generated from the difference between "empty calibr." (005) and "measured level" (see figure 34).

5.9.8 Function "detection window" (0A7)

```
detection window 0A7
  off
  on
  reset
```

This function is used to switch the detection window on and off and to reset an existing detection window.

If this function is switched on, a window is defined surrounding the current level echo (typical width: 1 to 2.5 m; depending on the application parameters). The window always moves together with a rising or a falling echo. Echoes beyond the limits of the window are ignored for a certain time.

The following options are available:

- **off** (factory setting)
- **on**
- **reset**

After selection of this option, the current window is reset, the level echo is looked for within the complete measuring range and a new window is defined surrounding the current level echo.

5.9.9 Function "application par." (0A8)

```
application par. 0A8
✓not modified
  modified
```

This function displays whether or not one of the settings dependent on the "tank shape" (002), "medium property" (003) and "process cond." (004) application parameters has been changed or not.

If, for example, the "output damping" (058) is changed, the "application par." shows "modified".

Display values:

- **not modified**
- **modified**

5.10 Function group "system parameters" (0C)

```
Group selection 0C
✓system parameters
  service
  basic setup
```

5.10.1 Function "tag no." (0C0)

```
tag no. 0C0
_____
```

Use this function to define the tag number (max. 16 alphanumeric characters) of the device. Press **Enter** to store the tag number.

5.10.2 Function "protocol+sw-no." (0C2)

```
Protocol+sw-no. 0C2
V01.01.00 HART
```

This function shows the protocol and the hardware and software version.

The display is composed as follows: Vxx.yy.zz

xx - hardware version

yy - software version

zz - software revision + protocol type (if necessary)

5.10.3 Function "serial no." (0C4)

```
serial no. 0C4
E HMLNR 011D
```

This function displays the serial number of the device (factory value).

5.10.4 Function "distance unit" (0C5)



Use this function to select the basic distance unit of the LEVEL-EX. The distance units "m" and "mm" can only be "decimal" in "format display" (094).

The following options are available:

- **m** (factory setting)
- **ft**
- **mm**
- **inch**

The units are changed for the following functions:

- | | |
|--------------------------|--------------------------|
| - empty calibr. (005) | - cust. tank map (055) |
| - full calibr. (006) | - offset (057) |
| - safety distance (015) | - simulation value (066) |
| - input level (044) | - measured dist. (0A5) |
| - diameter vessel (047) | - measured level (0A6) |
| - range of mapping (052) | |

5.10.5 Function "temperature unit" (0C6)



In this function you select the basic temperature unit of the LEVEL-EX.

The following options are available:

- **°F** (factory setting)
- **°C**

The units are changed for the following functions:

- | | |
|-------------------------|--------------------------|
| - measured temp. (030) | - max. temp. limit (031) |
| - max. meas. temp (032) | |

6 Commissioning

6.1 Transducer selection

Please select the used transducer LEVEL-EX-S with the S1 switch before start of operation.

	LEVEL-EX-S1A1A	LEVEL-EX-S1B1A	LEVEL-EX-S1D1A
S1			

6.2 First switch-on

When the device is switched on for the first time, the following messages appear on the display:

```
language 092
English
Deutsch
Français
```

Select the language (this message appears the first time the device is switched on).

```
distance unit 005
m
ft
mm
```

Select the basic distance unit (this message appears the first time the device is switched on).

```
measured value 000
63.460 %
■■■■■■■■■■
```

The current measured value is displayed.

```
Group selection 003
basic setup
safety settings
temperature
```

After **E** is pressed, you reach the group selection.

6.3 Basic setup

The basic setup is sufficient for successful commissioning in most applications. Complex measuring operations necessitate additional functions that the user can use to customise the LEVEL-EX as necessary to suit his specific requirements. The functions available to do this are described in chapter 5 "Description of device functions".

Notes to the "basic setup" (00):

- Select the functions as described in chapter 4 "Operation".
- Some functions can only be used depending on the parameterization of the device.
- Certain functions prompts you to confirm your data entries. Press "YES" to confirm, the function is now started.
- If you do not press a key during a configurable time period, an automatic return is made to the home position (measured value (000) display).
- The minimum reaction time of the LEVEL-EX device unit is 0.5 s. Consider this reaction time when making the basic setup.

NOTICE

- The device continues to measure while data entry is in progress, i.e. the current measured values are put out via the signal outputs in the normal way.
- If the envelope curve mode is active on the display, the measured values are updated in a slower cycle time. Thus, it is advisable to leave the envelope curve mode after the measuring point has been optimized.
- If the power supply fails, all preset and parameterized values remain safely stored in the EEPROM.
- You can find a list of all functions and their default values in chapter 10 "Appendix".

6.4 Functions of basic setup

Description of device functions → Page 32

Follow the functions the level meter LEVEL-EX needs for a basic setup:

- tank shape (002): e.g. "sphere"
- medium property (003): e.g. "solid > 4mm"
- process cond. (004): e.g. "standard solid"
- empty calibr. (005): e.g. "3.00"
- full calibr. (006): e.g. "2.50"

After you entered the basic setup, you can check/change optionally settings in the following function groups:

- safety settings (01) such as "output on alarm" (010)
- linearization (04) e.g. for horizontal cylindrical tank
- output (06) such as "curr. output mode" (063)
- display (09) such as "format display" (094)
- system parameters (0C) such as "distance unit" (0C5)

7 Trouble-shooting

There are different types of errors the LEVEL-EX can show you:

- System error: The software of the device detects an error, you can see an error code and a description of the current error on the display.
- Hardware error: The hardware of the transducer LEVEL-EX detects an error, you can see the error with help of the red LED.

You find all known errors, the possible causes and their remedy in the following chapters.

7.1 Hardware errors

Error description	Possible cause	Remedy
no device reaction, no display, red LED off	power supply missing	check power supply
no device reaction, no display, red LED on	power supply too low	
	hardware error	reset; if alarm prevails after reset, contact Kirchgassner company

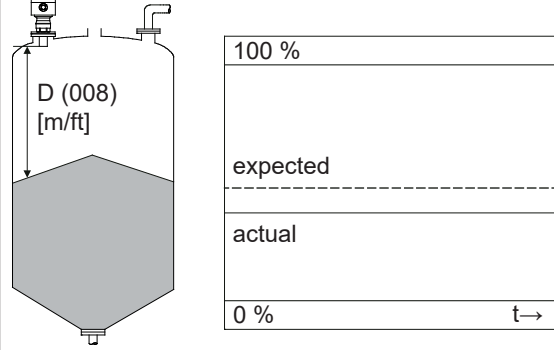
7.2 System errors

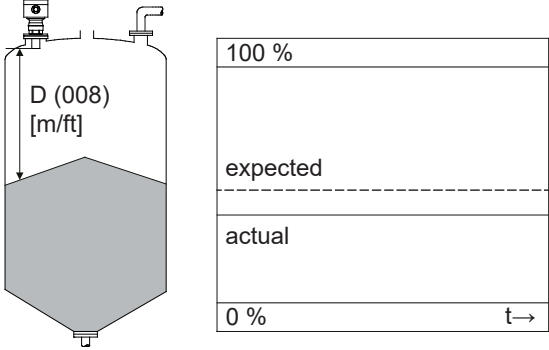
Code	Error description	Remedy
A102 A110 A152 A160	checksum error	reset; if alarm prevails after reset, contact Kirchgassner company
W103	initialising - please wait	
A111 A113 A114 A115 A121 A125 A155 A164 A171	electronics defect	reset; avoid emc problem; if alarm prevails after reset, contact Kirchgassner company
W153	initialising - please wait	wait some seconds; if warning prevails, power off device and power on again
A231	LEVEL-EX-S defect	contact Kirchgassner company for repair
A281	interruption temperature sensor	
A502	transducer not detected	
A512	recording of mapping	alarm disappears after a few seconds

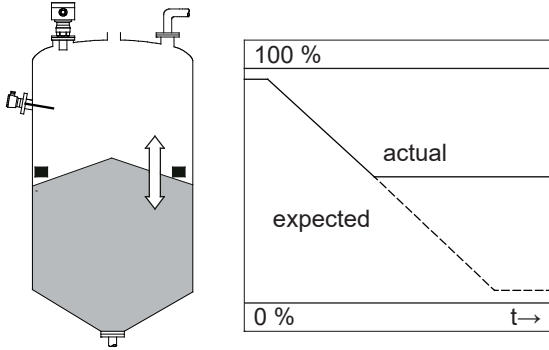
Code	Error description	Remedy
W601	linearization curve not monotone	correct table (enter monotonously increasing table)
W611	less than 2 linearization points	enter additional value pairs
W621	simulation on	switch simulation mode off
E641	no usable echo	check basic calibration and application
E651	level in safety distance	error disappears when the level leaves the safety distance
E661	overtemperature at the transducer	check temperature of the application
A671	linearization incomplete	carry out basic calibration; check linearization
W681	current out of range	
W691	filling noise detected	check application (level ramp is active)

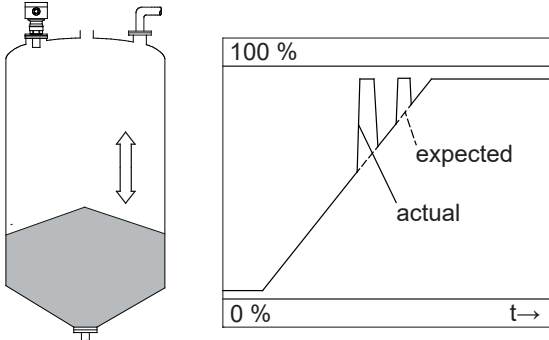
7.3 Application errors

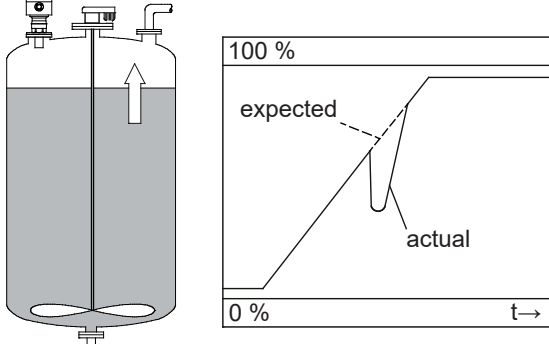
Error:	A warning or alarm has occurred.
Remedy	See table of error messages

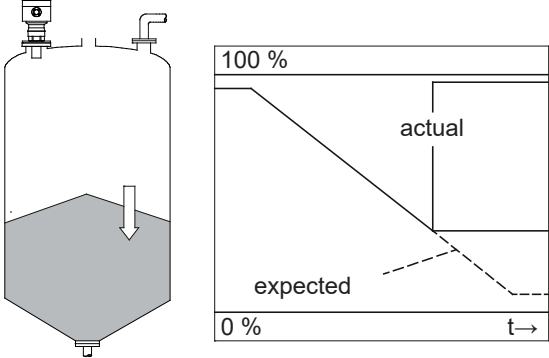
Error:	The distance value (008) is correct, but the measured value (000) is incorrect.
Example:	
Remedy	<ol style="list-style-type: none"> 1. Check "empty calibr." (005) and "full calibr." (006) 2. Check linearization: <ul style="list-style-type: none"> - "level/ullage" (040) - "max. scale" (046) - "diameter vessel" (047) - check linearization table

Error:	The measured value (000) and the distance value (008) are incorrect.
Example:	
Remedy	<ol style="list-style-type: none"> 1. For measurements in bypass or stilling well: Select the according option in the "tank shape" (002) function 2. Carry out interference echo suppression

Error:	There is no change of measured value during filling/emptying.
Example:	
Remedy	<ol style="list-style-type: none"> 1. Carry out interference echo suppression 2. Clean transducer LEVEL-EX-S if necessary 3. If necessary, select better installation position 4. If necessary due to wide interference echoes, set function "detection window" (0A7) to "off"

<p>Error:</p>	<p>With an uneven surface (e.g. filling, emptying, running agitator) the measured value may jump sporadically to higher levels.</p>
<p>Example:</p>	 <p>The diagram shows a tank with a flat bottom and a liquid level. A double-headed arrow indicates the liquid level. The graph shows a linear increase in level over time, with 'actual' showing sporadic spikes above the 'expected' line.</p>
<p>Remedy</p>	<ol style="list-style-type: none"> 1. Carry out interference echo suppression 2. Set the "process cond." (004) to "calm surface" or "add. agitator" 3. Increase "output damping" (058) 4. If necessary, select a different installation position and/or a transducer with higher measuring range

<p>Error:</p>	<p>On filling/emptying the measured value drops.</p>
<p>Example:</p>	 <p>The diagram shows a tank with a dome ceiling and a liquid level. A double-headed arrow indicates the liquid level. The graph shows a linear increase in level over time, with 'actual' showing a dip below the 'expected' line.</p>
<p>Remedy</p>	<ol style="list-style-type: none"> 1. Check "tank shape" (002), e.g. "dome ceiling" or "horizontal cyl." 2. If possible, do not select a central installation position 3. Possibly use stilling well/echo guide pipe

<p>Error:</p>	<p>E641 (loss of echo)</p>
<p>Example:</p>	 <p>The diagram shows a cylindrical tank with a transducer mounted on top. A downward arrow indicates the liquid level. To the right, a graph plots level percentage (0% to 100%) against time (t). A solid line labeled 'actual' shows a linear decrease from 100% to a point where it drops sharply to 0%. A dashed line labeled 'expected' shows a linear decrease from 100% to a point where it levels off at a non-zero percentage before reaching 0%.</p>
<p>Remedy</p>	<ol style="list-style-type: none"> 1. Check application parameters (002), (003) and (004) 2. If necessary, select a different installation position and/or a transducer with higher measuring range 3. Align the transducer LEVEL-EX-S parallel to product surface

8 Dimension sheets

LEVEL-EX-S1A

LEVEL-EX-S1B

LEVEL-EX-S1

Rev.	Change	Date	Drawn	Checked	Name	Version
1.5	Changed length to ~115 and ~250	21.08.20	Leit	Drum	Z2.07.2009	Missze
1.4	Test removed	11.11.14	Kürst	Approval		
1.3	Add LEVEL-EX-S1D	05.04.11	Leit			
1.2	Added hex studs	07.01.10	Leit			
1.1	Original length to 90	21.10.09	Missze			

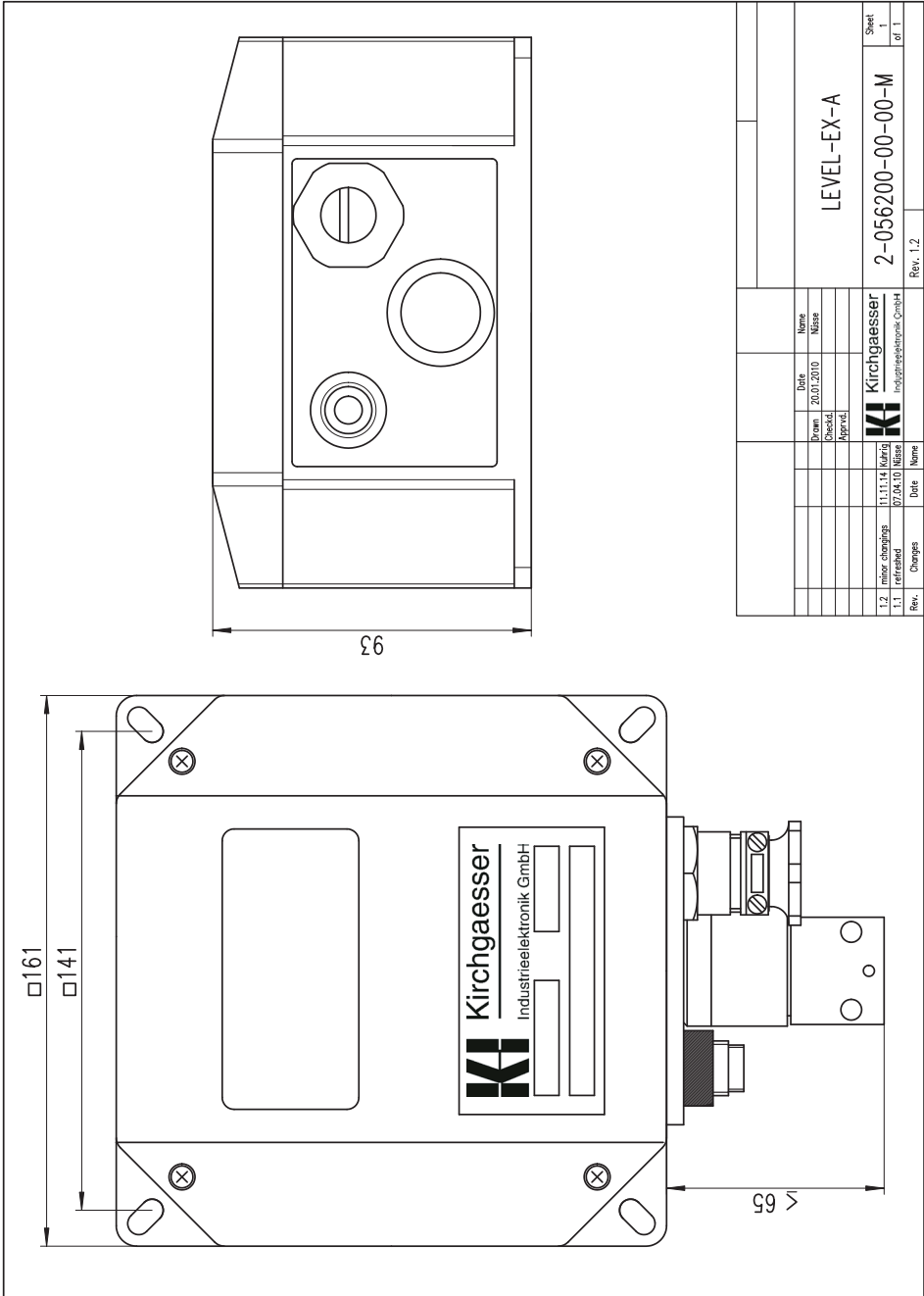
Kirchgaesser
Industriellelektronik GmbH

LEVEL-EX-S1

2-056100-00-00-M

Rev. 1.5

Sheet 1 of 1



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9 Technical data

General specifications	
Device function	Transmitter for level or volume measurement
Measuring principle	Ultrasonic
Explosion protection (according to EN 60079)	Intrinsic safety "i"
Marking (according to 94/9/EC)	I M2 Ex ia I
Mechanical specifications	
Housing	Glasfibre-reinforced polyester, graphite added
Weight	Approx. 2 kg (for each device)
Protection	IP65 (according to EN 60529)
Cable gland	
Cable gland	M25x1.5
Clamping range	8.5 ... 15.0 mm
Tightening torque	2 Nm
Environment	
Ambient temperature	Transducer: -20 ... +70 °C Evaluation and display unit: -20 ... +50 °C
Ambient pressure	0.8 ... 1.1 bar abs.
Process pressure	0.7 ... 3 bar abs.
Power supply	
Power supply	<ul style="list-style-type: none"> • LEVEL-EX-A*1A* and -A**B* with LEVEL-EX-S1A*: U_i = 9.0 ... 13.5 VDC • LEVEL-EX-A**B* with LEVEL-EX-S1B*: U_i = 10.0 ... 13.5 VDC • LEVEL-EX-A**B* with LEVEL-EX-S1D*: U_i = 11.0 ... 13.5 VDC • LEVEL-EX-A*3A*: U_i = 11.0 ... 13.5 VDC
Current consumption	I _N = 60 mA (without current output)
Internal capacity	Negligible
Internal inductance	Negligible
Measuring	
Measuring uncertainty:	± 1 % of the adjusted measuring distance (empty calibration)
Sampling rate	Max. 2 Hz

Frequency output	
Frequency	5 ... 15 Hz
Voltage	Max. 13.5 VDC
Current output	
Current output	4 ... 20 mA
Power supply	$U_{io} = 8.0 \dots 13.5$ VDC
Burden resistor (maximal)	<p>The graph plots the maximal burden resistor R/Ω on the y-axis against the supply voltage U_{io}/V on the x-axis. The y-axis has major ticks at 150, 250, 350, and 450. The x-axis has major ticks at 8, 10, 12, and 13.5. A solid line connects the point (8, 150) to the point (13.5, 450). Dashed lines indicate the coordinates of these two points.</p>
Optocoupler output	
Function	Alarm/limit
Voltage	Max. 13.5 VDC

Subject to change without notice!

10 Appendix

10.1 Settings

Basic settings		
Function	Default	Your setting
tank shape (002)	dome ceiling	
medium prop. (003)	liquid	
process cond.(004)	standard liquid	
empty calibr. (005)	LEVEL-EX-S1A*: 5 m LEVEL-EX-S1B*: 8 m LEVEL-EX-S1D*: 20 m	
full calibr. (006)	LEVEL-EX-S1A*: 4.75 m LEVEL-EX-S1B*: 7.6 m LEVEL-EX-S1D*: 19.5 m	
range of mapping (052)	—	
start mapping (053)	off	
Safety settings		
Function	Default	Your setting
output on alarm (010)	MAX 110% 22mA	
output on alarm (011)	—	
outp. echo loss (012)	hold	
ramp %span/min (013)	—	
delay time (014)	30 s	
safety distance (015)	0.1 m	
in safety dist. (016)	warning	
ackn. alarm (017)	no	
Temperature settings		
Function	Default	Your setting
react. high temp. (033)	warning	
defect temp. sens. (034)	alarm	
temperature unit (0C6)	°F	

Linearization settings		
Function	Default	Your setting
level/ullage (040)	level TE	
linearization (041)	linear	
customer unit (042)	%	
max. scale (046)	100	
diameter vessel (047)	—	
Settings of the extended calibration		
Function	Default	Your setting
cust. tank map (055)	inactive	
offset (057)	0	
output damping (058)	2 s	
detection window (0A7)	off	
Output settings		
Function	Default	Your setting
commun. address (060)	<i>Do not change this value on the LEVEL-EX!</i>	
no. of preambles (061)		
low output limit (062)	on	
curr. output mode (063)	standard	
fixed curr. value (064)	—	
4mA value (068)	—	
20mA value (069)	—	
Display settings		
Function	Default	Your setting
language (092)	English	
back to home (093)	100 s	
format display (094)	decimal	
no. of decimals (095)	X.XX	
sep. character (096)	. (point)	
System settings		
Function	Default	Your setting
tag no. (0C0)	—	
distance unit (0C5)	m	
temperature unit (0C6)	°F	

10.2 Table of linearization

tab.no	1	2	3	4	5	6	7	8
level								
volume								
tab.no	9	10	11	12	13	14	15	16
level								
volume								
tab.no	17	18	19	20	21	22	23	24
level								
volume								
tab.no	25	26	27	28	29	30	31	32
level								
volume								

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