



Level



Pressure



Flow



Temperature



Liquid  
Analysis



Registration



Systems  
Components



Services

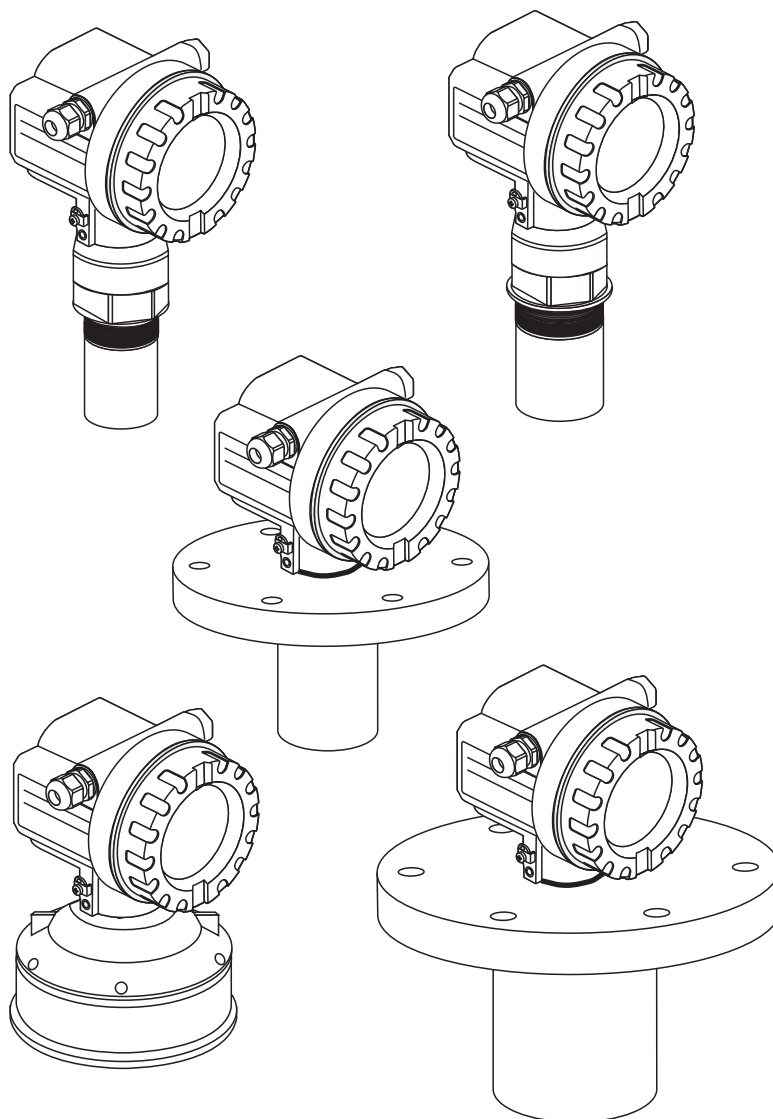


Solutions

## Operating Instructions

# Prosonic M FMU40/41/42/43/44

## Ultrasonic Level Measurement



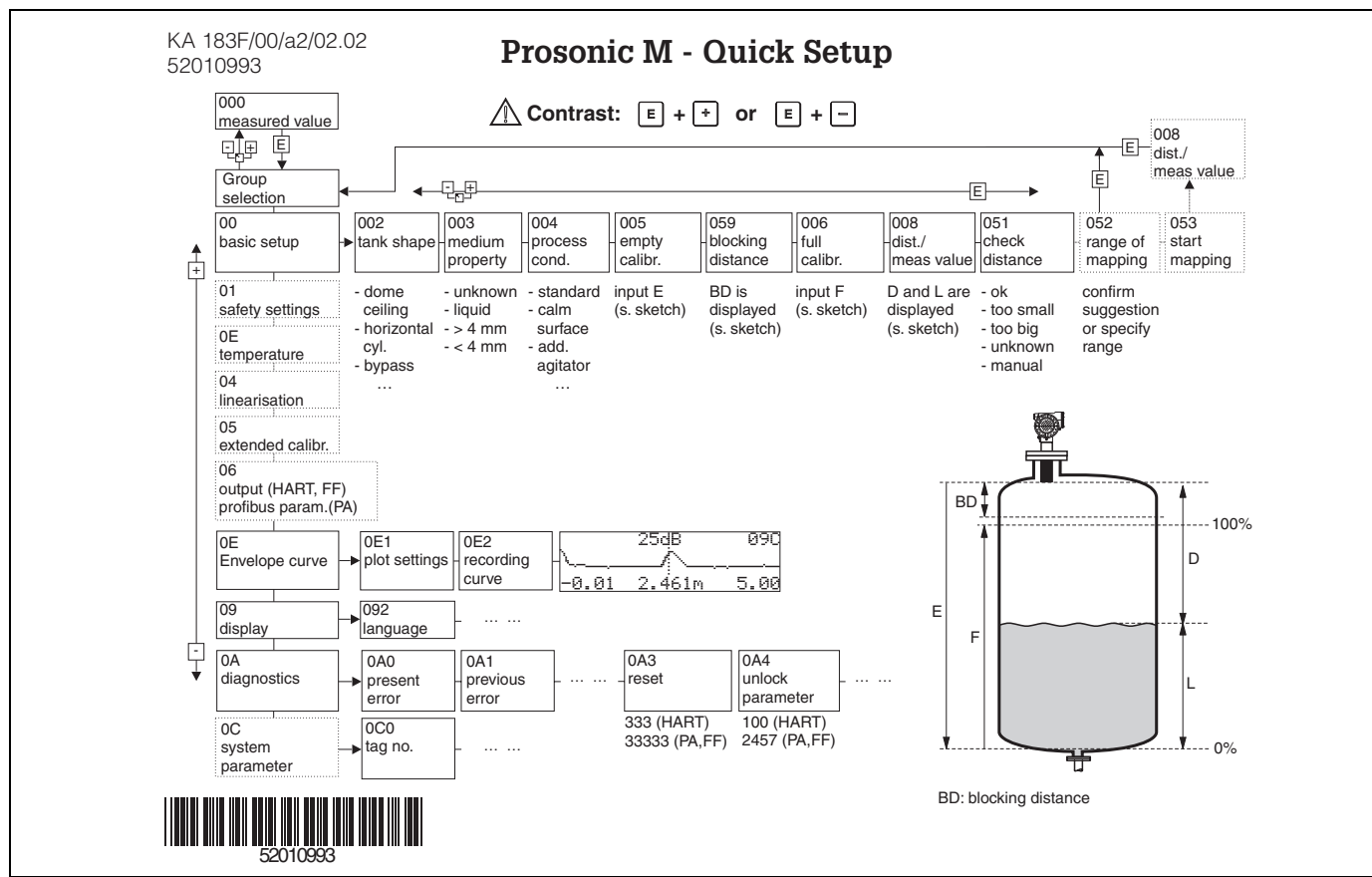
BA237F/00/en/04.07  
52010990

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

**Endress+Hauser**

People for Process Automation

## Short instructions



## Contents of the operating instructions

This operating instructions describes the installation and commissioning of the Prosonic M ultrasonic level transmitter. It contains all the functions required for a normal measuring operation. Also, the Prosonic 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 BA 240F/00/en "Prosonic M - Description of Instrument Functions". This is located on the supplied documentation CD-ROM.

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# **1 Safety instructions**

## **1.1 Designated use**

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

## **1.2 Installation, commissioning, operation**

The Prosonic 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 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 standards and regulations.

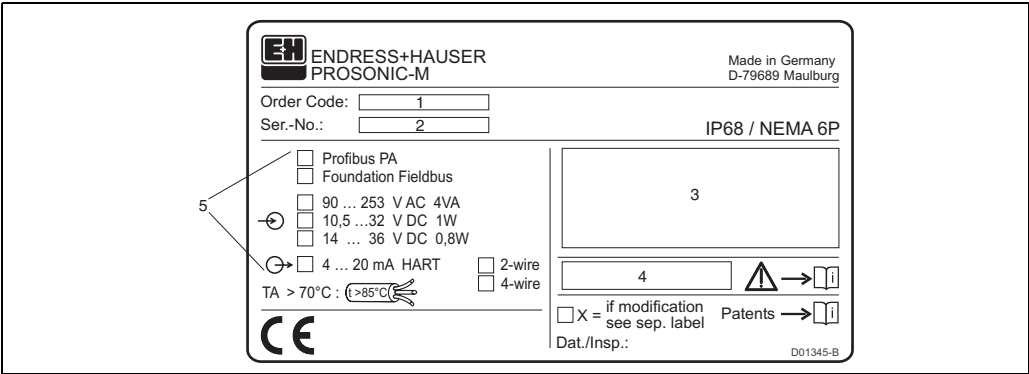
## 1.4 Notes on safety conventions and symbols

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	
	<b>Warning!</b> A warning highlights actions or procedures which, if not performed correctly, will lead to personal injury, a safety hazard or destruction of the instrument
	<b>Caution!</b> Caution highlights actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the instrument
	<b>Note!</b> 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	
	<b>Device certified for use in explosion hazardous area</b> If the device has this symbol embossed on its name plate it can be installed in an explosion hazardous area
	<b>Explosion hazardous area</b> 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.
	<b>Safe area (non-explosion hazardous area)</b> 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	
	<b>Direct voltage</b> A terminal to which or from which a direct current or voltage may be applied or supplied
	<b>Alternating voltage</b> A terminal to which or from which an alternating (sine-wave) current or voltage may be applied or supplied
	<b>Grounded terminal</b> A grounded terminal, which as far as the operator is concerned, is already grounded by means of an earth grounding system
	<b>Protective grounding (earth) terminal</b> A terminal which must be connected to earth ground prior to making any other connection to the equipment
	<b>Equipotential connection (earth bonding)</b> 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
	<b>Temperature resistance of the connection cables</b> States, that the connection cables must be resistant to a temperature of at least 85 °C.

## 2 Identification

### 2.1 Nameplate



*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)*

## 2.2 Product structure FMU 40

Certificates				
	A	Variant for non-hazardous area		
	1	ATEX II 1/2 G or II 2 G; EEX ia IIC T6		
	4	ATEX II 1/2 G or II 2 G; EEX d [ia] IIC T6		
	G	ATEX II 3G EEx nA II T6		
	2	ATEX II 1/2D, Alu blind cover		
	5	ATEX II 1/3D		
	S	FM IS Cl. I,II,III Div. 1 Gr. A-G / NI Cl. I Div. 2		
	T	FM XP Cl. I,II,III Div. 1 Gr. A-G		
	U	CSA IS Cl. I,II,III Div. 1 Gr. A-G / NI Cl. I Div. 2		
	V	CSA XP Cl. I,II,III Div. 1 Gr. A-G		
	N	CSA General Purpose		
	K	TIS Ex ia II C T6		
	Y	Special certificate		
Process connection				
	R	G 1½“ threadISO 228		
	N	NPT 1½“ - 11,5 thread		
	Y	Special version		
Power supply/communication				
	B	2 wire, 4...20mA-loop/HART		
	H	4 wire, 10,5...32VDC / 4-20mA HART		
	G	4 wire, 90...253VAC / 4-20mA HART		
	D	2 wire, PROFIBUS PA		
	F	2 wire, Foundation Fieldbus		
	Y	Special version		
Display / on-site operation				
	1	Without LC display		
	2	With LC display VU 331 incl. on-site operation		
	3	Prepared for remote display FHX 40		
	9	Special version		
Housing				
	A	Aluminium F12 housing coated to IP 68		
	C	Aluminium T12 housing coated to IP 68; with separate terminal compartment		
	D	Aluminium T12 housing coated to IP 68; with separate terminal compartment; with overvoltage protection		
	9	Special version		
Screw union/entry				
	2	M20x1.5 screw union		
	3	G 1/2“ entry		
	4	NPT 1/2“ entry		
	5	M12 PROFIBUS-PA plug-in connector		
	6	7/8" FF plug		
	9	Special version		
FMU 40 -				Product designation

## 2.3 Product structure FMU 41

Certificates					
A	Variant for non-hazardous area				
1	ATEX II 1/2 G or II 2 G; EEX ia IIC T6				
4	ATEX II 1/2 G or II 2 G; EEX d [ia] IIC T6				
G	ATEX II 3G EEx nA II T6				
2	ATEX II 1/2D, Alu blind cover				
5	ATEX II 1/3D				
S	FM IS Cl. I,II,III Div. 1 Gr. A-G / NI Cl. I Div. 2				
T	FM XP Cl. I,II,III Div. 1 Gr. A-G				
U	CSA IS Cl. I,II,III Div. 1 Gr. A-G / NI Cl. I Div. 2				
V	CSA XP Cl. I,II,III Div. 1 Gr. A-G				
N	CSA General Purpose				
K	TIIS Ex ia II C T6				
Y	Special certificate				
Process connection					
R	G 2" thread ISO 228				
N	NPT 2" - 11,5 thread				
Y	Special version				
Power supply/communication					
B	2 wire, 4...20mA-loop/HART				
H	4 wire, 10,5...32VDC / 4-20mA HART				
G	4 wire, 90...253VAC / 4-20mA HART				
D	2 wire, PROFIBUS PA				
F	2 wire, Foundation Fieldbus				
Y	Special version				
Display / on-site operation					
1	Without LC display				
2	With LC display VU 331 incl. on-site operation				
3	Prepared for remote display FHX 40				
9	Special version				
Housing					
A	Aluminium F12 housing coated to IP 68				
C	Aluminium T12 housing coated to IP 68 with separate terminal compartment				
D	Aluminium T12 housing coated to IP 68; with separate terminal compartment; with overvoltage protection				
9	Special version				
Screw union/entry					
2	M20x1.5 screw union				
3	G 1/2" entry				
4	NPT 1/2" entry				
5	M12 PROFIBUS-PA plug-in connector				
6	7/8" FF plug				
9	Special version				
FMU 41 -					Product designation



## 2.4 Product structure FMU 42

Certificates									
	A								Variant for non-hazardous area
	1								ATEX II 1/2 G EEX ia IIC T6
	4								ATEX II 1/2 G EEX d [ia] IIC T6
	G								ATEX II 3G EEx nA II T6 (in preparation)
	2								ATEX II 1/2 D, Alu bond cover
	5								ATEX II 1/3D
	S								FM IS Cl. I,II,III Div. 1 Gr. A-G / NI Cl. I Div. 2
	T								FM XP Cl. I,II,III Div. 1 Gr. A-G
	U								CSA IS Cl. I,II,III Div. 1 Gr. A-G / NI Cl. I Div. 2
	V								CSA XP Cl. I,II,III Div. 1 Gr. A-G
	N								CSA General Purpose
	K								TIIS Ex ia II C T6 (in preparation)
	Y								Special certificate
Process connection									
	M								mounting bracket FAU20
	P								DN80/ANSI 3"/JIS10K80, PP, Universal flange
	Q								DN80/ANSI 3"/JIS10K80, PVDF, Universal flange
	S								DN80/ANSI 3"/JIS10K80, 316L, Universal flange
	T								DN100/ANSI 4"/JIS16K100, PP, Universal flange
	U								DN100/ANSI 4"/JIS16K100, PVDF, Universal flange
	V								DN100/ANSI 4"/JIS16K100, 316L, Universal flange
	Y								Special version
Power supply/communication									
	B								2 wire, 4...20mA-loop/HART
	H								4 wire, 10,5...32VDC / 4-20mA HART
	G								4 wire, 90...253VAC / 4-20mA HART
	D								2 wire, PROFIBUS PA
	F								2 wire, Foundation Fieldbus
	Y								Special version
Display / on-site operation									
	1								Without LC display
	2								With LC display VU 331 incl. on-site operation
	3								Prepared for remote display FHX 40
	9								Special version
Housing									
	A								Aluminium F12 housing coated to IP 68
	C								Aluminium T12 housing coated to IP 68, with separate terminal compartment
	D								Aluminium T 12 housing coated to IP 68, with separate terminal compartment; with overvoltage protection
	Y								Special version
Gland/Entry									
	2								M20x1.5 gland
	3								G 1/2" entry
	4								NPT 1/2" entry
	5								M12 PROFIBUS-PA plug
	6								7/8" FF plug
	9								Special version
Sealing Sensor/Flange									
	2								VITON flat sealing
	3								EPDM flat sealing
	9								special version
Additional options									
	A								Additional options not selected
FMU 42 -									Product designation

## 2.5 Product structure FMU 43

Certificates					
	A				Variant for non-hazardous area
	2				ATEX II 1/2 D or II 2 D, Aluminium Deckel
	5				ATEX II 1/3 D or II 3 D, Sichtdeckel
	M				FM DIP Class II, III, Div. 1, Gr. E,F,G NI
	N				CSA General Purpose
	P				CSA DIP, Class II, III, Div. 1, Gr. E,F,G NI
	Y				Special version
Process connection/material					
	P				Flange DN 100/ANSI 4"/JIS 16K100, PP (universal slip-on flange included)
	S				Flange DN 100/ANSI 4"/JIS 16K100, SS 316TI (universal slip-on flange included)
	K				Without slip-on flange/without mounting bracket (customer mounting equipment)
	M				With mounting bracket
	Y				Special version
Power supply/communication					
	H				4 wire, 10,5...32VDC / 4-20mA HART
	G				4 wire, 90...253VAC / 4-20mA HART
	D				2 wire, PROFIBUS PA
	F				2 wire, Foundation Fieldbus
	Y				Special version
Display / on-site operation					
	1				Without LC display
	2				With LC display VU 331 incl. on-site operation
	3				Prepared for remote display FHX 40
	9				Special version
Housing					
	A				Aluminium F12 housing coated to IP 68
	9				Special version
Screw union/entry					
	2				M20x1.5 screw union
	3				G 1/2" entry
	4				NPT 1/2" entry
	5				M12 PROFIBUS-PA plug-in connector
	6				7/8" FF plug
	9				Special version
FMU 43 -					Product designation

## 2.6 Product structure FMU 44

Approval			
	A	Non-hazardous area	
	1	ATEX II 1/2G EEx ia IIC T6 (in preparation)	
	4	ATEX II 1/2G EEx d (ia) IIC T6 (in preparation)	
	G	ATEX II 3 G EEx nA II T6 (in preparation)	
	2	ATEX II 1/2 D, Alu blind cover (in preparation)	
	5	ATEX II 1/3 D	
	S	FM IS Cl.I,II,III Div.1 Gr.A-G, NI Cl.I Div.2 (in preparation)	
	T	FM XP Cl.I,II,III Div.1 Gr.A-G (in preparation)	
	N	CSA General Purpose (in preparation)	
	U	CSA IS Cl.I,II,III Div.1 Gr.A-G, NI Cl.I Div.2 (in preparation)	
	V	CSA XP Cl.I,II,III Div.1 Gr.A-G (in preparation)	
	K	TIIS EEx ia IIC T6 (in preparation)	
	I	NEPSI Ex ia IIC T6 (in preparation)	
	J	NEPSI Ex d(ia) IIC T6 (in preparation)	
	E	NEPSI Ex nA II T6 (in preparation)	
	Q	NEPSI DIP (in preparation)	
	Y	Special version, to be specified	
Process connection			
	T	UNI flange 4"/DN100/100, PP, max 3bar abs./ 44psia, suitable for 4" 150lbs / DN100 PN16 / 10K 100	
	U	UNI flange 4"/DN100/100, PVDF, max. 3bar abs./ 44 psia, suitable for 4" 150lbs / DN100 PN16 / 10K 100	
	V	UNI flange 4"/DN100/100, 316L, max 3bar abs./ 44psia, suitable for 4" 150lbs / DN100 PN16 / 10K 100	
	E	UNI flange 6"/DN150/150, PP, max 3bar abs./ 44psia, suitable for 6" 150lbs / DN150 PN16 / 10K 150	
	F	UNI flange 6"/DN150/150, PVDF, max 3bar abs./ 44psia, suitable for 6" 150lbs /DN150 PN16 / 10K 150	
	G	UNI flange 6"/DN150/150, 316L, max 3bar abs. 44psia, suitable for 6" 150lbs / DN150 PN16 / 10K 150	
	H	UNI flange DN200/200, PP, max 3bar abs./ 44 psia, suitable for DN200 PN16 / 10K 200	
	J	UNI flange DN200/200, PVDF, max 3bar abs./ 44psia, suitable for DN200 PN16 / 10K 200	
	K	UNI flange DN200/200, 316L, max 3bar abs./ 44psia, suitable for DN200 PN16 / 10K 200	
	L	8" 150lbs FF, PP, max 3bar abs./ 44psia	
	N	8" 150lbs FF, PVDF, max 2bar abs./ 44psia	
	A	8" 150lbs FF, 316L, max 3bar abs./44psia	
	M	Mounting bracket FAU20	
	Y	Special version, to be specified	
Power supply; Output			
	B	2-wire; 4-20mA HART	
	D	2-wire; PROFIBUS PA	
	F	2-wire; FOUNDATION Fieldbus	
	G	4-wire 90-250VAC; 4-20mA HART	
	H	4-wire 10.5-32VDC; 4-20mA HART	
	Y	Special version, to be specified	
Operation			
	1	w/o display, via communication	
	2	4-line display VU331, Envelope curve display on site	
	3	Prepared for FHX40, Remote display (accessory)	
	9	Special version, to be specified	
FMU 44 -			product designation, part 1



## 2.7 Scope of delivery

### 2.7.1 Instrument and accessories

- Instrument according to the version ordered
- "ToF Tool – FieldTool Package" (2 CD-ROMs)
- for FMU 40/41 in the versions FMU 40 \*R\*\*\*\* and FMU 41 \*R\*\*\*\*: counter nut (PC)
- for FMU 40/41: sealing ring (EPDM)
- for gland M20x1.5:
  - 1 cable gland for 2-wire instruments
  - 2 cable glands for 4-wire instruments
 The cable glands are mounted on delivery.

### 2.7.2 Supplied documentation

#### Short instructions (KA 183F, in the instrument)

intended as a memory jogger for users who are familiar with the operating concept of Endress+Hauser Time-of-Flight instruments.

#### Operating instructions (BA 237F, this booklet)

This describes the installation and commissioning of the Prosonic 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 (BA 240F)

contains a detailed description of all the functions of the Prosonic M. You can find this document as a pdf file on the supplied ToF Tool – FieldTool CD-ROM 1.

#### Safety instructions

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

## 2.8 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 EG directives. Endress+Hauser confirms the successful testing of the device by affixing to it the CE mark.

## 2.9 Registered trademarks

HART®

Registered trademark of HART Communication Foundation, Austin, USA

ToF®

Registered trademark of the company Endress+Hauser GmbH+Co. KG, Maulburg, Germany

PulseMaster®

Registered trademark of the company Endress+Hauser GmbH+Co. KG, Maulburg, Germany

### 3 Installation

#### 3.1 Design; dimensions

##### 3.1.1 FMU40, FMU41

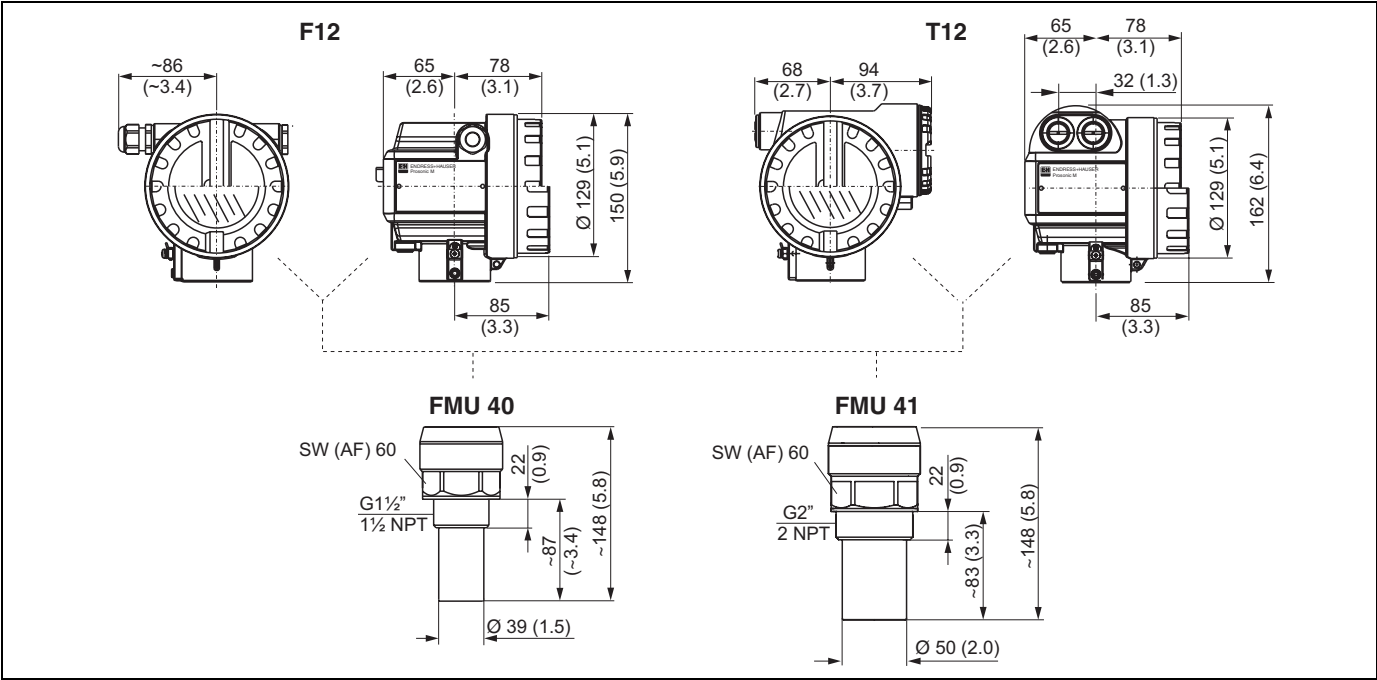
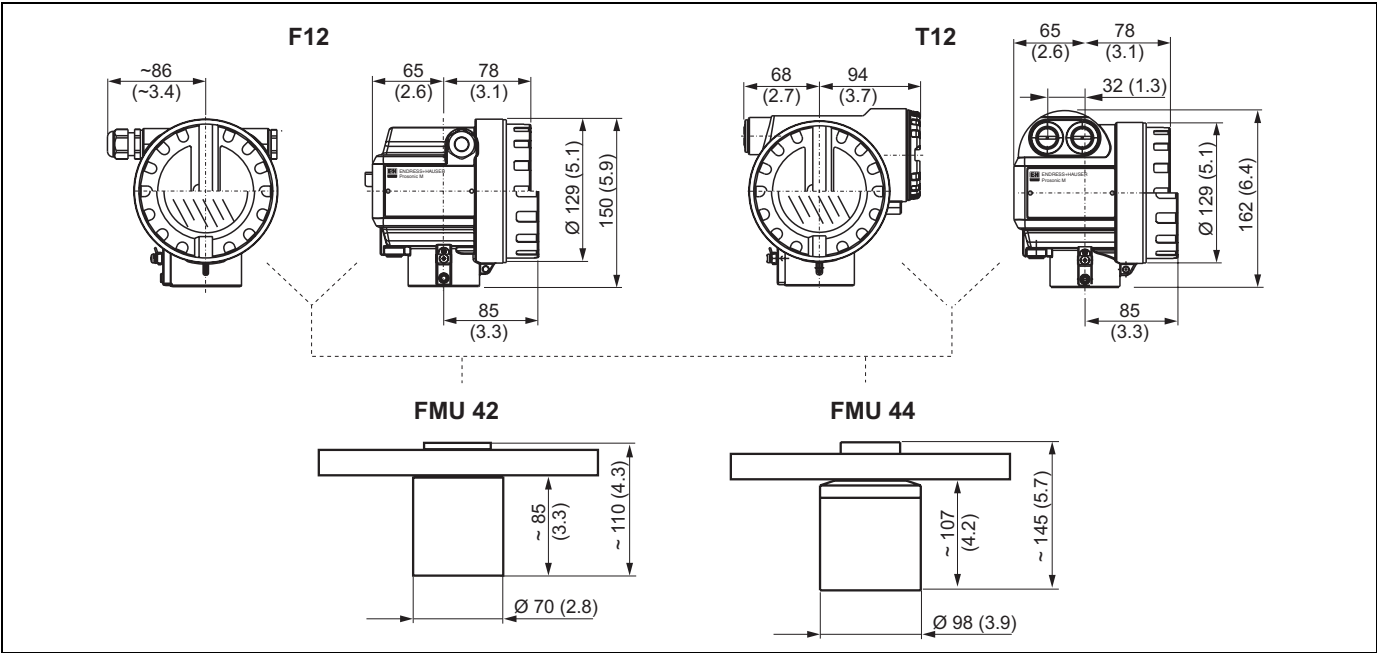


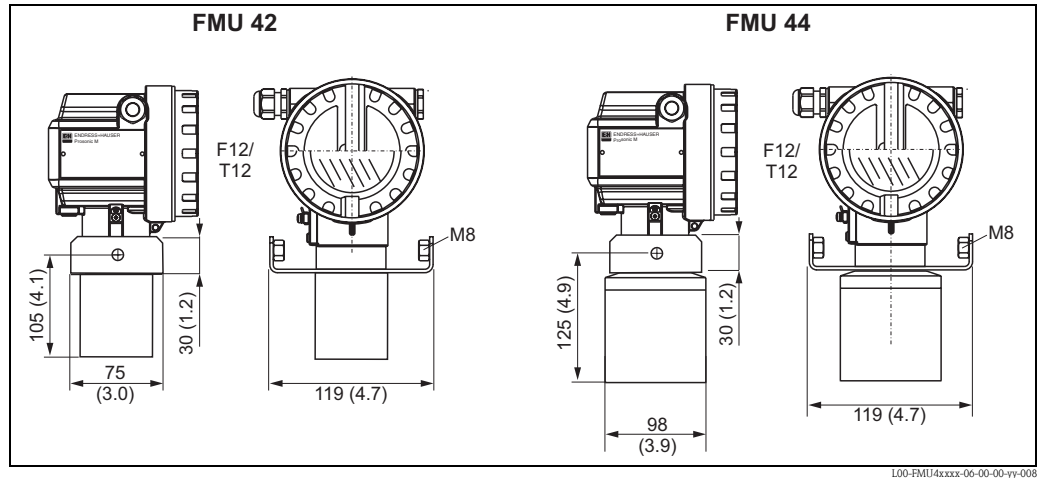
Abb. 1: Dimensions in mm (inch)

##### 3.1.2 FMU42, FMU44 with slip-on flange



Dimensions in mm (inch)

### 3.1.3 FMU42, FMU44 with mounting bracket



Dimensions in mm (inch)

### 3.1.4 FMU43

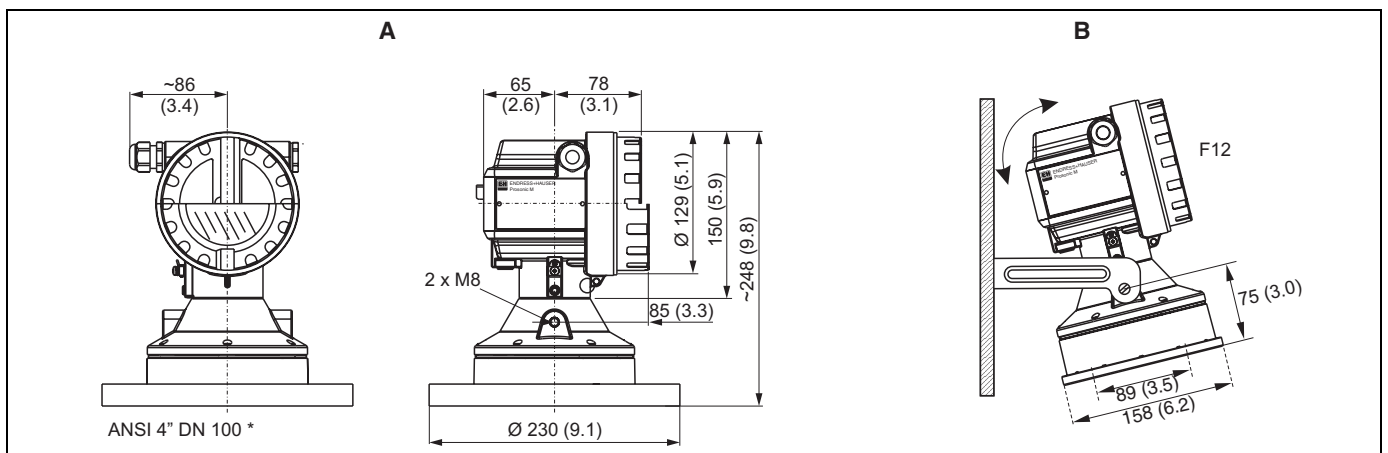


Abb. 2: Dimensions in mm (inch);  
A: with slip-on flange; B: with mounting bracket

### 3.1.5 Mounting bracket for FMU42, FMU43 and FMU44

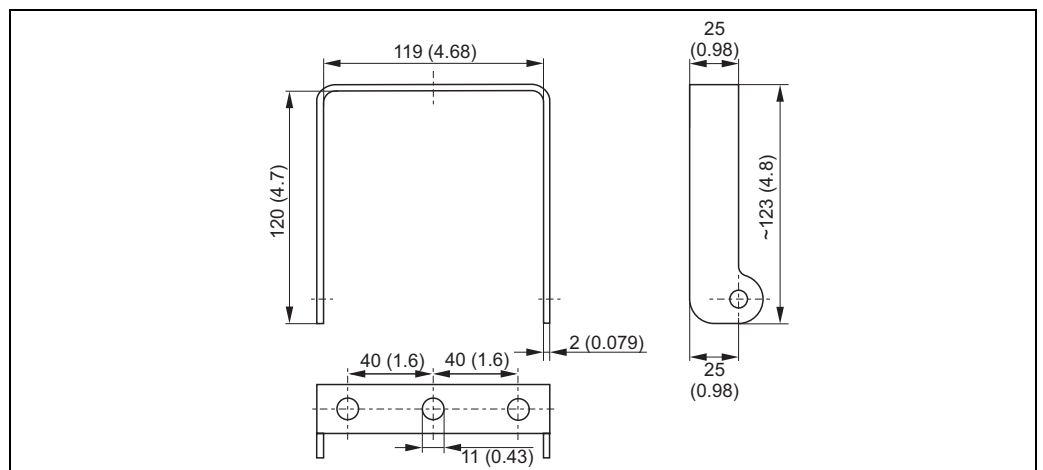
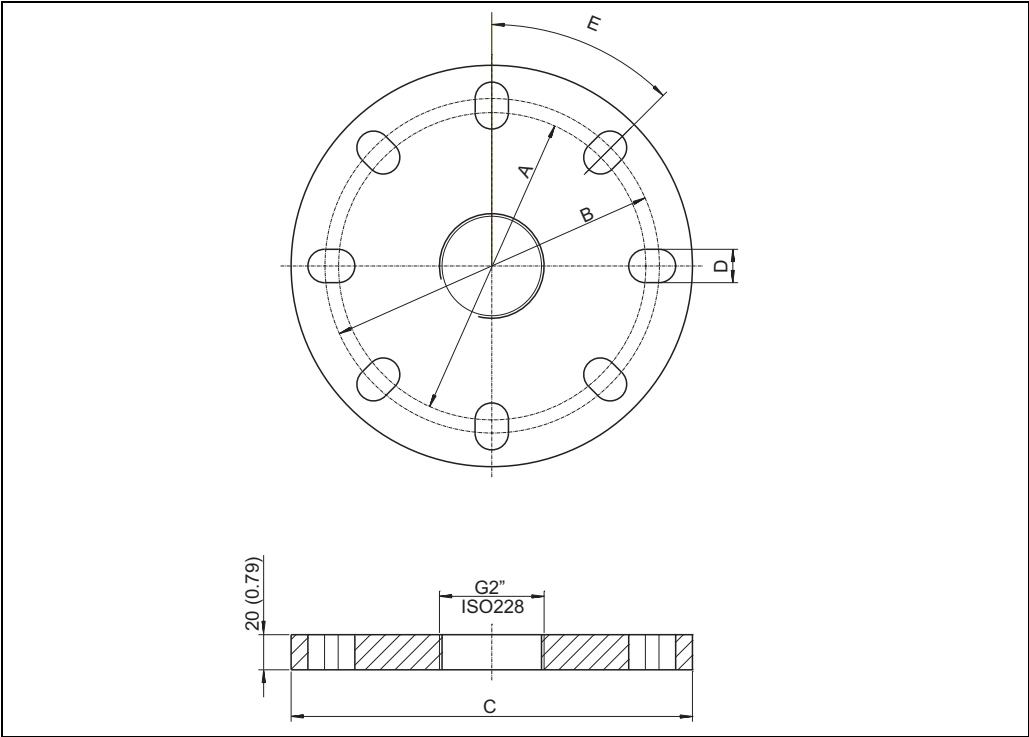


Abb. 3: Dimensions in mm (inch)

3.1.6 Flanges for FMU42 and FMU44



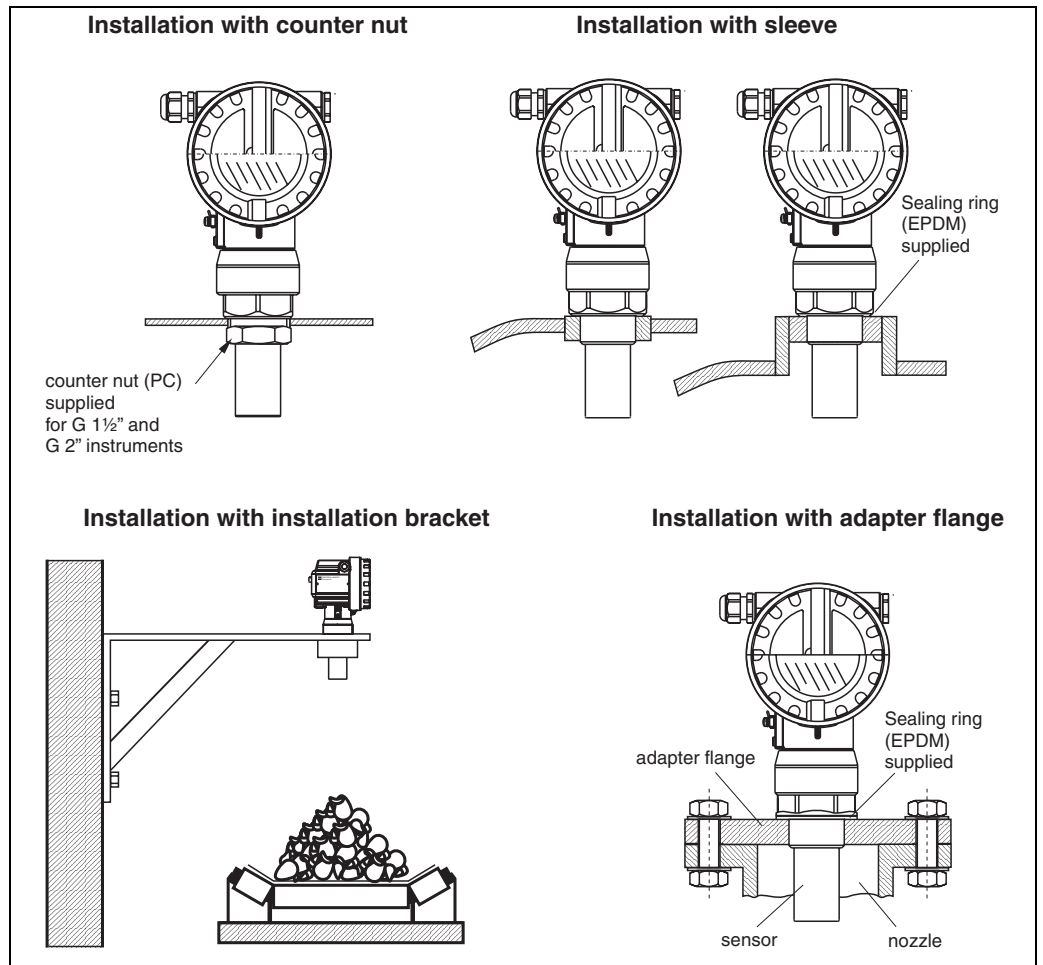
L00-FMU4xxxx-06-00-00-yy-011

suitable for	A	B	C	D	E	number of boreholes
3" 150lbs / 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

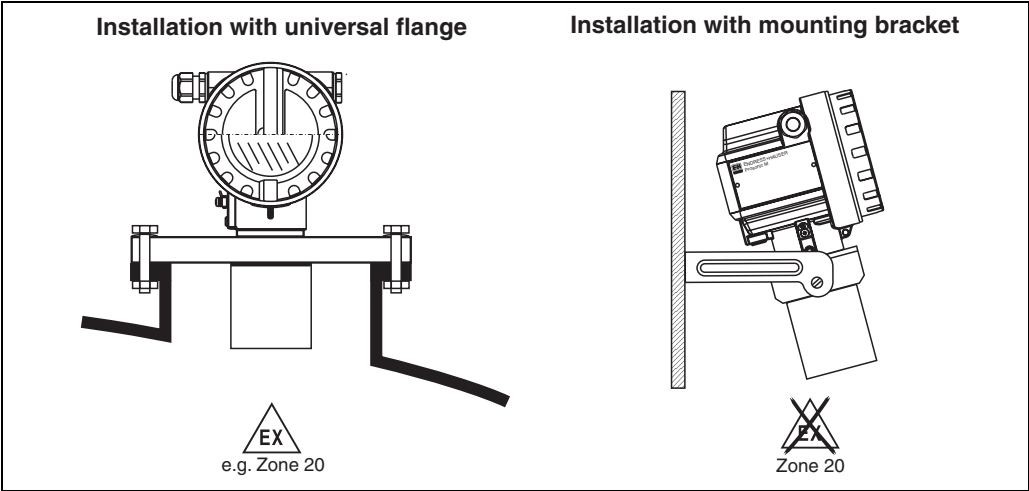
### 3.2.1 Installation variants FMU 40, FMU 41



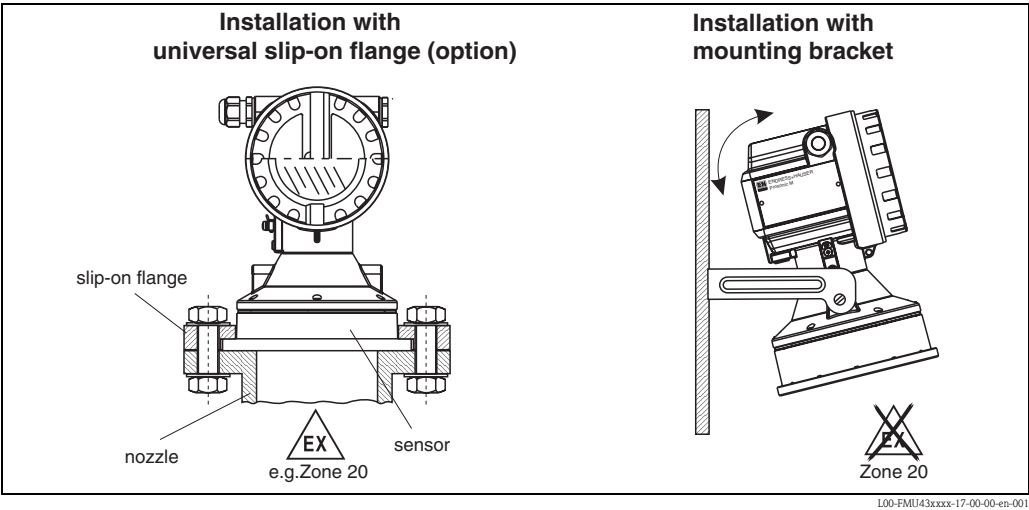
L00-FMU4xxxx-17-00-00-en-002

For installation bracket or adapter flange s. chapter "Accessories".

3.2.2 Installation variants FMU42, FMU44

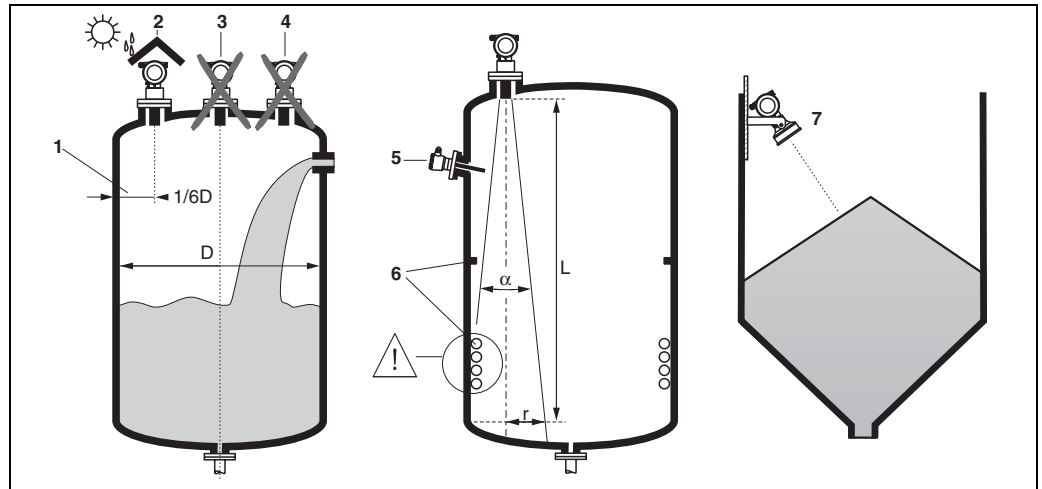


3.2.3 Installation variants FMU 43



### 3.3 Installation conditions

#### 3.3.1 Installation conditions for level measurements



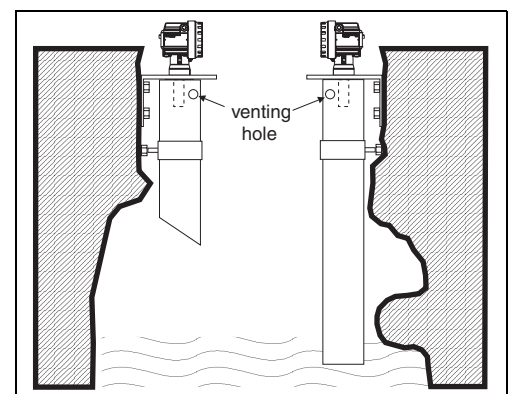
L00-FMU4xxxx-17-00-00-de-005

- 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  $\alpha$ . 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 detection range, use the 3 dB emitting angle  $\alpha$ .

Sensor	$\alpha$	$L_{\max}$	$r_{\max}$
FMU40	11°	5 m	0.48 m
FMU41	11°	8 m	0.77 m
FMU42	9°	10 m	0.79 m
FMU43	6°	15 m	0.79 m
FMU44	11°	20 m	1.93 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.

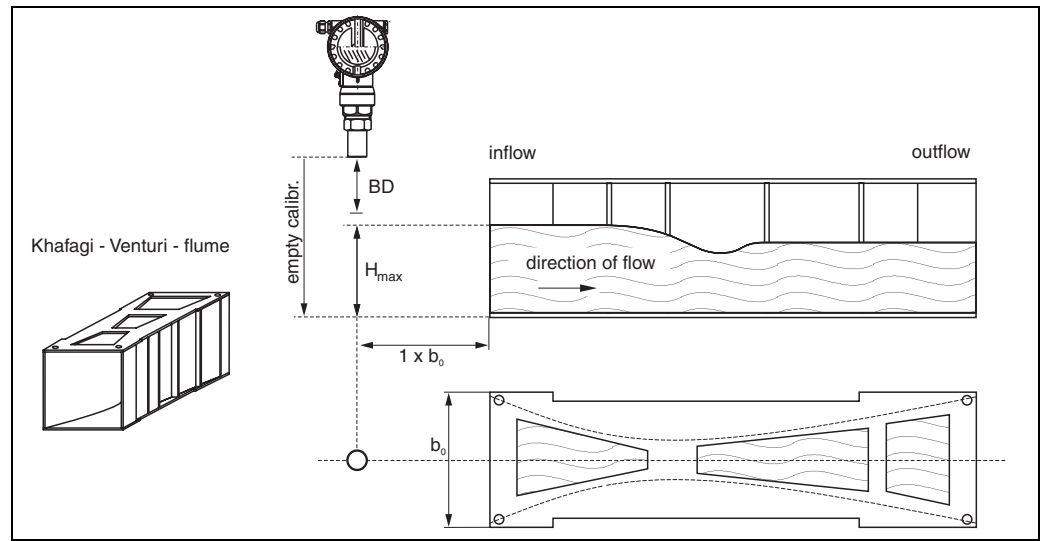


L00-FMU4xxxx-17-00-00-en-010

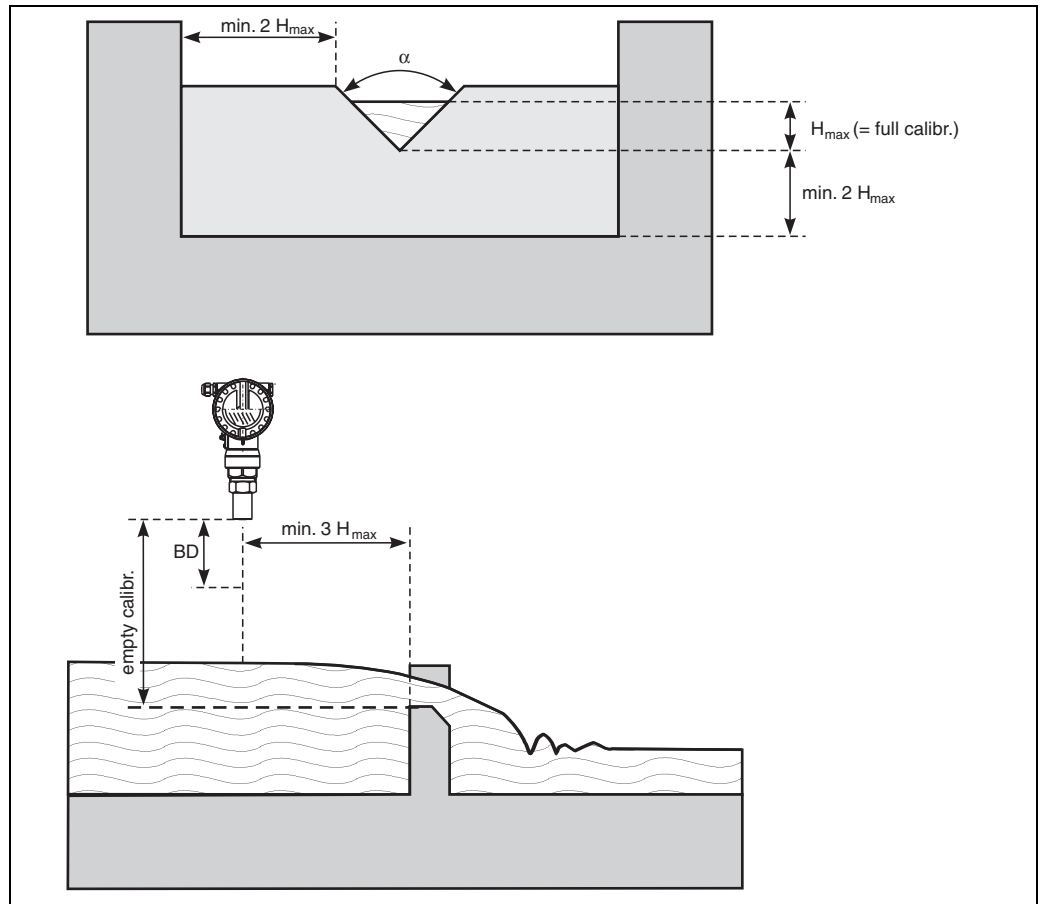
### 3.3.3 Installation conditions for flow measurements

- Install the Prosonic M at the inflow side, as close above the maximum water level  $H_{\max}$  as possible (take into account the blocking distance BD).
- Position the Prosonic 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 ToF Tool or manually via the on-site display.

#### Example: Khafagi-Venturi flume



### Example: Triangular weir

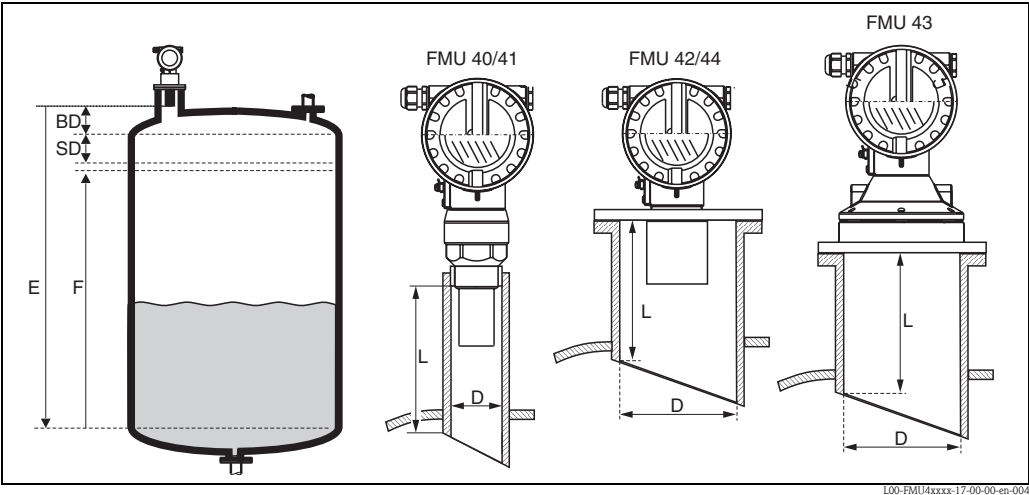


L00-FM14xxxx-17-00-00-en-012

### 3.4 Measuring range

#### 3.4.1 Blocking distance, Nozzle mounting

Install the Prosonic 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*

Sensor	BD	Max. range liquids	Max. range bulk materials	nozzle diameter	max. nozzle length
FMU40	0.25 m	5 m	2 m	50 mm	approx. 80 mm
				80 mm	approx. 240 mm
				100 mm	approx. 300 mm
FMU41	0.35 m	8 m	3.5 m	80 mm	approx. 240 mm
				100 mm	approx. 300 mm
FMU42	0.4 m	10 m	5 m	80 mm	approx. 250 mm
				100 mm	approx. 300 mm
FMU43	0.6 m	15 m	7 m	min. 100 mm	approx. 300 mm
FMU44	0.5 m	20 m	10 m	min. 150 mm	approx. 400 mm



**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.

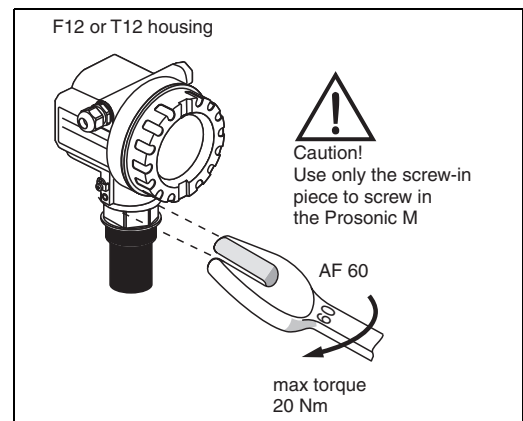
### 3.4.3 Range

The sensor range is dependent on the measuring conditions. Refer to Technical Information TI 365F/00/en for an estimation. The maximum range is shown in the above diagram (valid for good conditions).

Sensor	maximum range
FMU40	5 m
FMU41	8 m
FMU42	10 m
FMU43	15 m
FMU44	20 m

### 3.5 Installation hint for FMU 40/41

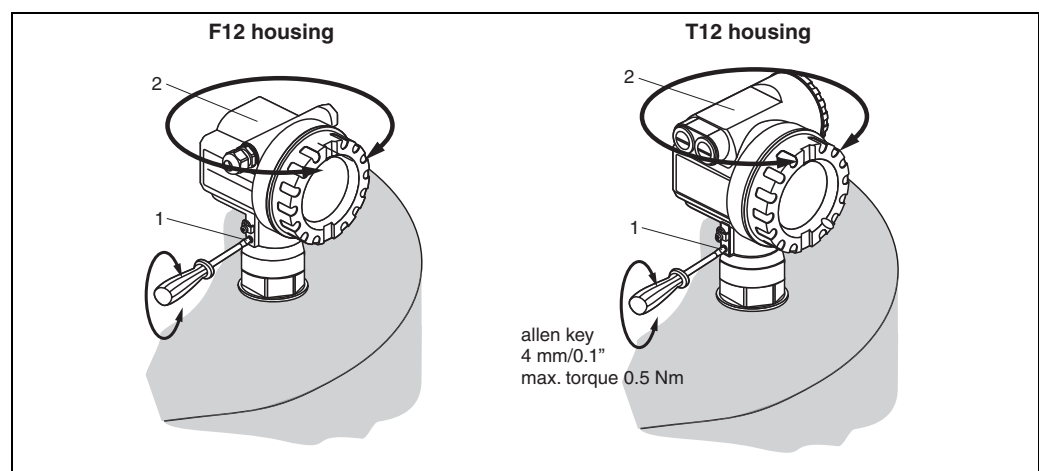
Screw the Prosonic M at the screw-in piece using an AF 60 spanner.  
Maximum torque: 20 Nm.



### 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 power supply must be identical to the data on the nameplate.
- Switch off power supply before connecting up the instrument.
- Connect equipotential bonding to transmitter ground terminal before connecting up the instrument (s. section "Potential matching")



Warning!

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

#### 4.1.1 Wiring in the housing F12

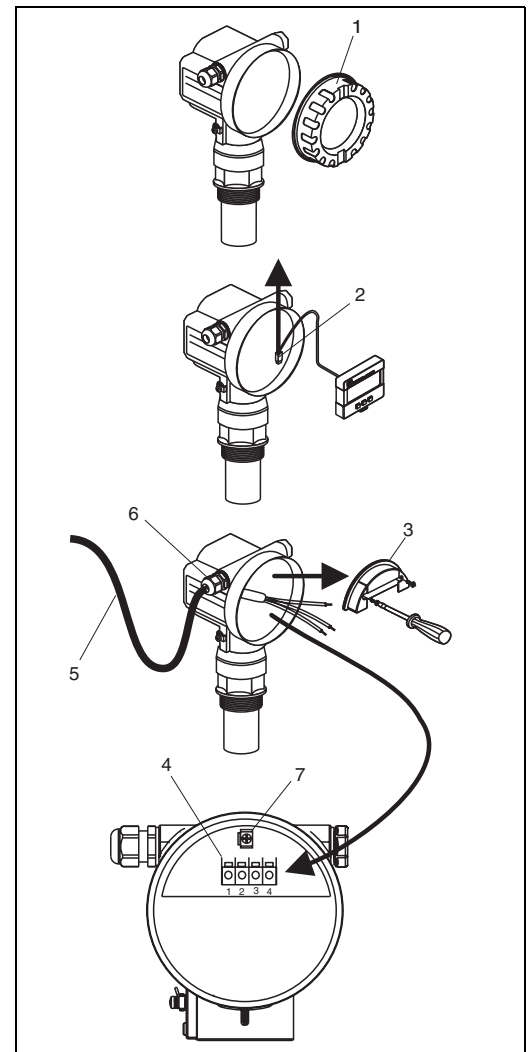
1. Unscrew housing cover (1).
2. Remove display (2) if fitted.
3. Remove cover plate (3) from terminal compartment.
4. Pull out terminal module (4) slightly using pulling loop.
5. Insert cable (5) through gland (6).



Caution!

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

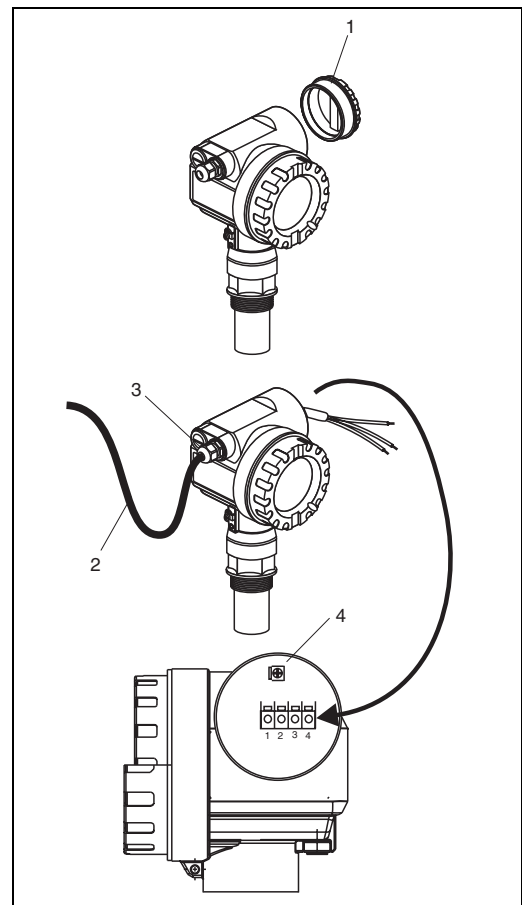
6. Connect cable screen to the grounding terminal (7) within the terminal compartment.
7. Make connection according to terminal assignment (see below).
8. Re-insert terminal module (4).
9. Tighten cable gland (6).
10. Tighten screws on cover plate (3).
11. Insert display (2) if fitted.
12. Screw on housing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



L00-FM14xxxx-04-00-00-yy-008

### 4.1.2 Wiring in the housing T12

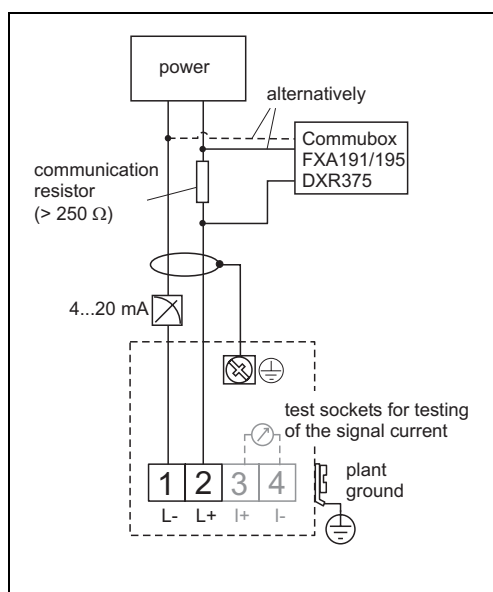
1. Unscrew the cover (1) of the separate connection room.
2. Insert cable (2) through gland (3).
- ⚠ **Caution!**  
If possible, insert the cable from above and let a draining loop in order to avoid intrusion of humidity.
3. Connect cable screen to the grounding terminal (4) within the connection room.
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.



100-FM14xxxx-04-00-00-yy-009

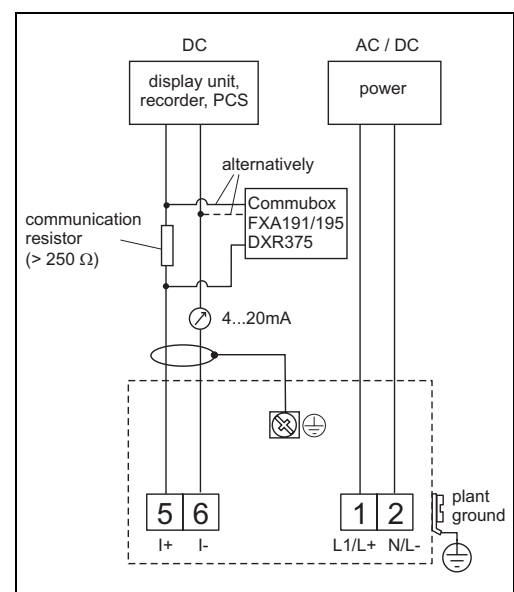
## 4.2 Terminal assignment

### Loop-powered version



100-FMxxxxxx-04-00-00-en-015

### 4-wire version (active)



100-FMxxxxxx-04-00-00-en-011

## 4.3 Supply voltage

### 4.3.1 HART, 2-wire

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

Version		Current consumption	Terminal voltage minimum	Terminal voltage maximum
2-wire HART	Standard	4 mA	14 V	36 V
		20 mA	8 V	36 V
	EEx ia	4 mA	14 V	30 V
		20 mA	8 V	30 V
	EEx d	4 mA	14 V	30 V
		20 mA	11 V	30 V
Fixed current, adjustable, e.g. for solar power operation (measured value via HART)	Standard	11 mA	10 V	36 V
	EEx ia	11 mA	10 V	30 V
Fixed current for HART multidrop mode	Standard	4 mA <sup>1)</sup>	14 V	36 V
	EEx ia	4 mA <sup>1)</sup>	14 V	30 V

1) Start-up current 11 mA

### 4.3.2 HART, 4-wire, active

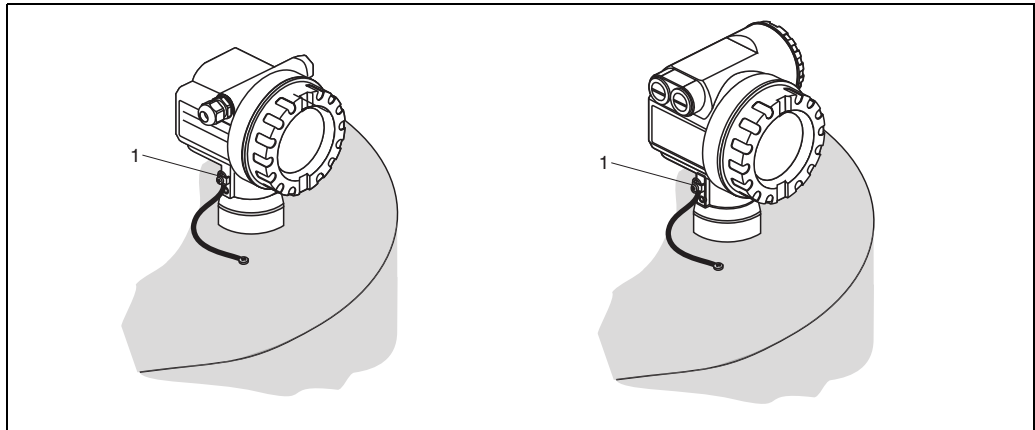
Version	Voltage	max. load
DC	10,5 ... 32 V	600 $\Omega$
AC 50/60 Hz	90 ... 253 V	600 $\Omega$



#### 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).

## 4.4 Potential matching



L00-FMU-xxxxx-17-00-00-yy-014

1: external ground terminal of the transmitter

Connect the equipotential bonding to the external ground terminal of the transmitter.



### Caution!

In Ex applications, the instrument must only be grounded on the sensor side. Further safety instructions are given in the separate documentation for applications in explosion hazardous areas.



### Note!

Since the housing is isolated from the tank by the plastic sensor, interference signals may occur if the potential matching line is not properly connected.

For optimum electromagnetic compatibility the potential matching line should be as short as possible and at least 2,5 mm<sup>2</sup> in cross-section.

If increased electromagnetic interference is to be expected due to the installation conditions, we recommend usage of a ground strap.

## 4.5 Checking the connection

After wiring the device, carry out the following checks:

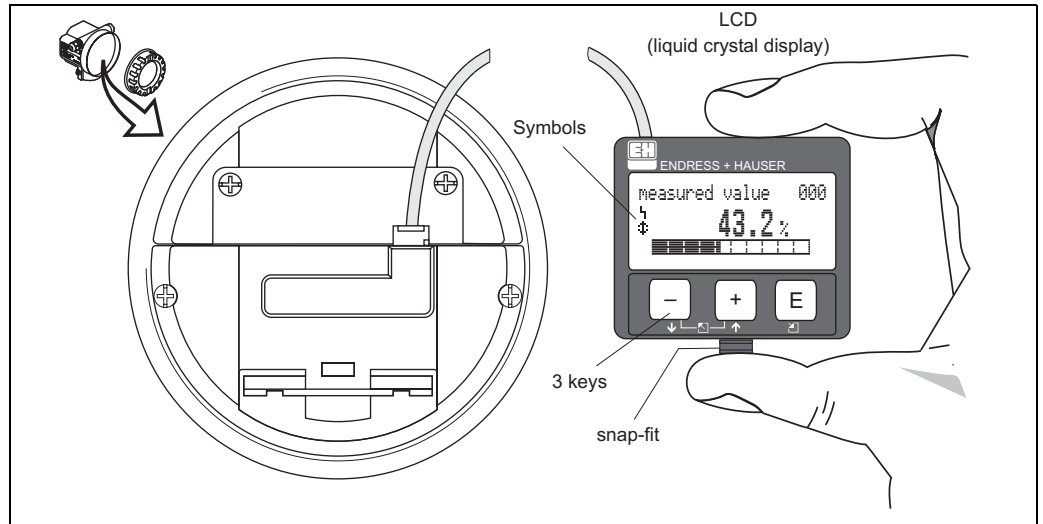
- Are the terminals correctly assigned?
- Is the cable gland tight?
- Is the housing cover fully screwed on?
- If power supply available: Does a display appear on the display module?

## 5 Operation

### 5.1 Display and operating elements

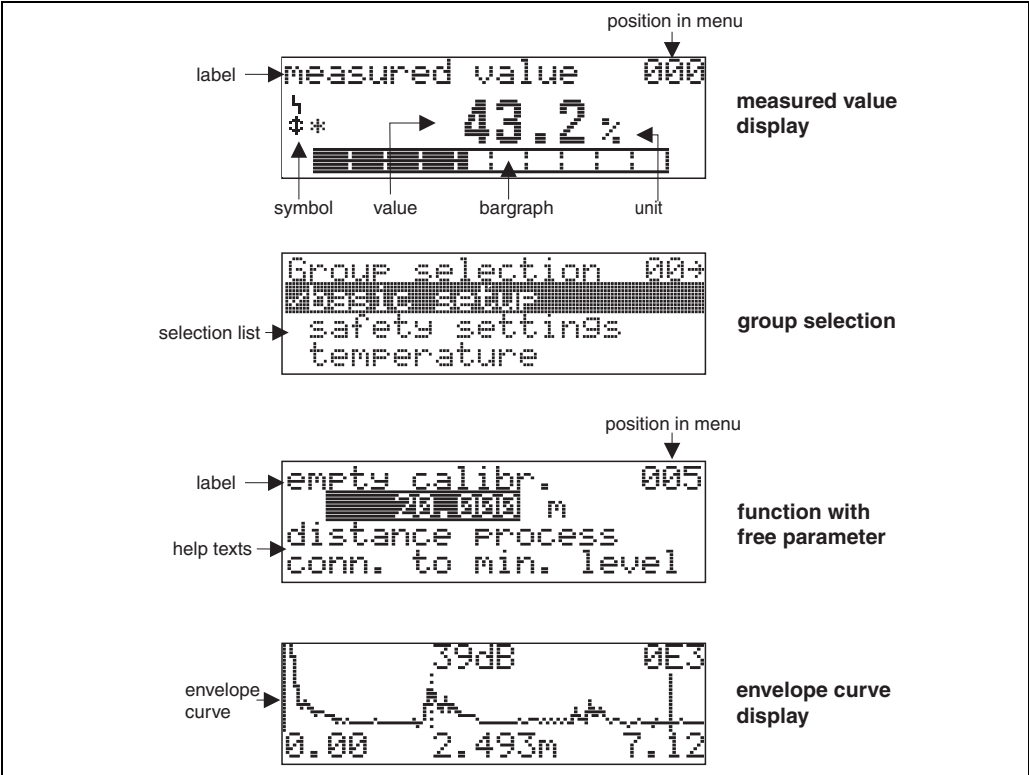
#### 5.1.1 On-site display VU 331

The LCD module VU 331 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.



L00-FMxxxxx-07-00-00-en-001

5.1.2 Display appearance



L00-FMxxxxxx-07-00-00-en-002















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:

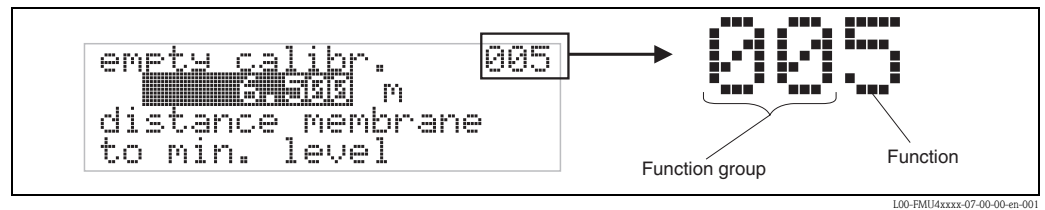
Sybmol	Meaning
	<b>ALARM_SYMBOL</b> This alarm symbol appears when the instrument is in an alarm state. If the symbol flashes, this indicates a warning.
	<b>LOCK_SYMBOL</b> This lock symbol appears when the instrument is locked,i.e. if no input is possible.
	<b>COM_SYMBOL</b> This communication symbol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

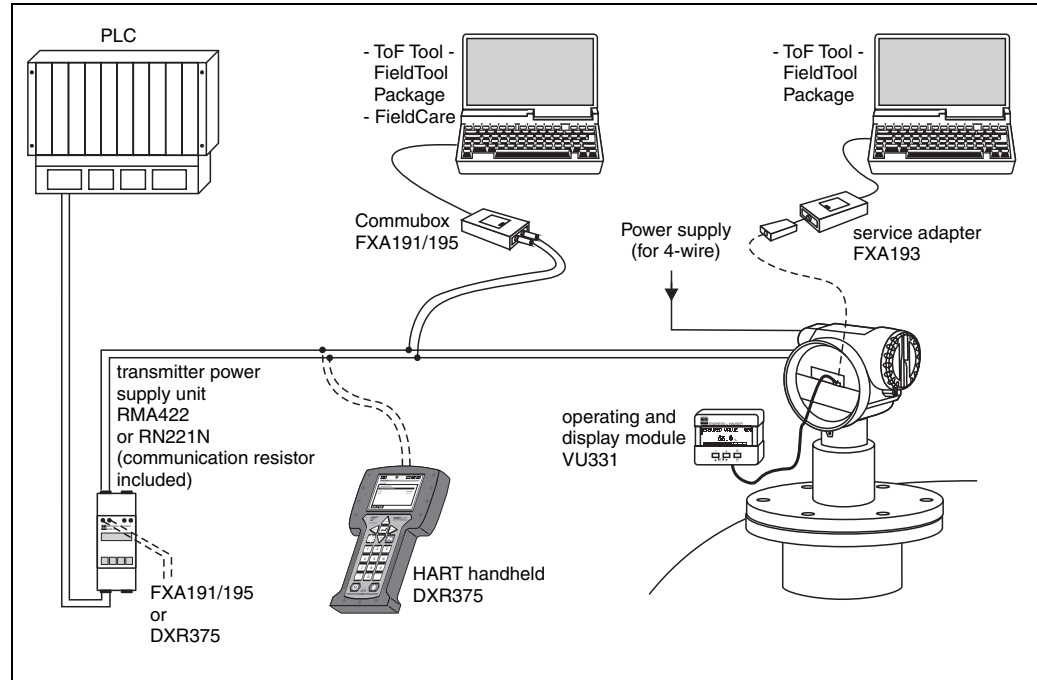
- **basic setup**            00    →   ■ **tank shape**                002
- **medium property**        003
- **process cond.**            004
- ...

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

## 5.3 Operating options

### 5.3.1 4...20 mA output with HART protocol

The complete measuring system consists of:

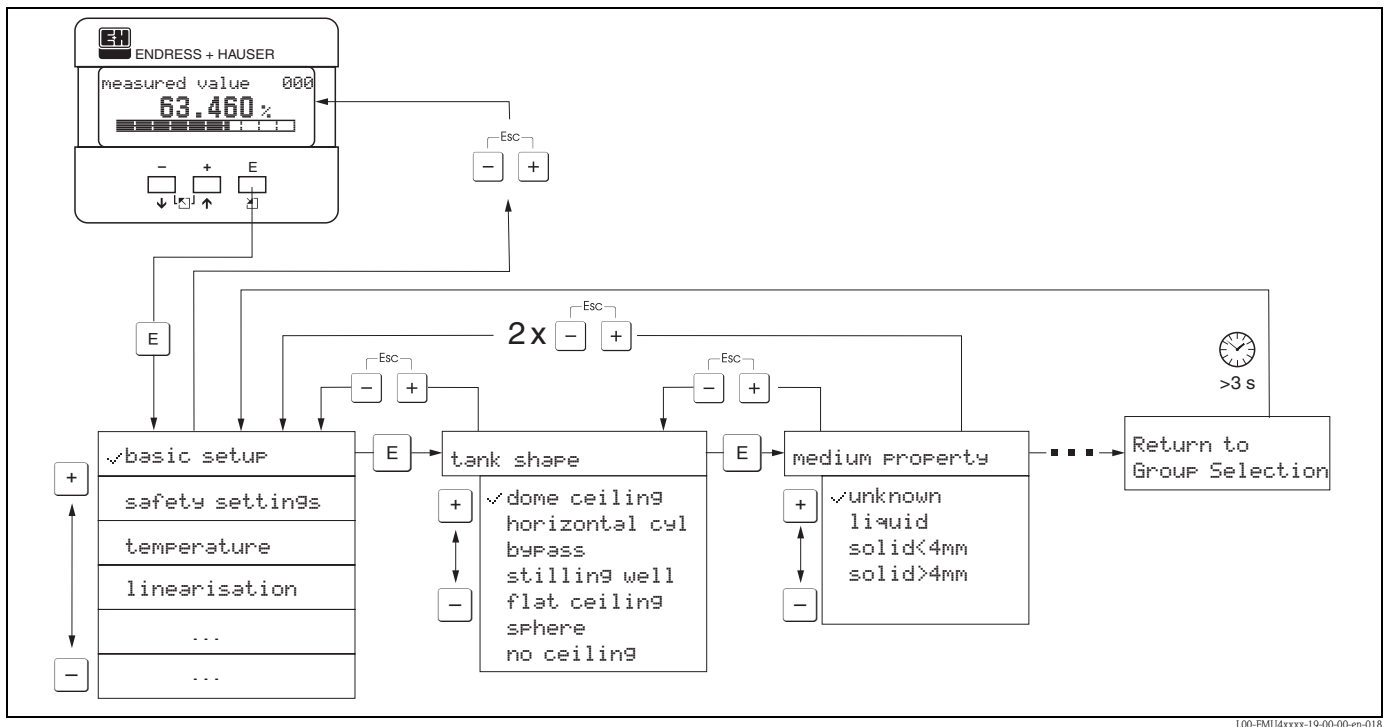


L00-FMxxxxxx-14-00-06-en-007

If the HART communication resistor is not built into the supply unit, it is necessary to insert a communication resistor of  $250\ \Omega$  into the 2-wire line.



## 5.4 Operation using the on-site display VU 331



100-FM14xxxx-19-00-00-en-018

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 3 in front of the menu text.
3. Activate Edit mode with **+** or **-**.

### Selection menus

- a. Select the required **Parameter** in selected **function** with **-** oder **+**.
- b. **E** confirms selection; 3 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 ToF Tool

The ToF Tool is a graphical operation software for instruments from Endress+Hauser. It is used to support commissioning, securing of data, signal analysis and documentation of the instruments. It is compatible with the following operating systems: WinNT4.0, Win2000 and WinXP.

The ToF Tool supports the following functions:

- Online configuration of transmitters
- Signal analysis via envelope curve
- Linearisation table (graphically supported creation, editing, importing and exporting)
- Loading and saving of instrument data (Upload/Download)
- Documentation of measuring point



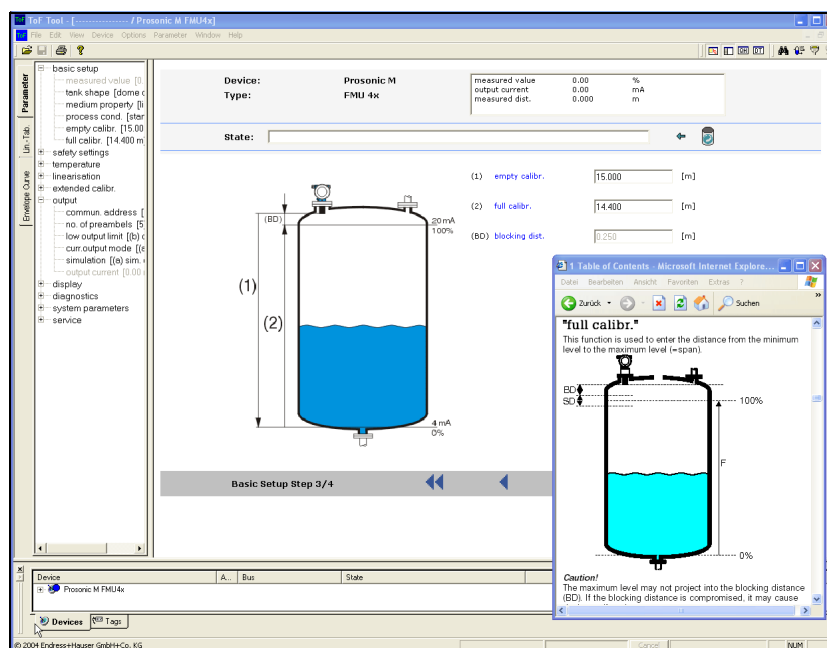
Note!

Further information you may find on the CD-ROM, which is enclosed to the instrument.

### 5.5.1 Connection options

- HART with Commubox FXA 191
- Service interface with adapter FXA 193

### 5.5.2 Menu guided commissioning

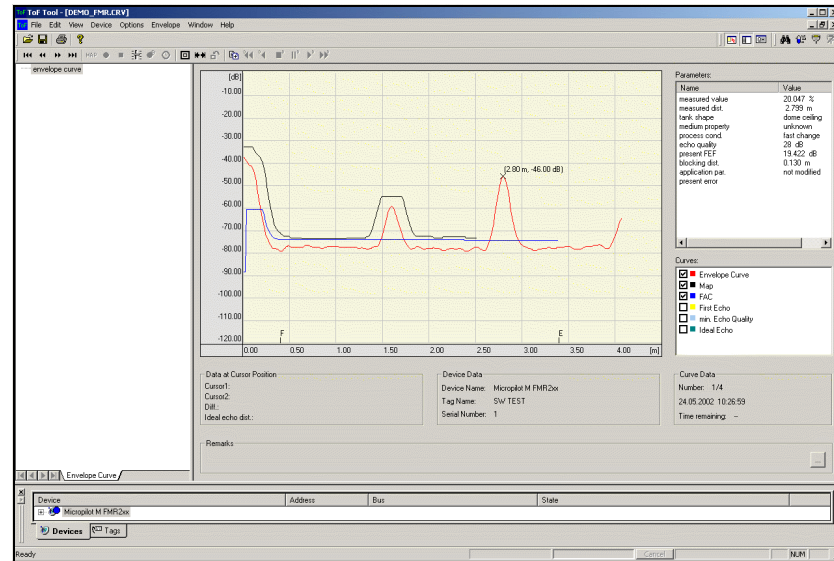


L00-FMU4xxxx-19-00-00-es-003

- You can find the function groups and functions of the device in the **navigation bar**.
- You can find the input fields for the parameters in the **main window**.
- If you click on a parameter name, the **Help pages** open with precise explanations of the required input.

### 5.5.3 Envelope curve display

The ToF Tool offers easy analysis of the envelope curve via the "Envelope" menu:



L00-FMU4xxxx-19-00-00-en-004

## 5.6 Operation with Commuwin II

Commuwin II is an operating software with graphical support (MS Windows) for intelligent transmitters with the communication protocols Rackbus, Rackbus RS-485, HART and PROFIBUS-PA.

Commuwin II 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



Note!

Further information on Commuwin II is given in the following E+H documentation:

- System Information: SI 018F/00/en “Commuwin II”
- Operating Manual: BA 124F/00/en “Commuwin II” operating program

### 5.6.1 Operation

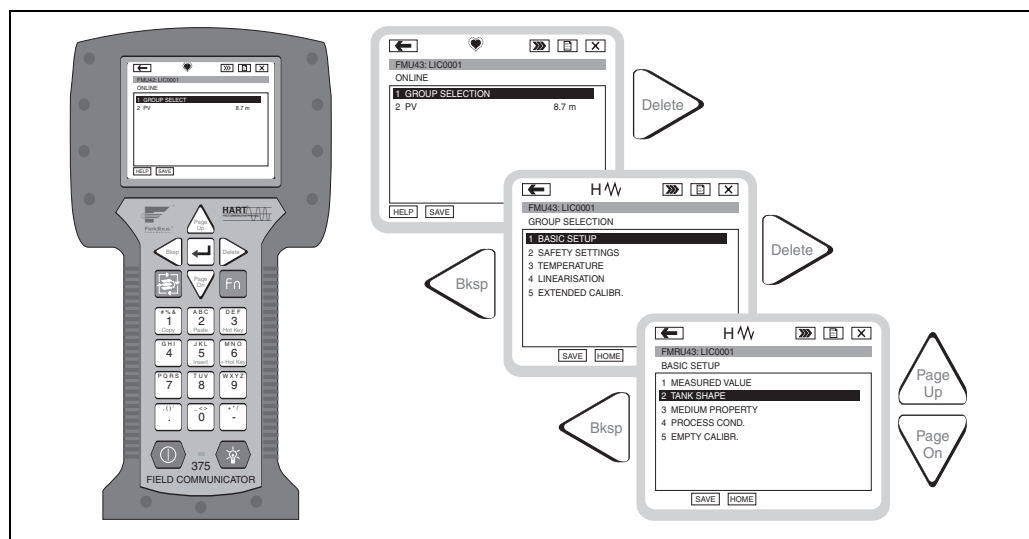
You make the settings using an operating matrix or via a graphic interface. Envelope curves can not be display in Commuwin II.

### 5.6.2 Connection

The computer ist connected to the HART communicatain line via the Commubox FXA 191.

## 5.7 Operation using a HART handheld terminal DXR 375

The operating menu of the Prosonic M can be accessed via the HART handheld terminal DXR 375.



L00-FMU4xxxx-07-00-00-de-005

Connect the handheld terminal directly to the HART communication line.

## 5.8 Lock/unlock configuration

### 5.8.1 Software security locking

Enter a number  $\frac{1}{4}$  100 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 "100"

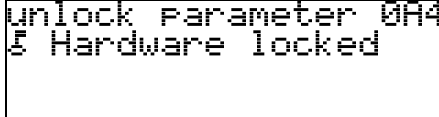
Now change the parameters.

### 5.8.2 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
```

L00-fmrz0a4-20-00-00-de-001




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

Enter "100"

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.

## 5.9 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 "333" 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.

## 5.10 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

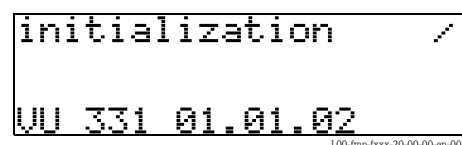
Commission the Prosonic M in the following stages:

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

The chapter describes the commissioning process using the on-site display. Commissioning using ToF Tool is identical. Access to the device functions using ToF Tool is described on Page 21. You can find detailed information in the ToF Tool operating instructions (BA 224F/00/en) on the supplied CD-ROM.

### 6.1 Power up instrument

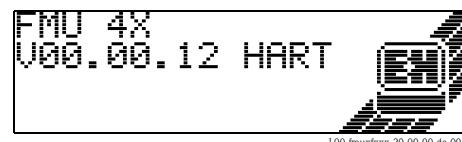
After switching on the supply voltage, the instrument is first initialised.



L00-fmp-fxxx-20-00-00-en-003

Then the following appear for approximately five seconds:

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



L00-fmxfxxx-20-00-00-de-001

Press **[E]** to exit this display.

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



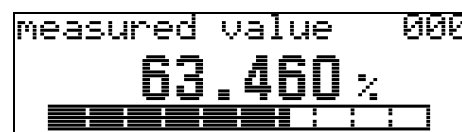
L00-fmxf092-20-00-00-en-001

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



L00-fmxf0C5-20-00-00-en-001

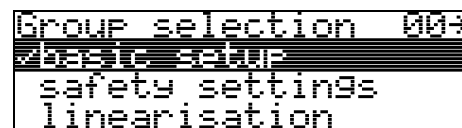
A measured value is displayed. This is NOT equivalent to the level in your tank. Firstly carry out a basic calibration.



L00-fmxf000-20-00-00-en-001

Press **[E]** to switch to the group selection.

Press **[E]** again to start the basic calibration.



L00-fmxf000-20-00-00-en-001

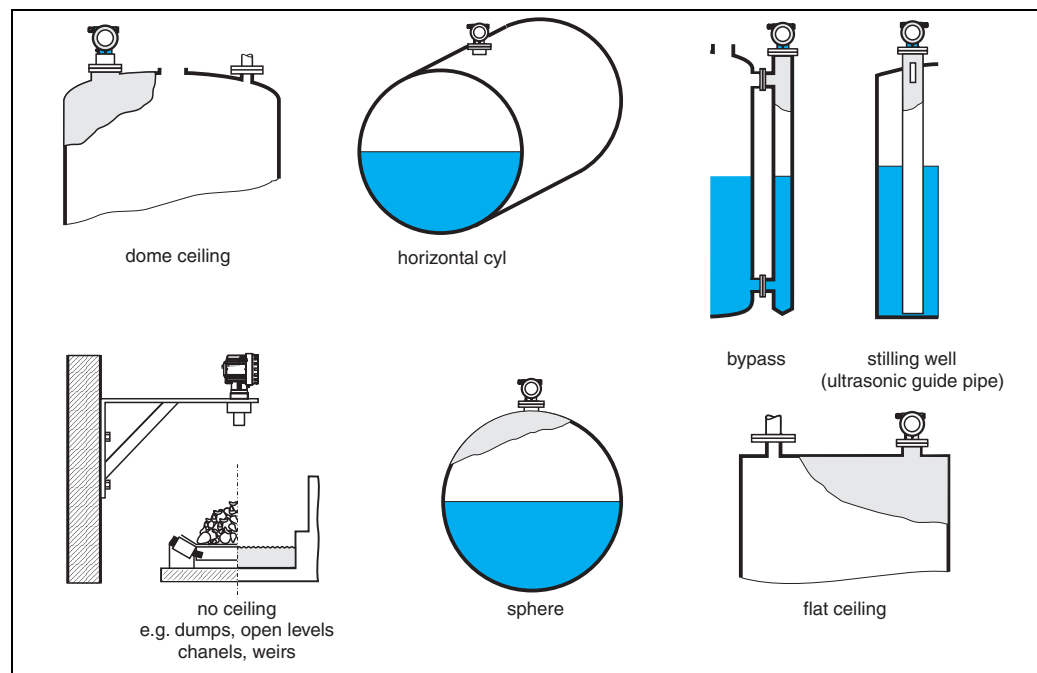
## 6.2 Basic calibration

The **"Basic setup" (00)** function group lists all the functions which are required for a standard measurement task to commission the Prosonic 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:



L00-FMU4xxxx-14-00-06-en-001

#### Function "medium property" (003)

Set the medium type in this function.

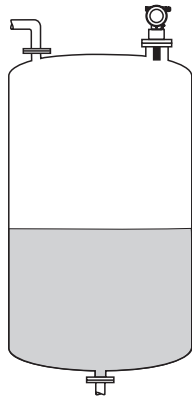
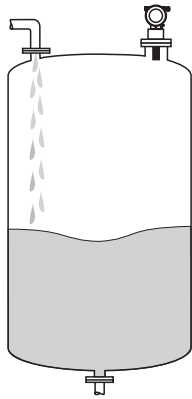
You have the following options:

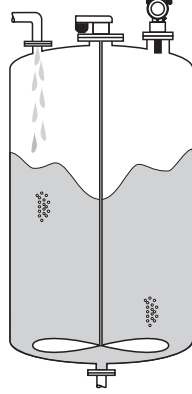
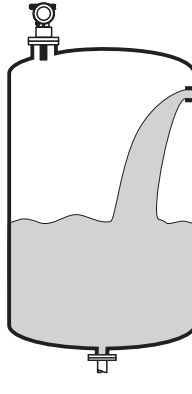
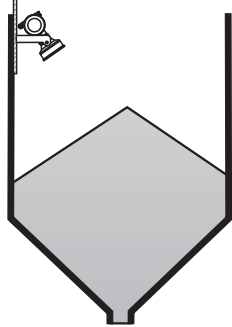
- unknown (e.g. pasty media such as greases, creams, gels etc.)
- liquid
- solid, grain size < 4 mm (fine)
- solid, grain size > 4 mm (coarse)

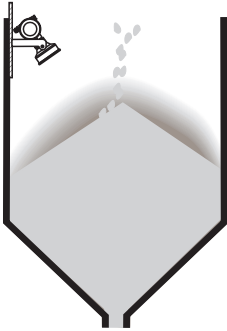
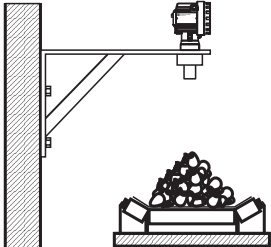


**Function "process conditions" (004)**

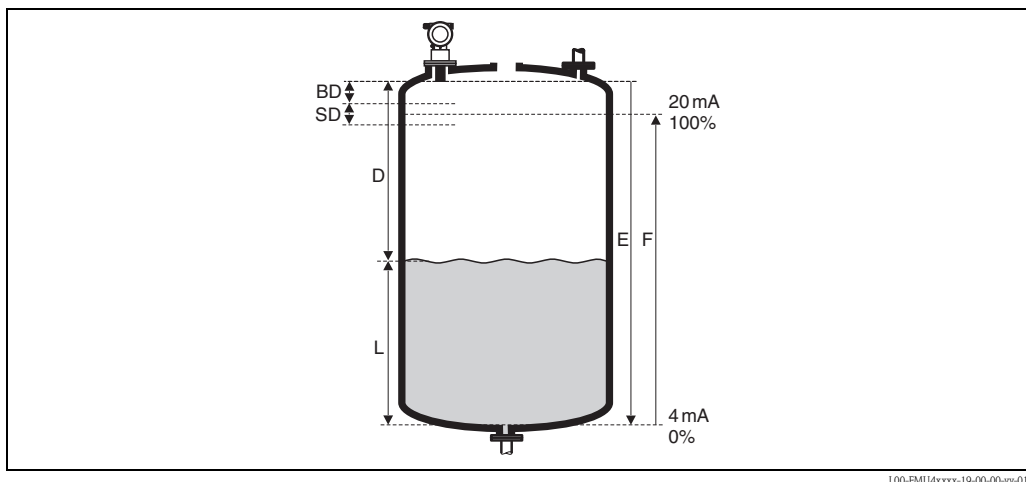
For this function, you have the following options:

standard liquids	calm surface	turb. surface
For all fluid applications which do not fit in any of the following groups.	Storage tanks with immersion tube or bottom filling	Storage / accumulation tanks with uneven surface due to free filling, mixing nozzles or small bottom stirrers
	 L00-FMU4xxxx-14-00-00-xx-001	 L00-FMU4xxxx-14-00-00-xx-002
The filters and output damping are set to average values.	The averaging filters and output damping are set to large values. -> Stable measured value -> Accurate measurement -> Slow reaction time	Special filters for stabilising the input signal are activated. -> Stable measured value -> Medium reaction time

add. agitator	fast change	standard solid
Moving surfaces (poss. with vortex formation) due to agitators	Rapid level change, particularly in small tanks	For all bulk solids applications which do not fit in any of the following groups.
 L00-FMU4xxxx-14-00-00-xx-003	 L00-FMU4xxxx-14-00-00-xx-004	 L00-FMU4xxxx-14-00-00-xx-006
Special filters for stabilising the input signal are set to large values. -> Stable measured value -> Medium reaction time	The averaging filters are set to small values. -> Rapid reaction time -> Possibly unstable measured value	The filter and output damping are set to average values.

solid dusty	conveyor belt	Test: no filter
Dusty bulk solids	Bulk solids with rapid level change	All the filters can be switched off for purposes of service and diagnosis.
 <p>L00-FMU4xxxx-14-00-00-xx-007</p>	 <p>L00-FMU4xxxx-14-00-00-xx-005</p>	
The filters are set to detect even relatively weak signals.	The averaging filters are set to small values. -> Rapid reaction time Possibly unstable measured value	All filters off

## 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 Prosonic 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.

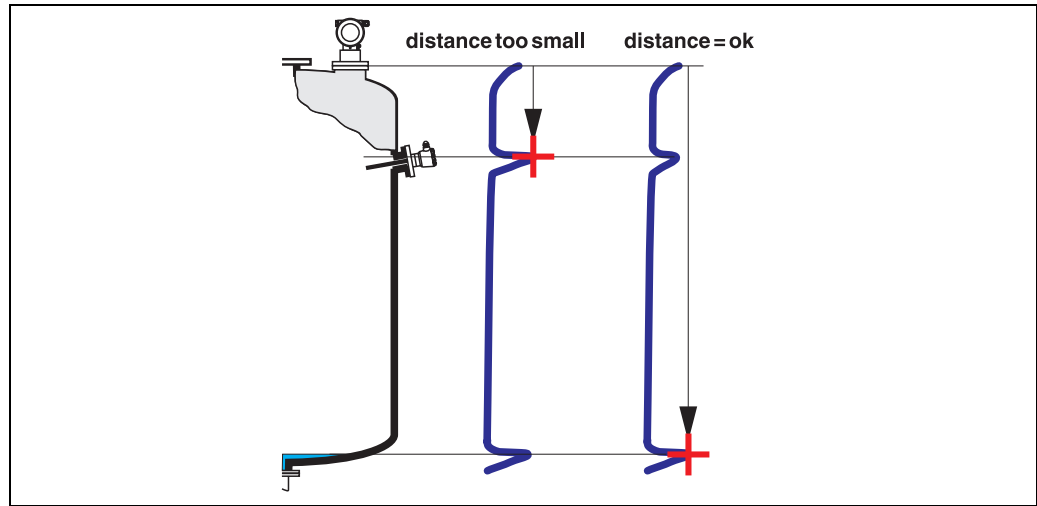
### 6.2.3 Interference echo suppression (tank mapping)

#### Function "dist./measured 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.



L00-FMR2xxxx-14-00-06-en-010

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.

### Rücksprung zur Gruppenauswahl

Nach der Störechoausblendung ist der Grundabgleich beendet und das Gerät springt automatisch in die Gruppenauswahl zurück.

## 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 Funxtion "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 240F "Prosonic M – Description of Instrument Functions"

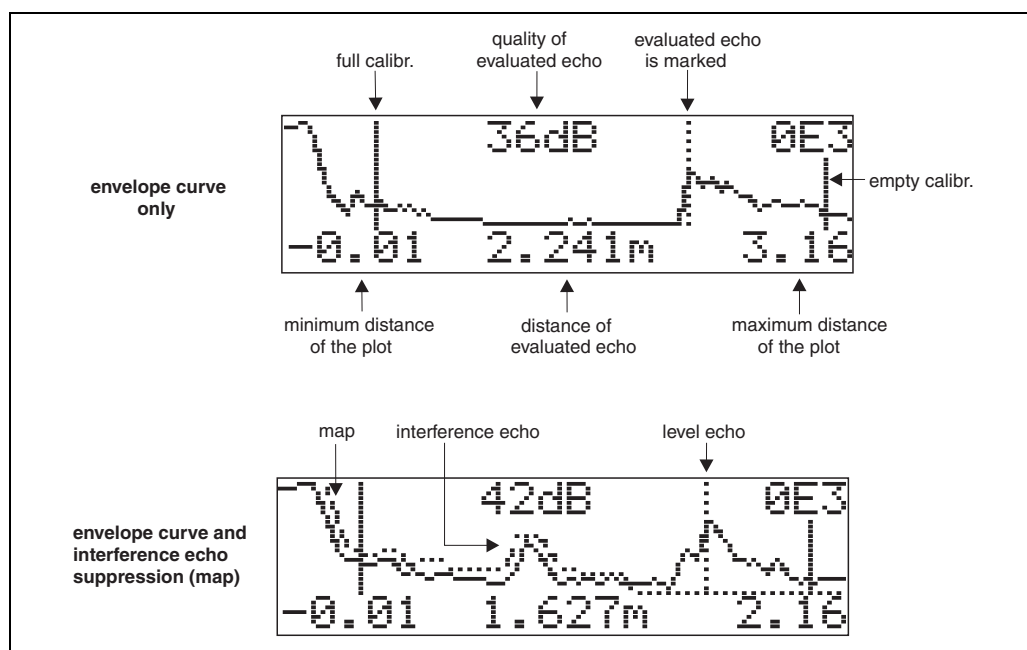
### 6.3.2 Function "recording curve" (0E2)

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:



100-FMU4xxxx-07-00-00-en-003

Check that the following conditions are fulfilled:

- The echo quality at the end of measuring range should be at least 10dB.
- 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.

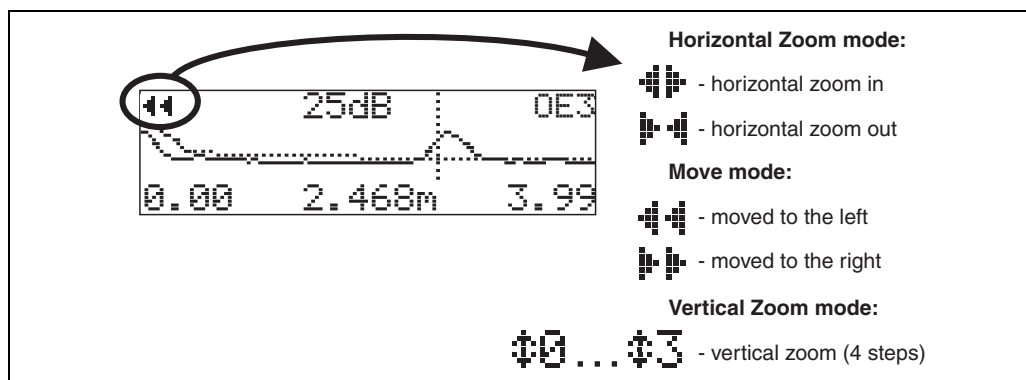


Note!

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 **[E]**. (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.

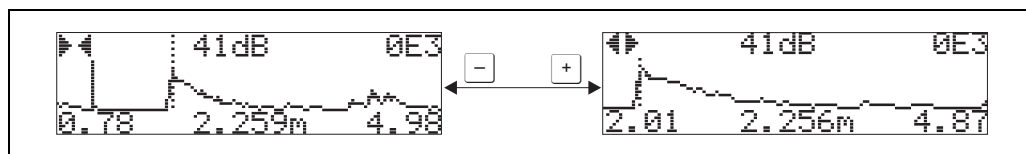


100-FMxxxxxx-07-00-00-en-004

#### Horizontal Zoom mode

Firstly, go into the envelope curve display. Then press or to switch to the envelope curve navigation. You are then in Horizontal Zoom mode. Either or is displayed.

- increases the horizontal scale.
- reduces the horizontal scale.

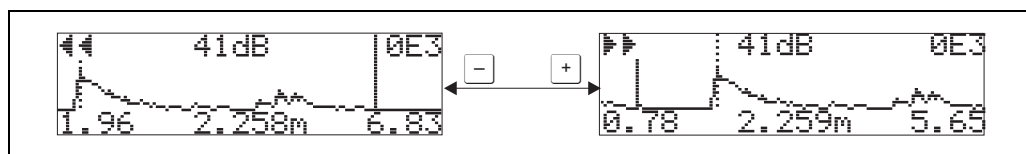


100-FMxxxxxx-07-00-00-yy-007

#### Move mode

Then press to switch to Move mode. Either or is displayed.

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



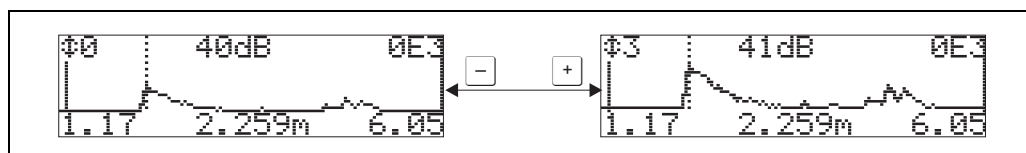
100-FMxxxxxx-07-00-00-yy-008

#### Vertical Zoom mode

Press once more to switch to Vertical Zoom mode. is displayed. You now have the following options.

- increases the vertical scale.
- reduces the vertical scale.

The display icon shows the current zoom factor ( to ).



100-FMxxxxxx-07-00-00-yy-009

### Exiting the navigation

- Press **E** again to run through the different modes of the envelope curve navigation.
- Press **+** and **-** 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 Prosonic 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  or .

#### 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

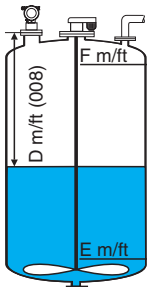
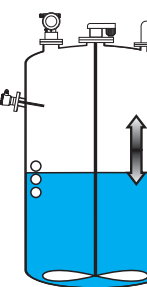
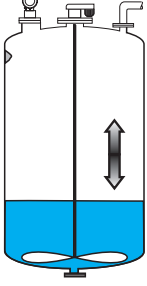
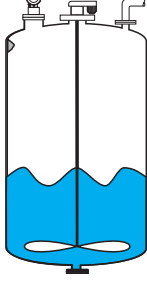
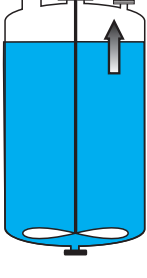
Type of error	Symbol	Meaning
Alarm (A)	 continuous	The output signal assumes a value which can be set using the <b>"output on alarm" (010)</b> function: <ul style="list-style-type: none"> <li>■ MAX: 110%, 22mA</li> <li>■ MIN: -10%, 3,8mA</li> <li>■ Hold: last value is on hold</li> <li>■ User-specific value</li> </ul>
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.	

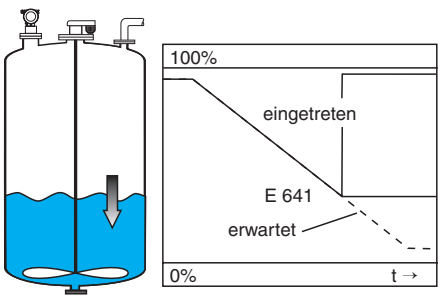
#### 7.1.4 Error codes

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

Code	Error description	Action
A281	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 linea-risation points	Enter additional value pairs
W621	simulation on	Switch simulation mode off [" <b>output</b> " (06) function group, " <b>simulation</b> " (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. [" <b>safety settings</b> " (01) function group, " <b>ackn. alarm</b> " (017) function]]
A661	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 (00) is incorrect but measured distance (008) is correct	 <p>100%</p> <p>expected</p> <p>actual</p> <p>0%</p> <p>t →</p> <p>L00-FMR2xxxx-19-00-00-en-019</p>	<ol style="list-style-type: none"> <li>1. Check empty calibration (005) and full calibration (006).</li> <li>2. Check linearisation                         <ul style="list-style-type: none"> <li>– level/ullage (040)</li> <li>– max. scale(046)</li> <li>– diameter vessel(047)</li> <li>– linearisation table</li> </ul> </li> </ol>
Measured value (000) and measured distance (008) are incorrect	 <p>100%</p> <p>actual</p> <p>expected</p> <p>0%</p> <p>t →</p> <p>L00-FMR2xxxx-19-00-00-en-014</p>	<ol style="list-style-type: none"> <li>1. For measurements in bypass or stilling well: Select the according option in the <b>"tank shape" (002)</b> function.</li> <li>2. Carry out interference echo suppression.</li> </ol>
No change in measured value on filling/emptying	 <p>100%</p> <p>actual</p> <p>expected</p> <p>0%</p> <p>t →</p> <p>L00-FMR2xxxx-19-00-00-en-015</p>	<ol style="list-style-type: none"> <li>1. Carry out interference echo suppression.</li> <li>2. Clean sensor if necessary</li> <li>3. If necessary, select better installation position</li> <li>4. If necessary due to wide interference echoes, set function "detection window" (0A7) to "off".</li> </ol>
With an uneven surface (e.g. filling, emptying, running agitator) the measured value may jump sporadically to higher levels	 <p>100%</p> <p>actual</p> <p>expected</p> <p>0%</p> <p>t →</p> <p>L00-FMR2xxxx-19-00-00-en-016</p>	<ol style="list-style-type: none"> <li>1. Carry out interference echo suppression</li> <li>2. Set the process cond. (004) to "calm surface" or "add. agitator"</li> <li>3. Increase output damping (058).</li> <li>4. If necessary, select a different installation position and/or a larger sensor</li> </ol>
On filling/emptying the measured value drops	 <p>100%</p> <p>expected</p> <p>actual</p> <p>0%</p> <p>t →</p> <p>L00-FMR2xxxx-19-00-00-en-017</p>	<ol style="list-style-type: none"> <li>1. Check tank shape (002), e.g. "dome ceiling" or "horizontal cyl."</li> <li>2. If possible, do not select a central installation position</li> <li>3. Possible user stilling well/echo guide pipe</li> </ol>

Error	Example	Elimination
E 641 (echo loss)	<div><p>The diagram shows a cross-section of a tank with a liquid level. A sensor is mounted at the top, pointing down into the liquid. To the right of the tank is a graph with a vertical axis from 0% to 100% and a horizontal axis labeled 't' with an arrow pointing right. A solid line labeled 'eingetreten' (actual) starts at 100% and slopes down to a point labeled 'E 641'. From this point, a dashed line labeled 'erwartet' (expected) continues to slope down towards 0%. The text 'L00-FMR2xxx-19-00-00-en-018' is at the bottom of the graph area.</p></div>	<div><ol style="list-style-type: none"><li>1. Check application parameters (002), (003) and (004)</li><li>2. If necessary, select a different installation position and/or a larger sensor</li><li>3. Align the sensor parallel to the product surface (particularly for bulk solids applications)</li></ol></div>

## **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 Endress+Hauser 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 Endress+Hauser 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 Endress+Hauser.

### **8.3 Repairs to Ex-approved devices**

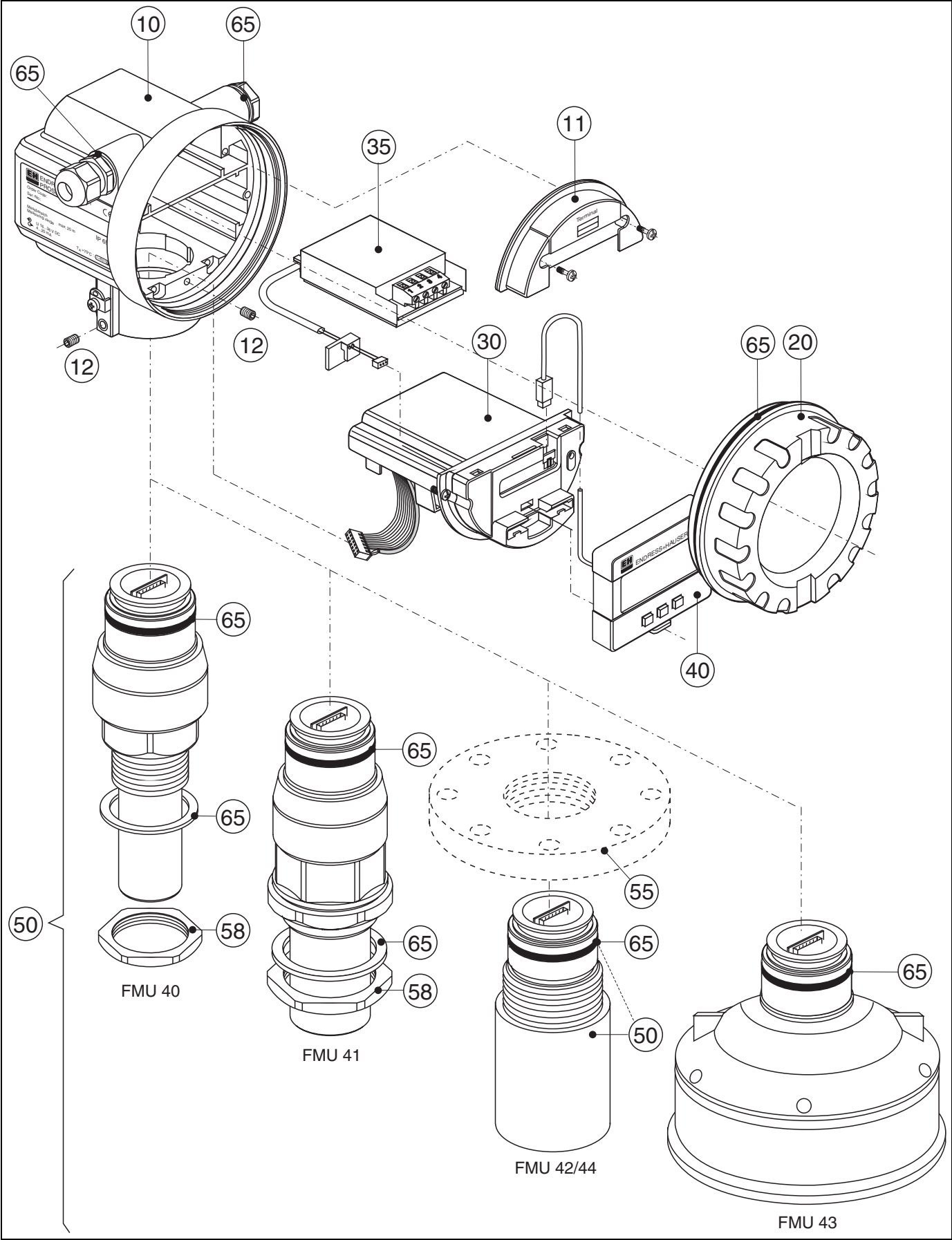
When carrying out repairs to Ex-approved devices, please note the following:

- Repairs to Ex-approved devices may only be carried out by trained personnel or by the Endress+Hauser Service.
- Comply with the prevailing standards, national Ex-area regulations, safety instructions (XA) and certificates.
- Only use original spare parts from Endress+Hauser.
- 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 Endress+Hauser 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 ToF Tool /FieldCare. 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)



100-FM14x-00-00-00-yy-007

**10 Housing**

543120-0022 Housing F12, aluminium, G1/2  
543120-0023 Housing F12, aluminium, NPT1/2  
543120-0024 Housing F12, aluminium, M20  
52001992 Housing F12, aluminium, M20, PA connector  
52008556 Housing F12, aluminium, M20, FF connector  
52013350 Housing F12, aluminium, coated, M20, 4-wire  
52013351 Housing F12, aluminium, coated, M20, metal  
52013348 Housing F12, aluminium, coated, G1/2, 4-wire  
52013349 Housing F12, aluminium, coated, NPT1/2, 4-wire

**11 Hood for terminal compartment**

52006026 Cover for the connection compartment F12  
52019062 Cover for the connection compartment F12, FHX40

**12 Set of screws**

535720-9020 Set of screws for housing F12/T12

**20 Cover**

52005936 Cover F12/T12 aluminium, inspection glass, seal  
517391-0011 Cover F12/T12 aluminium, coated, seal

**30 Electronics**

71025600 electronics FMU4x, Ex, 2-wire HART, V4.0  
71025602 electronics FMU4x, Ex, 4-wire HART, V4.0  
71025603 electronics FMU4x, Ex, PROFIBUS PA, V4.0  
52023759 Electronics Prosonic M, Ex, FF, V2.04

**35 Terminal module / power unit**

52006197 Terminal module 4-pin, HART, 2-wire with connecting cable  
52012156 Terminal module 4-pin, PROFIBUS PA, Foundation Fieldbus  
52013304 Power unit, 10.5...32V DC (housing F12) for electronics, 4-wire  
52013305 Power unit, 90 ...250V AC (housing F12) for electronics, 4-wire  
52015585 Power unit, CSA, 10.5...32V DC (housing F12) for electronics, 4-wire  
52015586 Power unit, CSA, 90...250V AC (housing F12) for electronics, 4-wire

**40 Display**

52005585 Display/operating module VU331

**50 Probe with process connection**

52010509 Sensor FMU40 G1-1/2  
52010507 Sensor FMU40 NPT1-1/2  
52010510 Sensor FMU41 G2  
52010508 Sensor FMU41 NPT2  
52023965 Sensor FMU42  
52013543 Sensor FMU43 4", gasket

71037028 Sensor FMU44, gasket

### **55 Flanges**

52023919 Flange, Uni-DN80/ANSI 3"/JIS 80A, PP

52023920 Flange, Uni-DN80/ANSI 3"/JIS 80A, PVDF

52023921 Flange, Uni-DN80/ANSI 3"/JIS 80A, 316L

52023922 Flange, Uni-DN100/ANSI 4"/JIS 100A, PP

52023923 Flange, Uni-DN100/ANSI 4"/JIS 100A, PVDF

### **58 Hexagon nut**

52000599 Hexagon nut (SW60) G1-1/2, bk, PC

52000598 Hexagon nut (SW70) G2, bk, PC

### **65 Sealing kit**

52010526 Sealing kit FMU4x

### **Miscellaneous**

52010545 Nameplate Prosonic M, modification

### **Spare parts for FHX40**

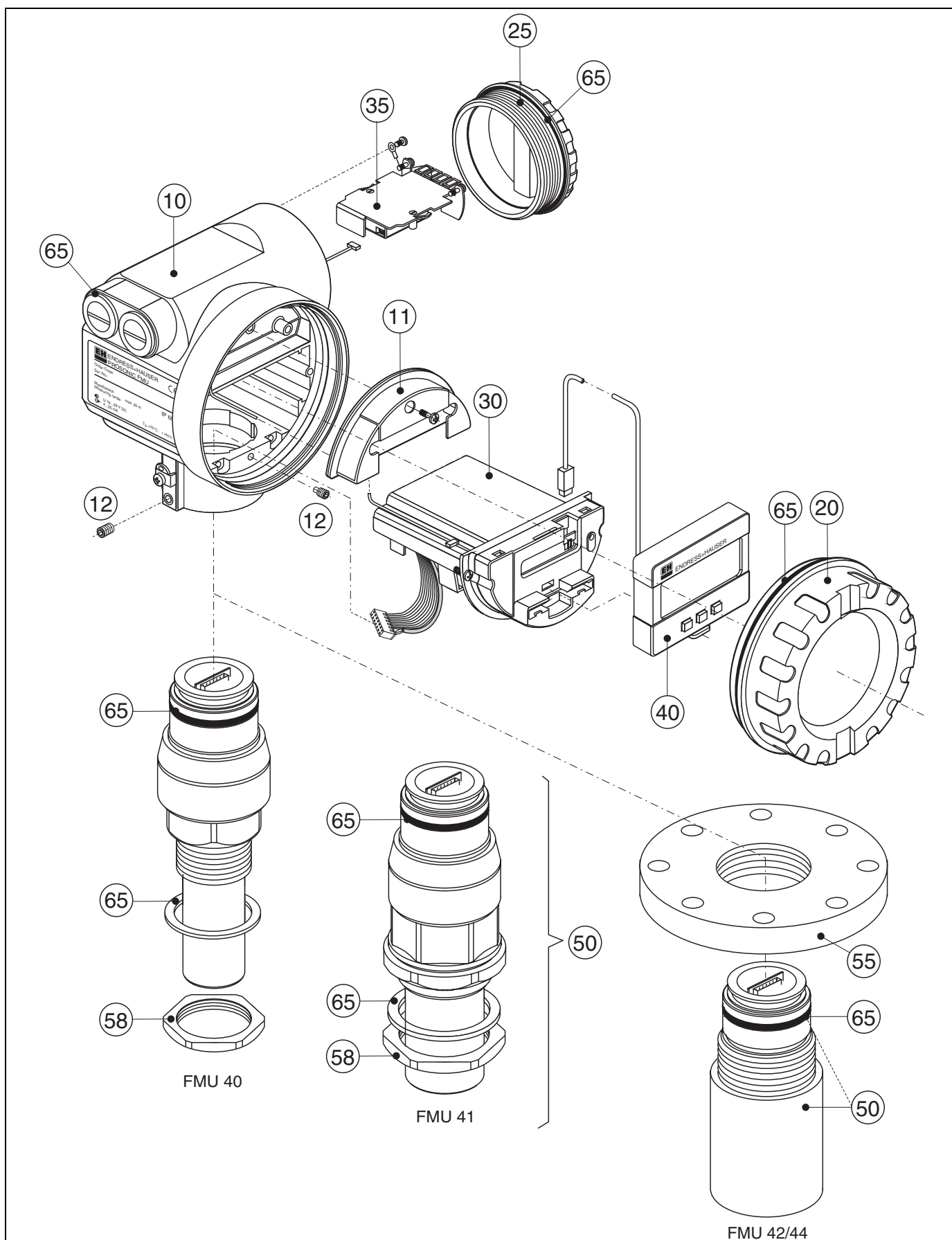
52018204 Adaption kit housing F12, 2-wire, FHX40

52018205 Adaption kit housing F12, 4-wire, FHX40

52016334 Cable FHX40, 20m



## 8.6 Spare parts (housing type T12)



L00-FMU4x-00-00-00-yy-008

### **10 Housing**

543180-1023 Housing T12, aluminium, NPT1/2, PEL

52006204 Housing T12, aluminium, G1/2, PEL, cover

52006205 Housing T12, aluminium, M20, PEL, cover

### **11 Hood for terminal compartment**

52005643 Hood T12

### **12 Set of screws**

535720-9020 Set of screws for housing F12/T12

### **20 Cover**

52005936 Cover F12/T12 aluminium, inspection glass, seal

517391-0011 Cover F12/T12 aluminium, coated, seal

### **25 Cover for the connection compartment**

518710-0020 Cover T3/T12, aluminium, coated, seal

### **30 Electronics**

71025600 electronics FMU4x, Ex, 2-wire HART, V4.0

71025603 electronics FMU4x, Ex, PROFIBUS PA, V4.0

52023759 Electronics Prosonic M, Ex, FF, V2.04

### **35 Terminal module / power unit**

52013302 Terminal module Ex d, 4-pin, 2-wire, HART, T12

52013303 Terminal module Ex d, 2-pin, 2-wire, PROFIBUS PA, Foundation Fieldbus, T12

52018949 Terminal module EEx ia, 4-pin, HART, T12, OVP

52018950 Terminal module EEx ia, 4-pin, PROFIBUS PA, Foundation Fieldbus, T12, OVP

### **40 Display**

52005585 Display/operating module VU331

### **50 Probe with process connection**

52010509 Sensor FMU40 G1-1/2

52010507 Sensor FMU40 NPT1-1/2

52010510 Sensor FMU41 G2

52010508 Sensor FMU41 NPT2

52023965 Sensor FMU42

71037028 Sensor FMU44, gasket

### **55 Flanges**

52023919 Flange, Uni-DN80/ANSI 3"/JIS 80A, PP

52023920 Flange, Uni-DN80/ANSI 3"/JIS 80A, PVDF

52023921 Flange, Uni-DN80/ANSI 3"/JIS 80A, 316L

52023922 Flange, Uni-DN100/ANSI 4"/JIS 100A, PP

52023923 Flange, Uni-DN100/ANSI 4"/JIS 100A, PVDF

52023924 Flange, Uni-DN100/ANSI 4"/JIS 100A, 316L

**58 Hexagon nut**

52000599 Hexagon nut (SW60) G1-1/2, bk, PC

52000598 Hexagon nut (SW70) G2, bk, PC

**65 Sealing kit**

52010526 Sealing kit FMU4x

**Miscellaneous**

52010545 Nameplate Prosonic M, modification

## 8.7 Return

The following procedures must be carried out before a transmitter is sent to Endress+Hauser 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 Endress +Hauser 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:

- An exact description of the application.
- The chemical and physical characteristics of the product.
- 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.

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: <ul style="list-style-type: none"><li>■ ToF Tool</li><li>■ Commuwin II (version 2.05.03 and higher)</li><li>■ HART Communicator DXR 275 (from OS 4.6) with Rev. 1, DD 1</li></ul>	
V 01.02.04/02.2004	<ul style="list-style-type: none"><li>■ FMU 42 added</li><li>■ compatible with HART Communicator DXR 375</li></ul>	FMU 42 added
V 01.04.00/07.2006	<ul style="list-style-type: none"><li>■ "detection window" function added can be operated via:<ul style="list-style-type: none"><li>■ ToF Tool from version 4.50</li><li>■ HART Communicator DXR375 with Rev. 1, DD1</li></ul></li></ul>	"detection window" added Version: 07.06

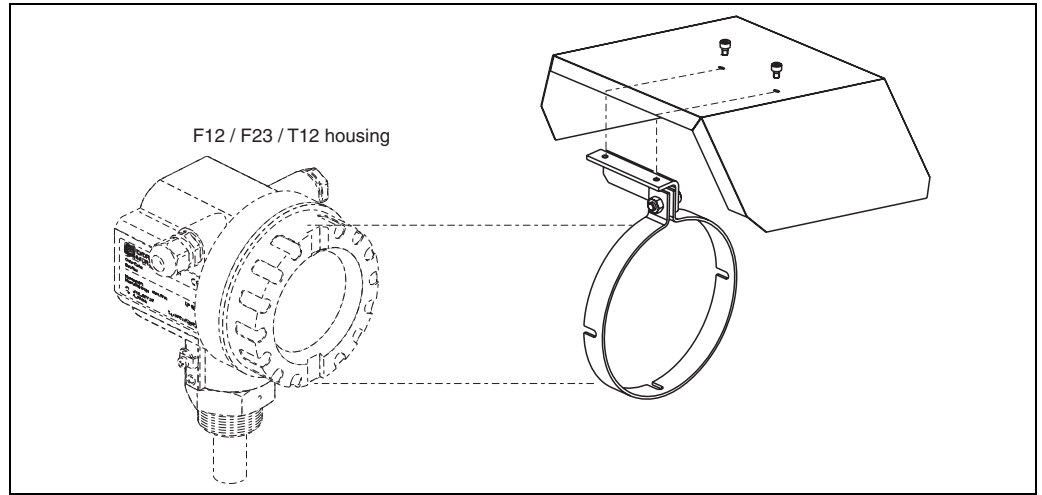
## 8.10 Contact addresses of Endress+Hauser

Contact addresses can be found on our homepage: [www.endress.com/worldwide](http://www.endress.com/worldwide). If you have any questions, please do not hesitate to contact your Endress+Hauser representative.

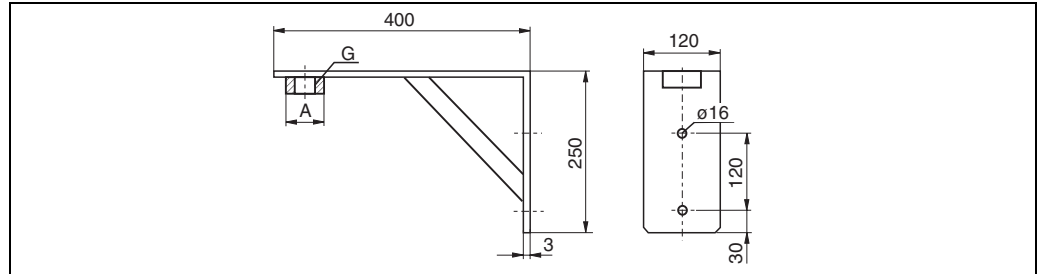
## 9 Accessories

### 9.1 Weather protection cover

A Weather protection cover made of stainless steel is recommended for outdoor mounting (order code: 543199-0001). The shipment includes the protective cover and tension clamp.



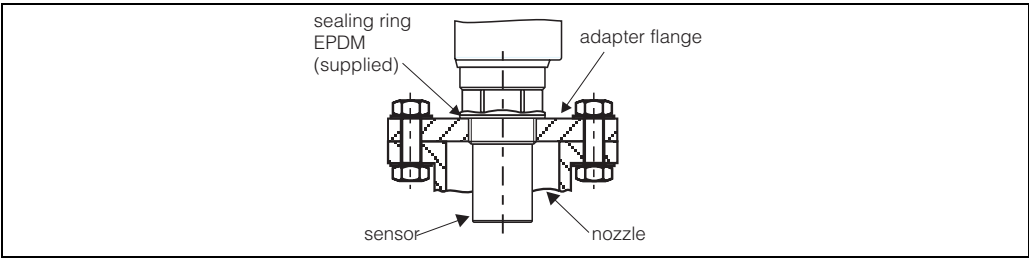
### 9.2 Installation bracket for FMU 40/41



- for FMU 40, G1½: Order No. 942669-0000
- for FMU 41, G2: Order No. 942669-0001

suited for NPT 1½" and 2" as well

9.3 Adapter flange



L00-FMUX3XXX-00-00-00-en-001

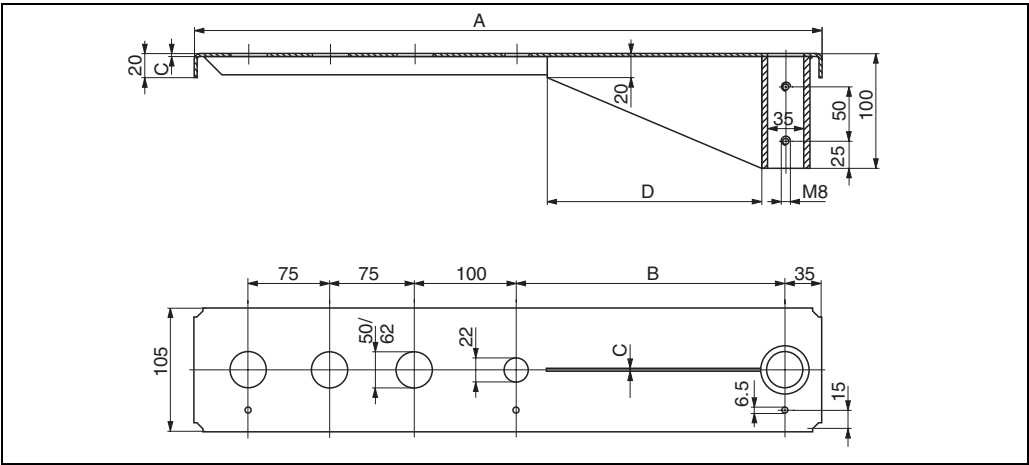
9.3.1 Version with metrical thread (FAU 70 E)

	Process Connection		
	12	DN 50 PN 16 A, flange EN1092-1 (DIN2527 B)	
	14	DN 80 PN 16 A, flange EN1092-1 (DIN2527 B)	
	15	DN 100 PN 16, A, flange EN1092-1 (DIN2527 B)	
		Sensor Connection	
	3	Thread ISO228 G1-1/2	
	4	Thread ISO228 G2	
		Flange Material	
	2	316L	
	7	Polypropylene	
FAU 70 E			Product designation

9.3.2 Version with conical thread(FAU 70 A)

	Process Connection		
	22	2" 150lbs FF, flange ANSI B16.5	
	24	3" 150lbs FF, flange ANSI B16.5	
	25	4" 150lbs FF, flange ANSI B16.5	
	Sensor Connection		
	5	Thread NPT1-1/2	
	6	Thread NPT2	
	Flange Material		
	2	316L	
	7	Polypropylene	
FAU 70 A			Product designation

9.4 Cantilever

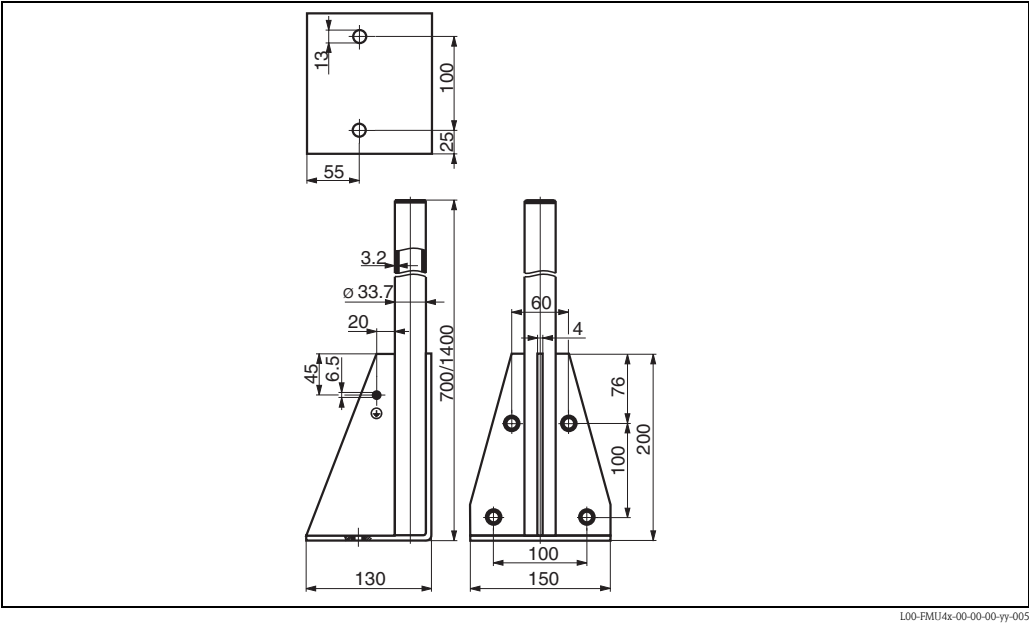


L00-FMU4xxxx-00-00-00-yy-005

A	B	C	D	for Sensor	Material	Order Code
585 mm	250 mm	2 mm	200 mm	FMU 40	1.4301 (AISI 304)	52014132
					galv. steel	52014131
				FMU 41	1.4301 (AISI 304)	52014136
					galv. steel	52014135
1085 mm	750 mm	3 mm	300 mm	FMU 40	1.4301 (AISI 304)	52014134
					galv. steel	52014133
				FMU 41	1.4301 (AISI 304)	52014138
					galv. steel	52014137

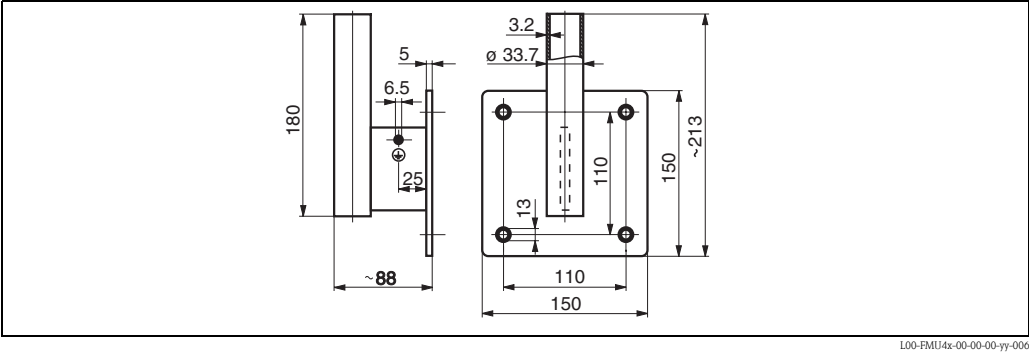
- The 50 mm or 62 mm orifices serve for the mounting of the FMU 40 or FMU 41 sensor, respectively.
- The 22 mm orifice may be used for an additional sensor.

9.5 Mounting Frame



Height	Material	Order Code
700 mm	galv. steel	919791-0000
700 mm	1.4301 (AISI 304)	919791-0001
1400 mm	galv. steel	919791-0002
1400 mm	1.4301 (AISI 304)	919791-0003

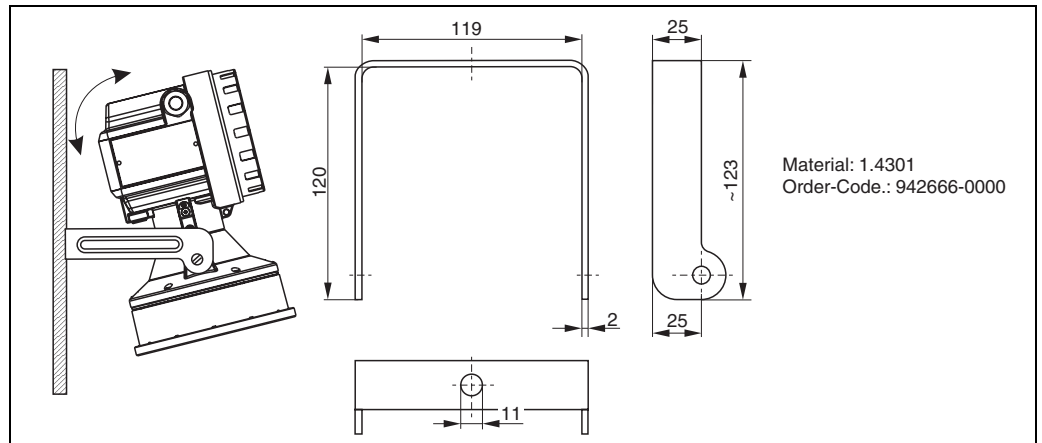
9.6 Wall Bracket



Material	Order Code
galv. steel	919792-0000
316Ti/1.4571	919792-0001



## 9.7 Mounting bracket for FMU 42/43/44



L00-FMU4x-00-00-00-en-003.eps

## 9.8 Commubox FXA191 HART

For intrinsically safe communication with ToF Tool/FieldCare via the RS232C interface. For details refer to TI237F/00/en.

## 9.9 Commubox FXA195 HART

For intrinsically safe communication with ToF Tool/FieldCare via the USB interface. For details refer to TI404F/00/en.

## 9.10 Commubox FXA291

The Commubox FXA291 connects Endress+Hauser field instruments with CDI interface (= Endress+Hauser Common Data Interface) to the USB interface of a personal computer or a notebook. For details refer to TI405C/07/en.



Note!

For the following Endress+Hauser instruments you need the "ToF Adapter FXA291" as an additional accessory:

- Cerabar S PMC71, PMP7x
- Deltabar S PMD7x, FMD7x
- Deltapilot S FMB70
- Gammapilot M FMG60
- Levelflex M FMP4x
- Micropilot FMR130/FMR131
- Micropilot M FMR2xx
- Micropilot S FMR53x, FMR540
- Prosonic FMU860/861/862
- Prosonic M FMU4x
- Tank Side Monitor NRF590 (with additional adapter cable)

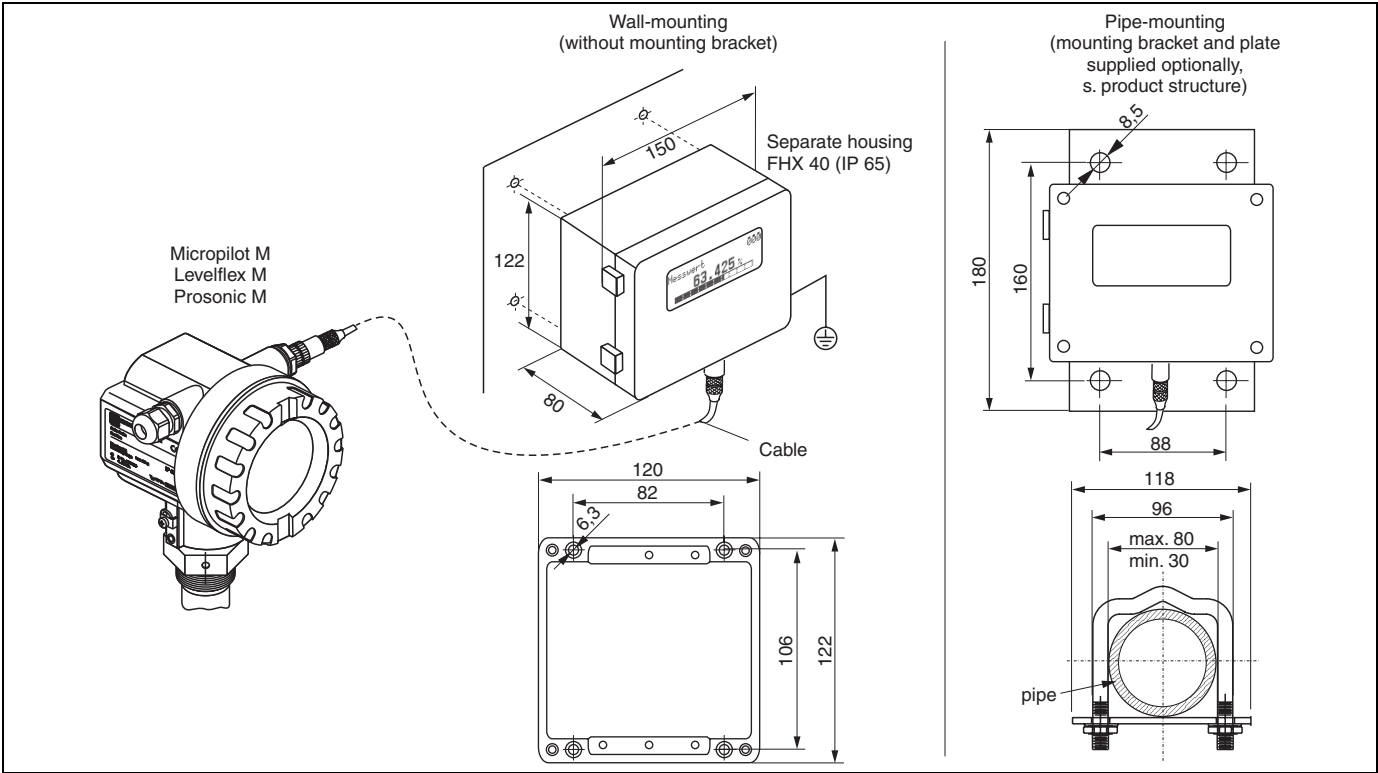
## 9.11 ToF Adapter FXA291

The ToF Adapter FXA291 connects the Commubox FXA291 via the USB interface of a personal computer or a notebook to the following Endress+Hauser instruments:

- Cerabar S PMC71, PMP7x
- Deltabar S PMD7x, FMD7x
- Deltapilot S FMB70
- Gammapilot M FMG60
- Levelflex M FMP4x
- Micropilot FMR130/FMR131
- Micropilot M FMR2xx
- Micropilot S FMR53x, FMR540
- Prosonic FMU860/861/862
- Prosonic M FMU4x
- Tank Side Monitor NRF590 (with additional adapter cable)

For details refer to KA271F/00/a2.

9.12 Remote display FHX40



100-FMxxxxxx-00-00-06-en-003

9.12.1 Technical data (cable and housing) and product structure:

Max. cable length	20 m (65 ft)
Temperature range	-30 °C...+70 °C (-22 °F...158 °F)
Degree of protection	IP65 acc. to EN 60529 (NEMA 4)
Materials	Housing: AlSi12; cable glands: nickle plated brass
Dimensions [mm] / [inch]	122x150x80 (HxWxD) / 4.8x5.9x3.2

		<b>Approval:</b>
	A	Nn-hazardous area
	1	ATEX II 2 G EEx ia IIC T6, ATEX II 3D
	S	FM IS Cl.I Div.1 Gr.A-D
	U	CSA IS Cl.I Div.1 Gr.A-D
	N	CSA General Purpose
	K	TIIS ia IIC T6 (in preparation)
		<b>Cable:</b>
	1	20m/65ft; for HART
	5	20m/65ft; for PROFIBUS PA/FOUNDATION Fieldbus
		<b>Additional option:</b>
	A	Basic version
	B	Mounting bracket, pipe 1" / 2"
FHX40 -		Complete product designation

For connection of the remote display FHX40 use the cable which fits the communication version of the respective instrument.

## 10 Technical Data

### 10.1 Technical data at a glance

#### 10.1.1 Input

Measured variable	<p>The distance D between the sensor membrane and the product surface is measured.</p> <p>Using the linearisation function, the device uses D to calculate:</p> <ul style="list-style-type: none"> <li>■ level L in any units</li> <li>■ volume V in any units</li> <li>■ flow Q across measuring weirs or open channels in any units</li> </ul>
-------------------	--

Maximum range/blocking distance

Sensor	Maximum range in liquids <sup>1</sup>	Maximum range in solids <sup>1</sup>	blocking distance
FMU40	5 m	2 m	0.25 m
FMU41	8 m	3.5 m	0.35 m
FMU42	10 m	5 m	0.4 m
FMU43	15 m	7 m	0.6 m
FMU44	20 m	10 m	0.5 m

<sup>1</sup>The actual range is dependent on the measuring conditions. Refer to Technical Information TI 365F/00/en for an estimation.

#### 10.1.2 Output

Output signal	4 ... 20 mA with HART protocol
---------------	--------------------------------

Signal on alarm	<ul style="list-style-type: none"> <li>■ Error symbol, error code and plain text description on the on-site display</li> <li>■ Error code via HART communication</li> <li>■ Current output (configurable)</li> </ul>
-----------------	--

#### 10.1.3 Auxiliary energy

Terminals	Cable cross-section: 0.5 to 2.5 mm (20 to 14 AWG)
-----------	---

Cable entry	<ul style="list-style-type: none"> <li>■ Cable gland M20x1.5 (recommended cable diameter 6 ... 10 mm)</li> <li>■ Cable entry G½ or ½ NPT</li> </ul>
-------------	---

Supply voltage	<ul style="list-style-type: none"> <li>■ Loop-powered HART: 14 ... 36 V (depending on output current)</li> <li>■ Loop-powered fixed current: 10 ... 36 V</li> <li>■ 4-wire DC: 10.5 ... 32 VDC</li> <li>■ 4-wire AC: 90 ... 253 VAC</li> </ul>
----------------	--

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

Power consumption

Version	Power consumption
2-wire	51 mW ... 800 mW
4-wire AC	max. 4VA
4-wire DC; FMU 40/41	330 mW ... 830 mW
4-wire DC; FMU 42/43	600 mW ... 1 W

Load HART

 Minimum load for HART communication: 250  $\Omega$ 

HART ripple

 47...125 Hz:  $V_{pp} = 200$  mV (measured at 500  $\Omega$ )

Max. noise HART

 500 Hz...10 kHz:  $V_{rms} = 2.2$  mV (measured at 500  $\Omega$ )

Galvanic isolation

With 4-wire devices, the evaluation electronics and mains voltage are galvanically isolated from each other.

### 10.1.4 Performance characteristics

Reaction time

The reaction time depends on the parameter settings. The minimum values are:

- 2-wire devices (FMU40/41/42): min. 2 s
- 2-wire devices (FMU44): min. 3 s
- 4-wire devices (FMU40/41/42/43/44): 0.5 s

Reference operating conditions

- Temperature = +20 °C
- 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
FMU40	1 mm
FMU41	1 mm
FMU42	2 mm
FMU43	2 mm
FMU44	2 mm

Measuring error

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

Sensor	Measuring error
FMU40	$\pm 2$ mm or 0.2% of set measuring distance (empty calibration) <sup>1</sup>
FMU41	$\pm 2$ mm or 0,2% of set measuring distance (empty calibration) <sup>1</sup>
FMU42	$\pm 4$ mm or 0,2% of set measuring distance (empty calibration) <sup>1</sup>
FMU43	$\pm 4$ mm or 0,2% of set measuring distance (empty calibration) <sup>1</sup>
FMU44	$\pm 4$ mm or 0,2% of set measuring distance (empty calibration) <sup>1</sup>

<sup>1</sup>whichever is greater

### 10.1.5 Ambient conditions

Ambient temperature

-40 °C ... +80 °C

The functionality of the LC display becomes restricted at  $T_u < -20$  °C and  $T_u > +60$  °C. If the device is operated outdoors in strong sunlight, you should use a protective cover.

Storage temperature

-40 °C ... +80 °C

Climate class

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

Ingress protection

- With closed housing, tested according to
  - IP 68, NEMA 6P (24h at 1.83m under water surface)
  - IP 66, NEMA 4x
- With open housing: IP 20, NEMA 1 (also ingress protection of the display)

Vibration resistance

DIN EN 60068-2-64 / IEC 68-2-64: 20...2000 Hz, 1 (m/s<sup>2</sup>)<sup>2</sup>/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).
- A standard installation cable is sufficient if only the analogue signal is used. Use a screened cable when working with a superimposed communication signal (HART).

### 10.1.6 Process conditions

Process temperature

-40 °C ... +80 °C

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

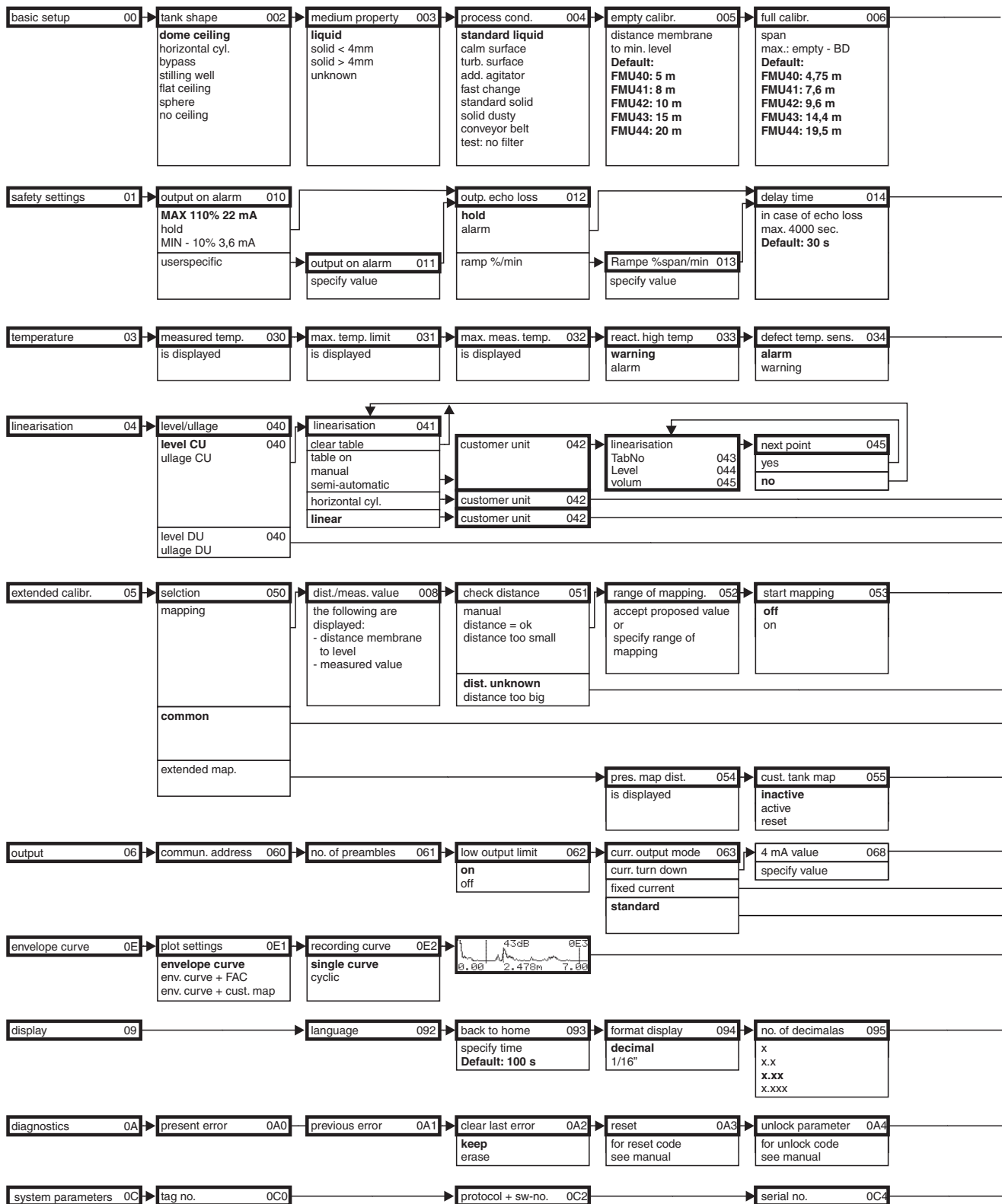
Process pressure

- FMU 40/41: 0.7 bar ... 3bar abs.
- FMU 42/43/44: 0.7 bar ... 2.5bar abs.



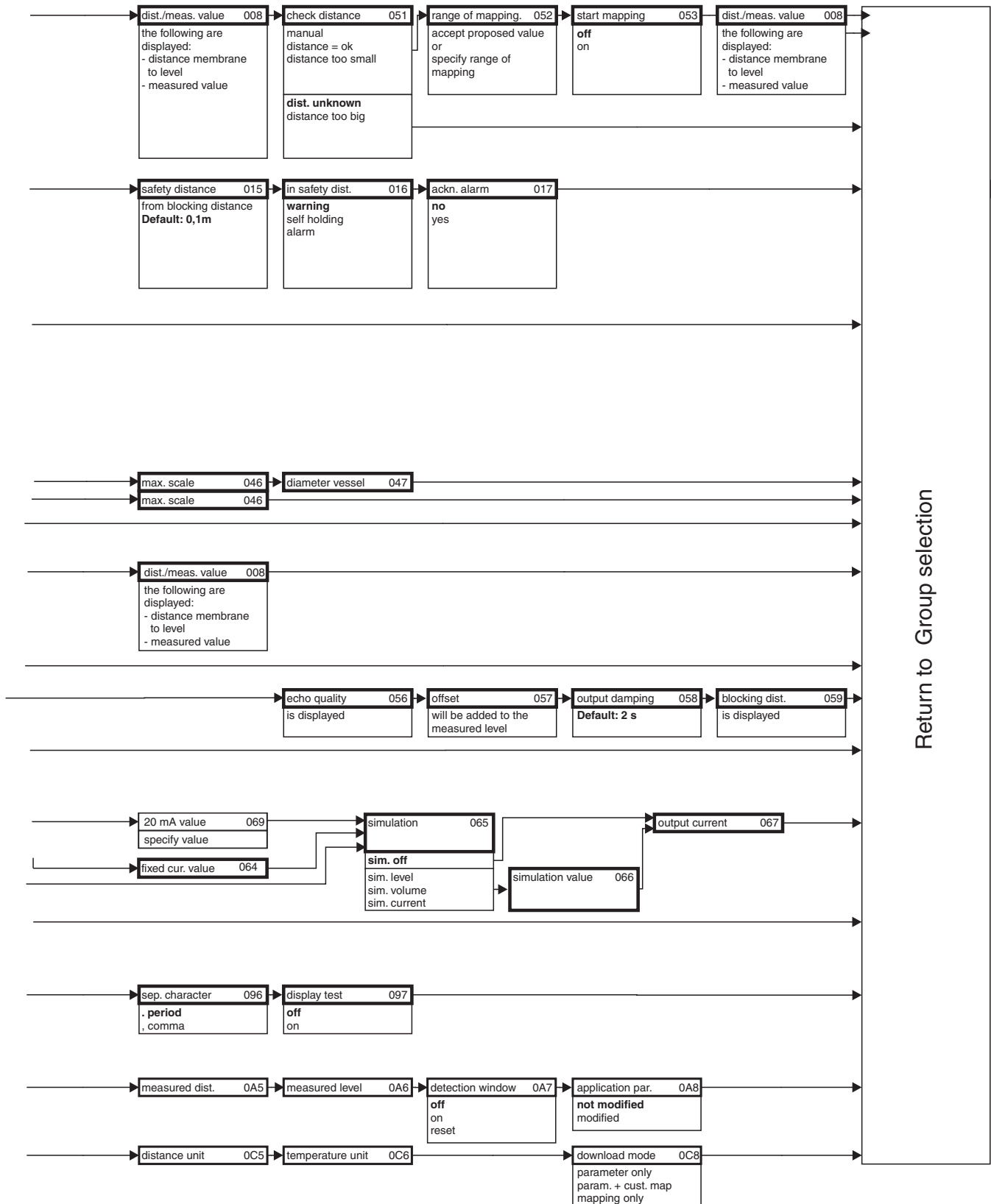
# 11 Appendix

## 11.1 Operating menu

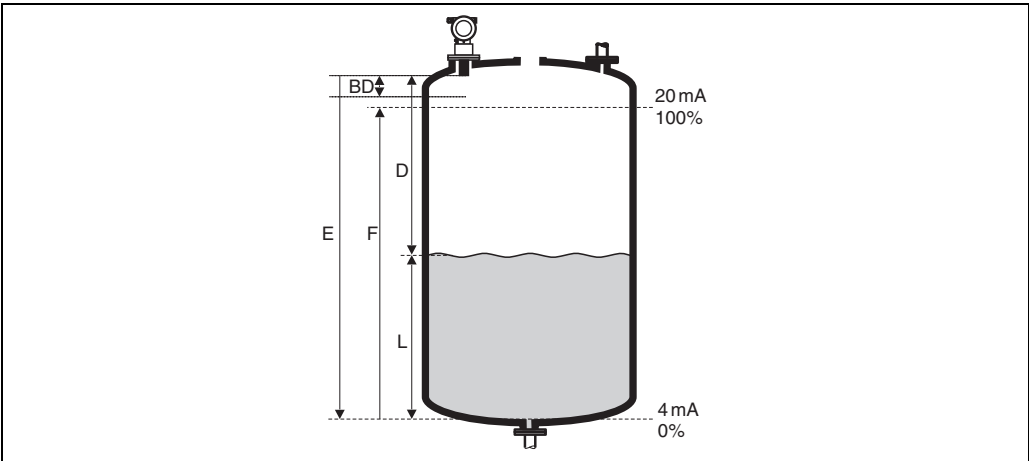


**Note!** The Default values of the parameters are typed in bold face.





## 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
FMU40	0.25 m	5 m	2 m
FMU41	0.35 m	8 m	3.5 m
FMU42	0.4 m	10 m	5 m
FMU43	0.6 m	15 m	7 m
FMU44	0.5 m	20 m	10 m

### 11.2.1 Time-of-flight method

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

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

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 Prosonic 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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## Declaration of Hazardous Material and De-Contamination *Erklärung zur Kontamination und Reinigung*

**RA No.**

Please reference the Return Authorization Number (RA#), obtained from Endress+Hauser, on all paperwork and mark the RA# clearly on the outside of the box. If this procedure is not followed, it may result in the refusal of the package at our facility.

Bitte geben Sie die von E+H mitgeteilte Rücklieferungsnummer (RA#) auf allen Lieferpapieren an und vermerken Sie diese auch außen auf der Verpackung. Nichtbeachtung dieser Anweisung führt zur Ablehnung ihrer Lieferung.

Because of legal regulations and for the safety of our employees and operating equipment, we need the "Declaration of Hazardous Material and De-Contamination", with your signature, before your order can be handled. Please make absolutely sure to attach it to the outside of the packaging.

Aufgrund der gesetzlichen Vorschriften und zum Schutz unserer Mitarbeiter und Betriebseinrichtungen, benötigen wir die unterschriebene "Erklärung zur Kontamination und Reinigung", bevor Ihr Auftrag bearbeitet werden kann. Bringen Sie diese unbedingt außen an der Verpackung an.

**Type of instrument / sensor**

Geräte-/Sensortyp

**Serial number**

Seriennummer

☐ **Used as SIL device in a Safety Instrumented System / Einsatz als SIL Gerät in Schutzzeineinrichtungen**

**Process data / Prozessdaten**

Temperature / Temperatur \_\_\_\_\_ [°F] \_\_\_\_\_ [°C]

Pressure / Druck \_\_\_\_\_ [psi] \_\_\_\_\_ [Pa]

Conductivity / Leitfähigkeit \_\_\_\_\_ [µS/cm]

Viscosity / Viskosität \_\_\_\_\_ [cp] \_\_\_\_\_ [mm<sup>2</sup>/s]

**Medium and warnings**

Warnhinweise zum Medium



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

\* explosive; oxidising; dangerous for the environment; biological risk; radioactive

\* explosiv; brandfördernd; umweltgefährlich; biogefährlich; radioaktiv

Please tick should one of the above be applicable, include safety data sheet and, if necessary, special handling instructions.

Zutreffendes ankreuzen; trifft einer der Warnhinweise zu, Sicherheitsdatenblatt und ggf. spezielle Handhabungsvorschriften beilegen.

**Description of failure / Fehlerbeschreibung**

**Company data / Angaben zum Absender**

Company / Firma _____	Phone number of contact person / Telefon-Nr. Ansprechpartner: _____
Address / Adresse _____	Fax / E-Mail _____
_____	Your order No. / Ihre Auftragsnr. _____

"We hereby certify that this declaration is filled out truthfully and completely to the best of our knowledge. We further certify that the returned parts have been carefully cleaned. To the best of our knowledge they are free of any residues in dangerous quantities."

"Wir bestätigen, die vorliegende Erklärung nach unserem besten Wissen wahrheitsgetreu und vollständig ausgefüllt zu haben. Wir bestätigen weiter, dass die zurückgesandten Teile sorgfältig gereinigt wurden und nach unserem besten Wissen frei von Rückständen in gefahrbringender Menge sind."

(place, date / Ort, Datum)

Name, dept./Abt. (please print / bitte Druckschrift)

Signature / Unterschrift

[www.endress.com/worldwide](http://www.endress.com/worldwide)

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People for Process Automation

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