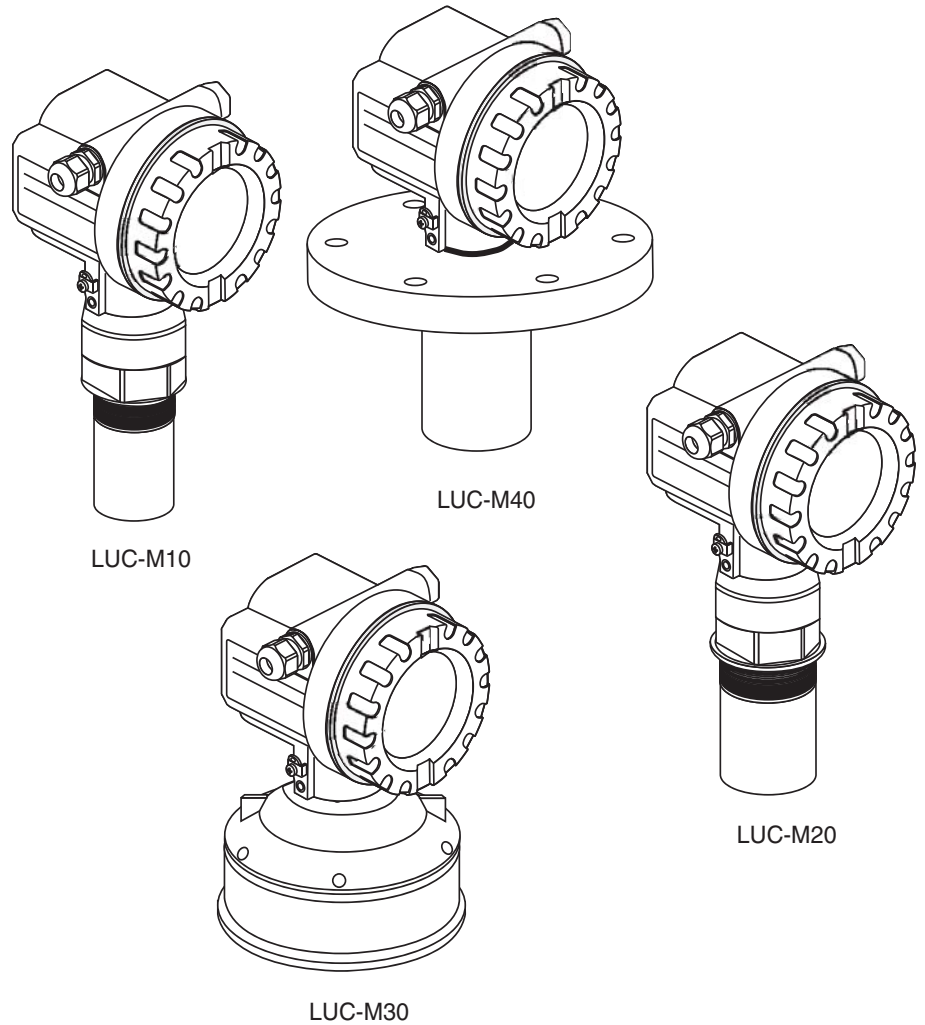


Ultrasonic Level Sensor LUC-M** with PROFIBUS PA

Operating instructions



Valid as of software version
V 01.04.00 (amplifier)
V 01.04.00 (communication)

KA 1830/98/a2/04.05
52027994
185587 04/05 00

LUC-M** - Quick setup

PEPPERL+FUCHS

008 dist./meas. value

Contrast: E + + or E + -

This operating instructions describes the installation and commissioning of the LUC-M** ultrasonic level transmitter. It contains all the functions required for a normal measuring operation.

Also, the LUC-M** provides additional functions for optimising the measuring point and for converting the measured value. These functions are not included in this operating instructions.

You can find an **overview of all the device functions** in the appendix.

You can find a **detailed description of all the device functions** in the operating instructions BA2400 "Description of instrument functions".

Additional information (certificates and data sheets for LUC-M**) is provided on our website www.pepperl-fuchs.com (Search for LUC-M* in the product search).

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1 Safety instructions

1.1 Designated use

The LUC-M** is a compact measuring device for continuous, non-contact level measurement. Depending on the sensor, the measuring range is up to 15 m in fluids and up to 7 m in bulk solids. By using the linearisation function, the LUC-M** can also be used for flow measurements in open channels and measuring weirs.

1.2 Installation, commissioning, operation

The LUC-M** is fail-safe and is constructed to the state-of-the-art. It meets the appropriate standards and EC directives. However, if you use it improperly or other than for its designated use, it may pose application-specific hazards, e. g. product overflow due to incorrect installation or configuration. Installation, electrical connection, start-up, operation and maintenance of the measuring device must therefore be carried out exclusively by trained specialists authorised by the system operator. Technical personnel must have read and understood these operating instructions and must adhere to them. You may only undertake modifications or repair work to the device when it is expressly permitted by the operating instructions.

1.3 Operational safety













Hazardous area

Measuring systems for use in hazardous environments are accompanied by separate "Ex documentation", which is an integral part of this Operating Manual. Strict compliance with the installation instructions and ratings as stated in this supplementary documentation is mandatory.

- Ensure that all personnel are suitably qualified.
- Observe the specifications in the certificate as well as national and local regulations.

1.4 Notes on safety conventions and symbols

In order to highlight safety-relevant or alternative operating procedures in the manual, the following conventions have been used, each indicated by a corresponding symbol in the margin.

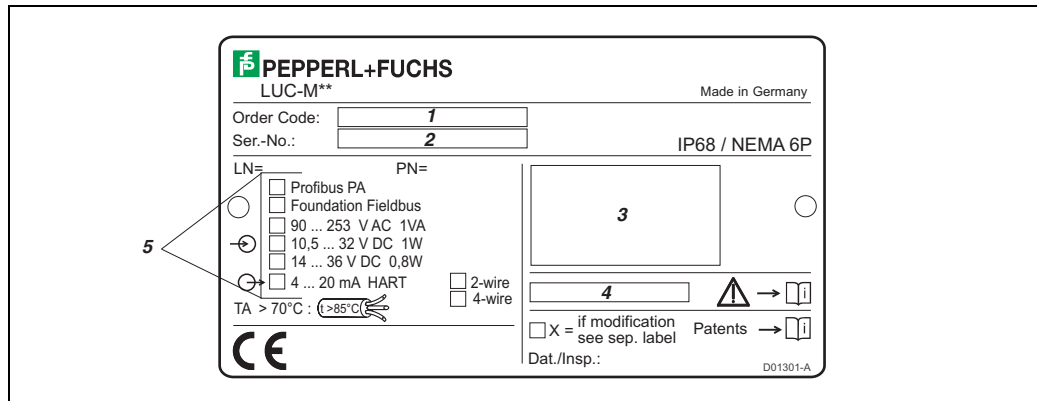
Safety conventions	
	Warning! A warning highlights actions or procedures which, if not performed correctly, will lead to personal injury, a safety hazard or destruction of the instrument.
	Caution! Caution highlights actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the instrument.
	Note! A note highlights actions or procedures which, if not performed correctly, may indirectly affect operation or may lead to an instrument response which is not planned.
Explosion protection	
	Device certified for use in explosion hazardous area If the device has this symbol embossed on its name plate it can be installed in an explosion hazardous area.
	Explosion hazardous area Symbol used in drawings to indicate explosion hazardous areas. Devices located in and wiring entering areas with the designation "explosion hazardous areas" must conform with the stated type of protection.
	Safe area (non-explosion hazardous area) Symbol used in drawings to indicate, if necessary, non-explosion hazardous areas. Devices located in safe areas still require a certificate if their outputs run into explosion hazardous areas.
Electrical symbols	
	Direct voltage A terminal to which or from which a direct current or voltage may be applied or supplied.
	Alternating voltage A terminal to which or from which an alternating (sine-wave) current or voltage may be applied or supplied.
	Grounded terminal A grounded terminal, which as far as the operator is concerned, is already grounded by means of an earth grounding system.
	Protective grounding (earth) terminal A terminal which must be connected to earth ground prior to making any other connection to the equipment.
	Equipotential connection (earth bonding) A connection made to the plant grounding system which may be of type e. g. neutral star or equipotential line according to national or company practice.
	Temperature resistance of the connection cables States, that the connection cables must be resistant to a temperature of at least 85 °C (358 K).

2 Identification

2.1 Device designation

2.1.1 Nameplate






Informations at the LUC-M** nameplate (example)



- 1: Order code
- 2: Serial number
- 3: Designation according to Directive 94/9/EC and designation of the type of protection (only for certified device variants)
- 4: Reference to additional safety-relevant documentation (only for certified device variants)
- 5: Communication variant and supply voltage (the appropriate option is highlighted)

2.1.2 Product structure LUC-M10






LUC-M10- - - - -

- Certificate**
- NA version for non-explosion hazardous areas
 - EX  II 1/2 G EEx ia IIC T6
 - ES  II 1/2 D, aluminium cover
 - E2  II 1/3 D
 - SX  II 1/2 G EEx d (ia) IIC T6
 - S2  II 3G EEx nA II T6
 - F1 FM IS, Cl. I/II/III, Div.1 Group A-G, N.I .Cl. I, Div.2
 - F2 FM XP, Cl. I/II/III, Div. 1, Group A-G
 - CG CSA, General Purpose
 - C1 CSA IS, Cl. I/II/III, Div. 1, Group A-D, G + coal dust, N.I.
 - C2 CSA XP, Cl. I/II/III, Div. 1, Group A-D, G + coal dust, N.I.
- Display**
- A * prepared for remote display, order display as accessory LUC-Z40
 - B without display
 - D with display LUC-Z15 inclusive on-site operation, envelope curve display
- Electrical output**
- AH 4-wire, 90 V AC ... 250 V AC, 4 mA ... 20 mA, HART
 - DH 4-wire, 10.5 V DC ... 32 V DC, 4 mA ... 20 mA, HART
 - PA 2-wire, PROFIBUS PA
 - IH 2-wire, 4 mA ... 20 mA, HART
- Cable entry**
- 2 cable gland M20 x 1.5
 - 3 thread G1/2
 - 4 thread 1/2 NPT
 - 5 connector M12, PROFIBUS PA
- Housing**
- A1 aluminium housing F12, IP68, thread M20 x 1.5
 - A2 aluminium housing T12, IP68, coated, with separate terminal compartment
 - A4 aluminium housing T12, IP68, coated, with separate terminal compartment, overvoltage protection
- Process connection**
- G5 thread G1 1/2 B, ISO 228, PVDF
 - N5 thread 1 1/2 NPT, ANSI, PVDF

* in preparation

2.1.3 Product structure LUC-M20

LUC-M20- - - - -

- Certificate**
- NA version for non-explosion hazardous areas
 - EX  II 1/2 G EEx ia IIC T6
 - ES  II 1/2 D, aluminium cover
 - E2  II 1/3 D
 - SX  II 1/2 G EEx d (ia) IIC T6
 - S2  II 3G EEx nA II T6
 - F1 FM IS, Cl. I/II/III, Div.1 Group A-G, N.I .Cl. I, Div.2
 - F2 FM XP, Cl. I/II/III, Div. 1, Group A-G
 - CG CSA, General Purpose
 - C1 CSA IS, Cl. I/II/III, Div. 1, Group A-D, G + coal dust, N.I.
 - C2 CSA XP, Cl. I/II/III, Div. 1, Group A-D, G + coal dust, N.I.
- Display**
- A * prepared for remote display, order display as accessory LUC-Z40
 - B without display
 - D with display LUC-Z15 inclusive on-site operation, envelope curve display
- Electrical output**
- AH 4-wire, 90 V AC ... 250 V AC, 4 mA ... 20 mA, HART
 - DH 4-wire, 10.5 V DC ... 32 V DC, 4 mA ... 20 mA, HART
 - PA 2-wire, PROFIBUS PA
 - IH 2-wire, 4 mA ... 20 mA, HART
- Cable entry**
- 2 cable gland M20 x 1,5
 - 3 thread G1/2
 - 4 thread 1/2 NPT
 - 5 connector M12, PROFIBUS PA
- Housing**
- A1 aluminium housing F12, IP68, thread M20 x 1.5
 - A2 aluminium housing T12, IP68, coated, with separate terminal compartment
 - A4 aluminium housing T12, IP68, coated, with separate terminal compartment, overvoltage protection
- Process connection**
- G6 thread G2B, ISO 228, PVDF
 - N6 thread 2 NPT, ANSI, PVDF

* in preparation

2.1.4 Product structure LUC-M30

LUC - M30 - - - - -

- Certificate**
 - NA version for non-explosion hazardous areas
 - ES II 1/2 D, aluminium cover
 - E2 II 1/3 D
 - FM FM DIP, Cl. II, Div.1 Group E-G, N.I. Cl. I, Div.2
 - CG CSA, General Purpose
 - CS CSA DIP, Cl. II, Div. 1, Group E-G, N.I. Cl. I, Div.2
- Display**
 - A * prepared for remote display, order display as accessory LUC-Z40
 - B without display
 - D with display LUC-Z15 inclusive on-site operation, envelope curve display
- Electrical output**
 - AH 4-wire, 90 V AC ... 250 V AC, 4 mA ... 20 mA, HART
 - DH 4-wire, 10.5 V DC ... 32 V DC, 4 mA ... 20 mA, HART
 - PA 2-wire, PROFIBUS PA
- Cable entry**
 - 2 cable gland M20 x 1,5
 - 3 thread G1/2
 - 4 thread 1/2 NPT
 - 5 connector M12, PROFIBUS PA
- Housing**
 - A1 aluminium housing F12, IP68, thread M20 x 1.5
- Process connection**
 - FA universal flange DN100/ANSI 4"/JIS16K100, PP
 - FS universal flange DN100/ANSI 4"/JIS16K100, 316Ti
 - FK without slip-on flange, without mounting bracket, customer mounting equipment
 - FM with mounting bracket LUC-Z17

* in preparation

2.1.5 Product structure LUC-M40

LUC - M40 - - - - -

- Certificate**
 - NA version for non-explosion hazardous areas
 - EX II 1/2 G EEx ia IIC T6
 - SX II 1/2 G EEx d (ia) IIC T6
 - S2 II 3G EEx nA II T6
 - F1 FM IS, Cl. I/II/III, Div.1 Group A-G, N.I. Cl. I, Div.2
 - F2 FM XP, Cl. I/II/III, Div. 1, Group A-G
 - CG CSA, General Purpose
 - C1 CSA IS, Cl. I/II/III, Div. 1, Group A-D, G + coal dust, N.I.
 - C2 CSA XP, Cl. I/II/III, Div. 1, Group A-D, G + coal dust, N.I.
- Additional option**
 - A basic version
- Sealing sensor/flange**
 - 2 Viton
 - 3 EPDM
- Display**
 - A * prepared for remote display, order display as accessory LUC-Z40
 - B without display
 - D with display LUC-Z15 inclusive on-site operation, envelope curve display
- Electrical output**
 - AH 4-wire, 90 V AC ... 250 V AC, 4 mA ... 20 mA, HART
 - DH 4-wire, 10.5 V DC ... 32 V DC, 4 mA ... 20 mA, HART
 - PA 2-wire, PROFIBUS PA
 - IH 2-wire, 4 mA ... 20 mA, HART
- Cable entry**
 - 2 cable gland M20 x 1.5
 - 3 thread G1/2
 - 4 thread 1/2 NPT
 - 5 connector M12, PROFIBUS PA
- Housing**
 - A1 aluminium housing F12, IP68, thread M20 x 1.5
 - A2 aluminium housing T12, IP68, coated, with separate terminal compartment
 - A4 aluminium housing T12, IP68, coated, with separate terminal compartment, overvoltage protection
- Process connection; max. 3 bar abs/44 psia, hole circle PN16/150 lbs/10K**
 - P universal flange DN80/ANSI 3"/JIS10K80, PP
 - Q universal flange DN80/ANSI 3"/JIS10K80, PVDF
 - S universal flange DN80/ANSI 3"/JIS10K80, 316L
 - T universal flange DN100/ANSI 4"/JIS16K100, PP
 - U universal flange DN100/ANSI 4"/JIS16K100, PVDF
 - V universal flange DN100/ANSI 4"/JIS16K100, 316L
 - M mounting bracket LUC-Z17

* in preparation

2.2 Scope of delivery

2.2.1 Instrument and accessories

- Instrument according to the version ordered
- for LUC-M10/20 in the versions LUC-M10-G5**** and LUC-M20-G6****:
counter nut (PA)
- for LUC-M10/20: sealing ring (EPDM)
- for gland M20 x 1.5:
 - 1 cable gland for 2-wire instruments
 - 2 cable glands for 4-wire instrumentsThe cable glands are mounted on delivery.

2.2.2 Supplied documentation

Short instructions (KA1830, in the instrument)

intended as a memory jogger for users who are familiar with the operating concept of Pepperl+Fuchs time-of-flight instruments.

Operating instructions (BA2380, this booklet)

This describes the installation and commissioning of the LUC-M**. The operating menu includes all the functions which are required for standard measurement tasks. Any additional functions are **not** included.

Description of instrument functions (BA2400)

contains a detailed description of all the functions of the LUC-M**.

Safety instructions

Additional safety instructions (SI, ZE, ZD) are supplied with certified device versions. Refer to the nameplate for the names of the safety instructions that apply to your device variant.

Note!



Additional information (certificates and data sheets for LUC-M**) is provided on our website www.pepperl-fuchs.com (Search for LUC-M* in the product search). The software tool **PACTware**TM and the appropriate DTM is provided on our website www.pepperl-fuchs.com (Search for Pactware in the product search).

2.3 Certificates and approvals

CE mark, declaration of conformity

The device is designed to meet state-of-the-art safety requirements, has been tested and left the factory in a condition in which it is safe to operate. The device complies with the applicable standards and regulations as listed in the EC declaration of conformity and thus complies with the statutory requirements of the EC directives. Pepperl+Fuchs confirms the successful testing of the instrument by affixing to it the CE mark.

2.4 Registered trademarks

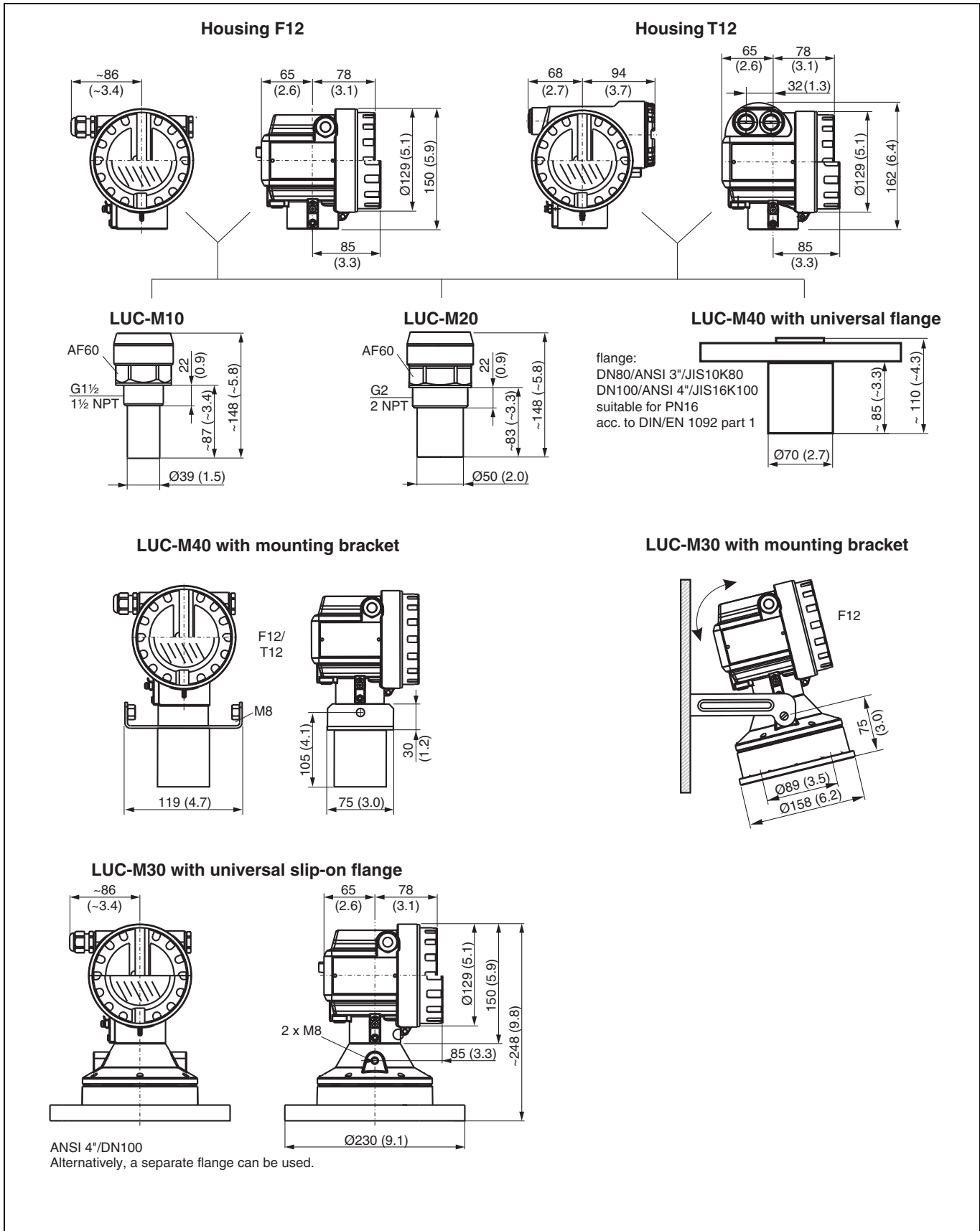
PROFIBUS®

Registered trademark of the PROFIBUS Trade Organisation, Karlsruhe, Germany

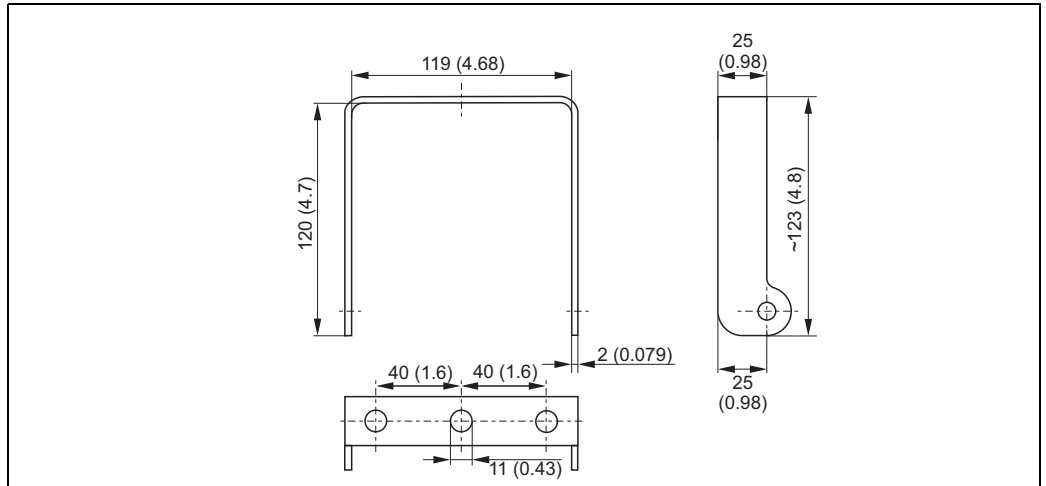
3 Installation

3.1 Dimensions

3.1.1 Level sensors

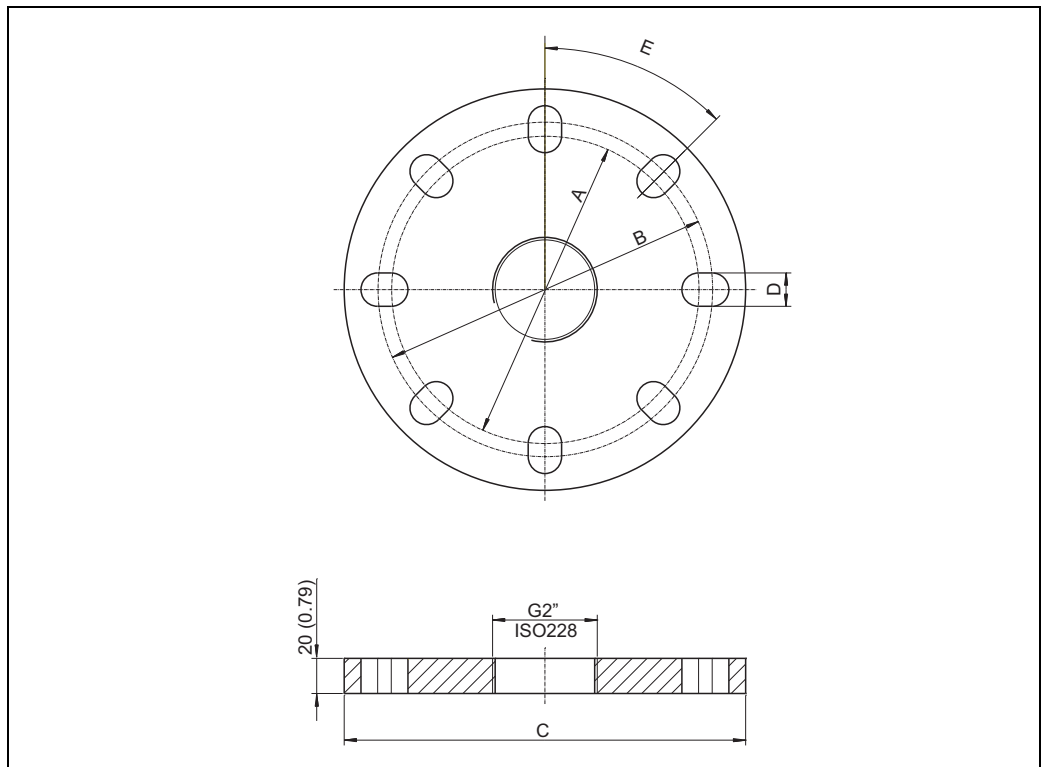


3.1.2 Mounting bracket for LUC-M30 and LUC-M40



Dimensions in mm (inch)

3.1.3 Universal flanges for LUC-M40

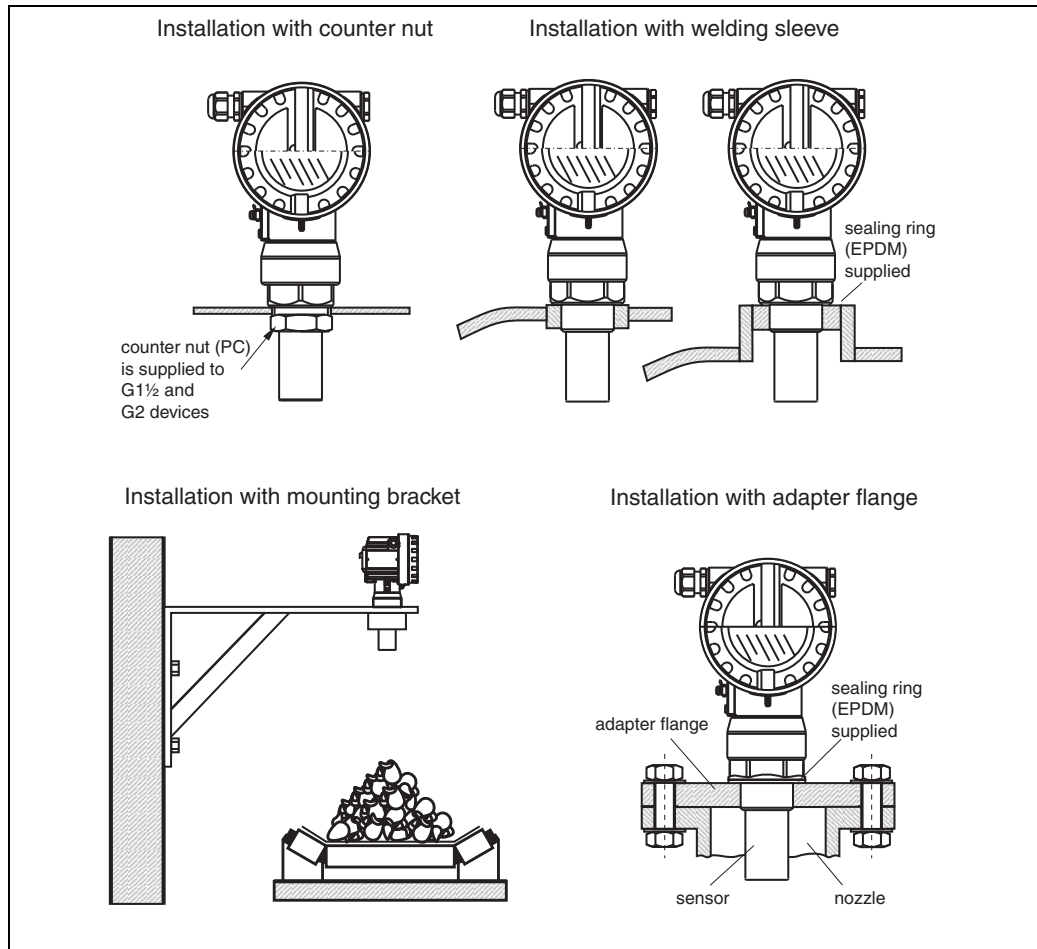


Dimensions in mm (inch)

suitable for	A	B	C	D	E	Number of boreholes
3" 150 lbs/DN80 PN16/10K 80	150 mm (5.91")	160 mm (6.30")	200 mm (7.87")	19 mm (0.75")	45°	8
4" 150 lbs/DN100 PN16/10K 100	175 mm (6.90")	190.5 mm (7.50")	228.6 mm (9.00")	19 mm (0.75")	45°	8
6" 150 lbs/DN150 PN16/10 K 150	240 mm (9.45")	241.3 mm (9.50")	285 mm (11.22")	23 mm (0.91")	45°	8
8" 150 lbs	298.5 mm (11.75")	298.5 mm (11.75")	342.9 mm (13.50")	22.5 mm (0.89")	45°	8
DN200 PN16/10 K 200	290 mm (11.42")	295 mm (11.61")	340 mm (13.39")	23 mm (0.91")	30°	12

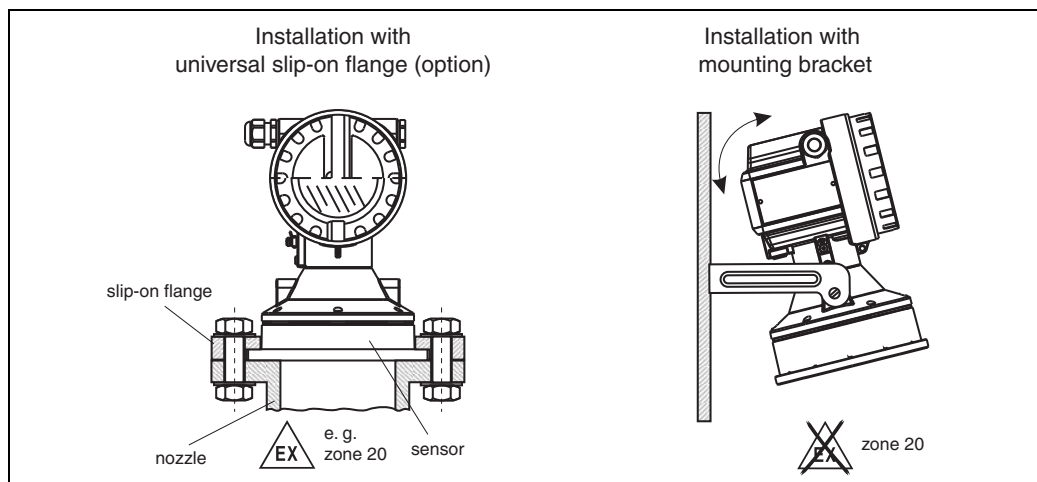
3.2 Installation variants

3.2.1 Installation variants LUC-M10, LUC-M20

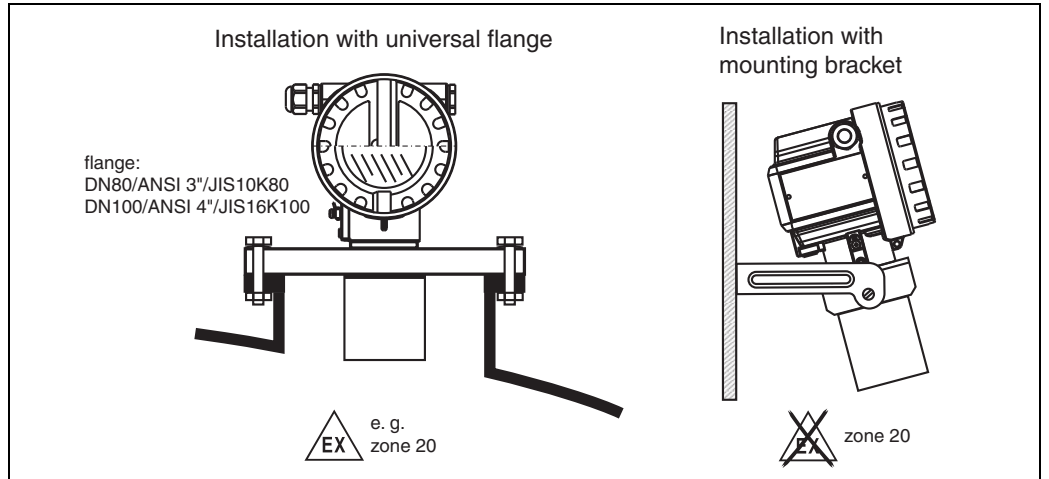


For mounting bracket or adapter flange see section "Accessories"

3.2.2 Installation variants LUC-M30

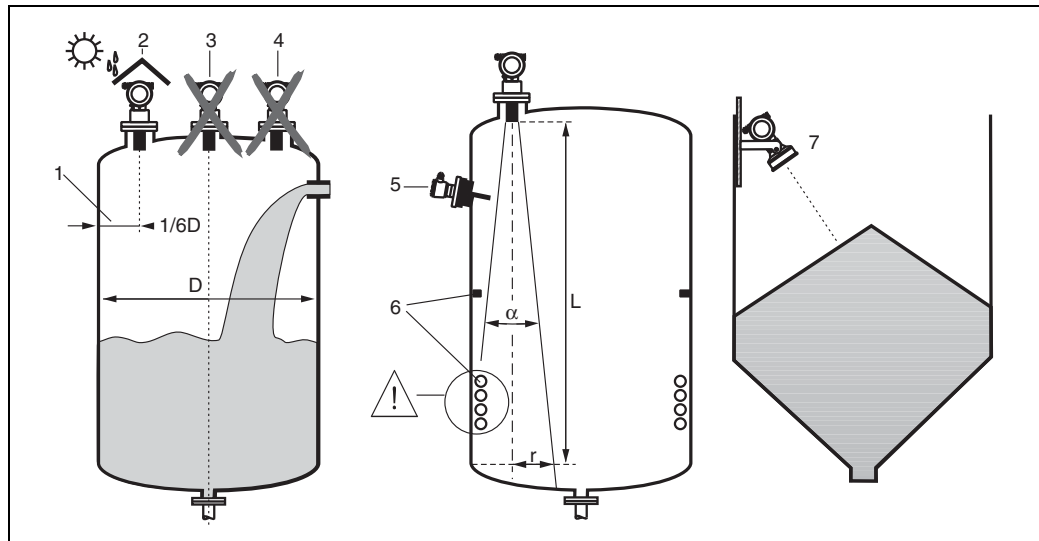


3.2.3 Installation variants LUC-M40



3.3 Installation conditions

3.3.1 Installation conditions for level measurements



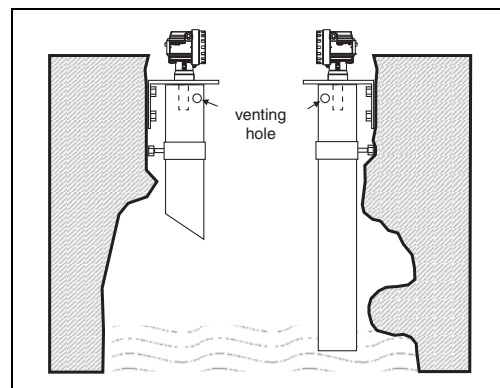
- Do not install the sensor in the middle of the tank (3). We recommend leaving a distance between the sensor and the tank wall (1) measuring 1/6 of the tank diameter.
- Use a protective cover, in order to protect the device from direct sun or rain (2).
- Avoid measurements through the filling curtain (4).
- Make sure that equipment (5) such as limit switches, temperature sensors, etc. are not located within the emitting angle α . In particular, symmetrical equipment (6) such as heating coils, baffles etc. can influence measurement.
- Align the sensor so that it is vertical to the product surface (7).
- Never install two ultrasonic measuring devices in a tank, as the two signals may affect each other.
- To estimate the transmitted echo beam and its detection range, use the 3 dB emitting angle α :

Sensor	α	L_{\max}	r_{\max}
LUC-M10	11°	5 m	0.48 m
LUC-M20	11°	8 m	0.77 m
LUC-M30	6°	15 m	0.79 m
LUC-M40	9°	10 m	0.79 m

3.3.2 Installation in narrow shafts

In narrow shafts with strong interference echoes, we recommend using an ultrasound guide pipe (e. g. PE or PVC wastewater pipe) with a minimum diameter of 100 mm.

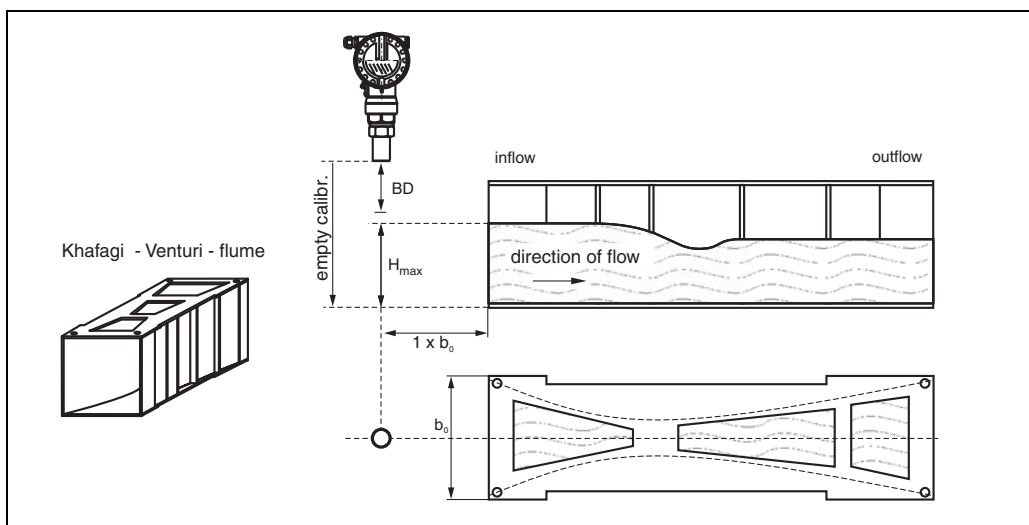
Make sure that the pipe is not soiled by accumulated dirt. If necessary, clean the pipe at regular intervals.



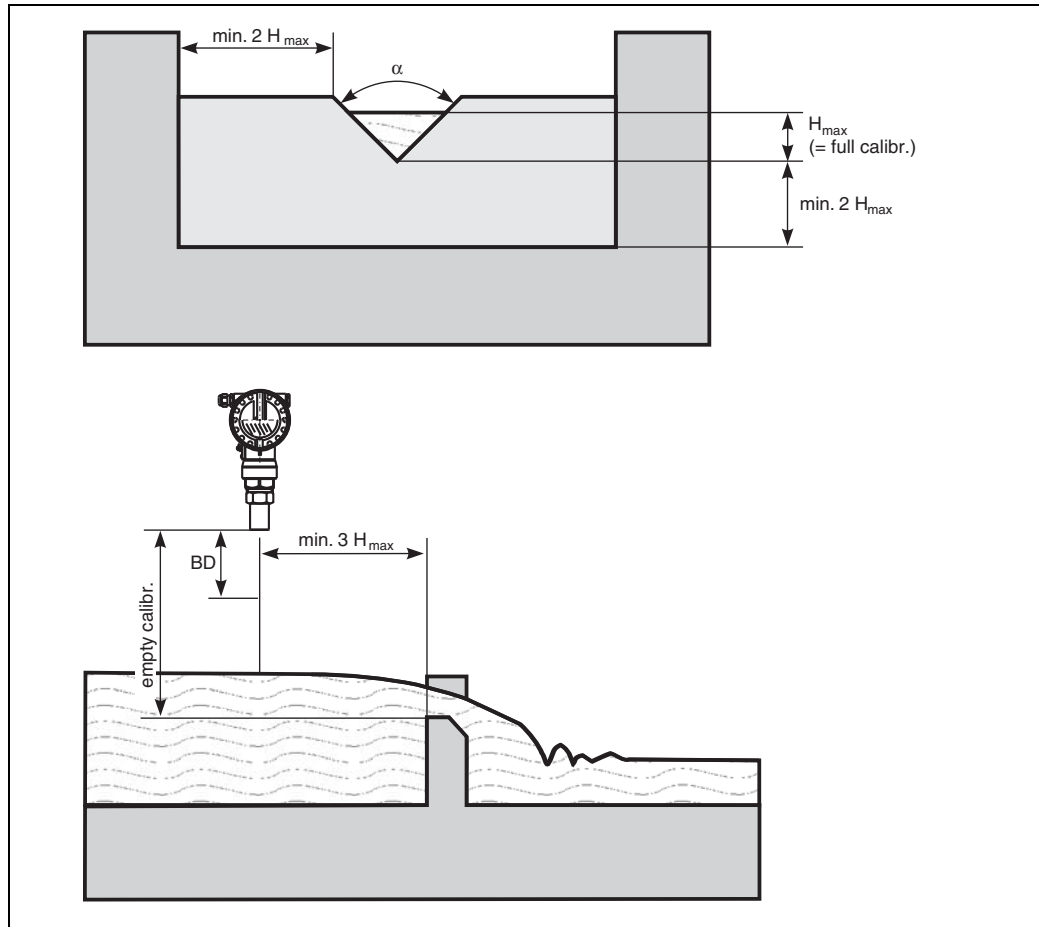
3.3.3 Installation conditions for flow measurements

- Install the LUC-M** at the inflow side, as close above the maximum water level H_{max} as possible, plus the blocking distance BD.
- Position the LUC-M** in the middle of the channel or weir.
- Align the sensor membrane parallel to the water surface.
- Keep to the installation distance of the channel or weir.
- You can enter the "flow to level" linearisation curve ("Q/h curve") using via the on-site display.

Example: Khafagi-Venturi flume



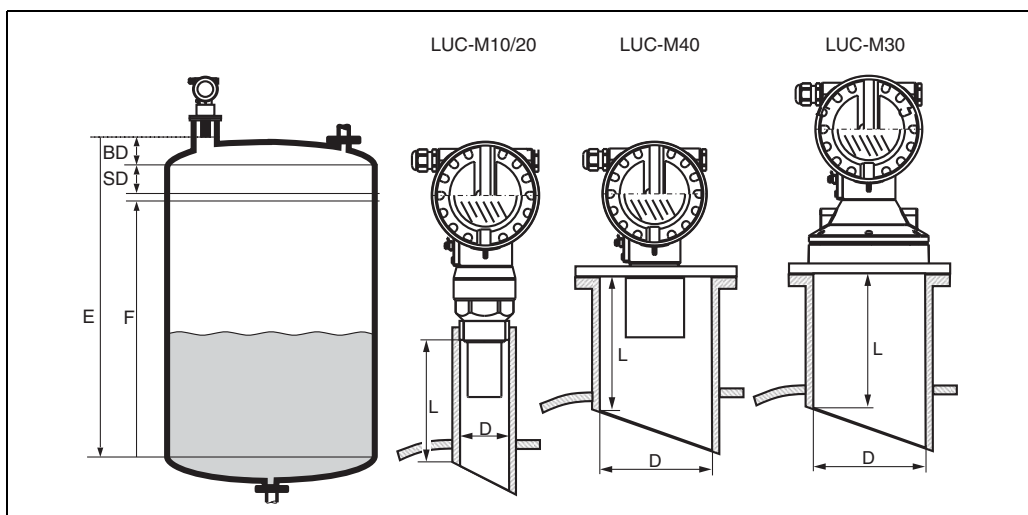
Example: Triangular weir



3.4 Measuring range

3.4.1 Blocking distance, nozzle mounting

Install the LUC-M** at a height so that the blocking distance BD is not undershot, even at maximum fill level. Use a pipe nozzle if you cannot maintain the blocking distance in any other way. The interior of the nozzle must be smooth and may not contain any edges or welded joints. In particular, there should be no burr on the inside of the tank side nozzle end. Note the specified limits for nozzle diameter and length. To minimise disturbing factors, we recommend an angled socket edge (ideally 45°).



BD: blocking distance; **SD:** safety distance; **E:** empty calibration; **F:** full calibration (span); **D:** nozzle diameter; **L:** nozzle length

Nozzle diameter D	Maximum nozzle length L			
	LUC-M10	LUC-M20	LUC-M30	LUC-M40
DN50/2"	80 mm			
DN80/3"	240 mm	240 mm		250 mm
DN100/4"	300 mm	300 mm	300 mm	300 mm
DN150/6"	400 mm	400 mm	300 mm	400 mm
DN200/8"	400 mm	400 mm	300 mm	400 mm
DN250/10"	400 mm	400 mm	300 mm	400 mm
DN300/12"	400 mm	400 mm	300 mm	400 mm
Emitting angle α	11°	11°	6°	9°
Blocking distance	0.25 m	0.35 m	0.6 m	0.4 m
Max. range in liquids	5 m	8 m	15 m	10 m
Max. range in solids	2 m	3,5 m	7 m	5 m



Caution!

If the blocking distance is undershot, it may cause device malfunction.

3.4.2 Safety distance

If the level rises to the safety distance SD, the device switches to warning or alarm status.

The size of SD can be set freely in the "**Safety distance**" (015) function. The "**in safety distance**" (016) function defines how the device reacts if the level enters the safety distance.

There are three options:

- **Warning:** The device outputs an error message but continues measurement.
- **Alarm:** The device outputs an error message. The output signal assumes the value defined in the "**Output on alarm**" (011) function (MAX, MIN, user-specific value or holds the last value). As soon as the level drops below the safety distance, the device recommences measurement.
- **Self holding:** The device reacts in the same way as for an alarm. However, the alarm condition continues after the level drops below the safety distance. The device only recommences measurement when you cancel the alarm using the "**Ackn. alarm**" (017) function.

3.4.3 Range

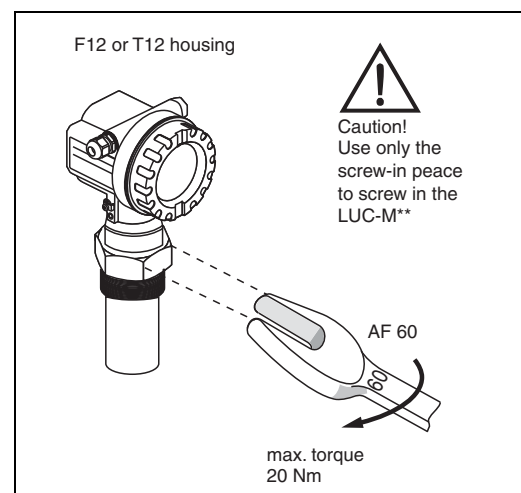
The sensor range is dependent on the measuring conditions. Refer to Technical Information TI 365O/98/en for an estimation. The maximum range is shown in the above diagram (valid for good conditions).

Sensor	Maximum range
LUC-M10	5 m
LUC-M20	8 m
LUC-M30	15 m
LUC-M40	10 m

3.5 Installation hint for LUC-M10/20

Screw the LUC-M** at the screw-in piece using an AF60 spanner.

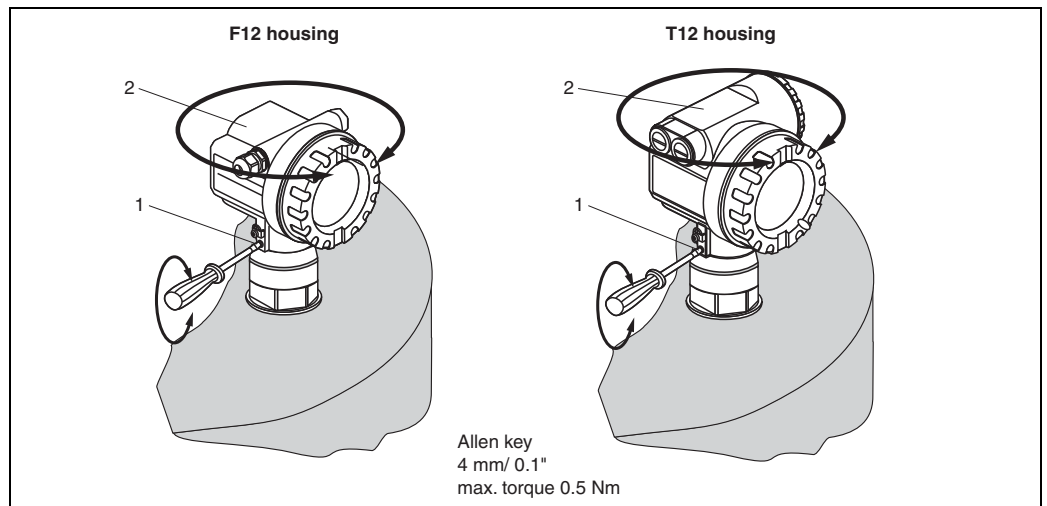
Maximum torque: 20 Nm.



3.6 Turn housing

After mounting, the housing can be turned 350° in order to simplify access to the display and the terminal compartment. Proceed as follows to turn the housing to the required position:

- undo the fixing screws (1)
- turn the housing (2) in the required direction
- tighten up the fixing screws (1). Maximum torque 0.5 Nm
- Loctite can be used for securing the screw.



3.7 Installation check

After installing the device, carry out the following checks:

- Is the device damaged (visual inspection)?
- Does the device correspond to the measuring point specifications for process temperature, process pressure, ambient temperature, measuring range etc.
- If available: Are the measuring point number and labelling correct (visual inspection)?
- Is the measuring device sufficiently protected against precipitation and direct sunlight?
- Are the cable glands tightened correctly?
- After aligning the housing, check the process seal at the nozzle or flange.

4 Wiring

4.1 Electrical connection



Caution!

Before connection please note the following:

- The voltage is determined by the PROFIBUS standard and the desired safety concept.(e. g. FISCO).
- Connect equipotential bonding to transmitter ground terminal before connecting up the instrument (s. section "Recommended connection").



Warning!

When you use the measuring system in hazardous areas, make sure to comply with national standards and the specifications in the safety instructions (SI). Make sure you use the specified cable gland.

4.1.1 Wiring in the housing F12

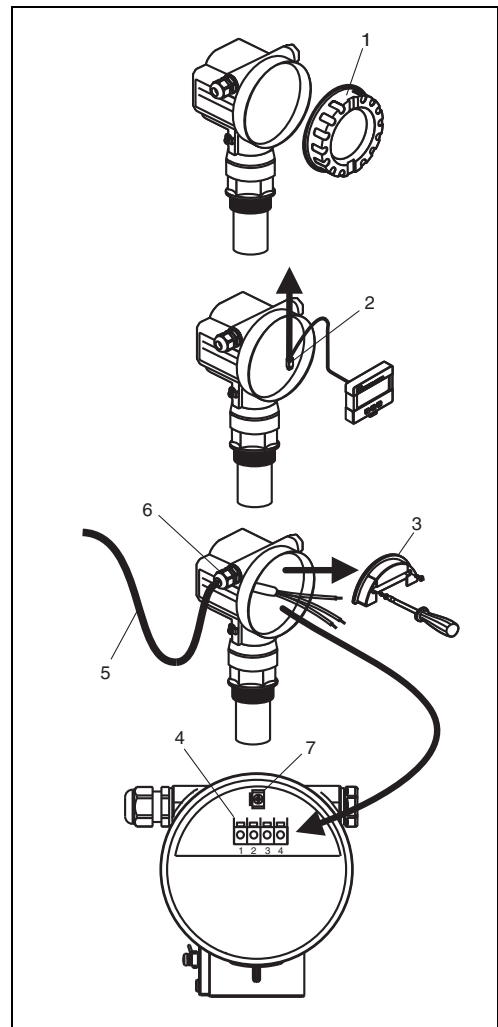
1. Unscrew housing cover (1).
2. Remove display (2) if fitted.
3. Remove cover plate (3) from terminal compartment.
4. Pull out terminal module (4) slightly using pulling loop.
5. Insert cable (5) through gland (6).



Caution!

If possible, insert the cable from above and let a draining loop in order to avoid intrusion of humidity.

6. Connect cable screen to the grounding terminal (7) within the terminal compartment.
7. Make connection according to terminal assignment (see below).
8. Re-insert terminal module (4).
9. Tighten cable gland (6).
10. Tighten screws on cover plate (3).
11. Insert display (2) if fitted.
12. Screw on housing cover (1).
13. Switch on power supply.



4.1.2 Wiring in the housing T12

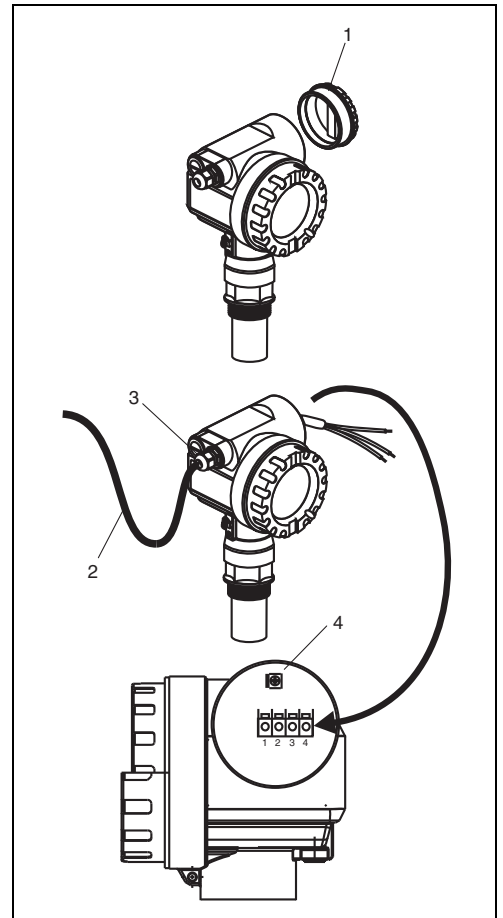
1. Unscrew the cover (1) of the separate connection room.
2. Insert cable (2) through gland (3).



Caution!

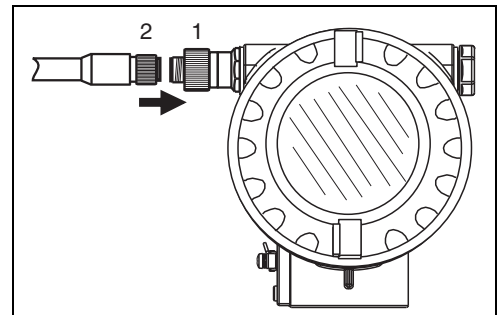
If possible, insert the cable from above and let a draining loop in order to avoid intrusion of humidity.

3. Connect cable screen to the grounding terminal (4) within the connection room.
4. Make connection according to the terminal assignment (see below).
5. Tighten cable gland (3).
6. Screw on housing cover (1).
7. Switch on power supply.



4.1.3 Wiring with M12 plug

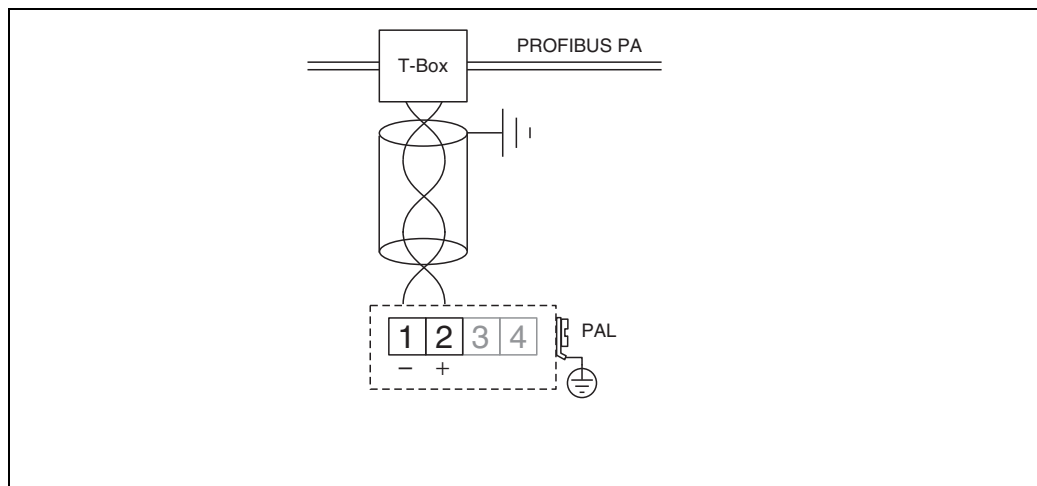
1. Insert plug (1) into bushing (2).
2. Screw firmly.
3. Ground instrument according to the desired safety concept.



Pin assignment of the M12 plug connector (PROFIBUS PA plug)

	Pin	Meaning
	1	Ground
	2	PA +
	3	PA -
	4	not connected

4.2 Terminal assignment



4.3 Cable specifications PROFIBUS

Twisted, screened pairs must be used. The following specification must be met for explosion hazardous application (EN 50020, FISCO model):

- Loop-resistance (DC): 15 Ω /km ... 150 Ω /km,
- Specific inductance: 0.4 mH/km ... 1 mH/km,
- Specific capacitance: 80 nF/km ... 200 nF/km

The following cable types can be used, for example

Non-Ex-area:

- Siemens 6XV1 830-5BH10 (grey),
- Kerpen CEL-PE/OSCR/PVC/FRLA FB-02YS(ST)YFL (grey)
- Belden 3076F (orange)

Ex-area:

- Siemens 6XV1 830-5AH10 (blue),
- Kerpen CEL-PE/OSCR/PVC/FRLA FB-02YS(ST)YFL (blue)
- Belden 3076F

4.4 Supply voltage

The following values are the voltages across the terminals directly at the instrument:

Type	minimum terminal voltage	maximum terminal voltage
standard	9 V	32 V
EEx ia (FISCO model)	9 V	17.5 V
EEx ia (Entity concept)	9 V	24 V

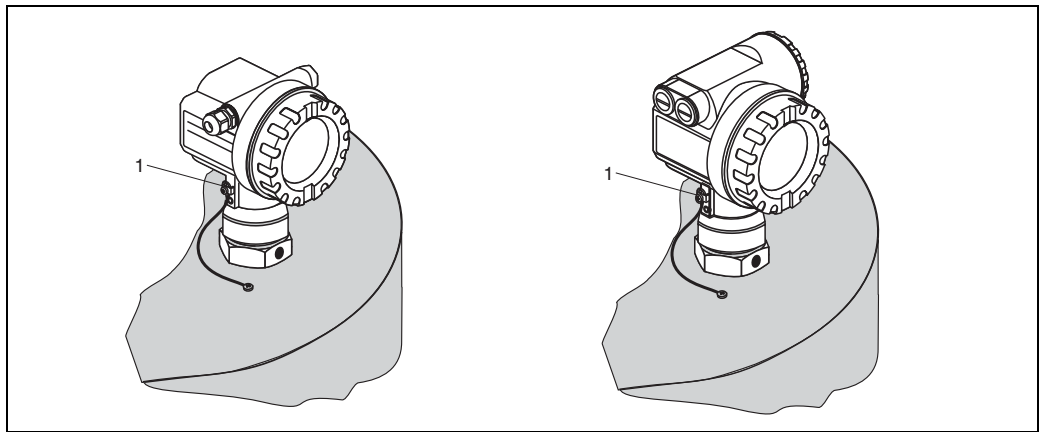
The current consumption is approx. 13 mA for the range of voltages given above.



Caution!

When using the public powers supply, install an easy accessible power switch in the proximity of the instrument. Mark the power switch as a disconnecter for the instrument (IEC/EN 61010).

4.5 Recommended connection



1: external ground terminal of the transmitter

For maximum EMC protection please observe the following points:

- As the metal housing of the LUC-M** is isolated from the tank by the plastic sensor, a low-impedance connection between the housing and tank/bracket/flange should be installed in order to ensure electromagnetic compatibility (EMC). For optimum EMC the connection should be as short as possible. Ideally, a ground strap should be used.
- The external ground terminal on the transmitter must be connected to ground.
- The continuity of the cable screening between tapping points must be ensured.
- If potential equalisation is present between the individual grounding points, ground the screening at each cable end or connect it to the device housing (as short as possible).
- If there are large differences in potential between grounding points, the grounding should run via a capacitor that is suitable for high frequency use (e. g. ceramic 10 nF/250 V~).



Caution!

Applications, which are subject to the explosion prevention, permit only under special conditions the repeated grounding of the protective screen, see to EN 60079-14.



Note!

Further recommendations concerning the structure and equipotential bonding of the network can be found in the PROFIBUS PA specifications EN 50170 (DIN 19245).

4.6 Checking the connection

After wiring the device, carry out the following checks:

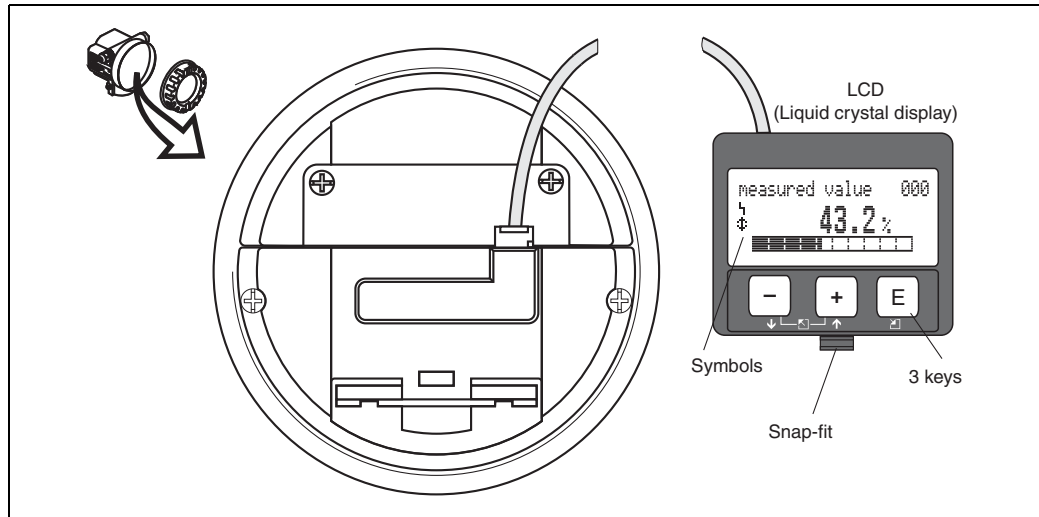
- Are the terminals correctly assigned?
- Is the cable gland tight?
- Is the M12 connector screwed tight?
- Is the housing cover fully screwed on?
- If power supply available: Does a display appear on the display module?

5 Operation

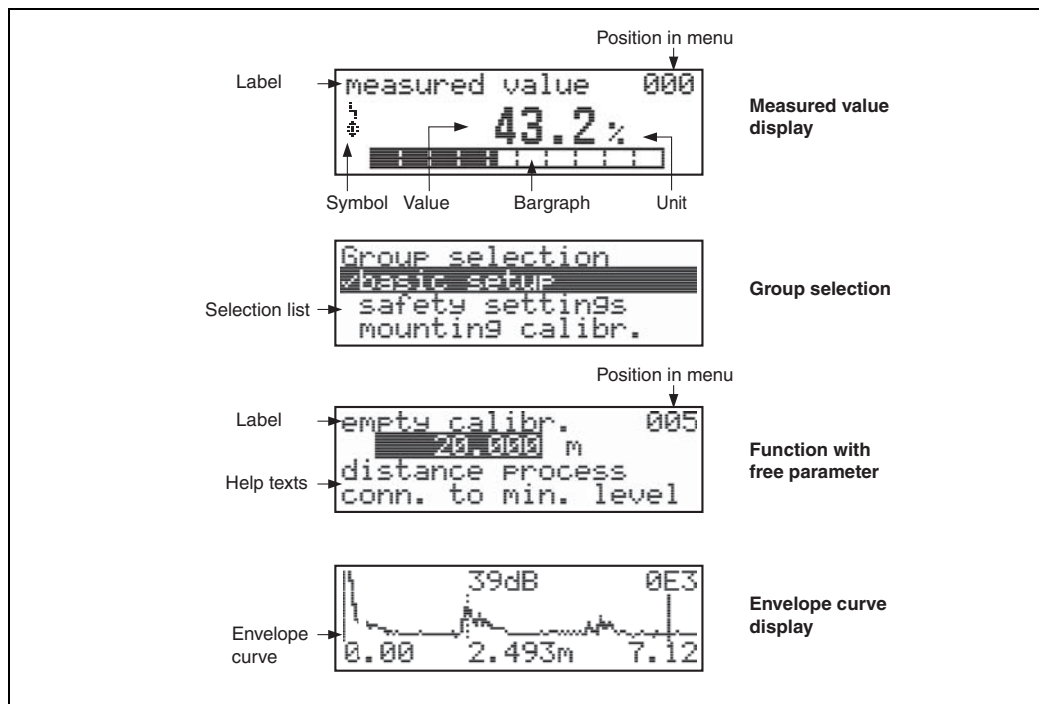
5.1 Display and operating elements

5.1.1 On-site display LUC-Z15

The LCD module LUC-Z15 for display and operation is located beneath the housing cover. The measured value is legible through the glass in the cover. Open the cover to operate the device.



5.1.2 Display appearance






In the measured value display, the bargraph corresponds to the output.















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

5.1.3 Display symbols

The following table describes the symbols that appear on the liquid crystal display:

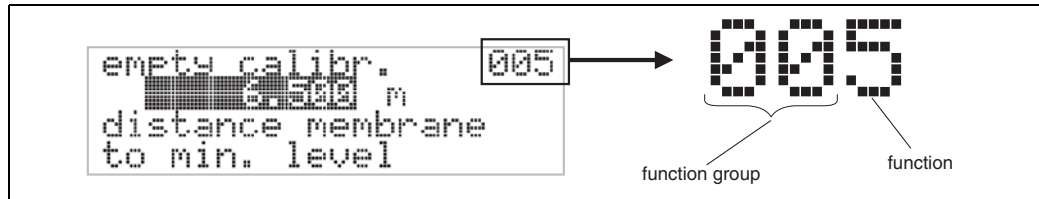
Symbol	Meaning
	ALARM_SYMBOL This alarm symbol appears when the instrument is in an alarm state. If the symbol flashes, this indicates a warning.
	LOCK_SYMBOL This lock symbol appears when the instrument is locked, i. e. if no input is possible.
	COM_SYMBOL This communication symbol appears when a data transmission via e. g. HART or PROFIBUS PA is in progress.

5.1.4 Function of the keys

Key(s)	Meaning
 or 	Navigate upwards in the selection list Edit numeric value within a function
 or 	Navigate downwards in the selection list Edit numeric value within a function
 or 	Navigate to the left within a function group
	Navigate to the right within a function group, confirmation
 and  or  and 	Contrast settings of the LCD
 and  and 	Hardware lock/unlock After a hardware lock, an operation of the instrument via display or communication is not possible! The hardware can only be unlocked via the display. An unlock parameter must be entered to do so.

5.2 Function codes

For easy orientation within the function menus, for each function a position is shown on the display.



The first two digits identify the function group:

- **basic setup** **00**
- **safety settings** **01**
- **linearisation** **04**
- ...

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

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

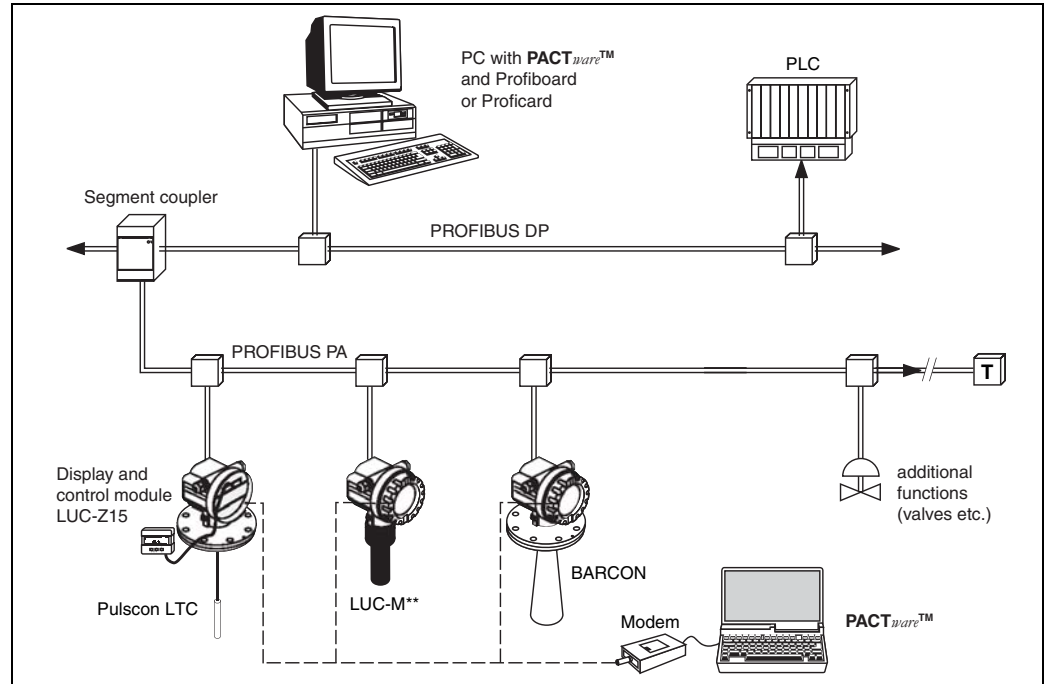
Hereafter the position is always given in brackets (e. g. "**tank shape**" (**002**)) after the described function.

5.3 PROFIBUS PA interface

5.3.1 System integration using PROFIBUS PA

A maximum of 32 transmitters (8 if mounted in an explosion hazardous location EEx ia IIC according to FISCO model) can be connected to the bus. The segment coupler provides the operating voltage to the bus. Both on-site as well as remote operation are possible.

For detailed information on the PROFIBUS PA standard refer to the standards EN 50170/DIN 19245 (PROFIBUS PA) and EN 50020 (FISCO model).



5.3.2 Device address

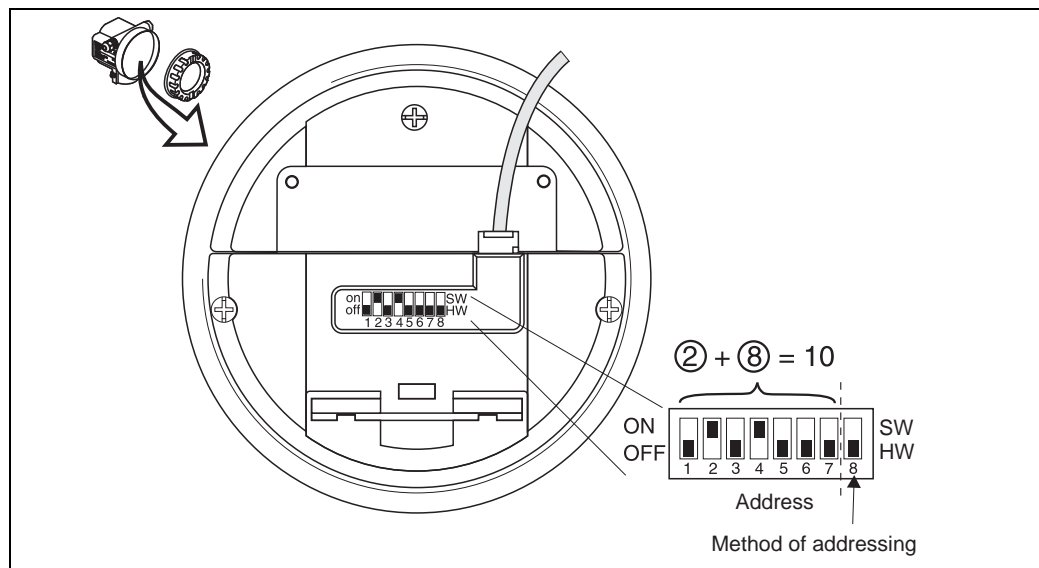
Selecting the device address

- Every PROFIBUS PA device must be given an address. If the address is not set correctly, the device will not be recognised by the process control system.
- A device address may appear only once within a particular PROFIBUS PA network.
- Valid device addresses are in the range 1 and 126. All devices are delivered from the factory with the software address 126.
- The default address can be used to check the function of the device and connect it to an operating PROFIBUS PA system. Afterwards the address must be changed to allow other devices to be connected to the network.

Software addressing

Software addressing comes into operation, when DIP switch 8 is in the position SW "ON" (factory setting).

Hardware addressing



Hardware addressing comes into operation, when DIP switch 8 is in the position "HW (OFF)". In this case the address is determined by the position of DIP-switches 1 to 7 according to the following table:

Switch No.	1	2	3	4	5	6	7
Value in position "OFF"	0	0	0	0	0	0	0
Value in Position "ON"	1	2	4	8	16	32	64

The new address becomes valid 10 seconds after switching. It results a new device restart.

5.3.3 Device database and type files (GSD)

A device database file (x.gsd) contains a description of the properties of the PROFIBUS PA device, e. g. the supported transmission rates and the type and format of the digital information output to the PLC.

Additional bitmap files are required in order to represent the device by an icon in the network design software.

Every device is allocated an identity code by the PROFIBUS User Organisation (PNO). This appears in the device data base file name (x.gsd).

Source of supply

- via Internet:
 - www.pepperl-fuchs.com (Downloads)
 - www.PROFIBUS.com (GSD library)
- or directly from Pepperl+Fuchs, Mannheim

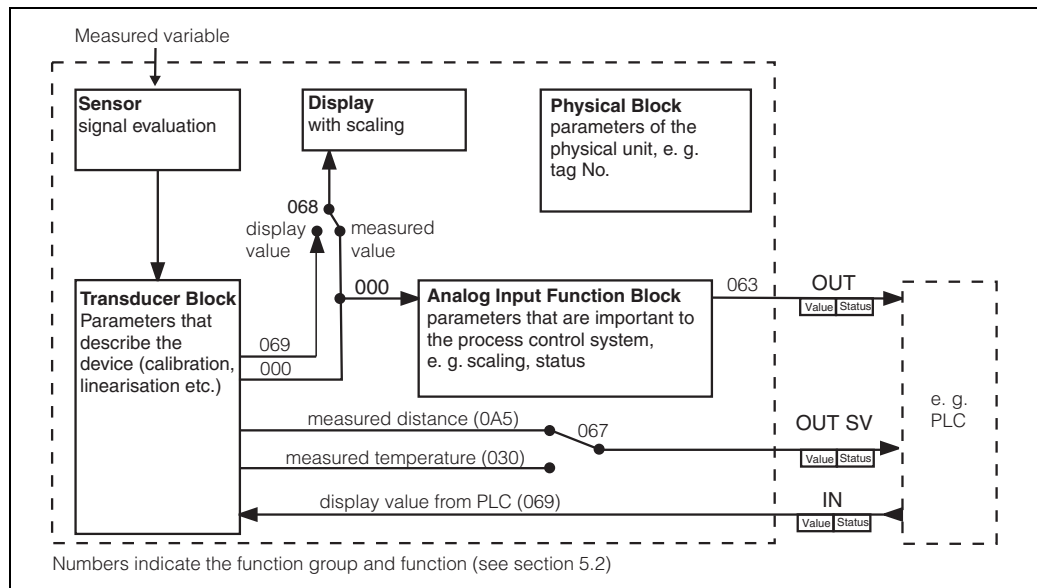
Universal Database File

As an alternative to the device specific GSD file, the PNO provides an universal database file with the designation PA139700.gsd for devices with one analogue input block. This file supports the transmission of the main value. Transmission of a second cyclic value or a display value is not supported.

When the universal database is used, the option "**Profile**" must be selected in the function "**Ident number**" (061).

5.3.4 Cyclic data exchange

Block model of the LUC-M



The block model shows, which data are exchanged continuously (i. e. by cyclic data transfer) between the LUC-M** and the PLC. The numbers refer to the function groups and functions:

- After linearisation and integration in the transducer block the **"measured value" (000)** is transmitted to the Analog Input Block. There, it may be scaled and checked for limit transgression, and is written out to the PLC via **"out value" (063)**.
- The function **"select V0H0" (068)** determines, if the main value, or a read in value from the PLC is shown on the display in the field for the main value.
- The function **"second cyclic value" (067)** determines, if the **"measured distance" (0A5)** or the **"measured temperature" (030)** is transmitted as the second cyclic value.

Modules for the cyclic data telegram

For the cyclic data telegram the LUC-M** provides the following modules:

1. **Main Process Value**
This is the main measured value scaled by the Analog Input Block (063).
2. **2nd Cyclic Value**
This is the measured distance between the sensor membrane and the product surface (0A5) or the measured temperature (030).
3. **Display Value**
This is a value which can be transferred from the PLC to the LUC-M** in order to be shown on the display.
4. **FREE PLACE**
This module must be applied during configuration (see below), if the 2nd cyclic value or the display value are not to appear in the data telegram.

Configuration of the cyclic data telegram

Use the configuration software of your PLC in order to compose the data telegram from these modules in one of the following ways:

1. **Main value**
In order to transmit the main measured value, select the module **"Main Process Value"**.
2. **Main value and second cyclic value**
In order to transmit the main value and the second cyclic value (temperature or measured distance), select the modules in the following order: **"Main Process Value"**, **"2nd Cyclic Value"**, **"FREE PLACE"**.
3. **Main value and display value**
In order to transmit the main value and to receive a display value select the modules in the following order: **"Main Process Value"**, **"FREE PLACE"**, **"Display Value"**.
4. **Main value, second cyclic value and display value**
In order to transmit the main value and the second cyclic value and to receive a display value, select the modules in the following order: **"Main Process Value"**, **"2nd Cyclic Value"**, **"Display Value"**.

The exact way of performing the configuration depends on the configuration software of the PLC.

Structure of the input data (Device → PLC)

The input data are transmitted according to the following structure:

Index Input data	Data	Access	Format/Remarks
0, 1, 2, 3	Main value (level)	read	32 Bit floating point number (IEEE-754)
4	Status code for main value	read	see "Status codes"
5, 6, 7, 8 (optional)	Secondary value (measured distance)	read	32 Bit floating point number (IEEE-754)
9 (optional)	Status code for secondary value	read	see "Status codes"

Structure of the output data (PLC → Device)

The output data are transmitted according to the following structure:

Index Output data	Data	Access	Format/Remarks
0, 1, 2, 3	Display value	write	32 Bit floating point number (IEEE-754)
4	Status code for Display value	write	see "Status codes"

IEEE-745 floating point number

The measured value is transmitted as a IEEE 754 floating point number, whereby:

$$\text{Measured value} = (-1)^{VZ} \times 2^{(E-127)} \times (1+F)$$

Byte 1								Byte 2							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Sign (S)	2 ⁷	2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰	2 ⁻¹	2 ⁻²	2 ⁻³	2 ⁻⁴	2 ⁻⁵	2 ⁻⁶	2 ⁻⁷
Exponent (E)								Mantissa (F)							

Byte 3								Byte 4							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
2 ⁻⁸	2 ⁻⁹	2 ⁻¹⁰	2 ⁻¹¹	2 ⁻¹²	2 ⁻¹³	2 ⁻¹⁴	2 ⁻¹⁵	2 ⁻¹⁶	2 ⁻¹⁷	2 ⁻¹⁸	2 ⁻¹⁹	2 ⁻²⁰	2 ⁻²¹	2 ⁻²²	2 ⁻²³
Mantissa (F)															

Example:

$$\begin{aligned}
 40 \text{ F0 } 00 \text{ } 00 \text{ (hex)} &= 0100 \text{ } 0000 \text{ } 1111 \text{ } 0000 \text{ } 0000 \text{ } 0000 \text{ } 0000 \text{ } 0000 \text{ (bin)} \\
 &= (-1)^0 \times 2^{(129 - 127)} \times (1 + 2^{-1} + 2^{-2} + 2^{-3}) \\
 &= 1 \times 2^2 \times (1 + 0.5 + 0.25 + 0.125) \\
 &= 1 \times 4 \times 1.875 \\
 &= 7.5
 \end{aligned}$$

Status codes

The status codes comprise one byte and have got the following meaning:

Status Code	Device status	Significance	Primary value	Secondary value
0C Hex	BAD	Device error		X
0F Hex	BAD	Device error	X	
1F Hex	BAD	out-of-service (target mode)	X	
40 Hex	UNCERTAIN	non-specific		X
47 Hex	UNCERTAIN	last usable value (fail-safe mode active)	X	
4B Hex	UNCERTAIN	Substitute set (fail-safe mode active)	X	
4F Hex	UNCERTAIN	initial value (fail-safe mode active)	X	
5C Hex	UNCERTAIN	Configuration error (limits not set correctly)	X	
80 Hex	GOOD	OK	X	X
84 Hex	GOOD	active block alarm (static revision counter incremented)	X	
89 Hex	GOOD	LOW_LIM (alarm active)	X	
8A Hex	GOOD	HI_LIM (alarm active)	X	
8D Hex	GOOD	LOW_LOW_LIM (alarm active)	X	
8E Hex	GOOD	HI_HI_LIM (alarm active)	X	

If a status other than "GOOD" is sent to the device, the display indicates an error.

5.3.5 Acyclic data exchange

Acyclic data exchange allows device parameters to be changed independently of the communication between the device and a PLC.

Acyclic data exchange is used

- to transmit device parameters during commissioning and maintenance;
- to display measured values that are not acquired in cyclic traffic.

There are two types of acyclic data exchange:

Acyclic communication with a Class 2 master (MS2AC)

In the case of MS2AC, a Class 2 master opens a communication channel via a so-called service access point (SAP) in order to access the device. Class 2 masters are for example:

- FieldCare
- PDM

Before data can be exchanged via PROFIBUS, however, the Class 2 master must be made aware of the parameters contained within the field device. This can be done by:

- a device description (DD)
- a device type manager (DTM)
- a software component within the master, which accesses the parameters via slot and index addresses.



Note!

- The DD or DTM is supplied by the device manufacturer.
- The number of Class 2 masters that can simultaneously access a device, is determined by the number of SAPs that the device can provide.
- The use of a Class 2 master increases the cycle time of the bus system. This must be taken into consideration when the control system or PLC is programmed.

Acyclic communication with a Class 1 master (MS1AC)

In the case of MS1AC, a Class 1 master that is already communicating cyclically with a device opens a communication channel via SAP 0x33, a special access point for MS1AC. As is the case for a Class 2 master, the parameter is read or written via the slot and index.



Note!

- At the time of writing, there are only a few PROFIBUS masters that support this type of communication.
- Not all PROFIBUS field devices support MS1AC.



Caution!

Permanent writing of parameters, e. g. with every cycle of the application program, must be avoided, since this can drastically reduce the life of the device.

Acyclic write parameters are stored electrically in the RAM (EEPROM, Flash, ...). The RAM modules are design for a limited number of write operations only. In standard operation without MS1AC, i. e. during parametrisation of the device, the number of write operations is negligible when compared to the limit. If the application program is badly designed, however, this limit can be reached quickly, and the RAM will fail.

5.3.6 Slot/index tables

Device management

Parameter	P+F matrix	Slot	Index	Size [Bytes]	Type	Read	Write	Storage class
Directory object header		1	0	12	Array of UNSIGNED16	X		constant
Composite list directory entries		1	1	24	Array of UNSIGNED16	X		constant
GAP directory continuous		1	2-8					
GAP reserved		1	9-15					

Analog Input Function Block

Parameter	P+F matrix	Slot	Index	Size [Bytes]	Type	Read	Write	Storage class
Standard parameters								
Block Data		1	16	20	DS-32*	X		constant
Static revision		1	17	2	UNSIGNED16	X		non-vol.
Device tag		1	18	32	OSTRING	X	X	static
Strategy		1	19	2	UNSIGNED16	X	X	static
Alert key		1	20	1	UNSIGNED8	X	X	static
Target Mode		1	21	1	UNSIGNED8	X	X	static
Mode		1	22	3		X		dynamic non-vol. constant
Alarm summary		1	23	8		X		dynamic
Batch		1	24	10		X	X	static
Gap		1	25					
Block parameters								
Out		1	26	5	DS-33*	X		dynamic
PV Scale		1	27	8	Array of FLOAT	X	X	static
Out Scale		1	28	11	DS-36*	X	X	static
Linearisation type		1	29	1	UNSIGNED8	X	X	static
Channel		1	30	2	UNSIGNED16	X	X	static
Gap		1	31					
PV fail safe time		1	32	4	FLOAT	X		non-vol.
Fail safe type		1	33	1	UNSIGNED8	X	X	static
Fail safe value		1	34	4	FLOAT	X	X	static
Alarm Hysteresis		1	35	4	FLOAT	X	X	static
Gap		1	36					
HI HI Limit		1	37	4	FLOAT	X	X	static
Gap		1	38					
HI Limit		1	39	4	FLOAT	X	X	static
Gap		1	40					
LO Limit		1	41	4	FLOAT	X	X	static
Gap		1	42					
LO LO Limit		1	43	4	FLOAT	X	X	static
Gap		1	44-45					
HI HI Alarm		1	46	16	DS-39*	X		dynamic
HI Alarm		1	47	16	DS-39*	X		dynamic
LO Alarm		1	48	16	DS-39*	X		dynamic
LO LO Alarm		1	49	16	DS-39*	X		dynamic
Simulate		1	50	6	DS-51*	X	X	non-vol.
Out unit text		1	51	16	OSTRING	X	X	static
Gap reserved		1	52-60					

Physical block

Parameter	P+F matrix	Slot	Index	Size [Bytes]	Type	Read	Write	Storage class
Standard parameters								
Block Data		0	16	20	DS-32*	X		constant
Static revision		0	17	2	UNSIGNED16	X		non-vol.
Device tag		0	18	32	OSTRING	X	X	static
Strategy		0	19	2	UNSIGNED16	X	X	static
Alert key		0	20	1	UNSIGNED8	X	X	static
Target mode		0	21	1	UNSIGNED8	X	X	static
Mode		0	22	3	DS-37*	X		dynamic non-vol. constant
Alarm summary		0	23	8	DS-42*	X		dynamic
Block parameters								
Software revision		0	24	16	OSTRING	X		constant
Hardware revision		0	25	16	OSTRING	X		constant
Device manufacturer ID		0	26	2	UNSIGNED16	X		constant
Device ID		0	27	16	OSTRING	X		constant
Device serial number		0	28	16	OSTRING	X		constant
Diagnosis		0	29	4	OSTRING	X		dynamic
Diagnosis extension		0	30	6	OSTRING	X		dynamic
Diagnosis mask		0	31	4	OSTRING	X		constant
Diagnosis mask ext.		0	32	6	OSTRING	X		constant
Device certification		0	33	32	OSTRING	X	X	non-vol.
Security locking		0	34	2	UNSIGNED16	X	X	non-vol.
Factory reset		0	35	2	UNSIGNED16		X	non-vol.
Descriptor		0	36	32	OSTRING	X	X	static
Device message		0	37	32	OSTRING	X	X	static
Device instal. date		0	38	8	OSTRING	X	X	static
Gap reserved		0	39					
Ident number select		0	40	1	UNSIGNED8	X	X	static
HW write protection		0	41	1	UNSIGNED8	X	X	static
Gap reserved		0	42-48					
Gap		0	49-53					
P+F parameters								
Error code		0	54	2	UNSIGNED16	X		dynamic
Last error code		0	55	2	UNSIGNED16	X	X	dynamic
Up Down features		0	56	1	OSTRING	X		constant
Up Down control		0	57	1	UNSIGNED8		X	dynamic
Up Down param		0	58	20	OSTRING	X	X	dynamic
Bus address		0	59	1	UNSIGNED8	X		dynamic
Device SW No.		0	60	2	UNSIGNED16	X		dynamic
Set unit to bus		0	61	1	UNSIGNED8	X	X	static
Input value		0	62	6	FLOAT+U8+U8	X		dynamic
Select Main value		0	63	1	UNSIGNED8	X	X	dynamic
PA profile revision		0	64	16	OSTRING	X		constant
Gap		0	65-69					
Gap reserved		0	119-125					

P+F specific level transducer block

Parameter	P+F matrix	Slot	Index	Size [Bytes]	Type	Read	Write	Storage class
Standard parameters								
Block data		1	130	20	DS-32*	X		constant
Static revision		1	131	2	UNSIGNED16	X		non-vol.
Device tag		1	132	32	OSTRING	X	X	static
Strategy		1	133	2	UNSIGNED16	X	X	static
Alert key		1	134	1	UNSIGNED8	X	X	static
Target mode		1	135	1	UNSIGNED8	X	X	static
Mode		1	136	3	DS-37*	X		dynamic/ non-vol./ static
Alarm summary		1	137	8	DS-42*	X		dynamic
P+F parameters								
Measured value	V0H0	1	138	4	FLOAT	X		dynamic
Tank shape	V0H2	1	140	1	UNSIGNED8	X	X	static
Medium cond.	V0H3	1	141	1	UNSIGNED8	X	X	static
Process cond.	V0H4	1	142	1	UNSIGNED8	X	X	static
Empty calibration	V0H5	1	143	4	FLOAT	X	X	static
Full calibration	V0H6	1	144	4	FLOAT	X	X	static
Output on alarm	V1H0	1	148	1	UNSIGNED8	X	X	static
Outp. echo loss	V1H2	1	150	1	UNSIGNED8	X	X	static
Ramp %span/min	V1H3	1	151	4	FLOAT	X	X	static
Delay time	V1H4	1	152	2	UNSIGNED16	X	X	static
Safety distance	V1H5	1	153	4	FLOAT	X	X	static
In safety dist.	V1H6	1	154	1	UNSIGNED8	X	X	static
Ackn. alarm	V1H7	1	155	1	UNSIGNED8	X	X	static
Measured temp.	V2H0	1	158	1	UNSIGNED8	X	X	static
Max. temp. limit	V2H1	1	159	1	UNSIGNED8	X	X	static
Max. meas. temp.	V2H2	1	160	1	UNSIGNED8	X	X	static
On high temp.	V2H3	1	161	1	UNSIGNED8	X	X	static
Def. temp. sens.	V2H4	1	162	2	ENUM	X	X	static
Level/ullage	V3H0	1	168	1	UNSIGNED8	X	X	static
Linearisation	V3H1	1	169	1	UNSIGNED8	X	X	static
Customer unit	V3H2	1	170	2	UNSIGNED16	X	X	static
Table no.	V3H3	1	171	1	UNSIGNED8	X	X	static
Input level	V3H4	1	172	4	FLOAT	X	X	static
Input volume	V3H5	1	173	4	FLOAT	X	X	static
Max. scale	V3H6	1	174	4	FLOAT	X	X	static
Diameter vessel	V3H7	1	175	4	FLOAT	X	X	static
Check distance	V4H1	1	179	1	UNSIGNED8	X	X	static
Range of mapping	V4H2	1	180	4	FLOAT	X	X	static
Start mapping	V4H3	1	181	1	UNSIGNED8	X	X	static
Pres. map. dist.	V4H4	1	182	4	FLOAT	X		dynamic
Cust. tank map	V4H5	1	183	1	UNSIGNED8	X	X	static
Echo quality	V4H6	1	184	1	UNSIGNED8	X		dynamic
Offset	V4H7	1	185	4	FLOAT	X	X	static
Output damping	V4H8	1	186	4	FLOAT	X	X	static
Blocking dist.	V4H9	1	187	4	FLOAT	X	X	static
Instrument_addr.	V5H0	1	188	1	UNSIGNED8	X		dynamic
Ident number	V5H1	1	189	1	UNSIGNED8	X	X	static
Set unit to bus	V5H2	1	190	1	UNSIGNED8	X	X	static
Out value	V5H3	1	191	4	FLOAT	X		dynamic
Out status	V5H4	1	192	1	UNSIGNED8	X		dynamic
Simulation	V5H5	1	193	1	UNSIGNED8	X	X	static
Simulation value	V5H6	1	194	4	FLOAT	X	X	static
2nd cyclic value	V5H7	1	195	1	UNSIGNED8	X	X	static
Select V0H0	V5H8	1	196	1	UNSIGNED8	X	X	static
Display value	V5H9	1	197	4	FLOAT	X		dynamic
Display contrast	V6H1	1	199	1	UNSIGNED8	X	X	static

Parameter	P+F matrix	Slot	Index	Size [Bytes]	Type	Read	Write	Storage class
Language	V6H2	1	200	1	UNSIGNED8	X	X	static
Back to home	V6H3	1	201	2	INT16	X	X	static
Format display	V6H4	1	202	1	UNSIGNED8	X	X	static
No. decimals	V6H5	1	203	1	UNSIGNED8	X	X	static
Sep. character	V6H6	1	204	1	UNSIGNED8	X	X	static
Display test	V6H7	1	205	1	UNSIGNED8	X	X	static
Present error	V9H0	1	228	2	U16	X		dynamic
Previous error	V9H1	1	229	2	U16	X		dynamic
Clear last error	V9H2	1	230	1	UNSIGNED8	X	X	static
Reset	V9H3	1	231	2	UNSIGNED16	X	X	static
Unlock parameter	V9H4	1	232	2	UNSIGNED16	X	X	static
Measured dist.	V9H5	1	233	4	FLOAT	X		dynamic
Measured level	V9H6	1	234	4	FLOAT	X		dynamic
Application par.	V9H8	1	236	1	UNSIGNED8	X		dynamic
Tag no.	VAH0	1	238	32	STRING	X		const
Profile version	VAH1	1	239	32	STRING	X	X	static
Protocol+sw-no.	VAH2	1	240	32	STRING	X		const
Serial no.	VAH4	1	242	32	STRING	X	X	static
Distance unit	VAH5	1	243	2	UNSIGNED16	X	X	static
Temperature unit	VAH6	1	244	2	ENUM	X	X	static
Download mode	VAH8	1	246	1	UNSIGNED8	X	X	static

Data strings

In the slot/index table some data types, e. g. DS-33 are marked by an asterisk. These are data strings according to the PROFIBUS PA specifications part 1, version 3.0. They contain several elements, which are addressed by an additional subindex. The following table gives an example.

Data type	Subindex	Type	Size [Bytes]
DS-33	1	FLOAT	4
	5	UNSIGNED8	1

5.3.7 Scaling of the output data

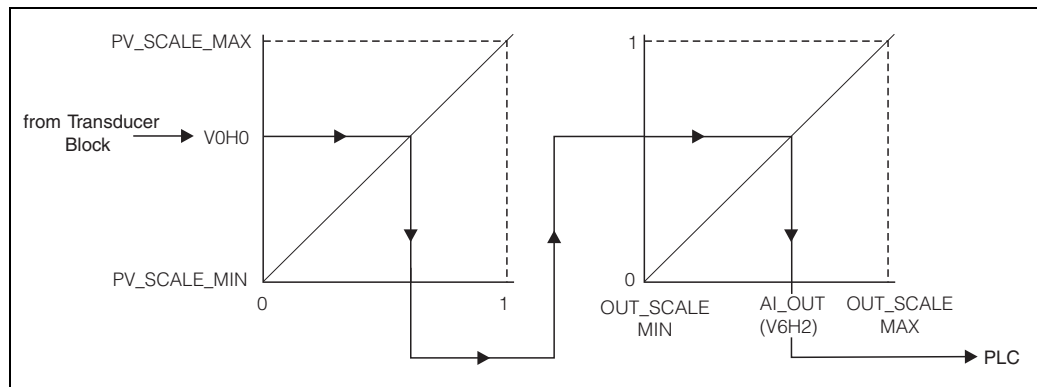
The on-site display and the digital output are working independently of each other.

On-site display

The on-site display always displays the main value V0H0 directly from the Transducer Block.

Digital output

For the digital output this value is rescaled in two steps:



1. In a first step, the main value is mapped to the interval [0, 1]. PV_SCALE_MIN and PV_SCALE_MAX determine the limits of this mapping.
2. In a second step, the interval [0, 1] is mapped to the interval [OUT_SCALE_MIN, OUT_SCALE_MAX]. The value resulting from this mapping is transferred via V6H2 to the PLC.



Note!

The scaling of the output value is required by the PROFIBUS profiles. It prevents uncontrolled jumps of the output value when one changes the unit of the measuring value in the Transducer Block. If units are changed, PV_SCALE_MIN and PV_SCALE_MAX automatically adapt themselves in such a way that the output value remains unchanged. Only after confirming the change by the "Set unit to bus" (062) function,

- OUT_SCALE_MIN is set equal to PV_SCALE_MIN and
- OUT_SCALE_MAX equal to PV_SCALE_MAX.

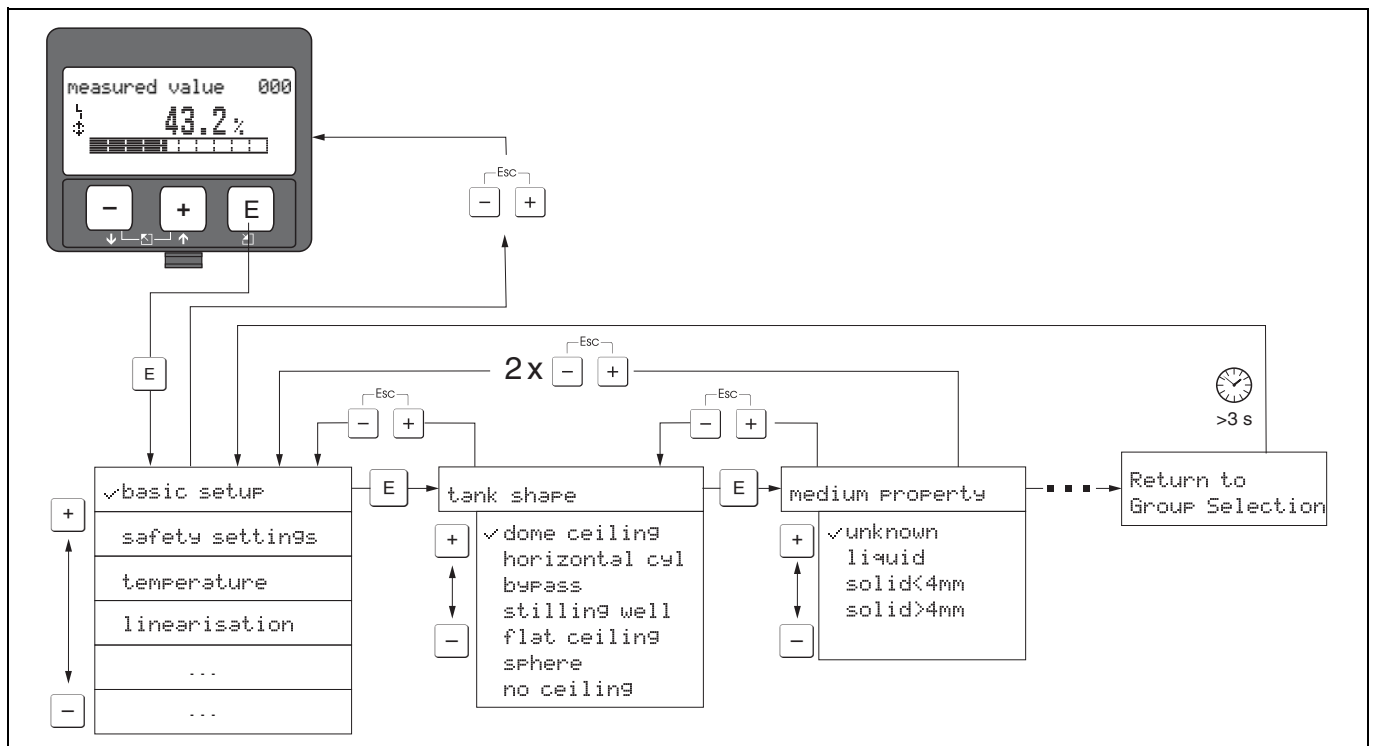
Thereby the new unit also becomes effective at the output.



Caution!

If a linearisation has been carried out, it must be confirmed by the "Set unit to bus" (062) function in order to become effective at the digital output.

5.4 Operation using the on-site display LUC-Z15



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**.

5.5 Operation using PACT_{ware}TM

PACT_{ware}TM is an operating software with graphical support (MS Windows) for intelligent transmitters with the communication protocols HART and PROFIBUS PA.

PACT_{ware}TM supports the following functions:

- Online configuration of transmitters
- Loading and saving of instrument data (Upload/Download)
- Orderly visualisation of measured values and limit values
- Display and recording of measured values with a line recorder

5.5.1 Operation

You make the settings using an operating matrix or via a graphic interface. Envelope curves can not be display in PACT_{ware}TM.

5.5.2 Connection

- HART with HART modem (available as accessory)
- PROFIBUS PA

5.6 Lock/unlock configuration

5.6.1 Software security locking

Enter a number ≠2457 in the "unlock parameter" (0A4) function in the "diagnostics" (0A) function group.

The  symbol appears on the display. Inputs are no longer possible.

If you try to change a parameter, the device jumps to the "unlock parameter" (0A4) function. Enter "2457".

Now change the parameters.

5.6.2 Hardware security locking

Press ,  and  simultaneously.

Inputs are no longer possible.

If you try to change a parameter, the following appears:




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

Press ,  and  simultaneously. The "unlock parameter" (0A4) function appears. Enter "2457".

Now change the parameters.



Note!

A hardware locking can **only** be unlocked again via the display by pressing the ,  and  keys at the same time again. It is **not** possible to unlock the hardware by communication.

5.7 Resetting the customer parameters

It is advisable to reset the customer parameters if you want to use a device with an unknown history.

Effects of resetting:

- All customer parameters are reset to their default values.
- Customer interference echo suppression is **not** deleted.
- Linearisation is switched to "**linear**", but the table values are kept. The table can be switched back on in the "**linearisation**" (04) function group in the "**linearisation**" (041) function.

In order to carry out the reset, enter the number "**33333**" in the "**reset**" (0A3) function in the "**diagnostics**" (0A) function group.



Caution!

A reset may lead to impairment of the measurement. As a rule, a basic calibration is required after a reset.



Note!

The default values of each parameter are shown in bold in the menu overview in the appendix.

5.8 Resetting an interference echo suppression (tank map)

It is always advisable to reset the interference echo suppression (tank mapping) when:

- a device with an unknown history is used
- an incorrect suppression was input.

Proceed as follows:

1. Switch to the "**extended calibr.**" (05) function group and to the "**selection**" (050) function.
2. Select "**extended map.**"
3. Then proceed to the "**cust. tank map**" (055) function.
4. Select
 - "**reset**", to delete (reset) the existing interference echo suppression.
 - "**inactive**" to deactivate an existing interference echo suppression. The suppression remains saved.
 - "**active**" to reactivate an existing interference echo suppression.

6 Commissioning

Commission the LUC-M** in the following stages:

- Installation check
- Power-up device
- Basic calibration
- Measuring signal check using the envelope curve

The section describes the commissioning process using the on-site display.

6.1 Power up instrument

After switching on the supply voltage, the instrument is first initialised.

```
initialization /
UU 331 01.01.02
```

Then the following appear for approximately five seconds:

```
LUC M
U01.00.42 PA
```

- Device type
- Software version
- Type of digital communication signal

On first power-up, you are requested to select the language for the display texts.

```
language 092
English
Deutsch
Français
```

Then you are requested to select the unit of length for your measurements.

```
distance unit 0C5
m
ft
mm
```

A measured value is displayed. This is **not** equivalent to the level in your tank. Firstly carry out a basic calibration.

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

Press to switch to the group selection.
Press again to start the basic calibration.

```
Group selection 00→
basic setup
safety settings
linearisation
```

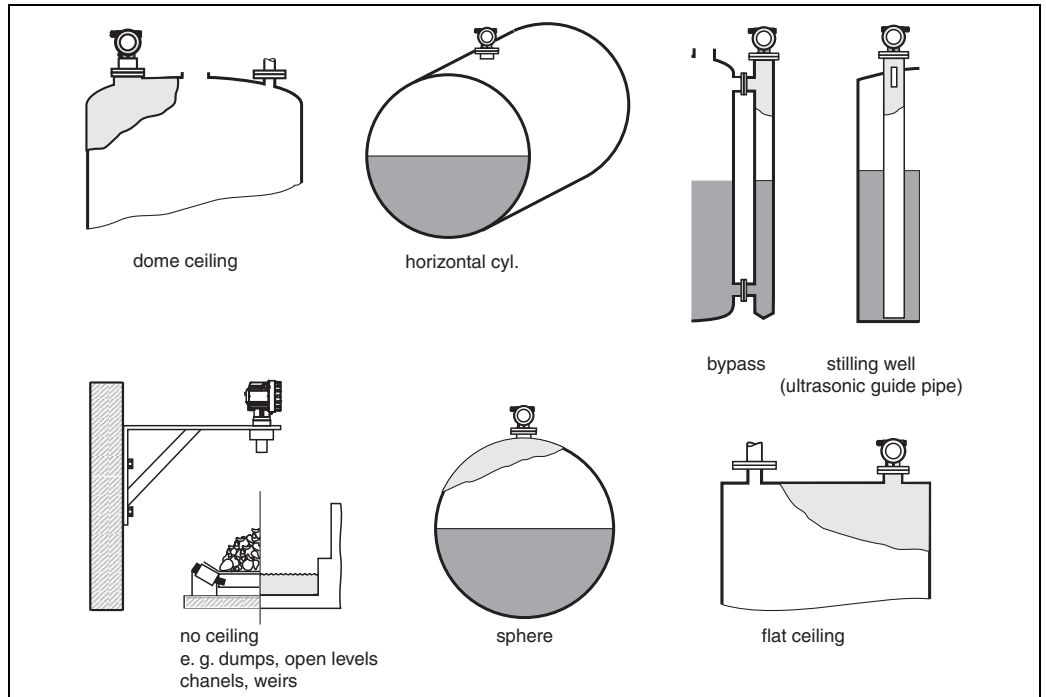
6.2 Basic calibration

The "**Basic setup**" (00) function group lists all the functions which are required for a standard measurement task to commission the LUC-M**. When you have completed your input for a function, the next function appears automatically. In this way, you are guided through the complete calibration.

6.2.1 Measuring point settings

Function "tank shape" (002)

In this function, select one of the following options:



Function "medium property" (003)

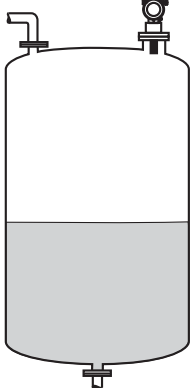
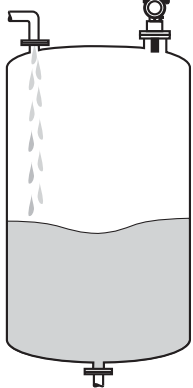
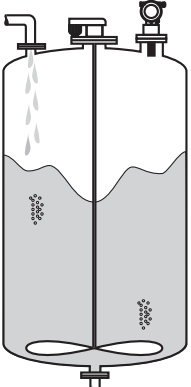
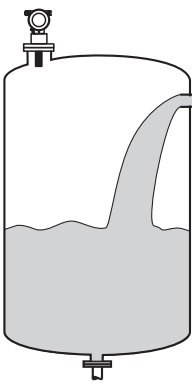
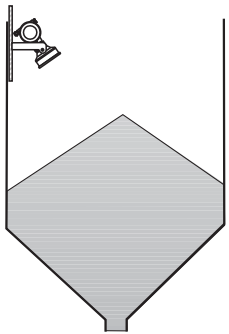
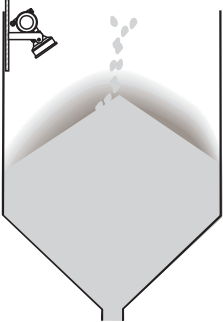
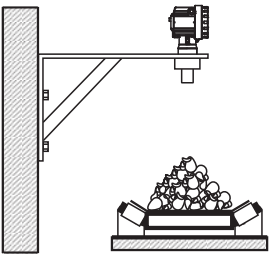
Set the medium type in this function.

You have the following options:

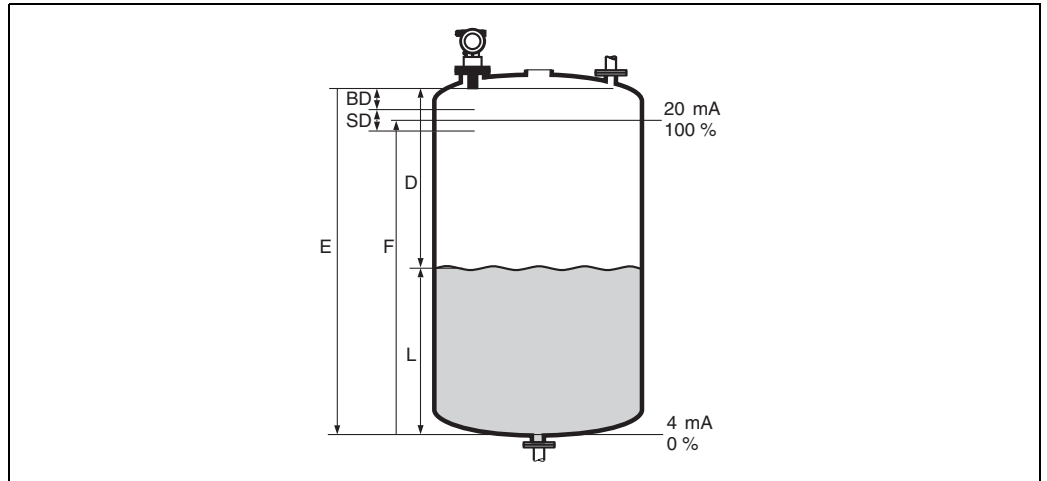
- unknown (e. g. pasty media such as greases, creams, gels etc.)
- liquid
- solid, grain size < 4mm (fine)
- solid, grain size > 4mm (coarse)

Function "process conditions" (004)

For this function, you have the following options:

<p>Standard liquids</p> <p>For all fluid applications which do not fit in any of the following groups.</p>	<p>Calm surface</p> <p>Storage tanks with immersion tube or bottom filling</p>	<p>Turb. surface</p> <p>Storage/accumulation tanks with uneven surface due to free filling, mixing nozzles or small bottom stirrers.</p>
		
<p>The filters and output damping are set to average values.</p>	<p>The averaging filters and output damping are set to large values.</p> <ul style="list-style-type: none"> - stable measured value - accurate measurement - slow reaction time 	<p>Special filters for stabilising the input signal are activated.</p> <ul style="list-style-type: none"> - stable measured value - medium reaction time
<p>Add. agitator</p> <p>Moving surfaces (poss. with vortex formation) due to agitators</p>	<p>Fast change</p> <p>Rapid level change, particularly in small tanks</p>	<p>Standard solid</p> <p>For all bulk solids applications which do not fit in any of the following groups.</p>
		
<p>Special filters for stabilising the input signal are set to large values.</p> <ul style="list-style-type: none"> - stable measured value - medium reaction time 	<p>The averaging filters are set to small values.</p> <ul style="list-style-type: none"> - rapid reaction time - possibly unstable measured value 	<p>The filter and output damping are set to average values.</p>
<p>Solid dusty</p> <p>Dusty bulk solids</p>	<p>Conveyor belt</p> <p>Bulk solids with rapid level change</p>	<p>Test:no filter</p> <p>All the filters can be switched off for purposes of service and diagnosis.</p>
		
<p>The filters are set to detect even relatively weak signals.</p>	<p>The averaging filters are set to small values.</p> <ul style="list-style-type: none"> - rapid reaction time - possibly unstable measured value 	<p>All filters off</p>

6.2.2 Empty and full calibration



Function "empty calibration" (005)

In this function, enter the distance E from the sensor membrane to the minimum level (zero point).



Caution!

With dished boiler heads or conical outflows, the zero point should not be deeper than the point at which the ultrasonic wave impinges on the tank bottom.

Function "blocking distance" (059)

In this function the blocking distance (BD) of the sensor is displayed.



Caution!

When entering the full calibration (span), please take into account, that the maximum level may not project into the blocking distance (BD)



Note!

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

Function "full calibration" (006)

In this function, enter the span F, i. e. the distance from the minimum level to the maximum level.

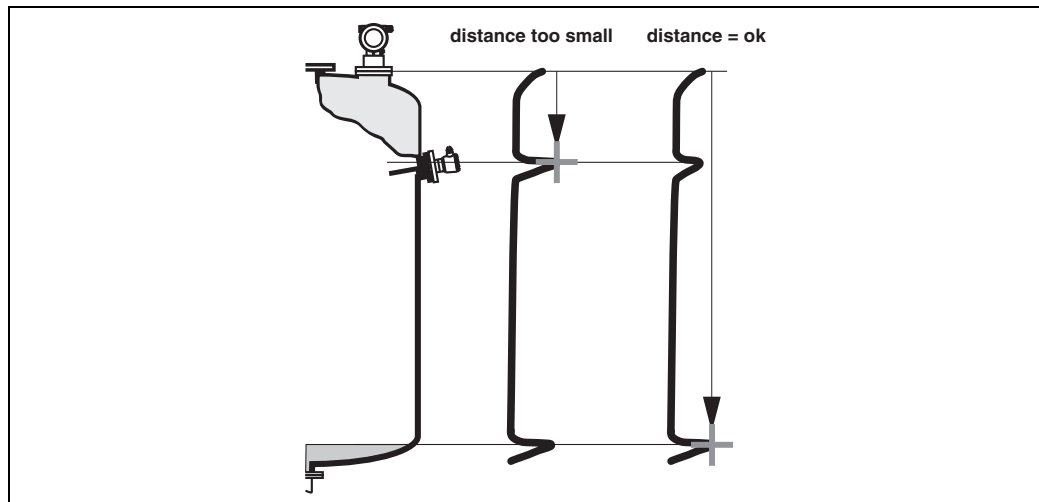
6.2.3 Interference echo suppression (tank mapping)

Function "dist./meas. value" (008)

In the "dist./meas.value" (008) function, the measured distance D from the sensor membrane to the product surface is displayed together with level L. Check these values.

Function "check distance" (051)

The mapping is initialized by this function.



Select

- "**distance=ok**" if the correct distance is displayed. Any echoes closer to the sensor will be suppressed by the following interference echo suppression.
- "**dist. too small**" if the displayed distance is too small. In this case, the signal comes from an interference echo which will be suppressed.
- "**dist. too big**" if the displayed distance is too large. This error cannot be cancelled by suppressing the interference echo. This means that the following two functions are skipped. Check the application parameters "**tank shape**" (002), "**medium proerty**" (003) and "**process cond.**" (004) and the "**empty calibr.**" (005) in the "**basic setup**" (00) function group.
- "**dist. unknown**" if you do not know the actual distance. This means that the following two functions are skipped.
- "**manual**" if you want to specify the suppression area yourself in the following function.

Function "range of mapping" (052)

The suggested suppression area is displayed in this function. The reference point is always the sensor membrane. You can still edit the value. With manual suppression, the default value is 0 m.



Caution!

The suppression range must end 0.5 m in front of the echo of the actual level. With an empty tank, do not enter E but E – 0.5 m.

Function "start mapping" (053)

You have the following options for this function:

- **off**: nothing is suppressed.
- **on**: starts suppression.



Note!

If a mapping already exists, it will be overwritten up to the distance specified in the "**range of mapping**" (052) function. Beyond this distance the existing mapping remains unchanged.

Function dist./measured value (008)

After suppression, the measured distance D from the sensor membrane to the product surface is displayed together with the level. Check that the values correspond to the actual level and/or the actual distance.

The following cases may occur:

- Distance correct – Level correct → end of basic calibration.
- Distance incorrect – Level incorrect → an additional interference echo suppression must be carried out. Go back to the "**check distance**" (051) function.
- Distance correct – Level incorrect → check the value of the "**empty calibr.**" (005) function.

Return to group selection

After the interference echo suppression the basic setup is terminated and the device reset automatically into the group selection.

6.3 Envelope curve

After the basic setup, an evaluation of the measurement with the aid of the envelope curve ("envelope curve" (0E) function group) is recommended.

6.3.1 Function "plot settings" (0E1)

In this function, select whether you want to display

- just the envelope curve
- the envelope curve and the echo evaluation line FAC
- the envelope curve and interference echo suppression (map)



Note!

The FAC and the interference echo suppression (map) are explained in BA 240O, "Description of instrument functions".

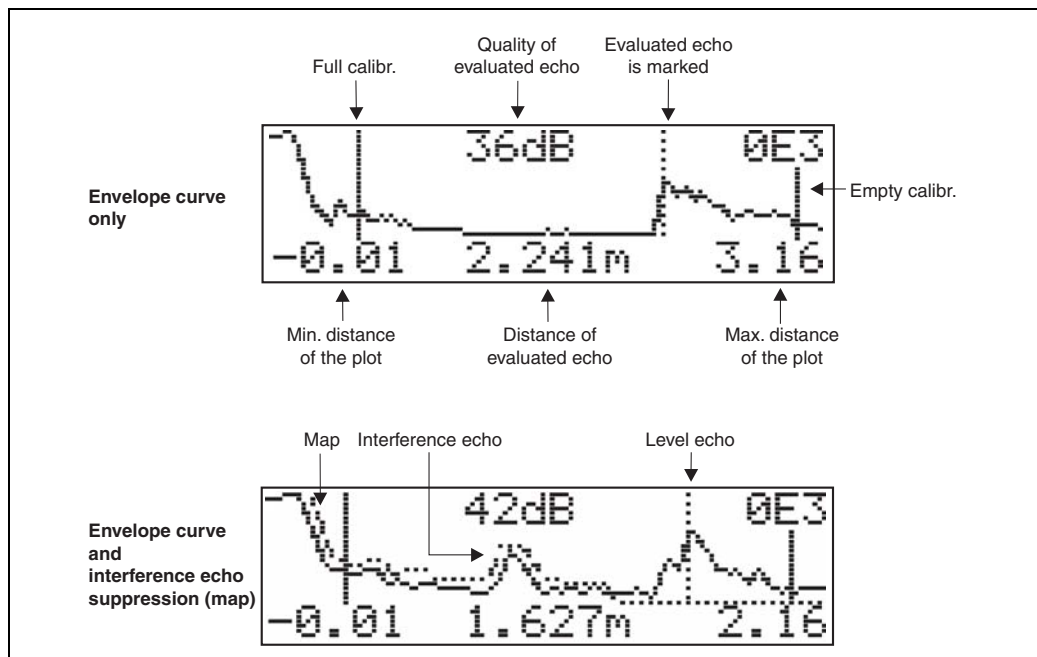
6.3.2 Function "recording curve" (0E2)

In this function, specify whether you want to display

- an individual envelope curve
- the current envelope curve, with cyclical refreshment

6.3.3 Function "envelope curve display" (0E3)

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



Check that the following conditions are fulfilled:

- The echo quality at the end of measuring range should be at least 10 dB.
- There should be practically no interference echoes in front of the level signal.
- If interference echoes cannot be avoided, they must be below the suppression curve.



Note!

If the cyclical envelope curve display is still active on the display, the measured value is updated at a slower cycle time. We therefore advise you to exit the envelope curve display after optimising the measuring point. To do this, press \square . (The instrument does not leave the envelope curve display automatically.)

6.3.4 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.

Horizontal Zoom mode:
 $\leftarrow \rightarrow$ - horizontal zoom in
 $\rightarrow \leftarrow$ - horizontal zoom out

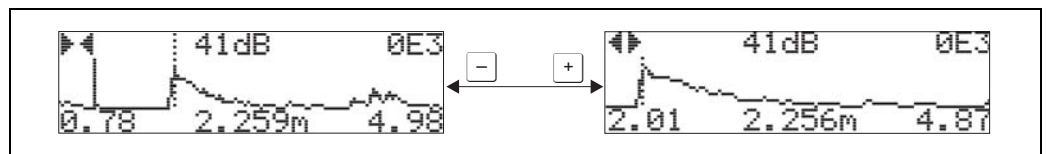
Move mode:
 $\leftarrow \leftarrow$ - move to the left
 $\rightarrow \rightarrow$ - move to the right

Vertical Zoom mode:
 $\$0 \dots \3 - vertical zoom (4 steps)

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 $\leftarrow \rightarrow$ or $\rightarrow \leftarrow$ is displayed.

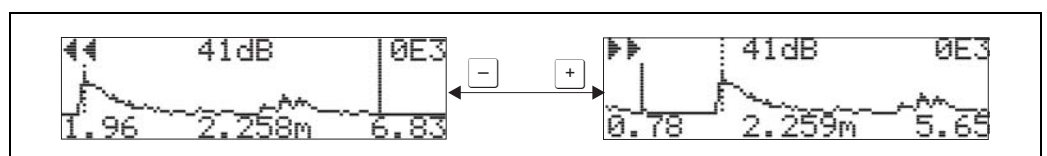
- \square increases the horizontal scale.
- \square reduces the horizontal scale.



Move mode

Then press \square to switch to Move mode. Either $\leftarrow \leftarrow$ or $\rightarrow \rightarrow$ is displayed.

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

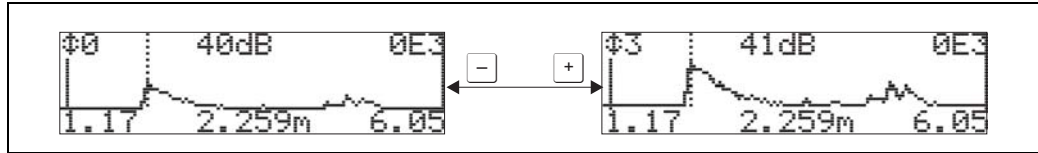


Vertical zoom mode

Press \square once more to switch to Vertical Zoom mode. $\Phi 1$ is displayed. You now have the following options.

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

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



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 display settings return to their standard values.

7 Troubleshooting

7.1 System error messages

7.1.1 Current error



Errors which the LUC-M** detects during commissioning or operation are displayed:

- In the "measured value" (000) function
- In the "diagnostics" (0A) function group in the "present error" (0A0) function
Only the highest priority error is displayed; in the case of multiple errors, you can scroll between the different error messages by pressing \square + or \square -.
- by the status of the main value in cyclic data telegram

7.1.2 Last error

The last error is displayed in the "diagnostics" (0A) function group in the "previous error" (0A1) function. This display can be deleted in the "clear last error" (0A2) function.

7.1.3 Types of error

Type of error	Symbol	Meaning
Alarm (A)	 continuous	The output signal assumes a value which can be set using the "output on alarm" (010) function: <ul style="list-style-type: none"> - MAX: +99999 - MIN: -99999 - Hold: last value is on hold - User-specific value
Warning (W)	 flashing	The device continues measurement. An error message is displayed.
Alarm/Warning (E)	You can define whether the error should behave as an alarm or as a warning.	

7.1.4 Error codes

Code	Error description	Action
A102 A110 A152 A160	checksum error	Reset; If alarm still present after reset, replace electronics
W103	initialising	If the message does not disappear after several seconds, replace the electronics
A106	downloading	Wait; message disappears after load sequence
A111 A113 A114 A115 A121 A125 A155 A164 A171	electronics defect	Reset; Check system for EMC, improve as necessary If alarm still present after reset, replace electronics
A116	download error	Check connection; Restart download
W153	initialising	Wait a few seconds; if error is still displayed, switch the power off and on again
A231	sensor defect	Check connection, if necessary replace HF module or electronics
E281	interruption temperature sensor	Exchange sensor
A502	Sensor type not detected	Exchange sensor and/or electronics
A512	recording of mapping	Alarm disappears after a few seconds
A521	new sensor type detected	Reset
W601	linearisation curve not monotone	Correct table (enter monotonously increasing table)
W611	less than 2 linearisation points	Enter additional value pairs
W621	simulation on	Switch simulation mode off ["output" (06) function group, "simulation" (065) function]
E641	no usable echo	Check basic calibration
E651	level in safety distance - risk of overspill	Error disappears when the level leaves the safety distance. Possibly reset the lock. ["safety settings" (01) function group, "ackn. alarm" (017) function]
E661	Sensor overtemperature	
A671	Linearisation incomplete	Activate linearisation table
W681	current out of range	Carry out basic calibration; check linearisation
W691	Filling noise detected, level ramp is active	

7.2 Application errors

Error	Example	Elimination
"measured value" (000) is incorrect but "measured distance" (008) is correct		<ol style="list-style-type: none"> 1. Check "empty calibration" (005) and "full calibration" (006). 2. Check linearisation <ul style="list-style-type: none"> - "level/ullage" (040) - "max. scale" (046) - "diameter vessel" (047) - linearisation table
"measured value" (000) and "measured distance" (008) are incorrect		<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.
No change in measured value on filling/emptying		<ol style="list-style-type: none"> 1. Carry out interference echo suppression. 2. Clean sensor if necessary 3. If necessary, select better installation position 4. If necessary due to wide interference echoes, set function "detection window" (0A7) to "off".
With an uneven surface (e. g. filling, emptying, running agitator) the measured value may jump sporadically to higher levels		<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 larger sensor
On filling/emptying the measured value drops		<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. Possible user stilling well/echo guide pipe
E641 (echo loss)		<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 larger sensor 3. Align the sensor parallel to the product surface (particularly for bulk solids applications)

8 Maintenance and repairs

8.1 Exterior cleaning

When cleaning the exterior, always use cleaning agents that do not attack the surface of the housing and the seals.

8.2 Repairs

The Pepperl+Fuchs repair concept assumes that the measuring devices have a modular design and that customers are able to undertake repairs themselves.

Spare parts are contained in suitable kits. They contain the related replacement instructions.

All the spare parts kits which you can order from Pepperl+Fuchs for repairs are listed with their order numbers in the section "Spare parts".

For more information on service and spare parts, contact the service department at Pepperl+Fuchs.

8.3 Repairs to Ex-approved devices

When carrying out repairs to Ex-approved devices, please note the following:

- Repairs to Ex-approved devices may only be carried out by trained personnel or by Pepperl+Fuchs service.
- Comply with the prevailing standards, national Ex-area regulations, safety instructions (SI) and certificates.
- Only use original spare parts from Pepperl+Fuchs.
- When ordering a spare part, please note the device designation on the nameplate. Only replace parts with identical parts.
- Carry out repairs according to the instructions. On completion of repairs, carry out the specified routine test on the device.
- Only Pepperl+Fuchs service may convert a certified device into a different certified variant.
- Document all repair work and conversions.

8.4 Replacement

After a complete instrument or electronic module has been replaced, the parameters can be downloaded into the instrument again via the communication interface.

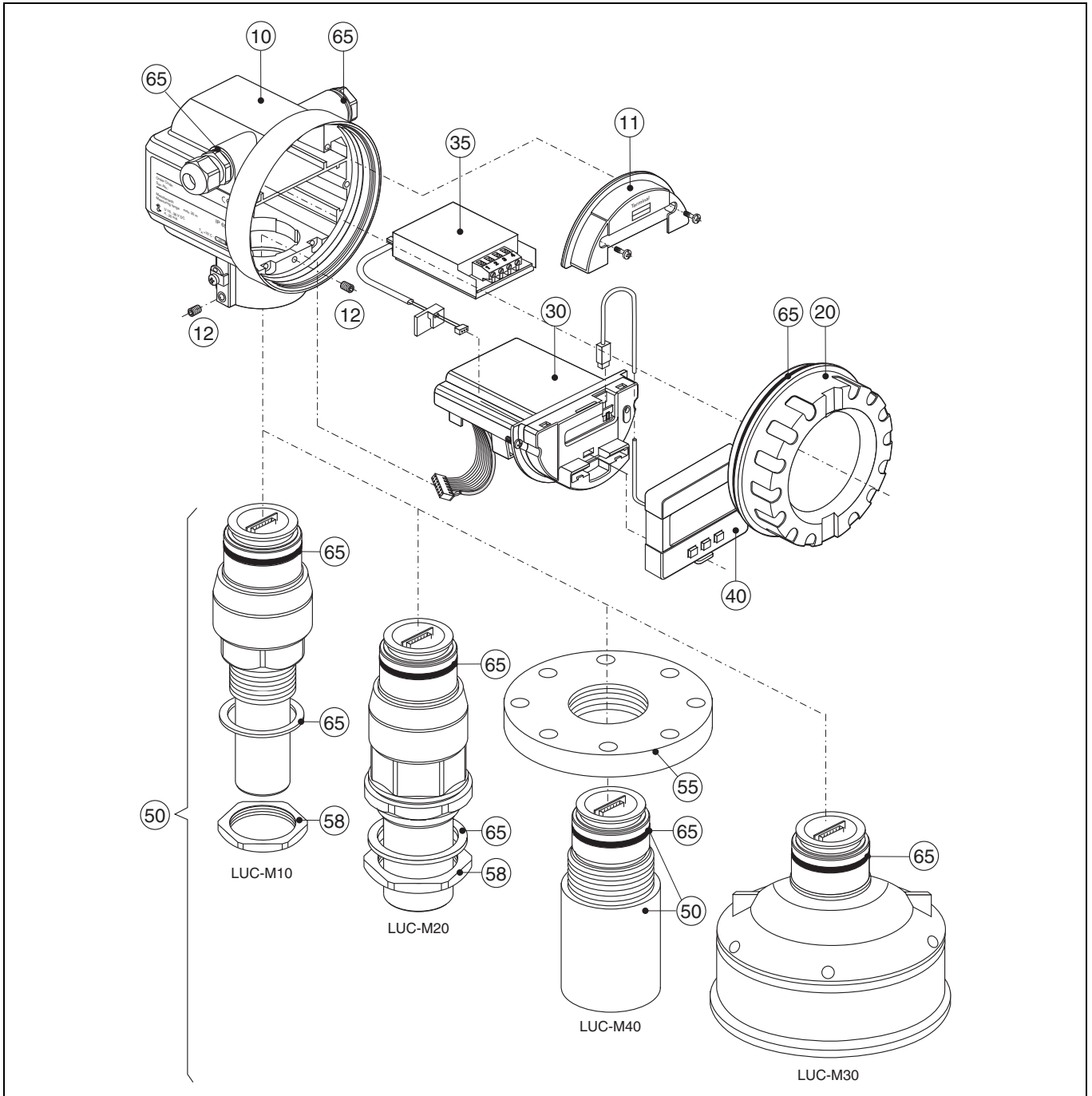
Prerequisite to this is that the data were uploaded to the PC beforehand using the **PACT^{ware}™**. Measurement can continue without having to carry out a new setup. Only a linearisation and a tank map (interference echo suppression) have to be recorded again.

8.5 Spare parts (housing type F12)



Caution!

Only identical, original Pepperl+Fuchs spare parts may be used. The instrument may only be maintained and repaired by qualified personnel. The device documentation, applicable standards and legal requirements as well as any certificates have to be observed!



10 – Housing

- Housing F12, aluminium, G $\frac{1}{2}$
- Housing F12, aluminium, $\frac{1}{2}$ NPT
- Housing F12, aluminium, M20
- Housing F12, aluminium, M20, PA connector
- Housing F12, aluminium, coated, M20, 4-wire
- Housing F12, aluminium, coated, M20, metal
- Housing F12, aluminium, coated, G $\frac{1}{2}$, 4-wire
- Housing F12, aluminium, coated, $\frac{1}{2}$ NPT, 4-wire

11 – Hood for terminal compartment

Cover for the connection compartment F12

Cover for the connection compartment F12, remote display and operation

12 – Set of screws

Set of screws for housing F12/T12

20 – Cover

Cover F12/T12 aluminium, inspection glass, seal

Cover F12/T12 aluminium, coated, seal

30 – Electronics

Electronics LUC-M**, Ex, 2-wire, HART, V4.0

Electronics LUC-M**, Ex, 4-wire, HART, V4.0

Electronics LUC-M**, Ex, PROFIBUS PA, V4.0

35 – Terminal module/power unit

Terminal module 4-pin, HART, 2-wire with connecting cable

Terminal module 4-pin, PROFIBUS PA

Power unit, 10.5 ... 32V DC (housing F12) for electronics, 4-wire

Power unit, 90 ... 250V AC (housing F12) for electronics, 4-wire

Power unit, CSA, 10.5 ... 32V DC (housing F12) for electronics, 4-wire

Power unit, CSA, 90 ... 250V AC (housing F12) for electronics, 4-wire

40 – Display

Display/operating module LUC-Z15

50 – Probe with process connection

Sensor LUC-M10 G1½

Sensor LUC-M10 1½ NPT

Sensor LUC-M20 G2

Sensor LUC-M20 2 NPT

Sensor LUC-M30, 4", gasket

Sensor LUC-M40

55 – Flanges

Flange, Uni-DN80/ANSI 3"/JIS 80A, PP

Flange, Uni-DN80/ANSI 3"/JIS 80A, PVDF

Flange, Uni-DN80/ANSI 3"/JIS 80A, 316L (1.4435)

Flange, Uni-DN100/ANSI 4"/JIS 100A, PP

Flange, Uni-DN100/ANSI 4"/JIS 100A, PVDF

58 – Hexagon nut

Hexagon nut (AF60) G1½, black, PC

Hexagon nut (AF70) G2, black, PC

65 – Sealing kit

Sealing kit LUC-M**

Miscellaneous

Nameplate LUC-M**, modification



Caution!

We are obliged to point out that each time devices with Ex certification have been repaired (replacement of assembly groups), the original condition has to be restored and another device check has to be carried out by authorised personnel.

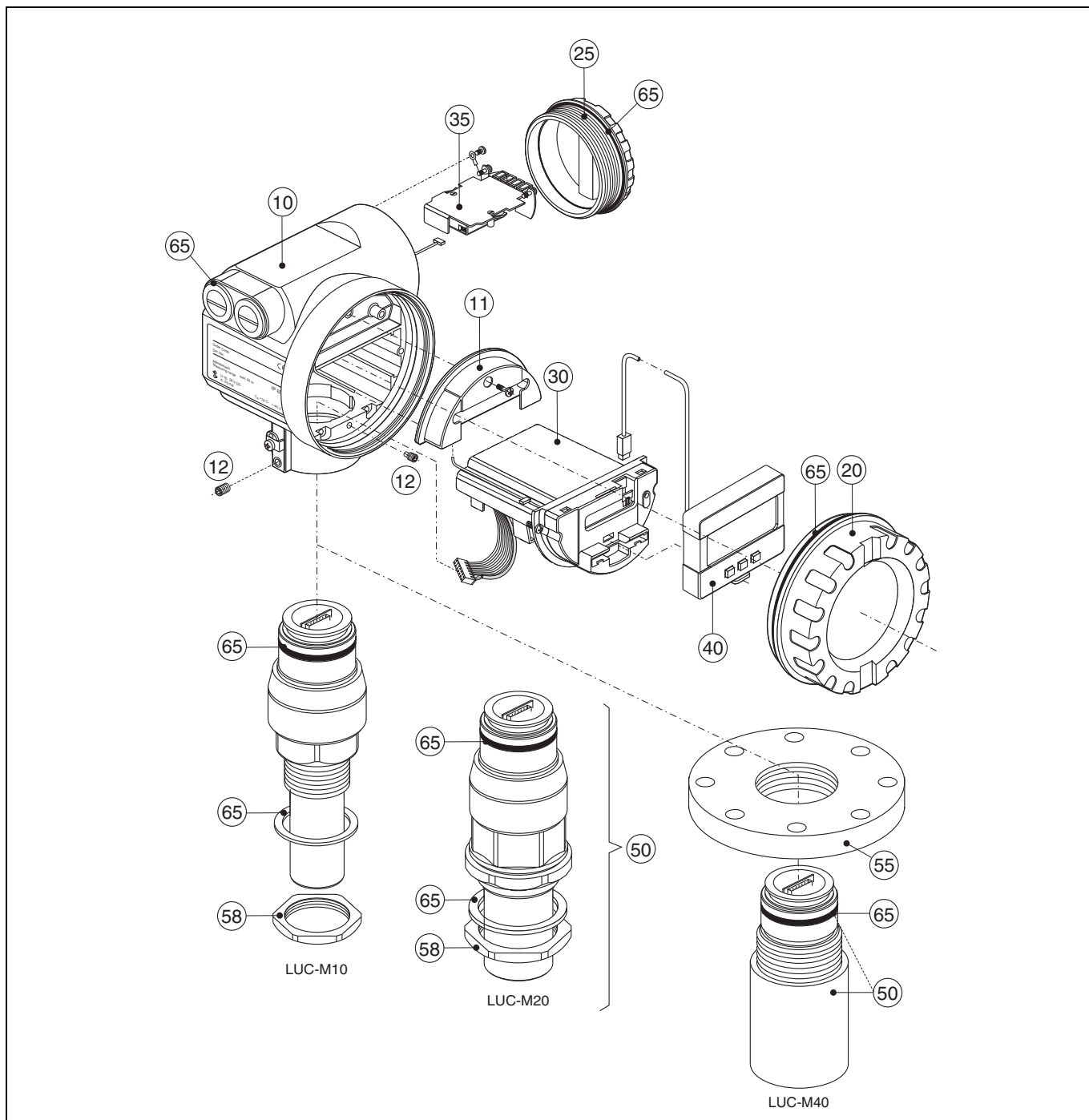
Spare parts for remote display and operation

Adaption kit housing F12, 2-wire

Adaption kit housing F12, 4-wire

Cable 20 m

8.6 Spare parts (housing type T12)



10 – Housing

Housing T12, aluminium, ½ NPT, PEL
Housing T12, aluminium, G½, PEL, cover
Housing T12, aluminium, M20, PEL, cover

11 – Hood for terminal compartment

Hood T12

12 – Set of screws

Set of screws for housing F12/T12

20 – Cover

Cover F12/T12 aluminium, inspection glass, seal
Cover F12/T12 aluminium, coated, seal

25 – Cover for the connection compartment

Cover T12, aluminium, coated, seal

30 – Electronics

Electronics LUC-M**, Ex, 2-wire, HART, V4.0

Electronics LUC-M**, Ex, PROFIBUS PA, V4.0

35 – Terminal module/power unit

Terminal module Ex d, 4-pin, 2-wire, HART

Terminal module Ex d, 2-pin, 2-wire, PROFIBUS PA

Terminal module EEx ia, 4-pin, HART, OVP

Terminal module EEx ia, 4-pin, PROFIBUS PA, OVP

40 – Display

Display/operating module LUC-Z15

50 – Probe with process connection

Sensor LUC-M10 G1½

Sensor LUC-M10 1½ NPT

Sensor LUC-M20 G2

Sensor LUC-M20 2 NPT

Sensor LUC-M40

55 – Flanges

Flange, Uni-DN80/ANSI 3"/JIS 80A, PP

Flange, Uni-DN80/ANSI 3"/JIS 80A, PVDF

Flange, Uni-DN80/ANSI 3"/JIS 80A, 316L (1.4435)

Flange, Uni-DN100/ANSI 4"/JIS 100A, PP

Flange, Uni-DN100/ANSI 4"/JIS 100A, PVDF

Flange, Uni-DN100/ANSI 4"/JIS 100A, 316L (1.4435)

58 – Hexagon nut

Hexagon nut (AF60) G1½, black, PC

Hexagon nut (AF70) G2, black, PC

65 – Sealing kit

Sealing kit LUC-M**

Miscellaneous

Nameplate LUC-M**, modification



Caution!

We are obliged to point out that each time devices with Ex certification have been repaired (replacement of assembly groups), the original condition has to be restored and another device check has to be carried out by authorised personnel.

8.7 Return

The following procedures must be carried out before a transmitter is sent to Pepperl+Fuchs e. g. for repair or calibration:

- Remove all residue which may be present. Pay special attention to the gasket grooves and crevices where fluid may be present. This is especially important if the fluid is dangerous to health, e. g. corrosive, poisonous, carcinogenic, radioactive, etc.
- Always enclose a duly completed "Declaration of contamination" form (a copy of the "Declaration of contamination" is included at the end of this operating manual). Only then can Pepperl+Fuchs transport, examine and repair a returned device.
- Enclose special handling instructions if necessary, for example a safety data sheet as per EN 91/155/EEC.

Additionally specify:

- The chemical and physical characteristics of the product.
- An exact description of the application.
- A short description of the error that occurred (specify error code if possible)
- Operating time of the device.

8.8 Disposal

In case of disposal please separate the different components according to their material consistence.

8.9 Software history

Software version/date	Changes to software	Changes to documentation
V 01.02.00/01.2002 V 01.02.02/03.2003	Original software. Compatible with: - PACTware™ - HART communicator 375 (from OS 4.6) with Rev. 1, DD 1.	
V 01.02.04/02.2004	LUC-M40 added Compatible with: - HART communicator 375 with Rev. 1, DD 1	LUC-M40 added
V 01.04.00/07.2006	Function "Detection window" added Compatible with: - PACTware™ - HART communicator 375 with Rev. 1, DD 1	"Detection window" added version: 07.06

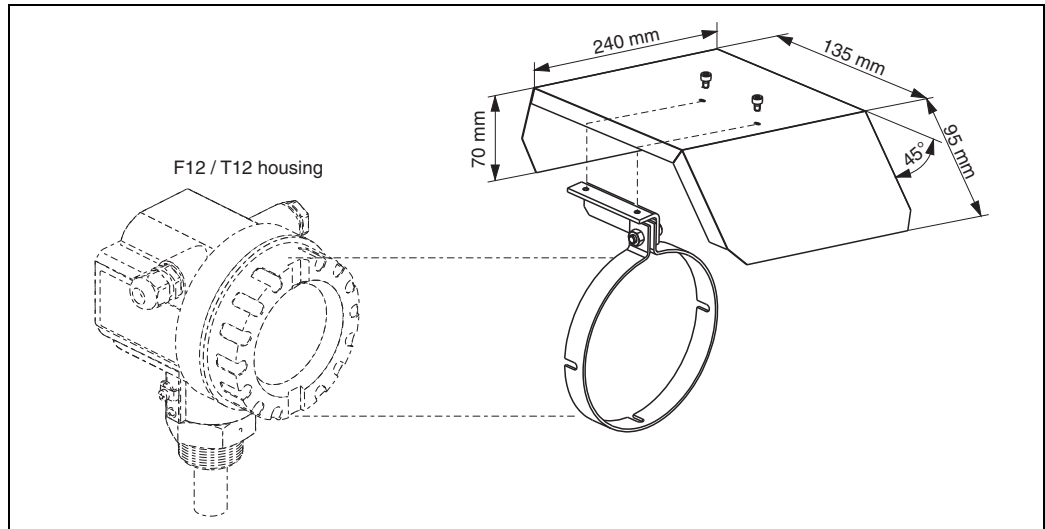
8.10 Contact addresses of Pepperl+Fuchs

The addresses of Pepperl+Fuchs are given on the back cover of this operating manual. If you have any questions, please do not hesitate to contact your Pepperl+Fuchs representative.

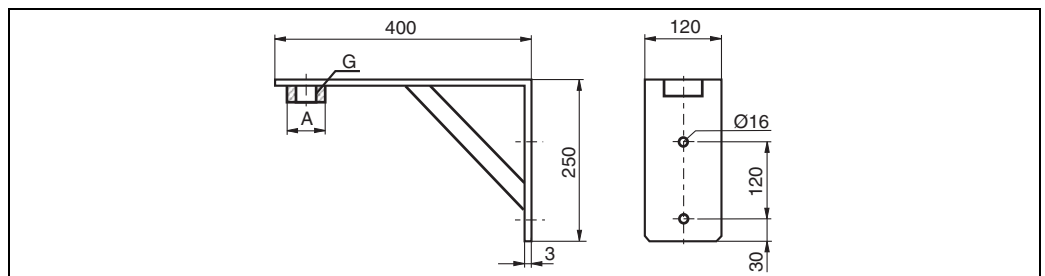
9 Accessories

9.1 Weather protection cover

A weather protection cover made of stainless steel is recommended for outdoor mounting (LUC-Z16). The shipment includes the protective cover and tension clamp.



9.2 Installation bracket for LUC-M10/LUC-M20

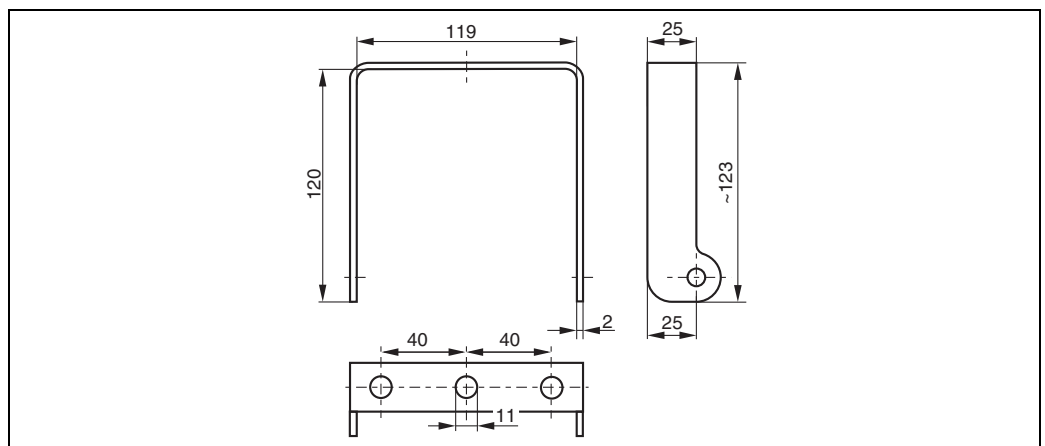


For sensor	Material	Order code
LUC-M10-G5***-***-** (G1½)	stainless steel 1.4301 (304)	LUC-Z18
LUC-M20-G6***-***-** (G2)	stainless steel 1.4301 (304)	LUC-Z19

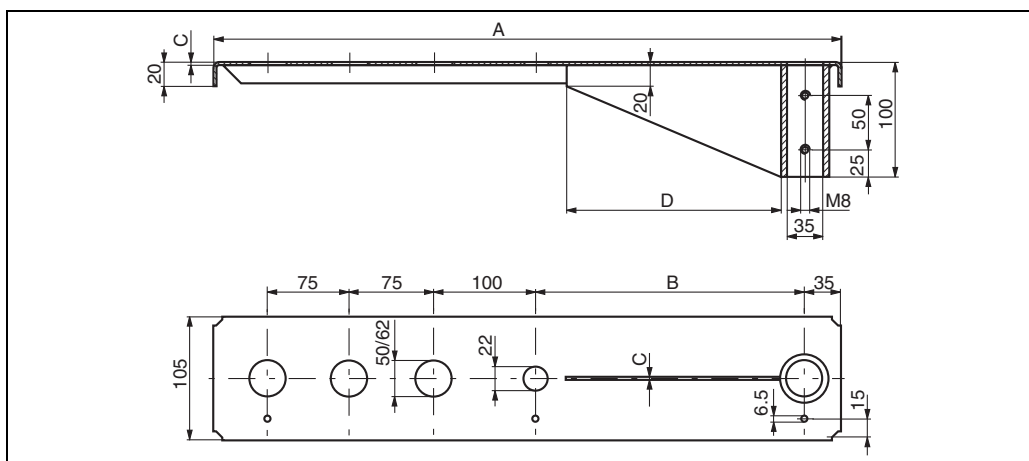
Suited for NPT 1½" and 2" as well.

9.3 Mounting bracket for LUC-M30/LUC-M40

Mounting bracket for LUC-M30/LUC-M40 (LUC-Z17) mounting.



9.4 Cantilever



A	B	C	D	For sensor	Material	Order code
585 mm	250 mm	2 mm	200 mm	LUC-M10	stainless steel 1.4571 (316Ti)	LUC-Z20
					galv. steel	LUC-Z21
				LUC-M20	stainless steel 1.4571 (316Ti)	LUC-Z22
					galv. steel	LUC-Z23
1085 mm	750 mm	3 mm	300 mm	LUC-M10	stainless steel 1.4571 (316Ti)	LUC-Z24
					galv. steel	LUC-Z25
				LUC-M20	stainless steel 1.4571 (316Ti)	LUC-Z26
					galv. steel	LUC-Z27

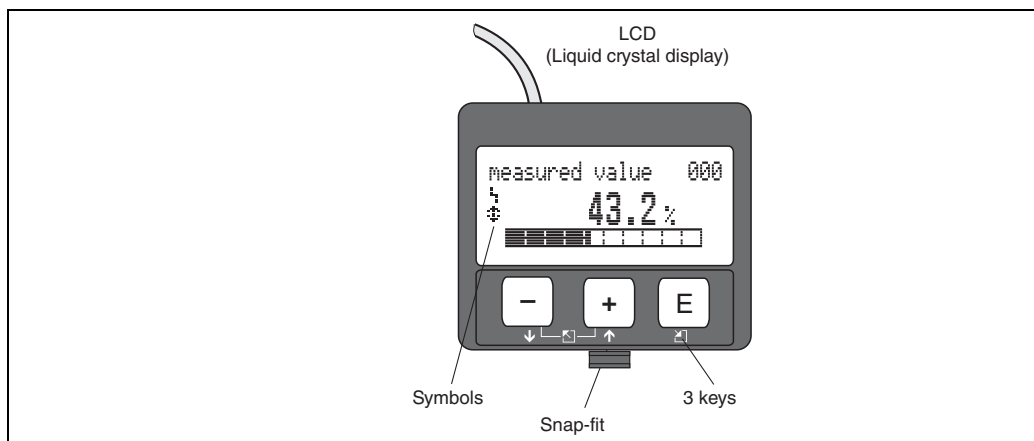
- The 50 mm or 62 mm orifices serve for the mounting of the LUC-M10 or LUC-M20 sensor, respectively.
- The 22 mm orifice may be used for an additional sensor.

For the assembly of the cantilever can be used:

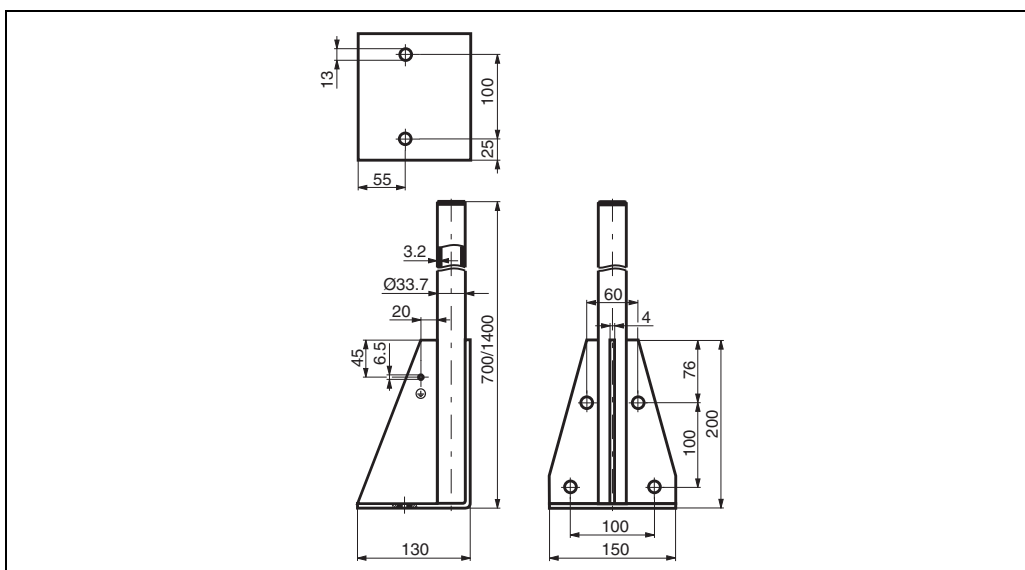
- a mounting frame, see page 62
- a wall bracket, see page 62

9.5 Operating and display module LUC-Z15

LCD display for on-site operation of the LUC-M** (LUC-Z15)

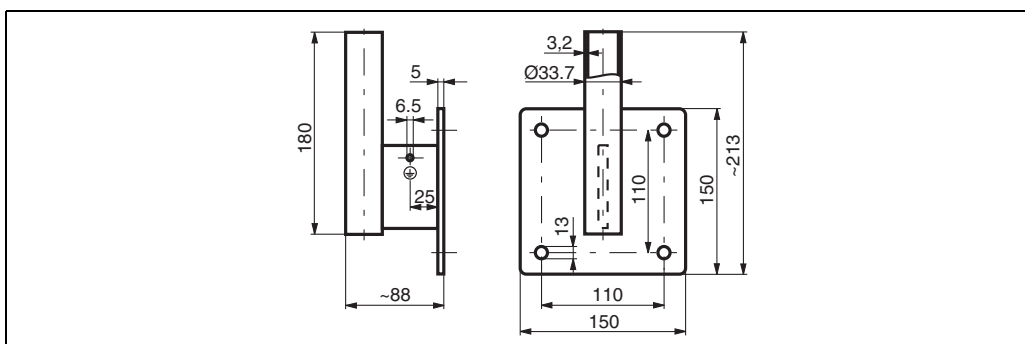


9.6 Mounting frame for cantilever



Height	Material	Order code
700 mm	galv. steel	LUC-Z30
700 mm	stainless steel 1.4571 (316Ti)	LUC-Z31
1400 mm	galv. steel	LUC-Z32
1400 mm	stainless steel 1.4571 (316Ti)	LUC-Z33

9.7 Wall bracket for cantilever



Order code	Material
LUC-Z50	galv. steel
LUC-Z51	stainless steel 1.4571 (316Ti)

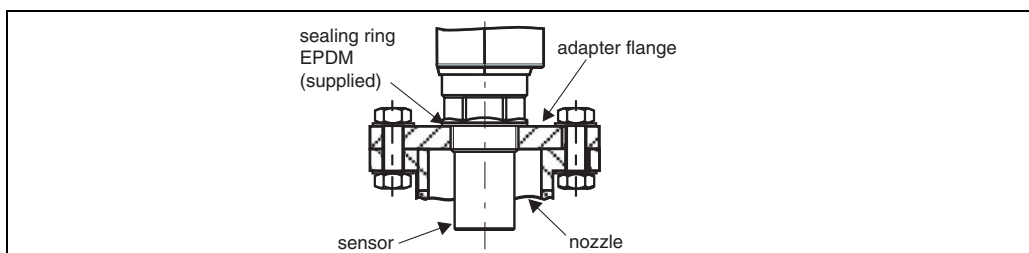
9.8 Proficard

To connect a laptop to the PROFIBUS

9.9 Profiboard

To connect a PC to the PROFIBUS

9.10 Adapter flange for LUC-M10/LUC-M20



9.10.1 Version with metrical thread

		Process gland	
	F73	DN50 PN16	
	F93	DN80 PN16	
	FA3	DN100 PN16	
	XXX	further process glands	
		Sensor gland	
	G5	G1½, ISO 228	
	G6	G2, ISO 228	
		Material	
	S	stainless steel 1.4435 (316L)	
	P	PPS (Polypropylen)	
LUC-Z-			product designation

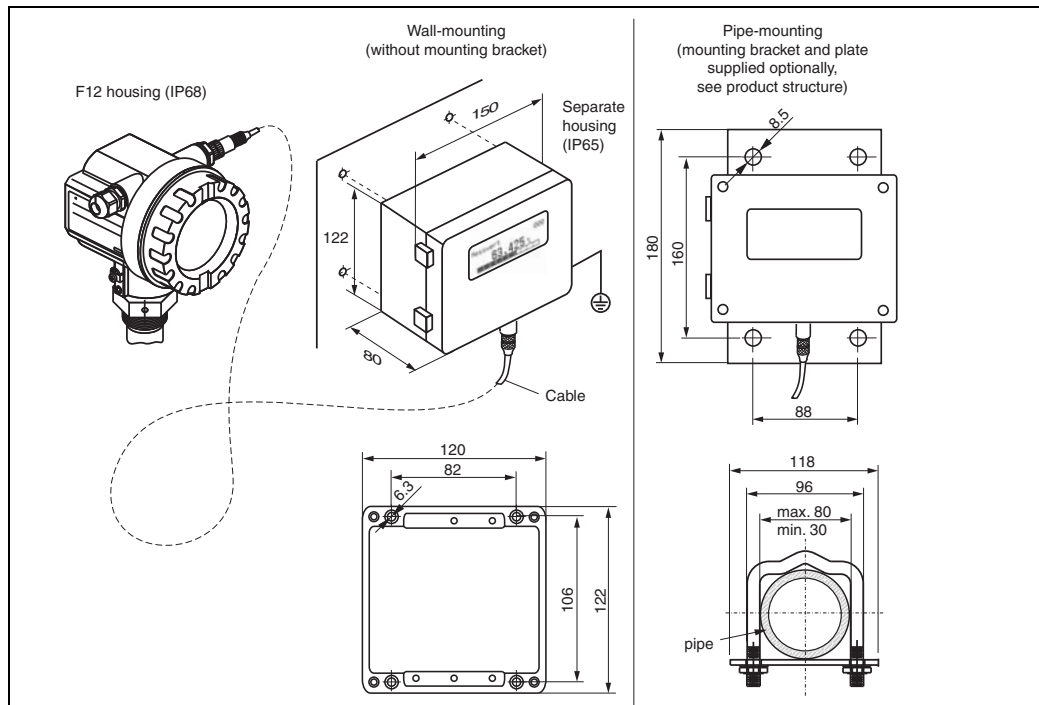
9.10.2 Version with conical thread

		Process gland	
	A61	ANSI 2", 150 psi	
	A81	ANSI 3", 150 psi	
	A91	ANSI 4", 150 psi	
	XXX	further process glands	
		Sensor gland	
	N5	NPT 1½	
	N6	NPT 2	
		Material	
	S	stainless steel 1.4435 (316L)	
	P	PPS (Polypropylen)	
LUC-Z-			product designation

9.11 Universal slip-on flange for LUC-M30

	Process gland	
FA3	DN100 PN16	
A91	ANSI 4", 150 psi	
J20	JIS16K100	
	Material	
P	PPS (Polypropylen), max. 1.5 bar abs.	
L	steel, varnished	
S	stainless steel 1.4571 (316Ti)	
LUC-Z-		product designation

9.12 Remote display and operation



Technical data:

max. cable length	20 m, 65 ft (fixed length with connection plug)
temperature range	-30 °C...+70 °C (243 K ... 343 K)
degree of protection	housing IP65/67, cable IP68 acc. to EN 60529
material	housing: alloy of aluminium ALSi12 cable gland: brass, nickel-plated
dimensions (H x B x T)	122 mm x 150 mm x 80 mm

Version	Order code
remote display with on-site operation, 20 m cable	LUC-Z40-NA1A
remote display with on-site operation, 20 m cable, with mounting bracket 2"	LUC-Z40-NA1B
remote display with on-site operation, 20 m cable, 2G EEx ia, 3D	LUC-Z40-EX1A
remote display with on-site operation, 20 m cable, with mounting bracket 2", 2G EEx ia, 3D	LUC-Z40-EX1B

10 Technical data

10.1 Input

Measured variable The distance D between the sensor membrane and the product surface is measured. Using the linearisation function, the device uses D to calculate:

- level L in any units
- volume V in any units
- flow Q across measuring weirs or open channels in any units

**Maximum range/
 blocking distance**

Sensor	BD	Max. range in liquids	Max. range in solids
LUC-M10	0.25 m	5 m	2 m
LUC-M20	0.35 m	8 m	3.5 m
LUC-M30	0.6 m	15 m	7 m
LUC-M40	0.4 m	10 m	5 m

The actual range is dependent on the measuring conditions. Refer to technical information TI 365O/98/en for an estimation.

10.2 Output

Output signal PROFIBUS PA

Signal on alarm Error information can be accessed via the following interfaces:

- Error symbol, error code and plain text description on the on-site display
- Status byte of the digital signal input

10.3 Auxiliary energy

Terminals Cable cross-section: 0.5 mm² ... 2.5 mm² (20 ... 14 AWG)

- Cable entry**
- Cable gland M20 x 1.5 (recommended cable diameter 6 mm ... 10 mm)
 - Cable entry G $\frac{1}{2}$ or $\frac{1}{2}$ NPT
 - PROFIBUS M12 plug

Supply voltage 9 V ... 32 V

There may be additional restrictions for devices with an explosion protection certificate. Refer to the notes in the appropriate safety instructions (SI).

Current consumption approx. 12 mA for the range of voltages given above

10.4 Performance characteristics

Reaction time The reaction time depends on the parameter settings: min. 2 s

- Reference operating conditions**
- temperature = +20 °C (293 K)
 - pressure = 1013 mbar abs.
 - humidity = 50 %
 - ideal reflective surface (e. g. calm, smooth fluid surface)
 - no interference reflections within signal beam
 - set application parameters:
 - tank shape = flat ceiling
 - medium property = liquid
 - process conditions = calm surface

Measured value resolution

Sensor	Measured value resolution
LUC-M10	1 mm
LUC-M20	1 mm
LUC-M30	2 mm
LUC-M40	2 mm

Measuring error Typical specifications for reference operating conditions (include linearity, repeatability, and hysteresis):

Sensor	Measuring error
LUC-M10	± 2 mm or 0.2 % of set measuring range ¹
LUC-M20	± 2 mm or 0.2 % of set measuring range ¹
LUC-M30	± 4 mm or 0.2 % of set measuring range ¹
LUC-M40	± 4 mm or 0.2 % of set measuring range ¹

¹whichever is greater.

Influence of the vapour pressure The vapour pressure at 20 °C (68 °F) gives a hint on the accuracy of the ultrasonic level measurement. If the vapour pressure at 20 °C (68 °F) is below 50 mbar, ultrasonic level measurement is possible with a very high accuracy. This is valid for water, aqueous solutions, watersolid-solutions, dilute acids (hydrochloric acid, sulfuric acid, ...), dilute bases (caustic soda, ...), oils, greases, slurries, pastes, ...

High vapour pressures or outgassing media (ethanol, acetone, ammonia, ...) can influence the accuracy. If conditions like these are present, please contact the Pepperl+Fuchs support.

10.5 Ambient conditions

Ambient temperature -40 °C ... +80 °C (233 K ... 353 K)

The functionality of the LC display becomes restricted at $T_u < -20\text{ °C}$ (253 K) and $T_u > +60\text{ °C}$ (333 K).

If the device is operated outdoors in strong sunlight, you should use a protective cover.

Storage temperature -40 °C ... +80 °C (233 K ... 353 K)

Climate class EN 60068-2-38 (Test Z/AD) DIN/IEC 68 T2-30Db

- Protection degree**
- with closed housing, tested according to
 - IP68, NEMA 6P (24h at 1.83 m under water surface)
 - IP66, NEMA 4x
 - with open housing: IP20, NEMA 1 (also ingress protection of the display)



Caution!

Degree of protection IP68 NEMA 6P applies for M12 PROFIBUS PA plugs only when the PROFIBUS cable is plugged in.

Vibration resistance EN 60068-2-64/IEC 68-2-64: 20 Hz ... 2000 Hz, $1\text{ (m/s}^2\text{)}^2\text{/Hz}$; 3 x 100 min

- Electromagnetic compatibility (EMC)**
- Interference emission to EN 61326, Equipment Class B
 - Interference immunity to EN 61326, Appendix A (Industrial) and NAMUR Recommendation NE 21 (EMC).

10.6 Process conditions

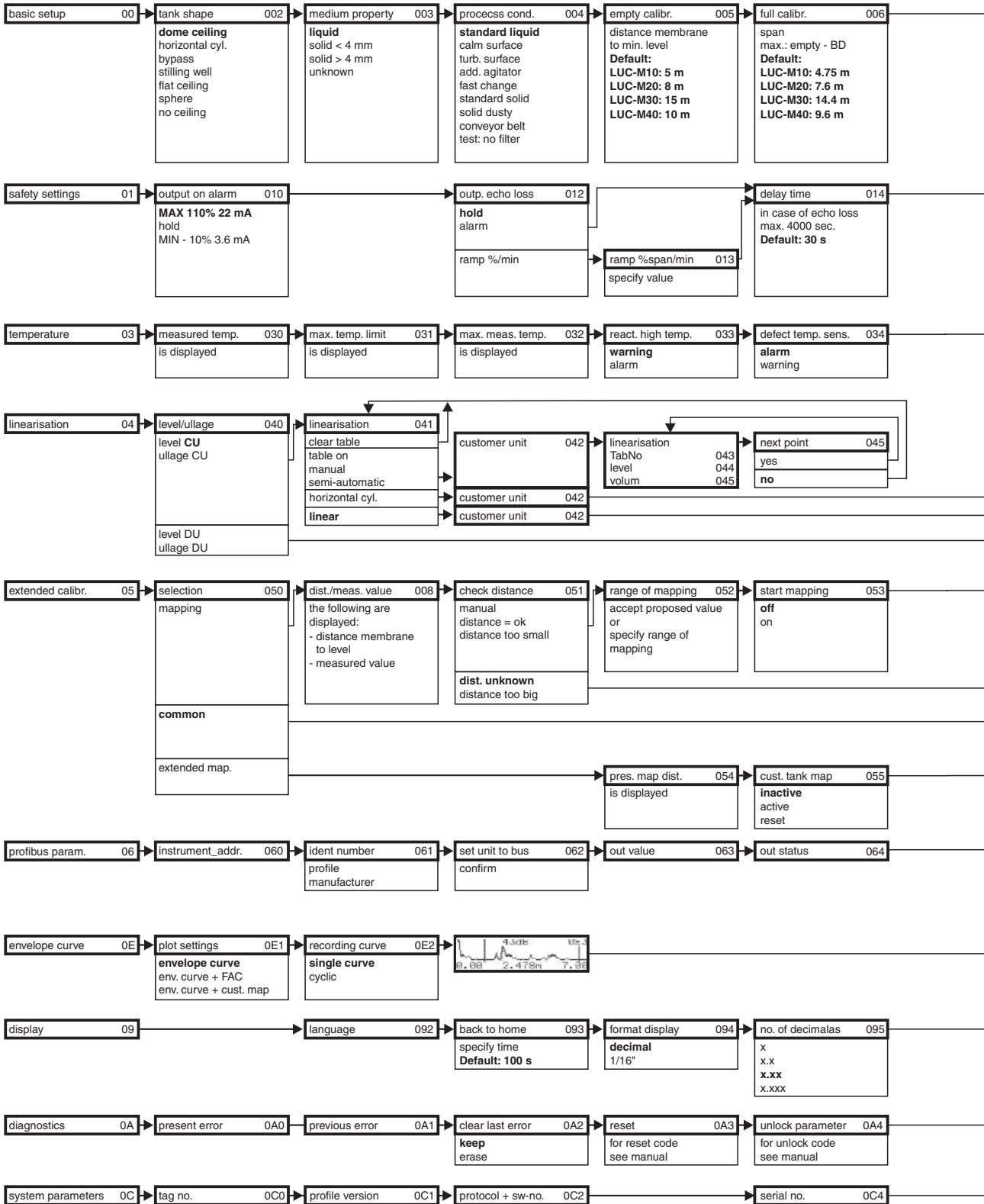
Process temperature -40°C ... +80°C (233 K ... 353 K)

A temperature sensor is integrated in the sensor for correction of the temperature-dependent time-of-flight.

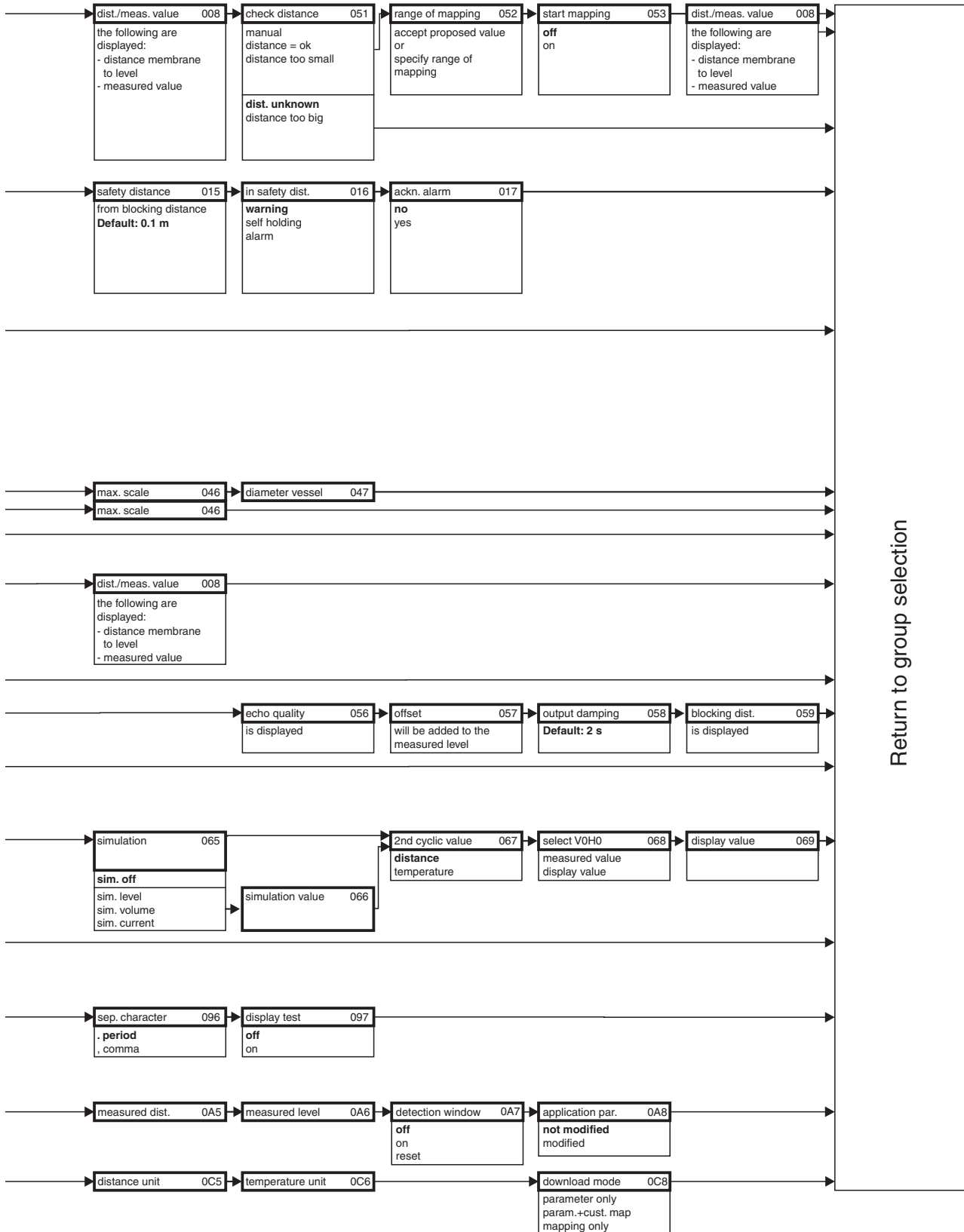
- Process pressure**
- LUC-M10/LUC-M20: 0.7 bar ... 3 bar abs.
 - LUC-M30/LUC-M40: 0.7 bar ... 2.5 bar abs.

11 Appendix

11.1 Operating menu

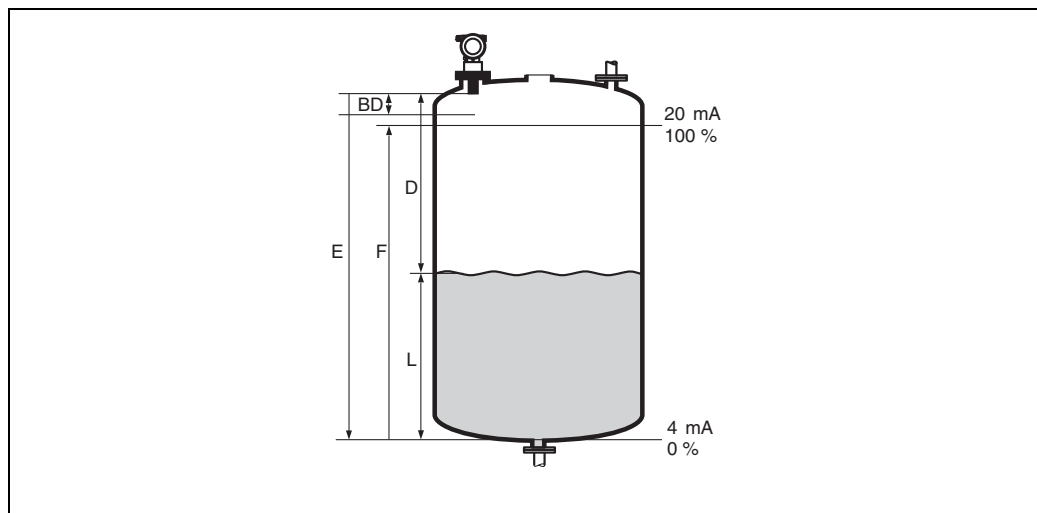


Note! The default values of the parameters are typed in bold face.



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11.2 Measuring principle



E: Empty distance; **F:** Span (full distance); **D:** Distance from sensor membrane - product surface; **L:** Level; **BD:** Blocking distance

Sensor	BD	Max. range fluids	Max. range bulk materials
LUC-M10	0.25 m	5 m	2 m
LUC-M20	0.35 m	8 m	3.5 m
LUC-M30	0.6 m	15 m	7 m
LUC-M40	0.4 m	10 m	5 m

11.2.1 Time-of-flight method

The sensor of the LUC-M** transmits ultrasonic pulses in the direction of the product surface. There, they are reflected back and received by the sensor.

The LUC-M** measures the time t between pulse transmission and reception. The instrument uses the time t (and the velocity of sound c) to calculate the distance D between the sensor membrane and the product surface:

$$D = c \times t / 2$$

As the device knows the empty distance E from a user entry, it can calculate the level as follows:

$$L = E - D$$

An integrated temperature sensor compensates for changes in the velocity of sound caused by temperature changes.

11.2.2 Interference echo suppression

The interference echo suppression feature on the LUC-M** ensures that interference echos (e. g. from edges, welded joints and installations) are not interpreted as a level echo.

11.2.3 Calibration

Enter the empty distance E and the span F to calibrate the device.

11.2.4 Blocking distance

Span F may not extend into the blocking distance BD . Level echos from the blocking distance cannot be evaluated due to the transient characteristics of the sensor.





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Type of instrument/sensor _____ **Serial number** _____
Geräte-/Sensortyp _____ **Seriennummer** _____

Used as SIL device in a Safety Instrumented System/Einsatz als SIL-Gerät in Schutzeinrichtungen

Process data/ Temperature/*Temperatur* _____ [°F] _____ [°C] Pressure/*Druck* _____ [psi] _____ [Pa]
Prozessdaten Conductivity/*Leitfähigkeit* _____ [µS/cm] Viscosity/*Viskosität* _____ [cp] _____ [mm²/s]

Medium and warnings
Warnhinweise zum Medium



	Medium/concentration <i>Medium/Konzentration</i>	Identification <i>CAS No.</i>	flammable <i>entzündlich</i>	toxic <i>giftig</i>	corrosive <i>ätzend</i>	harmful/ irritant <i>gesundheitsschädlich/ reizend</i>	other * <i>sonstiges*</i>	harmless <i>unbedenklich</i>
Process medium <i>Medium im Prozess</i>								
Medium for process cleaning <i>Medium zur Prozessreinigung</i>								
Returned part cleaned with <i>Medium zur Endreinigung</i>								

* explosive; oxidising; dangerous for the environment; biological risk; radioactive
 * *explosiv; brandfördernd; umweltgefährlich; biogefährlich; radioaktiv*

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