



Level



Pressure



Flow



Temperature



Liquid
Analysis



Registration



Systems
Components



Services

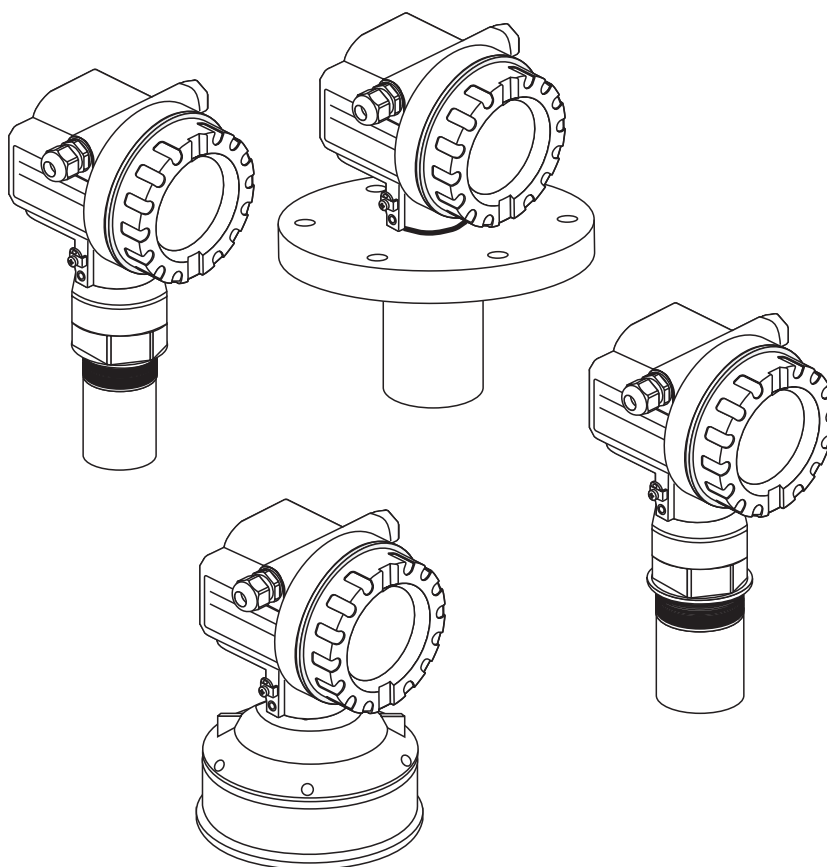


Solutions

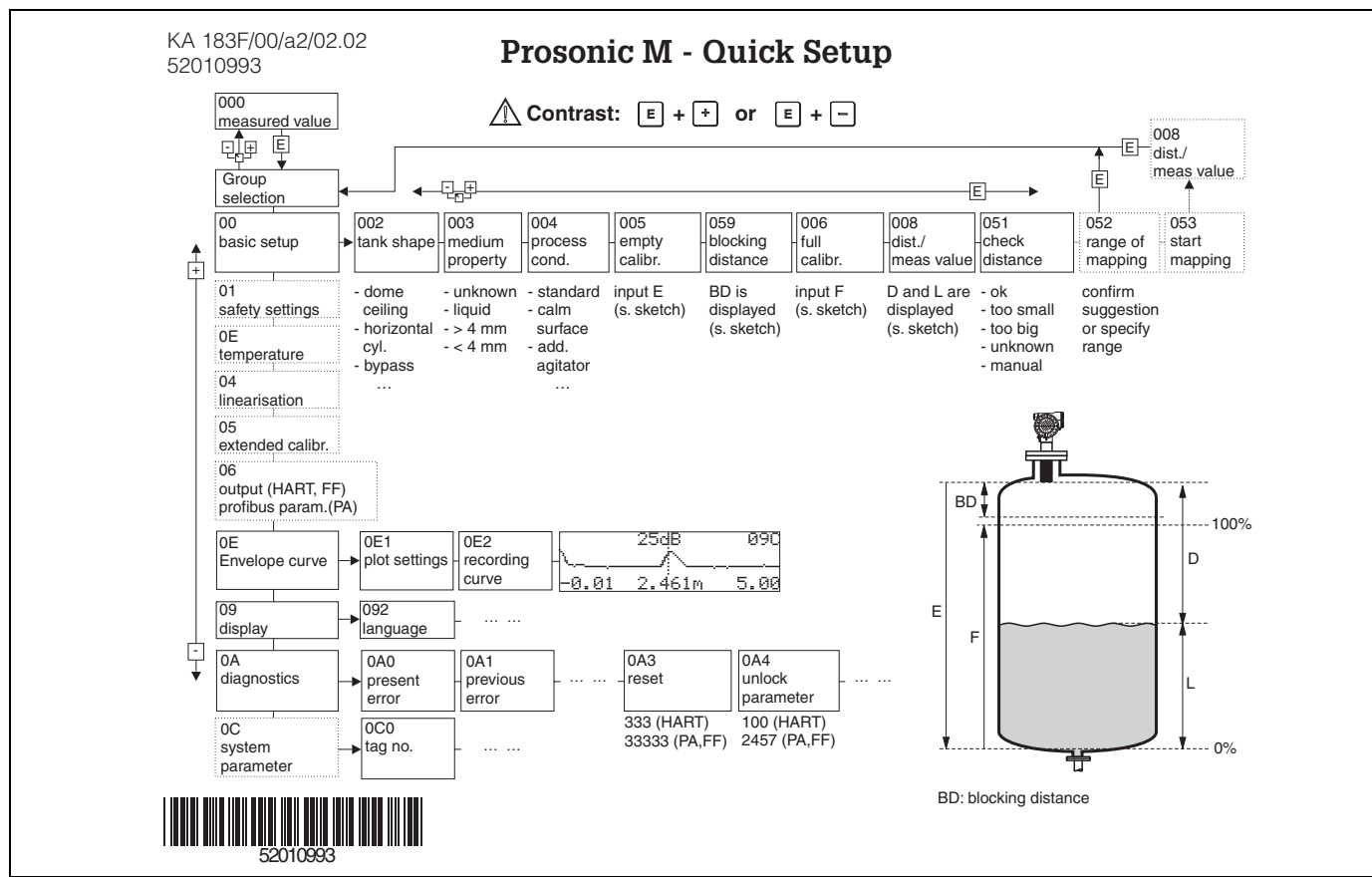
Operating Instructions

Prosonic M FMU40/41/42/43

Ultrasonic Level Measurement



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.

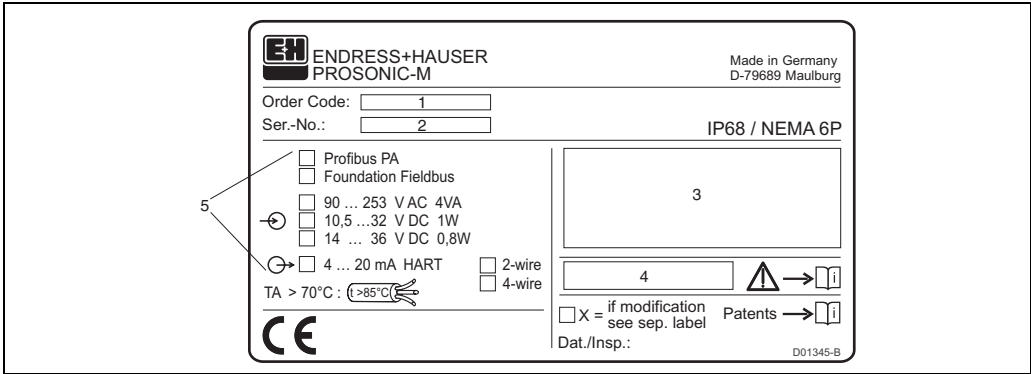
1.4 Notes on safety conventions and symbols

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

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				TIIS Ex ia II C T6
	Y				Special certificate
Process connection					
	R				G 1½" thread ISO 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)
	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 Scope of delivery

2.6.1 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 instrumentsThe cable glands are mounted on delivery.

2.6.2 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 239F, 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.

2.7 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.

2.8 Registered trademarks

ToF®

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

PulseMaster®

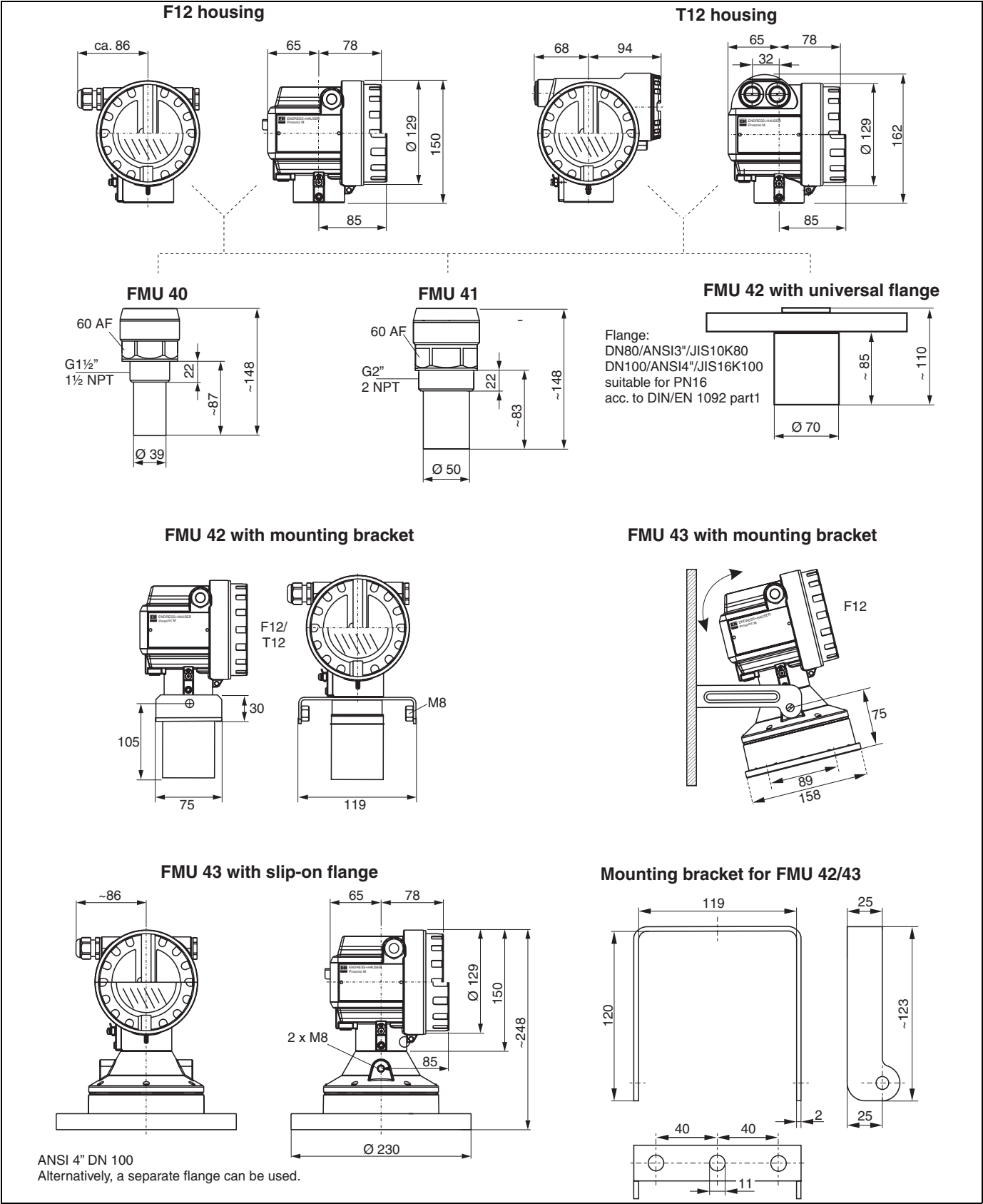
Registered trademark of the company Endress+Hauser GmbH+Co. KG, Maulburg, Germany

Foundation™ Fieldbus

Registered trademark of Fieldbus Foundation Austin, Texas, USA

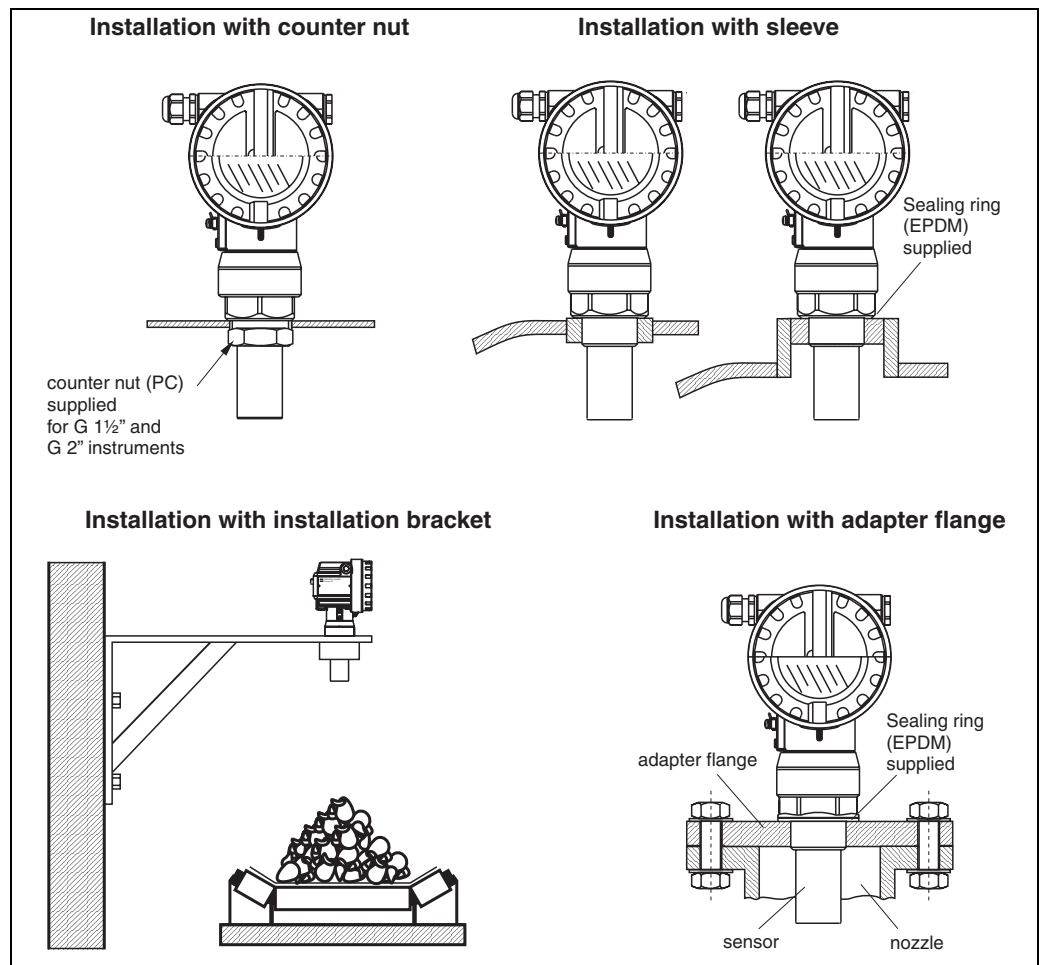
3 Installation

3.1 Dimensions



3.2 Installation variants

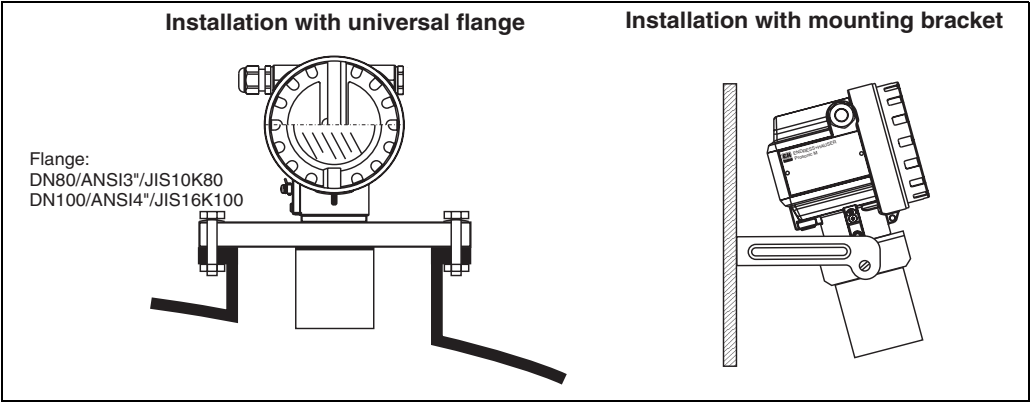
3.2.1 Installation variants FMU 40, FMU 41



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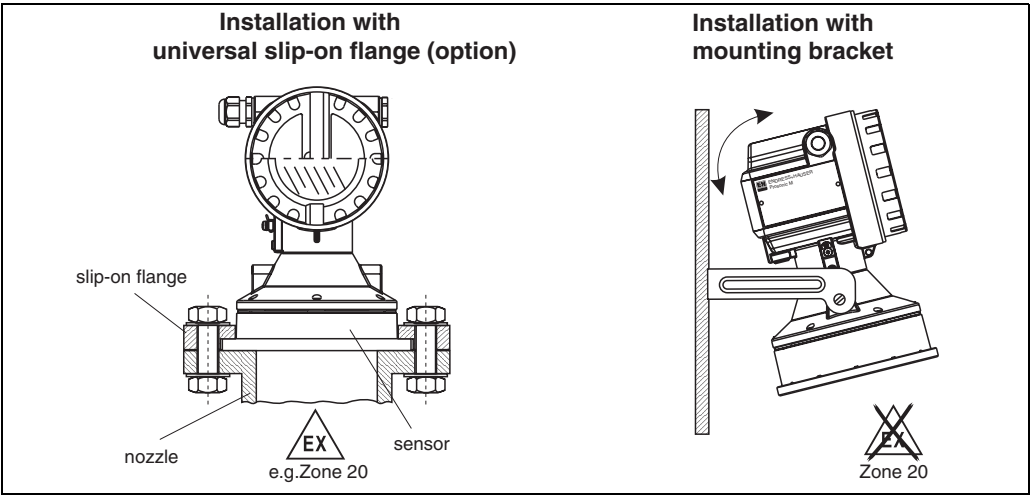
For installation bracket or adapter flange s. chapter "Accessories".

3.2.2 Installation variants FMU 42



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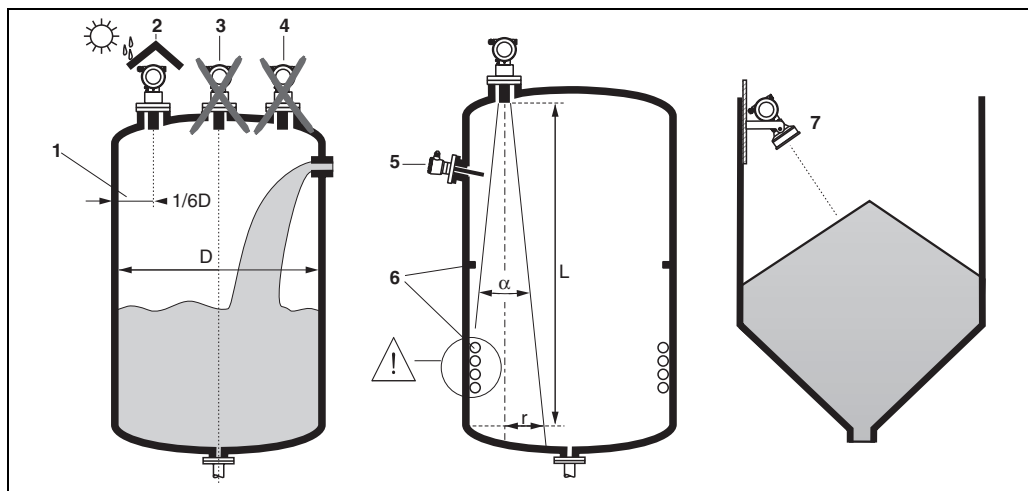
3.2.3 Installation variants FMU 43



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3.3 Installation conditions

3.3.1 Installation conditions for level measurements



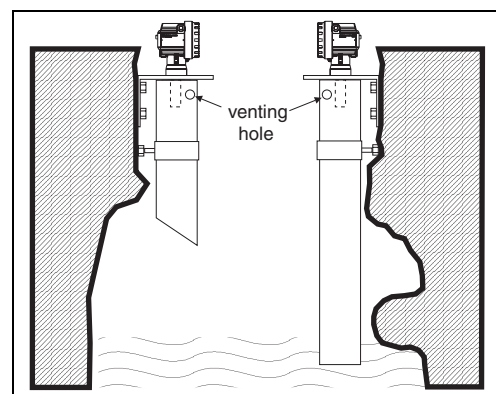
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- Do not install the sensor in the middle of the tank (3). We recommend leaving a distance between the sensor and the tank wall (1) measuring $1/6D$ of the tank diameter.
- Use a protective cover, in order to protect the device from direct sun or rain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

Sensor	α	$L_{\max}$	$r_{\max}$
FMU 40	11°	5 m	0,48 m
FMU 41	11°	8 m	0,77 m
FMU 42	9°	10 m	0,96 m
FMU 43	6°	15 m	0,79 m

3.3.2 Installation in narrow shafts

In narrow shafts with strong interference echoes, we recommend using an ultrasound guide pipe (e.g. PE or PVC wastewater pipe) with a minimum diameter of 100 mm. Make sure that the pipe is not soiled by accumulated dirt. If necessary, clean the pipe at regular intervals.

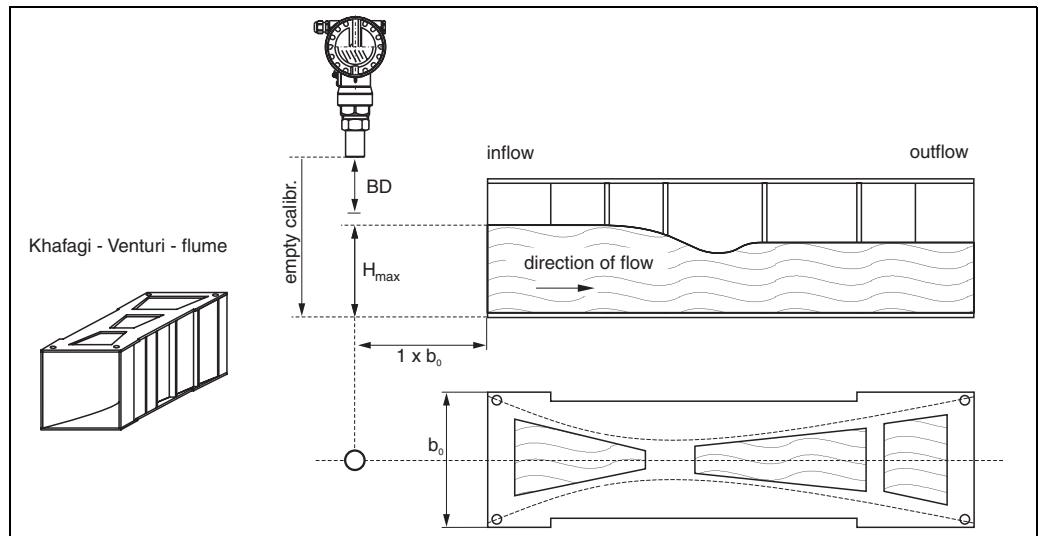


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3.3.3 Installation conditions for flow measurements

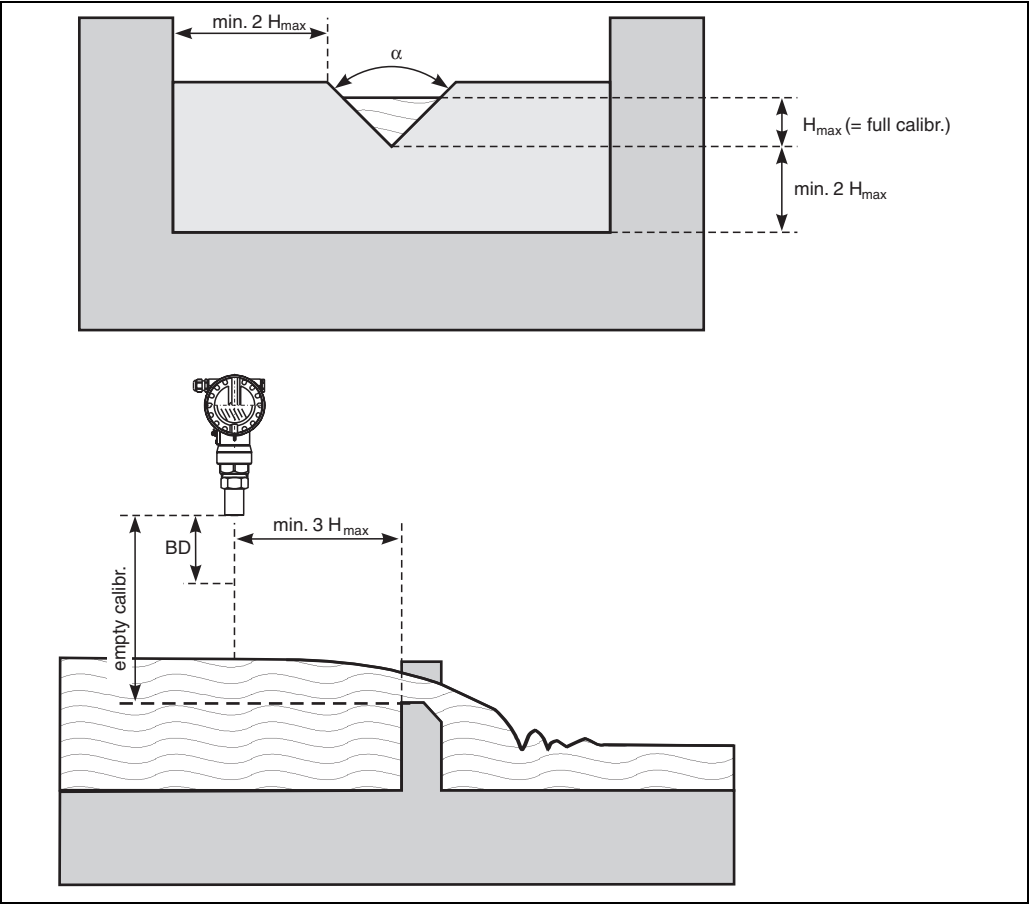
- Install the Prosonic M at the inflow side, as close above the maximum water level $H_{\max}$ as possible (take into account the blocking distance BD).
- Position the Prosonic M in the middle of the channel or weir.
- Align the sensor membrane parallel to the water surface.
- Keep to the installation 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



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Example: Triangular weir

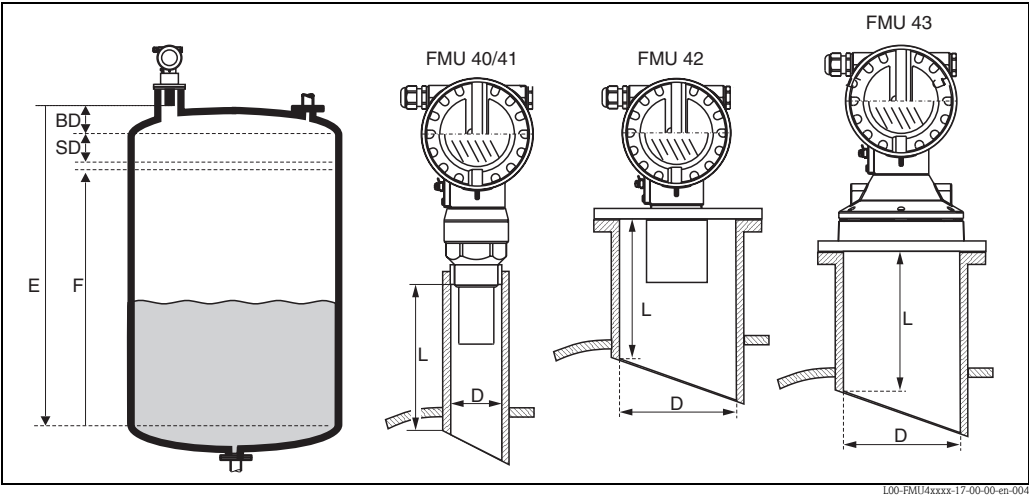


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3.4 Measuring range

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
FMU 40	0.25 m	5 m	2 m	50 mm	ca. 80 mm
				80 mm	ca. 240 mm
				100 mm	ca. 300 mm
FMU 41	0.35 m	8 m	3.5 m	80 mm	ca. 240 mm
				100 mm	ca. 300 mm
FMU 42	0.4 m	10 m	5 m	80 mm	ca. 250 mm
				100 mm	ca. 300 mm
FMU 43	0.6 m	15 m	7 m	min. 100 mm	ca. 300 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.

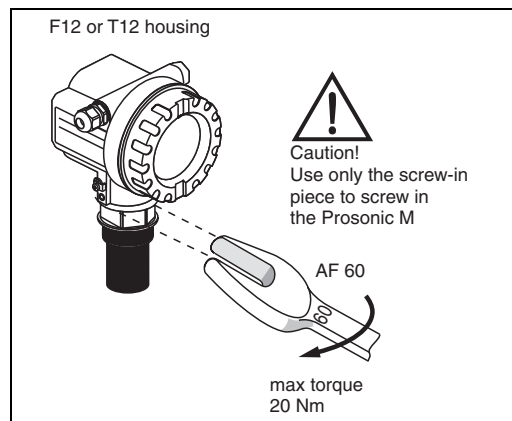
3.4.3 Range

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
FMU 40	5 m
FMU 41	8 m
FMU 42	10 m
FMU 43	15 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.

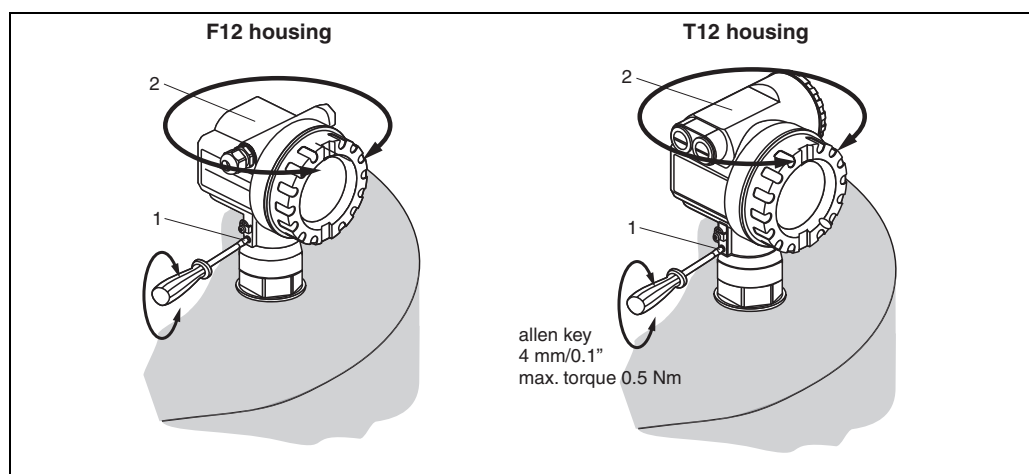


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3.6 Turn housing

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.



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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

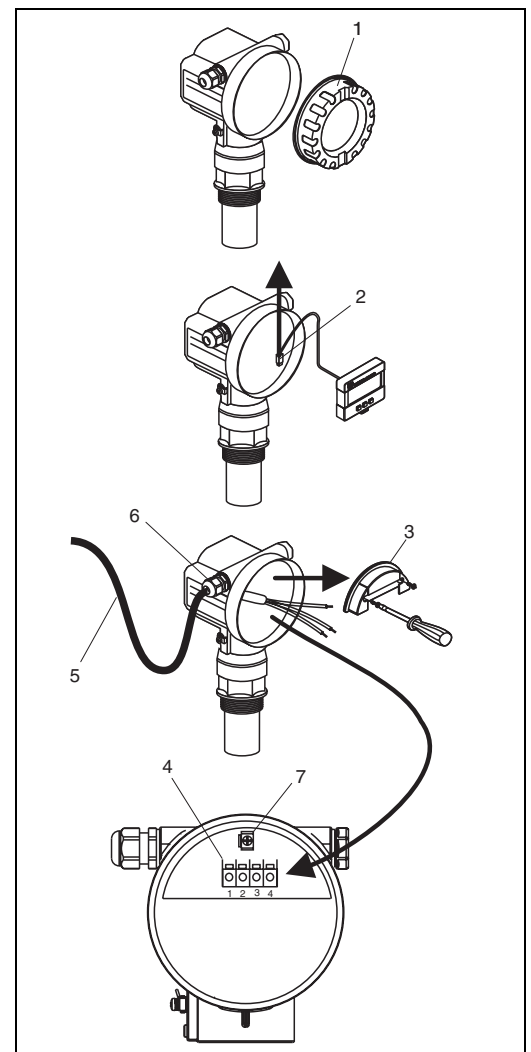
1. Unscrew housing cover (1).
2. Remove display (2) if fitted.
3. Remove cover plate (3) from terminal compartment.
4. Pull out terminal module (4) slightly using pulling loop.
5. Insert cable (5) through gland (6).



Caution!

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

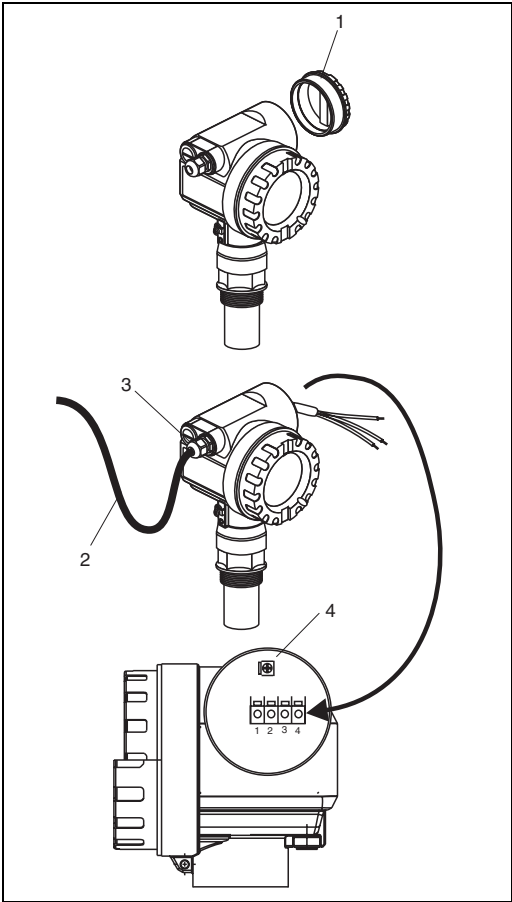
6. Connect cable screen to the grounding terminal (7) within the terminal compartment.
7. Make connection according to terminal assignment (see below).
8. Re-insert terminal module (4).
9. Tighten cable gland (6).
10. Tighten screws on cover plate (3).
11. Insert display (2) if fitted.
12. Screw on housing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



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4.1.2 **Wiring in the housing T12**

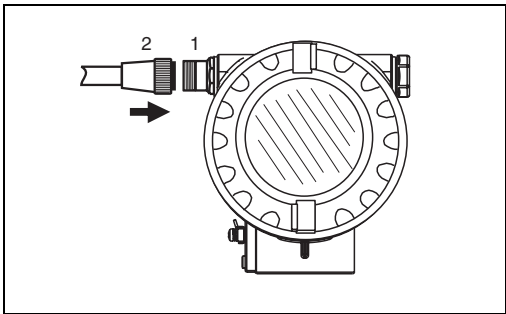
- 1. Unscrew the cover (1) of the separate connection room.
- 2. Insert cable (2) through gland (3).
-  **Caution!**
 If possible, insert the cable from above and let a draining loop in order to avoid intrusion of humidity.
- 3. Connect cable screen to the grounding terminal (4) within the connection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



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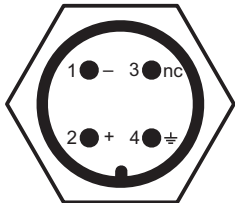
4.1.3 **Wiring with Foundation Fieldbus plug**

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



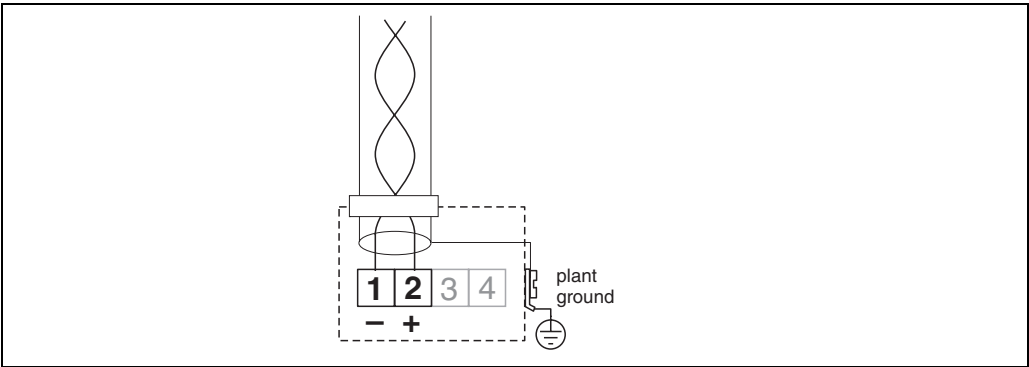
L00-FMU4xxxx-04-00-00-yy-011

Pin assignment of the 7/8" plug connector (FOUNDATION Fieldbus plug)

	Pin	Meaning
	1	FF -
	2	FF +
	3	not connected
	4	ground

L00-FMxxxxxx-04-00-00-yy-017

4.2 Terminal assignment



L00-FMxxxxxx-04-00-00-en-013

4.3 Cable specifications Foundation Fieldbus

Twisted, shielded pairs must be used. The cable specifications can be taken from the FF specification or IEC 61158-2. The following have been found suitable:

Non-Ex-area:

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

Ex-area:

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

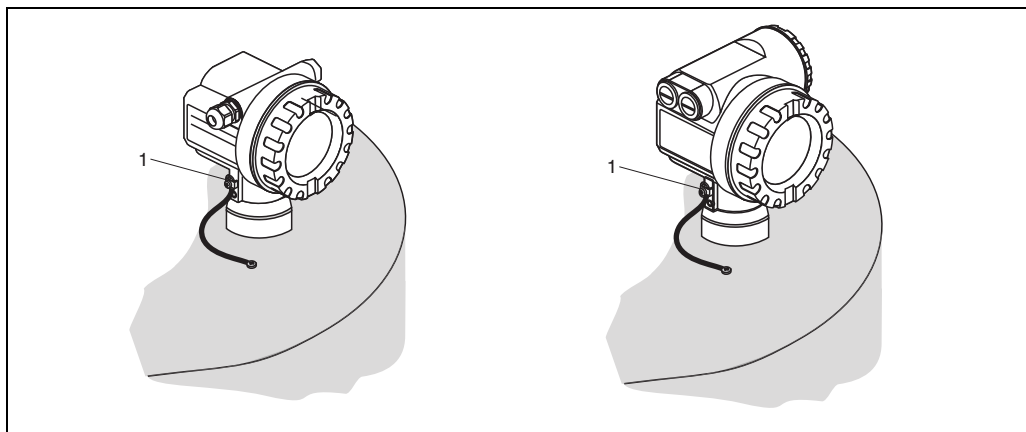
4.4 Supply voltage

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

Type	minimum terminal voltage	maximum terminal voltage
standard	9 V	32 V
EEx ia (FISCO model)	9 V	17,5 V
EEx ia (Entity concept)	9 V	24 V

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

4.5 Recommended connection



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1: external ground terminal of the transmitter

For maximum EMC protection please observe the following points:

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



Caution!

Applications, which are subject to the explosion prevention, permit only under special conditions the repeated grounding of the protective screen, see to EN 60 079-14..

4.6 Checking the connection

After wiring the device, carry out the following checks:

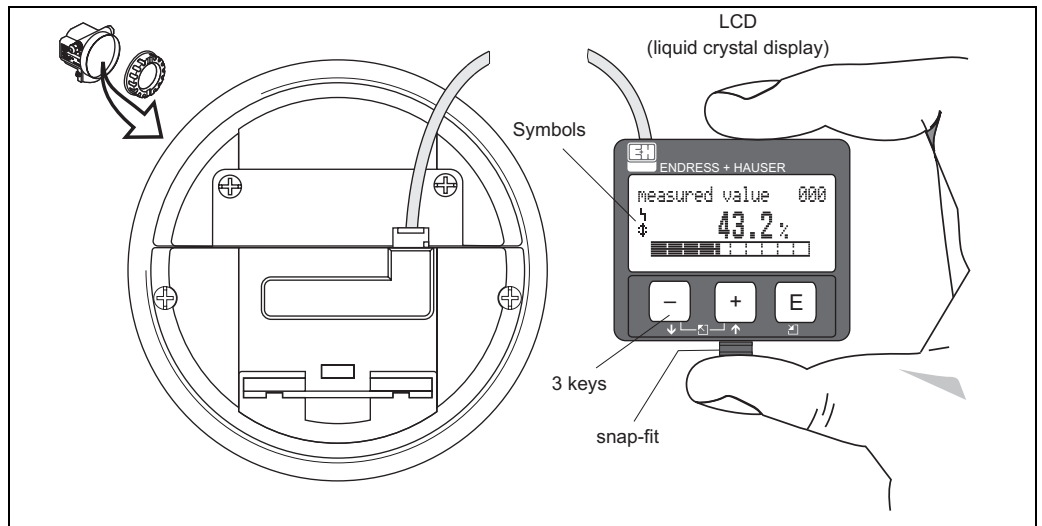
- Are the terminals correctly assigned?
- Is the cable gland tight?
- Is the Foundation Fieldbus connector screwed tight?
- Is the housing cover fully screwed on?
- If power supply available: Does a display appear on the display module?

5 Operation

5.1 Display and operating elements

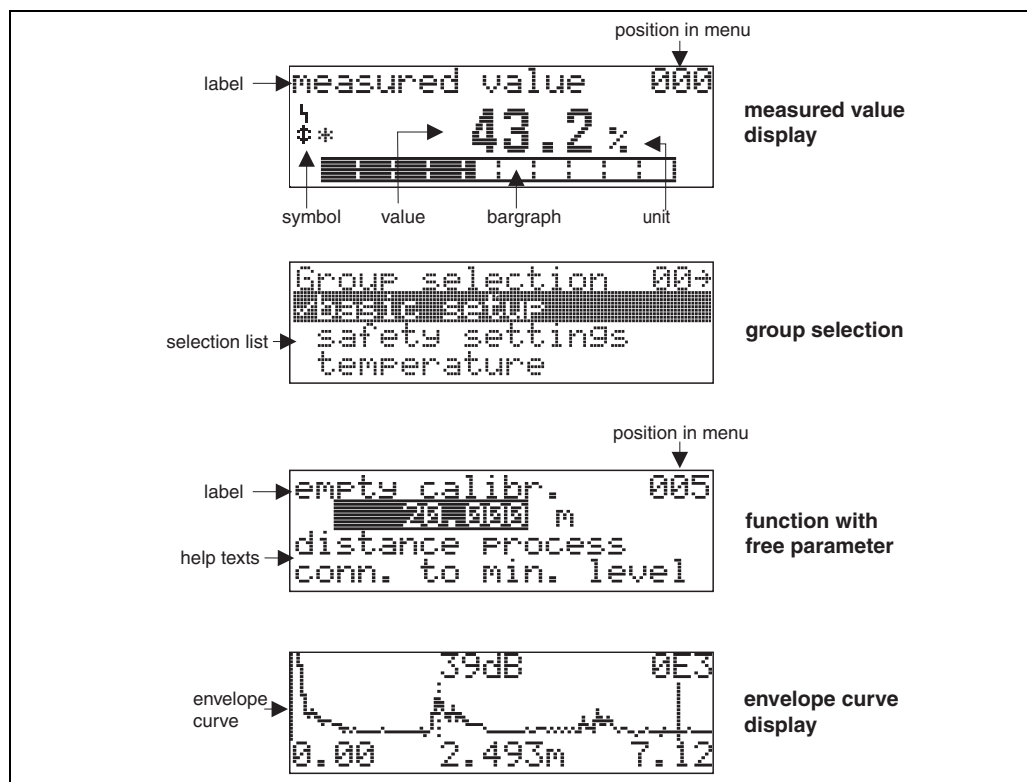
5.1.1 On-site display VU 331

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.



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5.1.2 Display appearance



In the measured value display, the bargraph corresponds to the output. The bargraph is segmented in 10 bars. Each completely filled bar represents a change of 10% of the adjusted span.

5.1.3 Display symbols

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

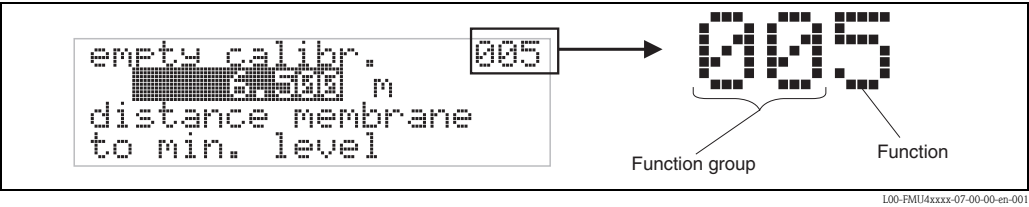
Sybmol	Meaning
	ALARM_SYMBOL This alarm symbol appears when the instrument is in an alarm state. If the symbol flashes, this indicates a warning.
	LOCK_SYMBOL This lock symbol appears when the instrument is locked,i.e. if no input is possible.
	COM_SYMBOL This communication symbol appears when a data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

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
E	Navigate to the right within a function group, confirmation.
+ and E or - and E	Contrast settings of the LCD
+ and - and E	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
- ...

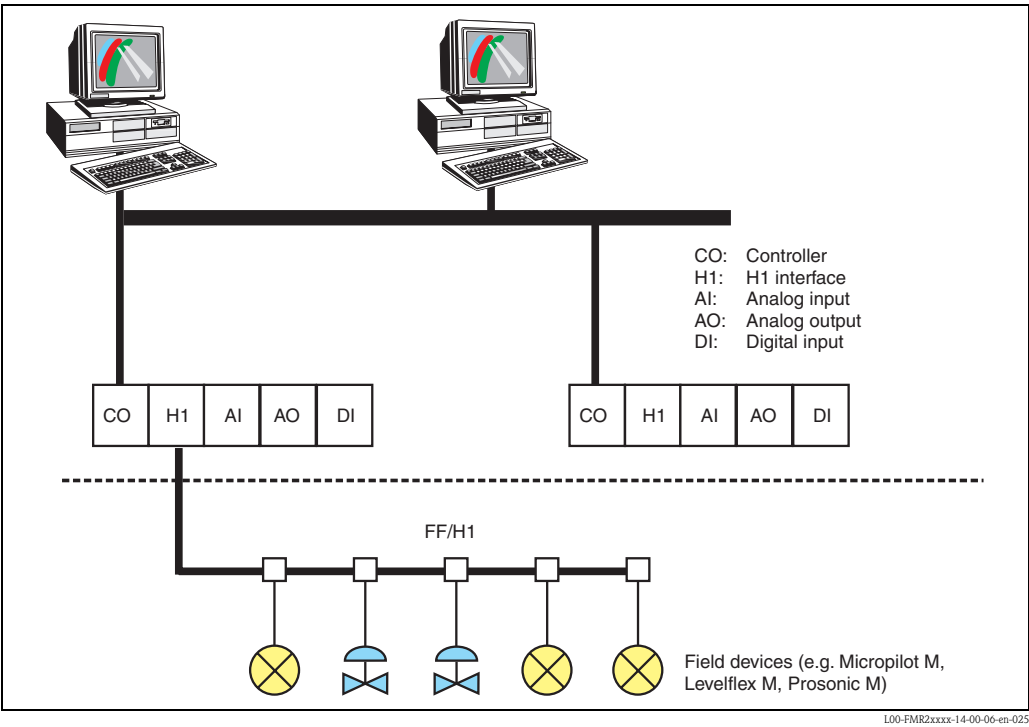
Hereafter the position is always given in brackets (e.g. "**tank shape**" (002)) after the described function.

5.3 Foundation Fieldbus interface

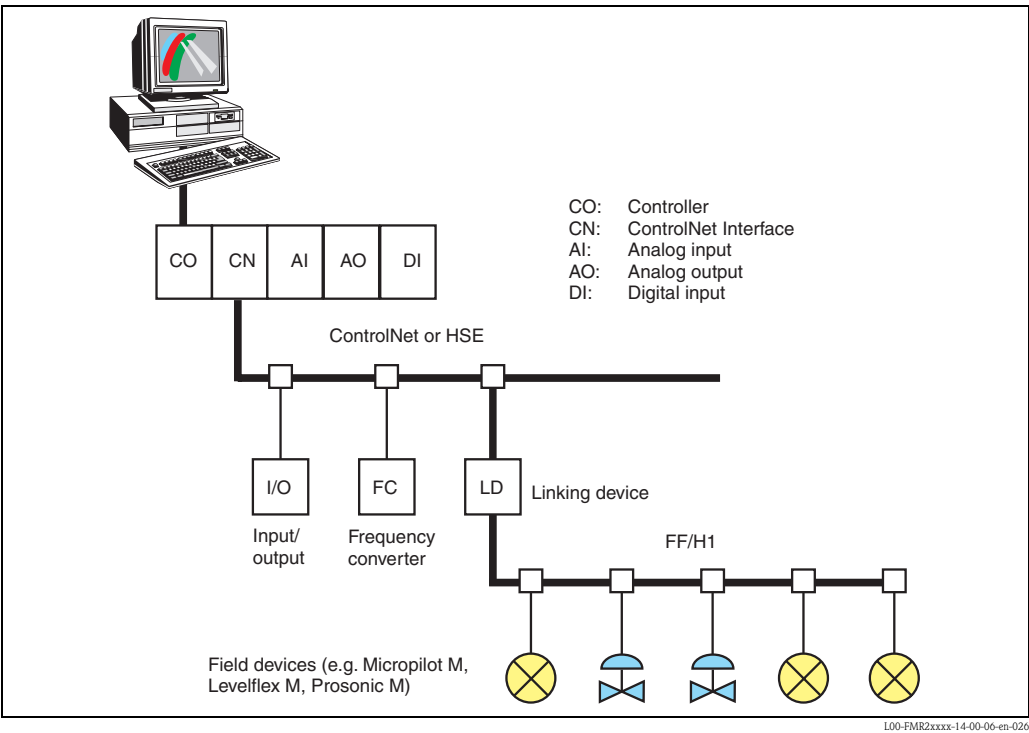
5.3.1 Synopsis

There are two possibilities of connecting up a Foundation Fieldbus:

Direct connection to a FF/H1 card



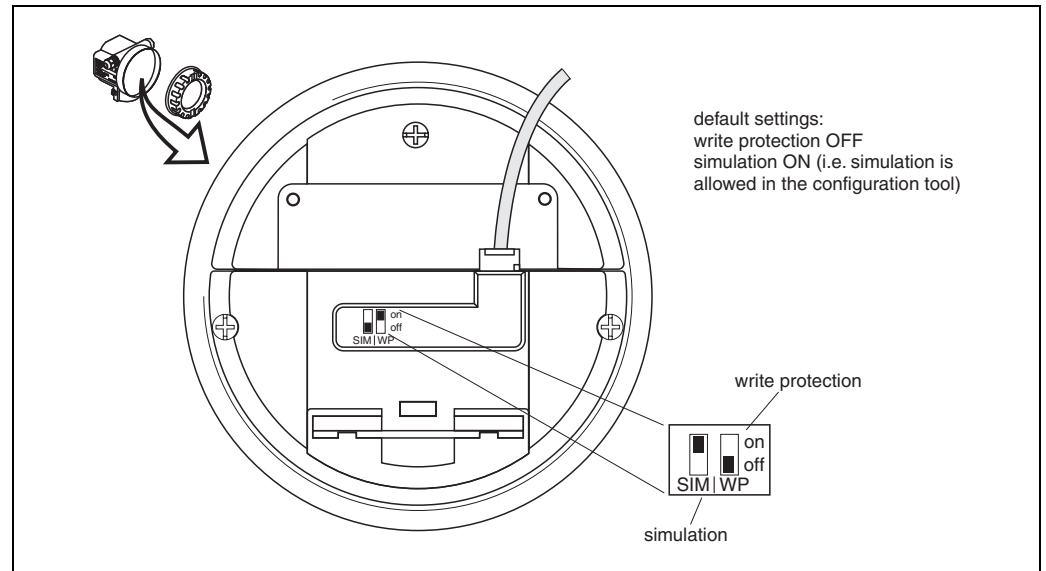
Indirect connection via a linking device



5.3.2 Hardware settings

A DIP-switch in the connection compartment of the instrument allows the write protection and simulation functions to be set via hardware.

- If "SIM" is switched off, the simulation function is not accessible in the configuration tool.
- If "WP" is switched on, parameter access is disabled



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Device identification

Foundation Fieldbus identifies the device by its identification code and automatically allocates an appropriate field address. There is no separate hardware switch for this purpose.

5.3.3 Network configuration

During the configuration of the FF network the device description (DD) of the Prosonic M must be downloaded into the directory foreseen for it.

- Start the interface configuration tool.
- Configure the interface.
- Call the DD download routine
- Download the device descriptions (.ffo and .sym files) to the directory offered.
- When the configuration is complete, close the tool and the FF stack (if open).

The Prosonic M device descriptions can be ordered direct from Endress+Hauser or downloaded from our website **www.endress.com**. They contain all data necessary to operate Endress+Hauser Foundation Fieldbus devices.

Example: Start-up using the NI-Fieldbus configurator

Start the bus configuration tool. After start-up, the tool shows the network configuration in the form of an expandable tree. If the Prosonic M has been connected correctly, it can now be identified:

E+H_PROSONIC_M_XXXXXXX

A double click on the name reveals the device data.

PD_TAG	the physical name of the device
DEVICE_ID	the unique device identifier
NODE_ADDRESS	device address (is automatically allocated by the Configurator; can be changed by the user)

The device ID is made up of the following components:

Device_ID = 452B48100F-XXXXXXX

whereby:

452B48	ID code for Endress+Hauser
1011	ID code for Prosonic M
XXXXXXX	Device serial number, as printed on the nameplate

A right-hand mouse click on the name opens up a menu from which the PD_TAG and NODE_ADDRESS can be changed.

A click on the name expands the device tree to show the function blocks available for it:

E+H_PROSONIC_M_XXXXXXX
RESOURCE_XXXXXX (RB2)
TRANSDUCER_XXXXXX (TBRL)
ANALOG_INPUT_1_XXXXXX (AI)
ANALOG_INPUT_2_XXXXXX (AI)
PID_XXXXXX(PID)
AR_XXXXXX (AR)
IS_XXXXXX (IS)
SC_XXXXXX (SC)
IT_XXXXXX (IT)

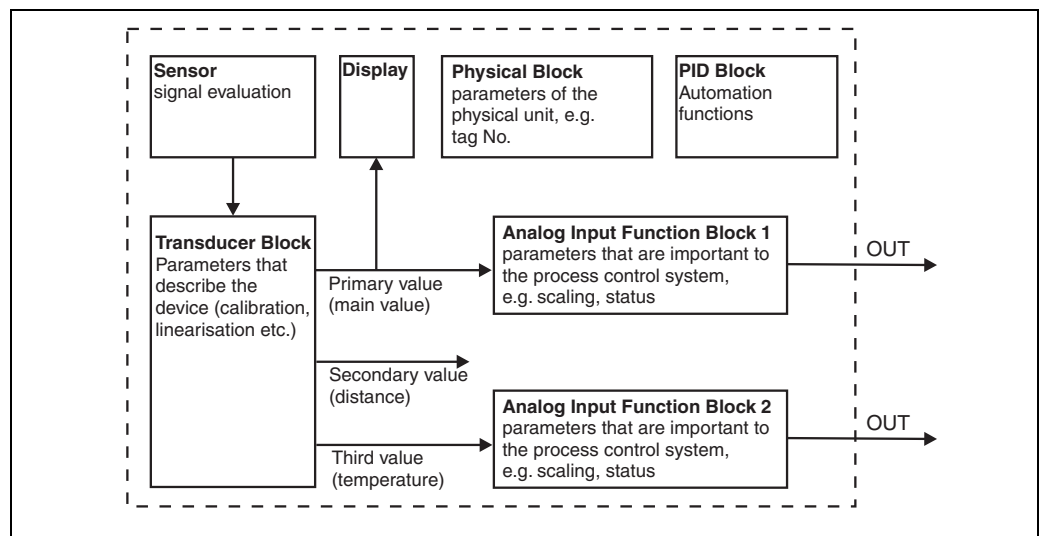
5.3.4 Block model of the Prosonic M

The Prosonic M contains the following blocks:

- **Resource Block (RB2)**
s. Operating Instructions BA 013S: "Foundation Fieldbus – Overview"
- **Transducer Block (TB)**
contains the parameters relevant to the measurement
- **Analog-Input-Block 1 bzw. 2 (AI)**
scale the signal of the Transducer Block and transmit them to the PLCs
- **PID Block (PID)**
s. Operating Instructions BA 013S: "Foundation Fieldbus – Overview"
- **Arithmetic Block (AR)**
s. Operating Instructions BA 013S: "Foundation Fieldbus – Overview"
- **Input Selector Block (IS)**
s. Operating Instructions BA 013S: "Foundation Fieldbus – Overview"
- **Signal Characterizer Block (SC)**
s. Operating Instructions BA 013S: "Foundation Fieldbus – Overview"
- **Integrator Block (IT)**
s. Operating Instructions BA 013S: "Foundation Fieldbus – Overview"

Default Block configuration

The input and output variables of the blocks can be interconnected by a network configuration tool (e.g. NI-Fieldbus configurator). The figure below shows, how these connections are set by default.



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5.3.5 Resource Block

E+H_PROSONIC_M_XXXXXXX
RESOURCE_XXXXXX (RB2)
 TRANSDUCER_XXXXXX (TBUL)
 ANALOG_INPUT_1_XXXXXX (AI)

Operation

The resource block contains the parameters used to describe physical resources of the device. It has no linkable inputs or outputs.

The resource block is opened by a click on the resource line.

If the NI-FBUS Configurator is being used, a series of file tabs appears on the screen. The files can be opened to view and/or edit the parameters in the following table. A short description of the parameter function appears on the side of the screen. A change in the parameter is stored by pressing the WRITE CHANGES button when the block is out of service. Press the READ ALL button to check the values stored in the device.

Parameters

Parameter	Description
TAG_DESC	User description of the intended application of the block.
MODE_BLK	Lists the actual, target, permitted and normal operating modes of the block. – Target: changes the operating mode of the block – Actual: indicates the current operating mode of the block – Permitted: states which operating modes are allowed – Normal: indicates the normal operating mode of the block The possible operating modes of the resources block are: – AUTO: the block is operating as normal – OOS: the block is out of service. If the resource block is out of service, then all blocks within the device (resource) are forced into the same status.
RS_STATE	Indicates the state of the resource block application state machine – On-line: block in AUTO mode – Standby: block in OOS mode
WRITE_LOCK	Indicates the status of DIP-switch WP – LOCKED: device data can be modified – NOT LOCKED: device data can be modified
RESTART	Allows a manual restart: – UNINITIALISED: no status – RUN: normal operational status – RESOURCE: resets the resource block parameters – DEFAULTS: Resets all Foundation Fieldbus parameters within the device, but not the manufacturer specific parameters. – PROCESSOR: make a warm start of the processor
BLOCK_ERROR	Shows error status of software and hardware components – Out-of-Service: the block is in OOS mode – Simulation active: shows the setting of DIP-switch SIM
BLOCK_ALM	Shows any configuration, hardware, connection and system problems in the block. The cause of the alert is to be seen in the subcode field.

The function of the resource block parameters not described here can be taken from the Foundation Fieldbus specification, see **www.fieldbus.org**.

5.3.6 Transducer Block

E+H_PROSONIC_M_XXXXXXX
 RESOURCE_XXXXXX (RB2)
TRANSDUCER_XXXXXX (TBUL)
 ANALOG_INPUT_1_XXXXXX (AI)

Operation

The transducer block contains the parameters required to calibrate the device. These parameters can also be addressed by using the VU 331 display module.

The transducer block is opened by clicking on the transducer line.

Parameter changes from the tool are made off-line while the device is operating. The changes are downloaded by first setting MODE_BLK = OOS then pressing the WRITE CHANGES button. Press the READ ALL button to check the values stored in the device. In order to resume operation, change MODE_BLK to AUTO¹.

Block administration parameters

Parameter	Description
MODE_BLK	See description in Resource block. The possible operating modes of the transducer block are: – AUTO: the block is operating as normal. – OOS: the block is out of service.
TAG_DESC	User description of the intended application of the block.
BLOCK_ERROR	Shows the error status associated with the block components – Out-of-Service: the block is in OOS mode.

Output values

Parameter	Description
PRIMARY_VALUE	Main value (level, volume or flow)
SECONDARY_VALUE	Measured distance
THIRD_VALUE	Measured temperature

Configuration parameters

The transducer block also contains the configuration parameters, which are used to commission and calibrate the instrument. They are identical to the functions of the operating menu, except for the service parameters which are not accessible on the bus. Thus, the calibration procedure via the display module (chapter "Commissioning") is equally valid for a calibration via a network configuration tool.

A complete list of the configuration parameters can be found in the "Description of Instrument Functions", BA 240F/00/en.

1) If MODE_BLK refuses to be changed to AUTO, an error is present. Control all parameters, perform the required changes and try again to change MODE_BLK to AUTO.

Methods

The Foundation Fieldbus specification provides for the use of so-called methods to simplify the operation of the device. A method is an interactive sequence of steps that must be followed in order to obtain a particular function from the device.

The Prosonic M has got the following methods:

- Set to customer default
- Basic setup
- Safety settings
- Acknowledge alarm
- temperature
- Linearisation
- Extended calibration
- Output
- Display
- Diagnostics
- System parameters
- Lock TB Manufacturer parameters

Most of these methods are identical to the respective function group in the operating menu. A detailed description of them can be found in the "Description of Instrument functions", BA 240F.

Profile code of Transducer Block

The current profile code of the Prosonic M Transducer Block is 0x8010

Parameter list of the Prosonic M Transducer Block

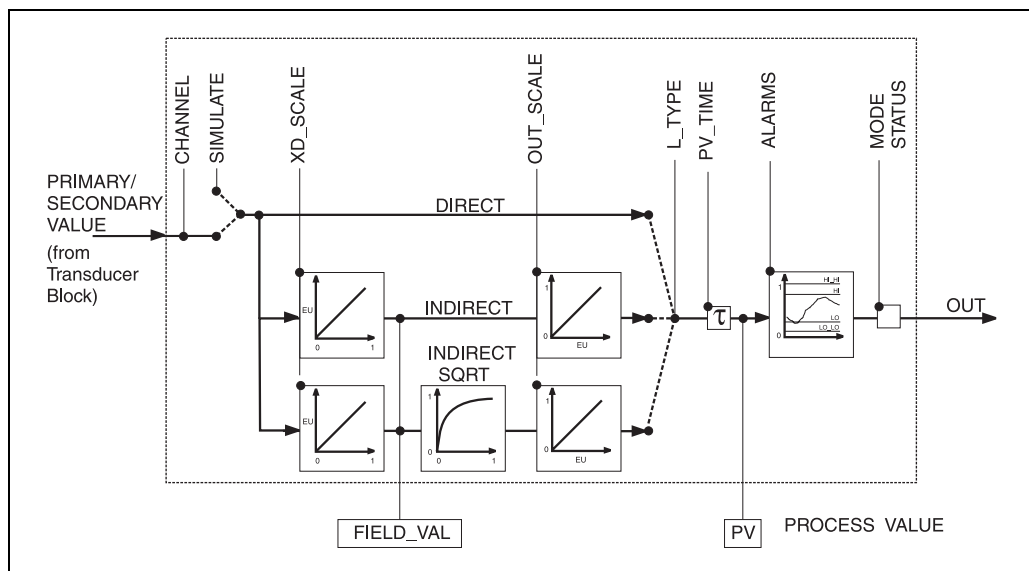
Parameter	Position Indicator	rel. Index	Variable Name	Size [bytes]	Type	Read	Write	Storage Class
		0	EH_USONICLEVEL_CAL_BASIC					
Standard Parameter								
ST_REV		1	ST_REV	2	UNSIGNED16	X		non-vol.
TAG_DESC		2	TAG_DESC	32	OCTET_STRING	X	X	static
STRATEGY		3	STRATEGY	2	UNSIGNED16	X	X	static
ALERT_KEY		4	ALERT_KEY	1	UNSIGNED8	X	X	static
MODE_BLK		5	MODE_BLK	4	DS-69	X	X	static
BLOCK_ERROR		6	BLOCK_ERROR	2	BIT_STRING	X		dynamic
UPDATE_EVT		7	UPDATE_EVT	16	DS-73	X	X	dynamic
BLOCK_ALM		8	BLOCK_ALM	18	DS-72	X	X	dynamic
Transducer Directory Entry		9	TRANSDUCER_DIRECTORY	2	UNSIGNED16	X		non-vol.
Transducer Type		10	TRANSDUCER_TYPE	2	UNSIGNED16	X		non-vol.
Transducer Error		11	XD_ERROR	1	UNSIGNED8	X		dynamic
Collection Directory		12	COLLECTION_DIRECTORY	4	UNSIGNED32	X		non-vol.
Primary Value Type		13	PRIMARY_VALUE_TYPE	2	UNSIGNED16	X		static
Primary Value		14	PRIMARY_VALUE	5	DS-65	X		dynamic
Primary Value Range		15	PRIMARY_VALUE_RANGE	11	DS-68	X		non-vol.
Secondary Value		15	SECONDARY_VALUE	5	DS-65	X		dynamic
Secondary Value Unit		17	SECONDARY_VALUE_UNIT	2	UNSIGNED16	X	X	static
Third Value		18	THIRD_VALUE	5	DS-65	X		dynamic
Third Value Unit		19	THIRD_VALUE_UNIT	2	UNSIGNED16	X	X	static
E+H Parameter								
measured value	000	20	PARMEASUREDVALUE	4	FLOAT	X		dynamic
tank shape	002	21	PARTANKSHAPE	1	UNSIGNED8	X	X	static
medium property	003	22	PARMEDIUMCONDITION	1	UNSIGNED8	X	X	static
process cond.	004	23	PARPROCESSCONDITION	1	UNSIGNED8	X	X	static
empty calibration	005	24	PAREMPTYCALIBRATION	4	FLOAT	X	X	static
full calibration	006	25	PARFULLCALIBRATION	4	FLOAT	X	X	static
echo quality	056	26	PARCHOQUALITY	1	UNSIGNED8	X		dynamic
check distance	051	27	PARCHECKDISTANCE	1	UNSIGNED8	X	X	static
range of mapping	052	28	PARSUPPRESIONDISTANCE	4	FLOAT	X	X	static
start mapping	053	29	PARSTARTMAPPINGRECORD	1	UNSIGNED8	X	X	static
dist./meas. value	054	30	PARPRESMAPRANGE	4	FLOAT	X	X	dynamic
cust. tank map	055	31	PARCUSTTANKMAP	1	UNSIGNED8	X	X	static
offset	057	32	PAROFFSETOFMEASUREDDISTANCE	4	FLOAT	X	X	static
output damping	058	33	PAROUTPUTDAMPING	4	FLOAT	X	X	static
blocking distance	059	34	PARHIGHBLOCKINGDISTANCE	4	FLOAT	X	X	static
output on alarm	010	35	PAROUTPUTONALARM	1	UNSIGNED8	X	X	static

Parameter	Position Indicator	rel. Index	Variable Name	Size [bytes]	Type	Read	Write	Storage Class
outp. echo loss	012	36	PARREACTIONLOSTECHO	1	UNSIGNED8	X	X	static
ramp %span/min	013	37	PARRAMPINPERCENTPERMIN	4	FLOAT	X	X	static
delay time	014	38	PARDELAYTIMEONLOSTECHO	2	UNSIGNED16	X	X	static
safety distance	015	39	PARLEVELWITHINSAFETYDISTANCE	4	FLOAT	X	X	static
in safety distance	016	40	PARINSAFETYDISTANCE	1	UNSIGNED8	X	X	static
acknowledge alarm	017	41	PARACKNOWLEDGEALARM	1	UNSIGNED8	X	X	static
measured temp.	030	42	PARMEASUERDTEMPERATURE	4	FLOAT	X		dynamic
max temp limit	031	43	PARMAXTEMPLIMIT	4	FLOAT	X		dynamic
max. meas. temp.	032	44	PARMAXMEASUREDTEMPERATURE	4	FLOAT	X		dynamic
react high temp.	033	45	PARONHIGHTEMPERATURE	1	UNSIGNED8	X	X	static
def. temp. sensor	034	46	PARDEFECTTEMPERATURESENSOR	1	UNSIGNED8	X	X	static
level/ullage	040	47	PARLEVELULLAGEMODE	1	UNSIGNED8	X	X	static
linearisation	041	48	PARLINEARISATION	1	UNSIGNED8	X	X	static
customer unit	042	49	PARCUSTOMERUNIT	2	UNSIGNED16	X	X	static
tab No.	043	50	PARTABLENUMBER	1	UNSIGNED8	X	X	non-vol.
level (half-automatic)	044	51	PARINPUTLEVELHALFAUTOMATIC	4	FLOAT	X		dynamic
level	044	52	PARINPUTLEVELMANUAL	4	FLOAT	X	X	static
volume	045	53	PARINPUTVOLUME	4	FLOAT	X	X	static
max. scale	046	54	PARMAXVOLUME	4	FLOAT	X	X	static
diameter vessel	047	55	PARCYLINDERVESSEL	4	FLOAT	X	X	static
simulation	065	56	PARSIMULATION	1	UNSIGNED8	X	X	static
simulation value level	066	57	PARSIMULATIONVALUELEVEL	4	FLOAT	X	X	non-vol.
simulation value volume	066	58	PARSIMULATIONVALUEVOLUME	4	FLOAT	X	X	non-vol.
language	092	59	PARALANGUAGE	1	UNSIGNED8	X	X	non-vol.
back to home	093	60	PARBACKTOHOME	2	UNSIGNED16	X	X	non-vol.
Anzeigeformat	094	61	PARFORMATDISPLAYFT	1	UNSIGNED8	X	X	non-vol.
no. of decimals	095	62	PARNOOFDECIMALS	1	UNSIGNED8	X	X	non-vol.
sep. character	096	63	PARSEPARATIONCHARACTER	1	UNSIGNED8	X	X	non-vol.
present error	0A0	64	PARACTUALERROR	2	UNSIGNED16	X		dynamic
previous error	0A1	65	PARLASTERROR	2	UNSIGNED16	X		dynamic
clear last error	0A2	66	PARCLEARLASTERROR	1	UNSIGNED8	X	X	static
reset	0A3	67	PARRESET	2	UNSIGNED16	X	X	static
unlock parameter	0A4	68	PAROPERATIONCODE	2	UNSIGNED16	X	X	static
measured dist.	0A5	69	PARMEASUREDDISTANCE	4	FLOAT	X		dynamic
measured level	0A6	70	PARMEASUREDLEVEL	4	FLOAT	X		dynamic
application par.	0A8	71	PARAPPLICATIONPARAMETER	1	UNSIGNED8	X		dynamic
protocol + sw-no	0C2	72	PARPROTOSFTVERSIONSTRING	16	OCTET_STRING	X		dynamic
distance unit	0C5	73	PARDISTANCEUNIT	1	UNSIGNED8	X	X	static
temperature unit	0C6	74	PARTEMPERATUREUNIT	1	UNSIGNED8	X	X	static
download mode	0C8	75	PARDOWNLOADMODE	1	UNSIGNED8	X	X	static
max. meas. dist.	0D84	76	PARABSMAXMESSDIST	4	FLOAT	X		dynamic
max sample dist.	0D88	71	PAREDITRANGEMAXSAMPLEDIST	4	FLOAT	X		dynamic

5.3.7 Analog input block

E+H_MICROPILOT_M_XXXXXXX
 RESOURCE_XXXXXX (RB2)
 TRANSDUCER_XXXXXX (TBRL)
ANALOG_INPUT_1_XXXXXX (AI)

The analog input block conditions the signal output by the transducer block and outputs signal to the PCL or other function blocks.



Operation

The resource block is opened by a click on the resource line.

Parameter changes from the tool are made off-line while the device is operating. The changes are downloaded by first setting MODE_BLK = OOS then pressing the WRITE CHANGES button. Press the READ ALL button to check the values stored in the device. Normally operation is resumed as soon as MODE-BLK is set to AUTO.

Block administration parameters

Parameter	Description
MODE_BLK	See description in Resource block. The possible operating modes of the transducer block are: – AUTO: the block is operating as normal – MAN: the block is operated with a manually entered primary value. – OOS: the block is out of service.
TAG_DESC	User description of the intended application of the block.
BLOCK_ERROR	Shows error status of software and hardware components – Out-of-Service: the block is in OOS mode – Simulation active: shows the setting of DIP-switch SIM. Input failure/process variable has BAD status. – configuration error

Output values

Parameter	Description
PV	Either the primary/secondary transducer block value used to execute the block or a process value associated with it. Comprises value and status.
OUT	The primary value output as a result of executing the analog input block. Comprises value and status.
FIELD_VALUE	Raw value of field device in % of PV range with a status reflecting the transducer condition before signal characterisation L_Type or filtering V_TIME. Comprises value and status.

Scaling parameters

Parameter	Description
CHANNEL	Selects the measured value to be input to the analogue input block – 0 = no channel defined – 1 = primary value: measured level/volume – 2 = secondary value: measured distance
XD_SCALE	Scales the transducer block value in the required engineering units (EU).
OUT_SCALE	Scales the output value in the required engineering units (EU).
L_TYPE	Sets the linearization type: – DIRECT: the transducer block value bypasses the scaling functions – INDIRECT: the transducer block value is fed through the linear scaling functions – INDIRECT SORT: the transducer block value is fed through the square root scaling functions

The relationship between the output values and scaling parameters is as follows:

$$\text{FIELD_VAL} = 100 \times \frac{\text{CHANNEL_VALUE} - \text{XD_SCALE_MIN}}{\text{XD_SCALE_MAX} - \text{XD_SCALE_MIN}}$$

The L_TYPE parameter influences the signal conversion:

■ Direct:

$$\text{PV} = \text{CHANNEL_VALUE}$$

■ Indirect:

$$\text{PV} = \frac{\text{FIELD_VALUE}}{100} \times (\text{OUT_SCALE_MAX} - \text{OUT_SCALE_MIN}) + \text{OUT_SCALE_MIN}$$

■ Indirect square root:

$$\text{PV} = \sqrt{\frac{\text{FIELD_VALUE}}{100}} \times (\text{OUT_SCALE_MAX} - \text{OUT_SCALE_MIN}) + \text{OUT_SCALE_MIN}$$

Output response parameters

Parameter	Description
LOW_CUT	Not relevant to level measurement! Determines a threshold for square root linearization below which the output value is set to zero.
PV_FTIME	Sets the time constant for the output value.

Alarm parameters

Parameter	Description
ACK_OPTION	Sets the way in which alarms and warnings are to be acknowledged.
ALARM_HYS	Sets the hysteresis (in output engineering units) for all configured alarms. A hysteresis of e.g. 2% on a HI_HI_LIMIT of 95% would cause the alarm to activate when the level reaches 95% and to deactivate when the level drops below 93%. A hysteresis of e.g. 2% on a LO_LO_LIMIT of 5% would cause the alarm to activate when the level drops below 5% and to deactivate when the level rises to 7%.
HI_HI_PRI	The priority (1 – 15) of the HI_HI alarm
HI_HI_LIM	Sets the HI_HI alarm limit in output engineering units
HI_PRI	The priority (1 – 15) of the HI alarm
HI_LIM	Sets the HI warning limit in output engineering units
LO_PRI	The priority (1 – 15) of the LO alarm
LO_LIM	Sets the LO warning limit in output engineering units
LO_LO_PRI	The priority (1 – 15) of the LO_LO alarm
LO_LO_LIM	Sets the LO_LO alarm limit in output engineering units

Alarm priorities

Parameter	Description
0	Alarm is suppressed
1	Recognised by the system but not reported
2	Reported to the operator, but does not require his attention
3 - 7	Advisory alarms of increasing priority
8 - 15	Critical alarms of increasing priority

Alarm status

Parameter	Description
HI_HI_ALM	The status of the HI_HI alarm
HI_ALM	The status of the HI alarm
LO_ALM	The status of the LO alarm
LO_LO_ALM	The status of the LO_LO alarm

Simulation

The SIMULATE parameter allows the transducer block output value to be simulated, provided simulation has also been enabled at the device DIP switch. The simulation must be enabled, a value and/or status entered and the block must be in AUTO mode. During simulation the transducer output value is substituted by the simulated value.

A simulation is also possible by switching MODE_BLK to "MAN" and entering a value for OUT.

Parameter	Description
SIMULATE	Enables, sets and displays a simulated value, options: – enable/disable – simulated value – output value

5.3.8 Checklist for commissioning

The following checklist refers to the configuration via the NI-Fieldbus configurator. In general, the operation is rather similar for other network design tools.

1. Configure the network and integrate the device.
 - Identify the device by means of the device ID and serial number.
 - If appropriate, assign a new PD_TAG.
2. Configure the resource block.
 - Check the position of the hardware switch in WRITE_LOCK
 - If "locked" is displayed, change the position of the DIP-switch.
 - If appropriate, change the block tag (right-hand click on tree).
 - Set MODE_BLK_TARGET to Out-of-Service.
 - Reset the device to factory values by using the function RESTART => Defaults (this function may also be available with a right-hand click on the device name)
 - If appropriate, assign a tag description (TAG_DESC).
 - Set MODE_BLK_TARGET to Auto.
3. Configure the transducer block.
 - If appropriate, change the block tag (right-hand click on tree).
 - Set MODE_BLK_TARGET to Out-of-Service.
 - If appropriate, assign a tag description (TAG_DESC)
 - Configure the device as described in Chapter 6.4.
 - Set MODE_BLK_TARGET to Auto.
4. Configure the analog input block.
 - If appropriate, change the block tag (right-hand click on tree).
 - Set MODE_BLK_TARGET to Out-of-Service.
 - If appropriate, assign a tag description (TAG_DESC).
 - Set Channel to measured value or distance.
 - Set L_TYPE to "DIRECT" if the OUT value is to be in technical units e.g. ft to "INDIRECT" if the OUT value is to be scaled.
 - Set the desired output damping in PV_TIME.
 - If appropriate, set the advisory and critical alarms.
 - Set MODE_BLK_TARGET to Auto.
5. Link the function blocks in the function block editor.
6. Download the configuration (menu configure).
7. If appropriate, check the configuration by using the SIMULATE function.

5.3.9 List of start indices

The following list indicates the start indices for all blocks and objects:

Object	Start Index
Object Dictionary	298

Object	Start Index
Resource Block	300
Analog Input 1 Function Block	350
Analog Input 2 Function Block	390
PID Function Block	430
Arithmetic Function Block	500
Input Selector Function Block	550
Signal Characterizer Function Block	600
Integrator Function Block	650
Transducer Block	700

Object	Start Index
Link Objects	1000
Alert Objects	1030
Trend Objects	1040

Object	Start Index
View Objects Resource Block	1500
View Objects Analog Input 1 Function Block	1505
View Objects Analog Input 2 Function Block	1510
View Objects PID Function Block	1515
View Objects Arithmetic Function Block	1520
View Objects Input Selector Function Block	1525
View Objects Signal Characterizer Function Block	1530
View Objects Integrator Function Block	1535
View Objects Transducer Block	1540

5.3.10 Parameter access via 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.



Note!

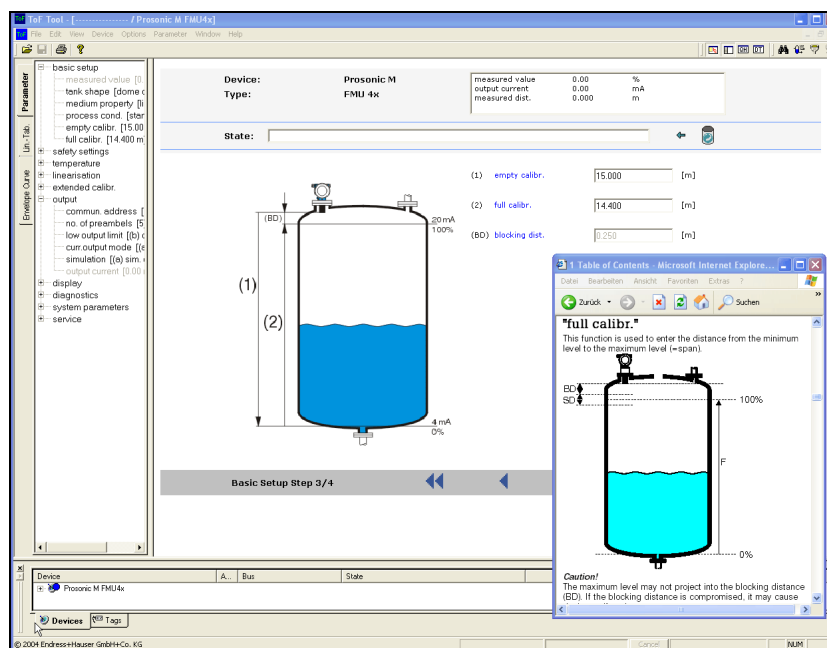
The parameters of the Analog-Input block are presently not accessible via ToF Tool.



Note!

ToF-Tool operation of the Prosonic M is not possible via Foundation Fieldbus. Instead, the PC or Laptop must be connected via the interface FXA 193 to the service adapter, to which normally the display is connected.

Menu-guided commissioning

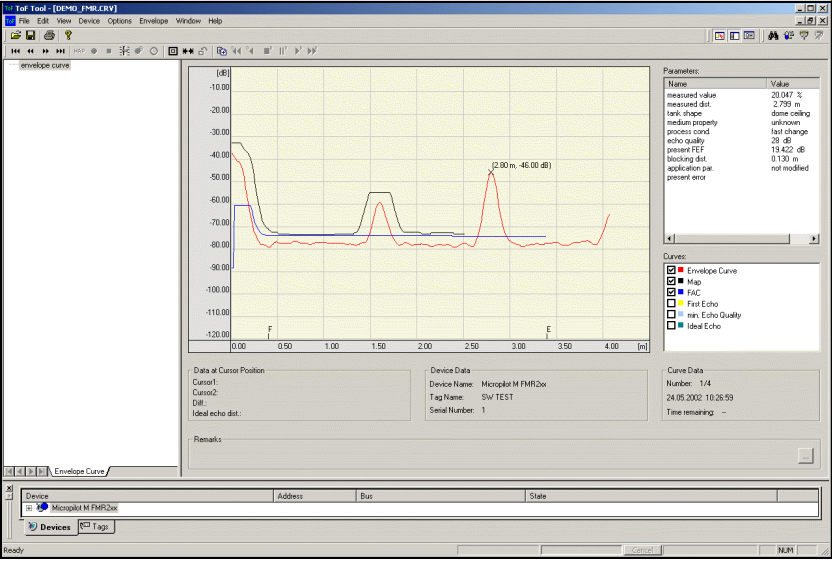


L00-FMU4xxxx-19-00-00-en-003

- 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.

Signal analysis via envelope curve

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

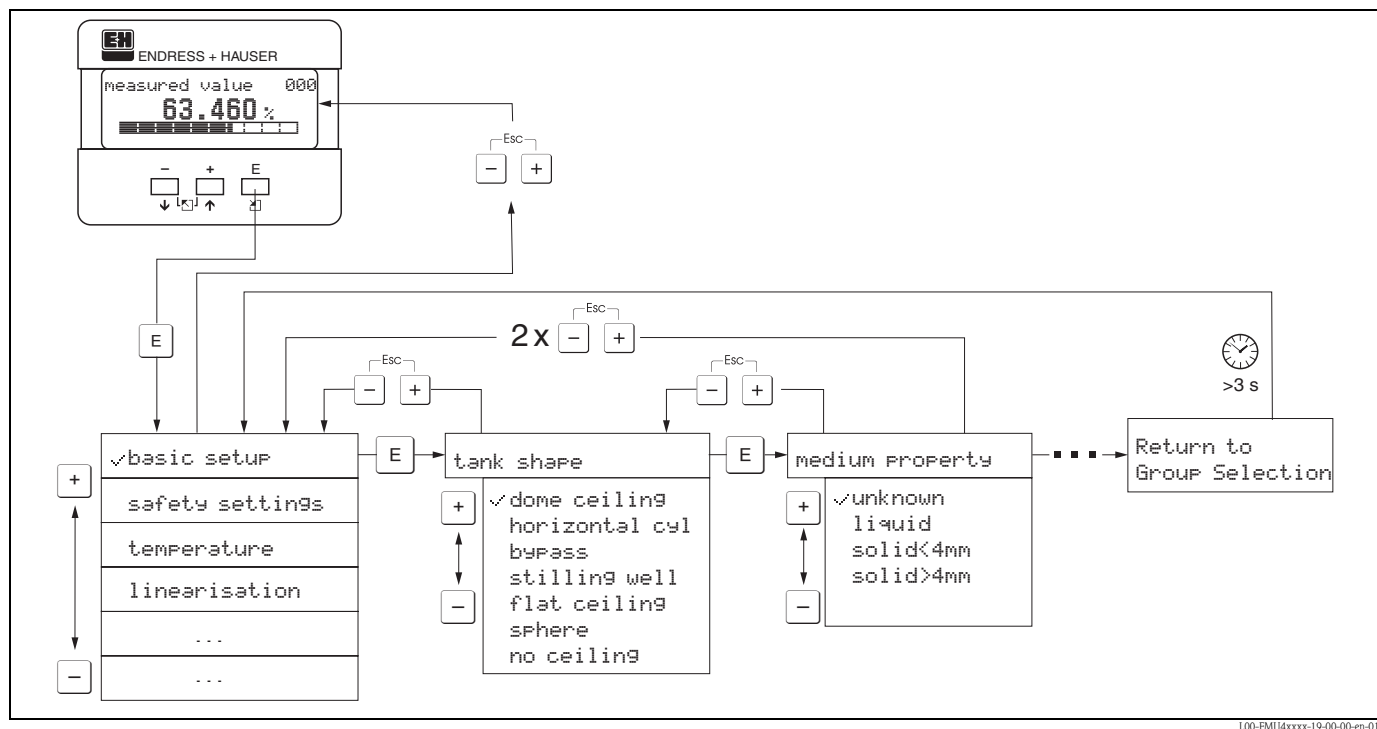


L00-FMU4xxxx-19-00-00-en-004

Connection

- Service-Interface with adapter FXA 193

5.4 Operation using the on-site display VU 331



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 Lock/unlock configuration

5.5.1 Software security locking

Enter a number $\neq 2457$ in the "**unlock parameter**" (0A4) function in the "**diagnostics**" (0A) function group.

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

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

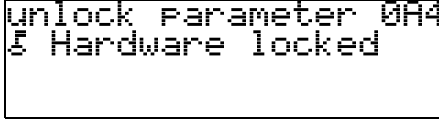
Now change the parameters.

5.5.2 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 "2457"

Now change the parameters.



Note!

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

5.6 Resetting the customer parameters

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

Effects of resetting:

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

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



Caution!

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



Note!

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

5.7 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

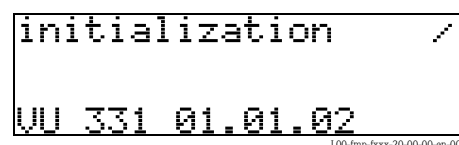
Commission the Prosonic M in the following stages:

- 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

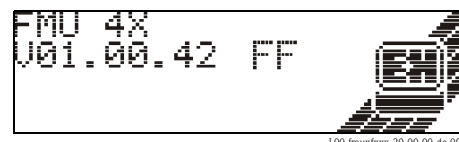
After switching on the supply voltage, the instrument is first initialised.



L00-fmp-bxxx-20-00-00-en-003

Then the following appear for approximately five seconds:

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



L00-fmrxlxxx-20-00-00-de-002

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

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



L00-fmrxl092-20-00-00-en-001

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



L00-fmrxl0C5-20-00-00-en-001

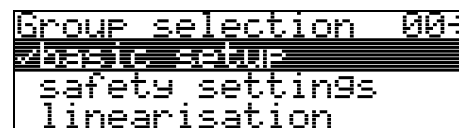
A measured value is displayed. This is NOT equivalent to the level in your tank. Firstly carry out a basic calibration.



L00-fmrxl000-20-00-00-en-001

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

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



L00-fmrxl000-20-00-00-en-001

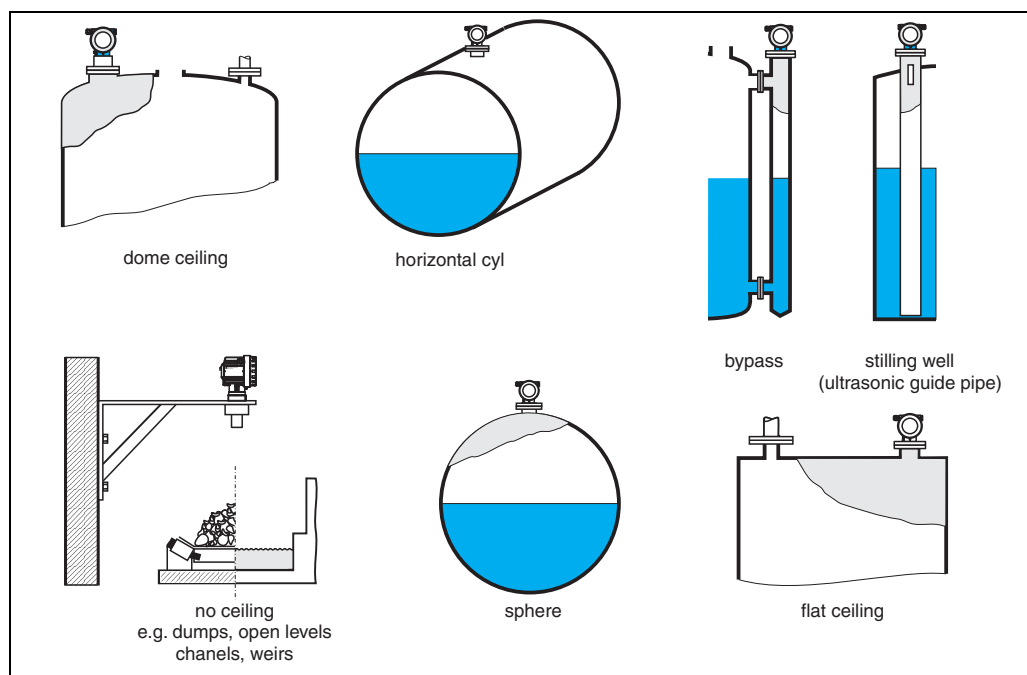
6.2 Basic calibration

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-1.4-00-06-en-001

Function "medium property" (003)

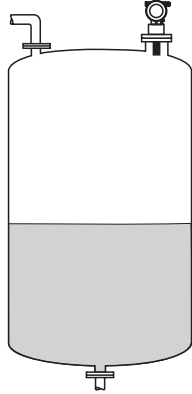
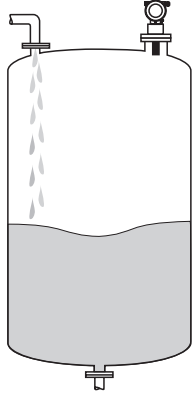
Set the medium type in this function.

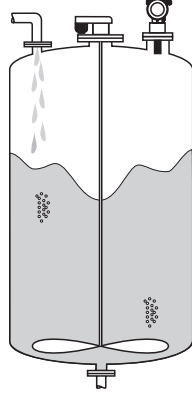
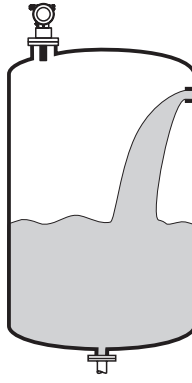
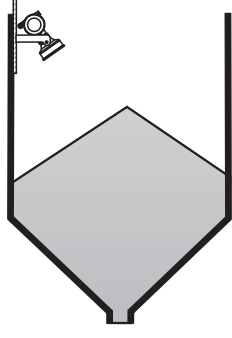
You have the following options:

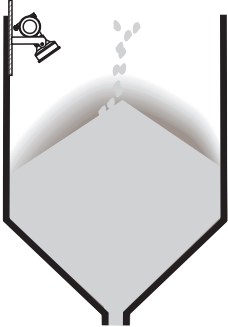
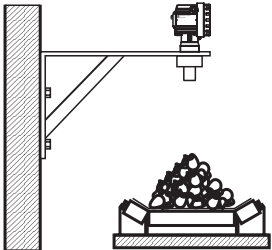
- unknown (e.g. pasty media such as greases, creams, gels etc.)
- liquid
- solid, grain size < 4 mm (fine)
- solid, grain size > 4 mm (coarse)

Function "process conditions" (004)

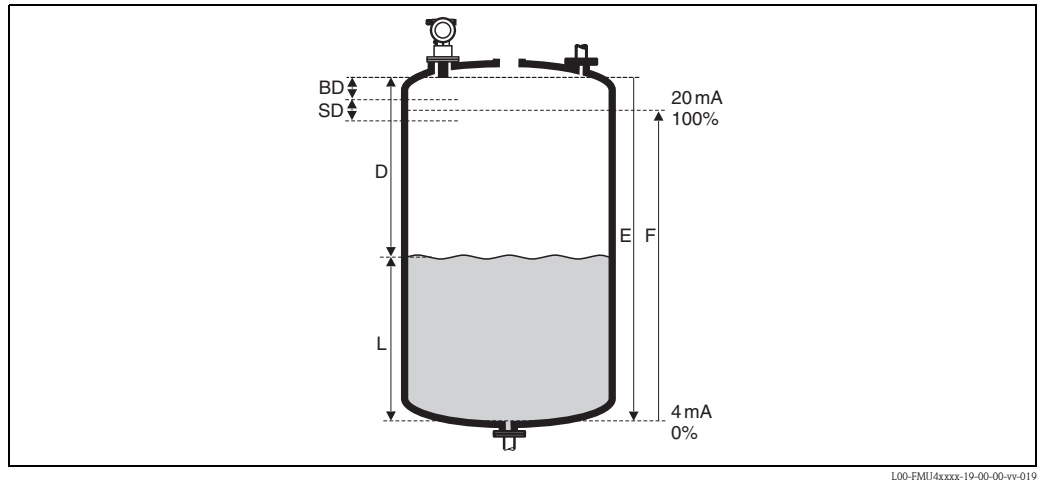
For this function, you have the following options:

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.
 L00-FMU4xxxx-14-00-00-xx-007		 L00-FMU4xxxx-14-00-00-xx-005	
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.

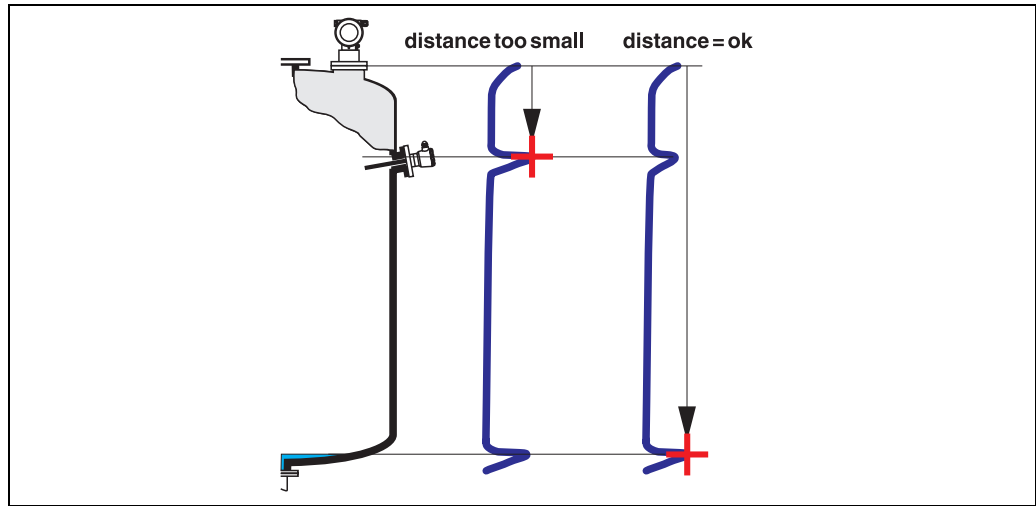
6.2.3 Interference echo suppression (tank mapping)

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 property" (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"

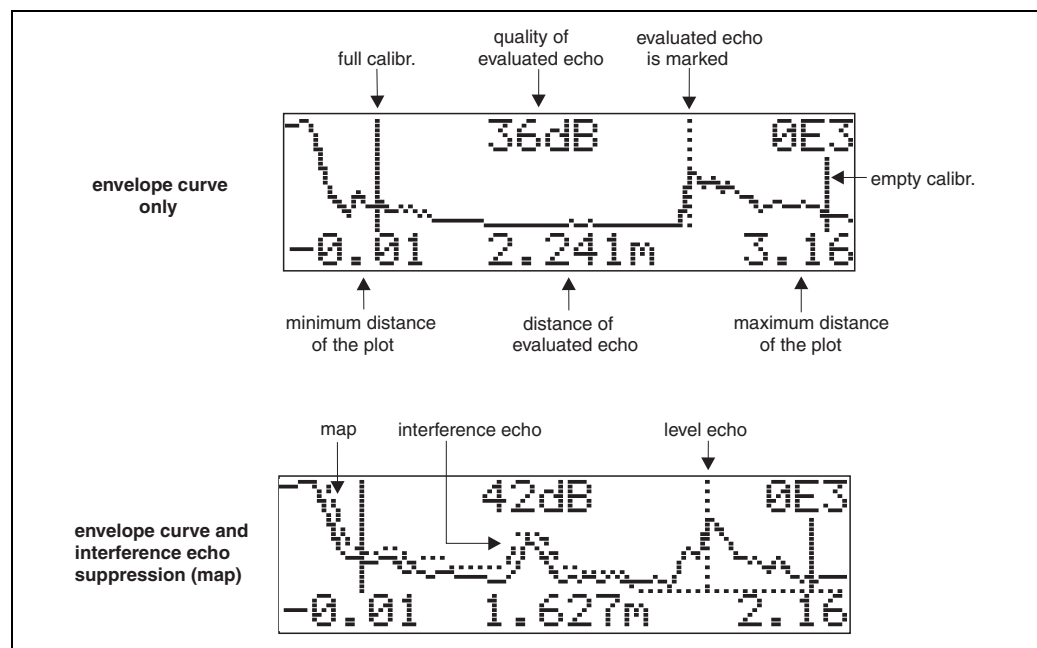
6.3.2 Function "recording curve" (0E2)

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:



L00-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.

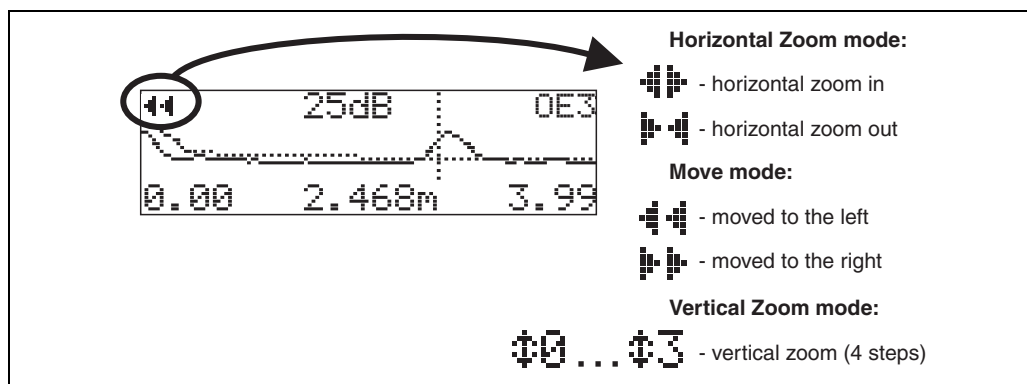


Note!

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

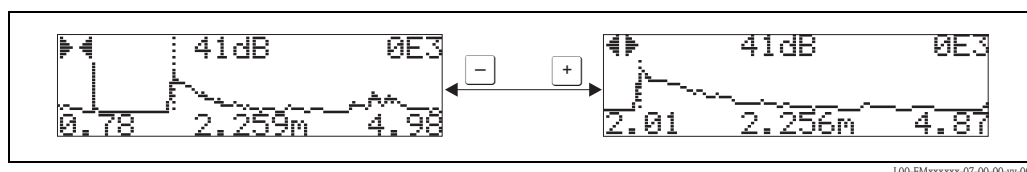
Using navigation, the envelope curve can be scaled horizontally and vertically and shifted to the left or the right. The active navigation mode is indicated by a symbol in the top left hand corner of the display.



Horizontal Zoom mode

Firstly, go into the envelope curve display. Then press $\boxed{+}$ or $\boxed{-}$ to switch to the envelope curve navigation. You are then in Horizontal Zoom mode. Either or is displayed.

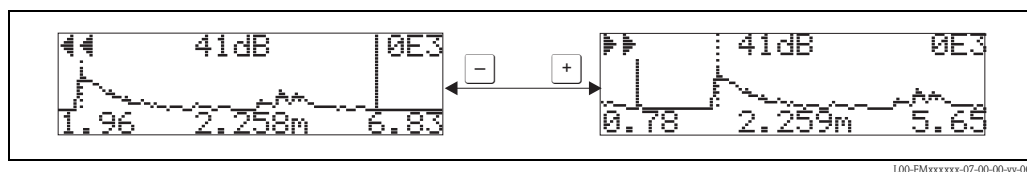
- $\boxed{+}$ increases the horizontal scale.
- $\boxed{-}$ reduces the horizontal scale.



Move mode

Then press $\boxed{E}$ to switch to Move mode. Either or is displayed.

- $\boxed{+}$ shifts the curve to the right.
- $\boxed{-}$ shifts the curve to the left.

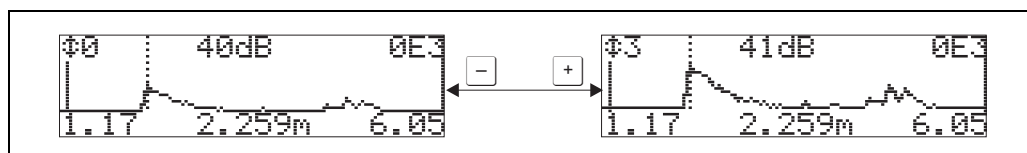


Vertical Zoom mode

Press $\boxed{E}$ once more to switch to Vertical Zoom mode. $\$1$ is displayed. You now have the following options.

- $\boxed{+}$ increases the vertical scale.
- $\boxed{-}$ reduces the vertical scale.

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



Exiting the navigation

- Press  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 $\boxed{+}$ or $\boxed{-}$.
- by the status of the main value

7.1.2 Last error

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

7.1.3 Types of error

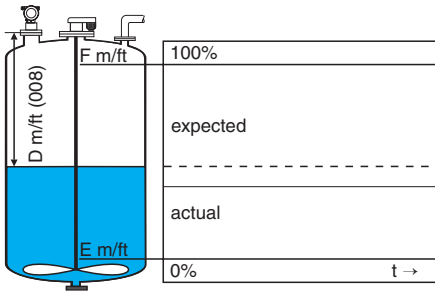
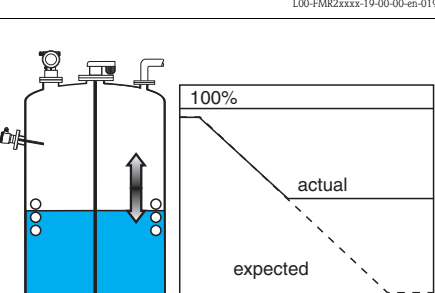
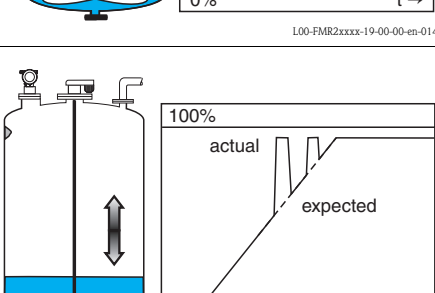
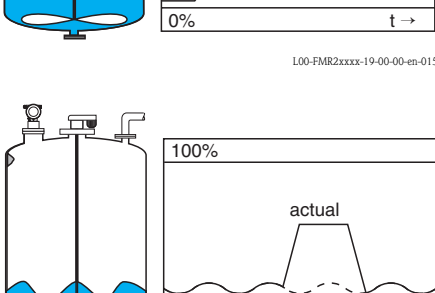
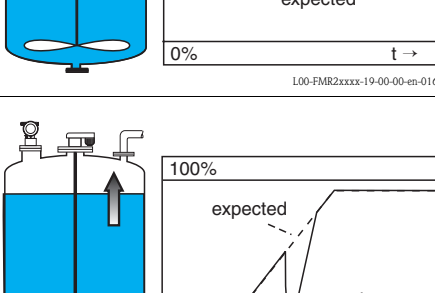
Type of error	Symbol	Meaning
Alarm (A)	 continuous	The output signal assumes a value which can be set using the "output on alarm" (010) function: ■ MAX: 110% ■ MIN: -10% ■ Hold: last value is on hold ■ User-specific value
Warning (W)	 flashing	The device continues measurement. An error message is displayed.
Alarm/Warning (E)	You can define whether the error should behave as an alarm or as a warning.	

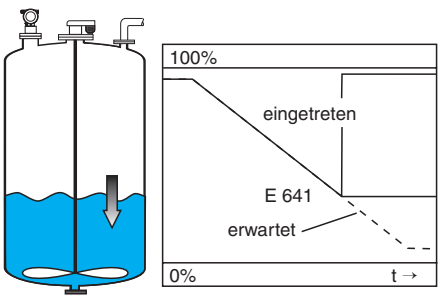
7.1.4 Error codes

Code	Error description	Action
A102 A110 A152 A160	checksum error	Reset; If alarm still present after reset, replace electronics
W103	initialising	If the message does not disappear after several seconds, replace the electronics
A106	downloading	Wait; Message disappears after load sequence
A111 A113 A114 A115 A121 A125 A155 A164 A171	electronics defect	Reset; Check system for EMC, improve as necessary If alarm still present after reset, replace electronics
A116	download error	Check connection; Restart download
W153	initialising	Wait a few seconds; if error is still displayed, switch the power off and on again
A231	sensor defect	Check connection, if necessary replace HF module or electronics

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 [" output " (06) function group, " simulation " (065) function]]
E641	no usable echo	Check basic calibration
E651	level in safety distance - risk of overspill	Error disappears when the level leaves the safety distance. Possibly reset the lock. [" safety settings " (01) function group, " ackn. alarm " (017) function]]
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	 100% expected actual 0% t → L00-FMR2xxxx-19-00-00-en-019	1. Check empty calibration (005) and full calibration (006). 2. Check linearisation – level/ullage (040) – max. scale(046) – diameter vessel(047) – linearisation table
Measured value (000) and measured distance (008) are incorrect	 100% actual expected 0% t → L00-FMR2xxxx-19-00-00-en-014	1. For measurements in bypass or stilling well: Select the according option in the "tank shape" (002) function. 2. Carry out interference echo suppression.
No change in measured value on filling/emptying	 100% actual expected 0% t → L00-FMR2xxxx-19-00-00-en-014	1. Carry out interference echo suppression. 2. Clean sensor if necessary 3. If necessary, select better installation position
With an uneven surface (e.g. filling, emptying, running agitator) the measured value may jump sporadically to higher levels	 100% actual expected 0% t → L00-FMR2xxxx-19-00-00-en-015	1. Carry out interference echo suppression 2. Set the process cond. (004) to "calm surface" or "add. agitator" 3. Increase output damping (058). 4. If necessary, select a different installation position and/or a larger sensor
On filling/emptying the measured value drops	 100% expected actual 0% t → L00-FMR2xxxx-19-00-00-en-017	1. Check tank shape (002), e.g. "dome ceiling" or "horizontal cyl." 2. If possible, do not select a central installation position 3. Possible user stilling well/echo guide pipe

Error	Example	Elimination
E 641 (echo loss)	 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, a graph plots level percentage (0% to 100%) against time (t). A solid line labeled 'eingetreten' (actual) shows a sharp drop from 100% to 0%. A dashed line labeled 'E 641 erwartet' (expected) shows a gradual decline from 100% to 0%. The sensor is labeled 'E 641'. L00-FMR2xxxx-19-00-00-en-018	1. Check application parameters (002), (003) and (004) 2. If necessary, select a different installation position and/or a larger sensor 3. Align the sensor parallel to the product surface (particularly for bulk solids applications)

8 Maintenance and repairs

8.1 Exterior cleaning

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

8.2 Repairs

The 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

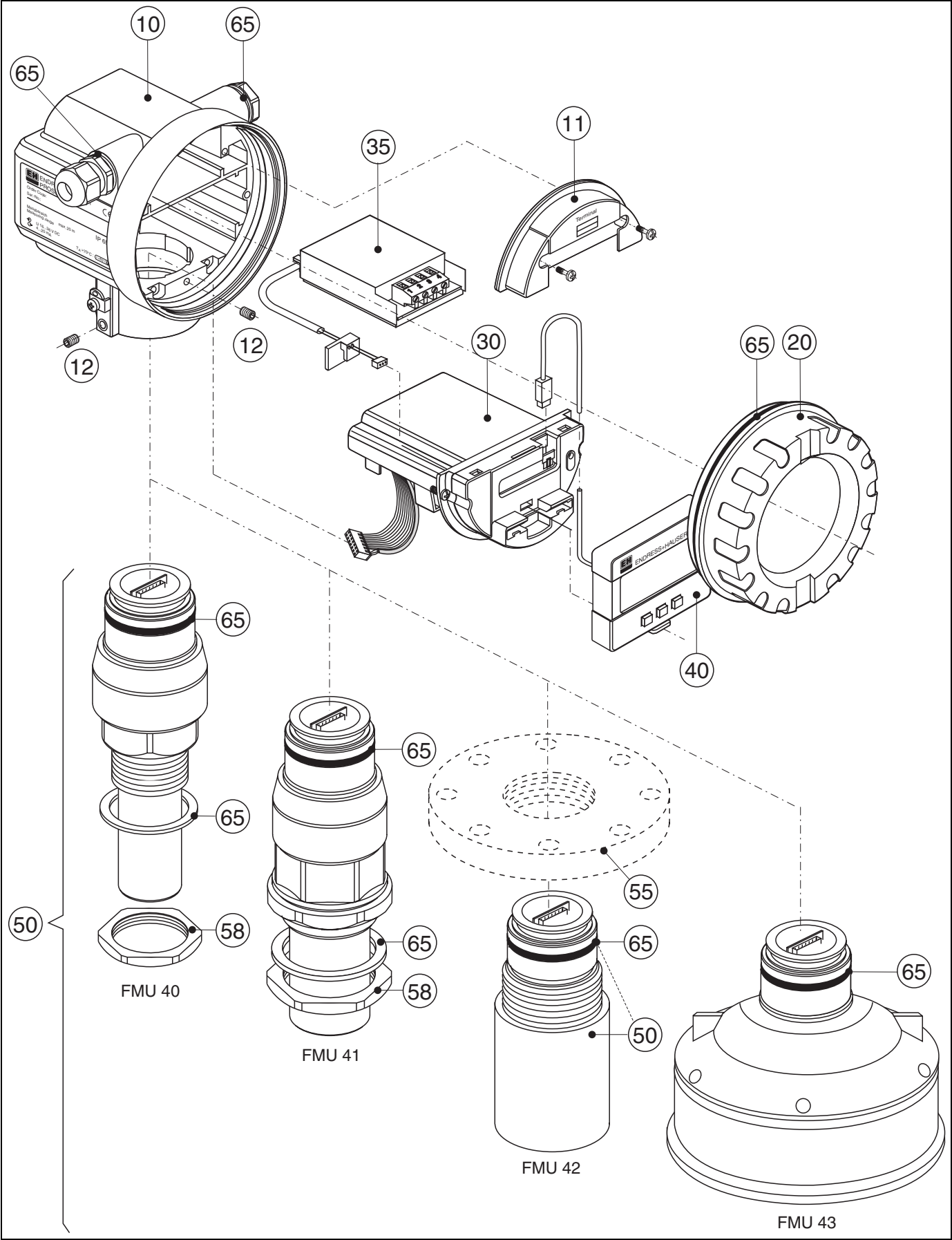
When carrying out repairs to Ex-approved devices, please note the following:

- 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 the ToF Tool / Commuwin II. 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)



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

52023756 Electronics Prosonic M, Ex, 2-wire, HART
52023757 Electronics Prosonic M, Ex, 4-wire, HART
52023758 Electronics Prosonic M, Ex, PA, V2.04
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

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

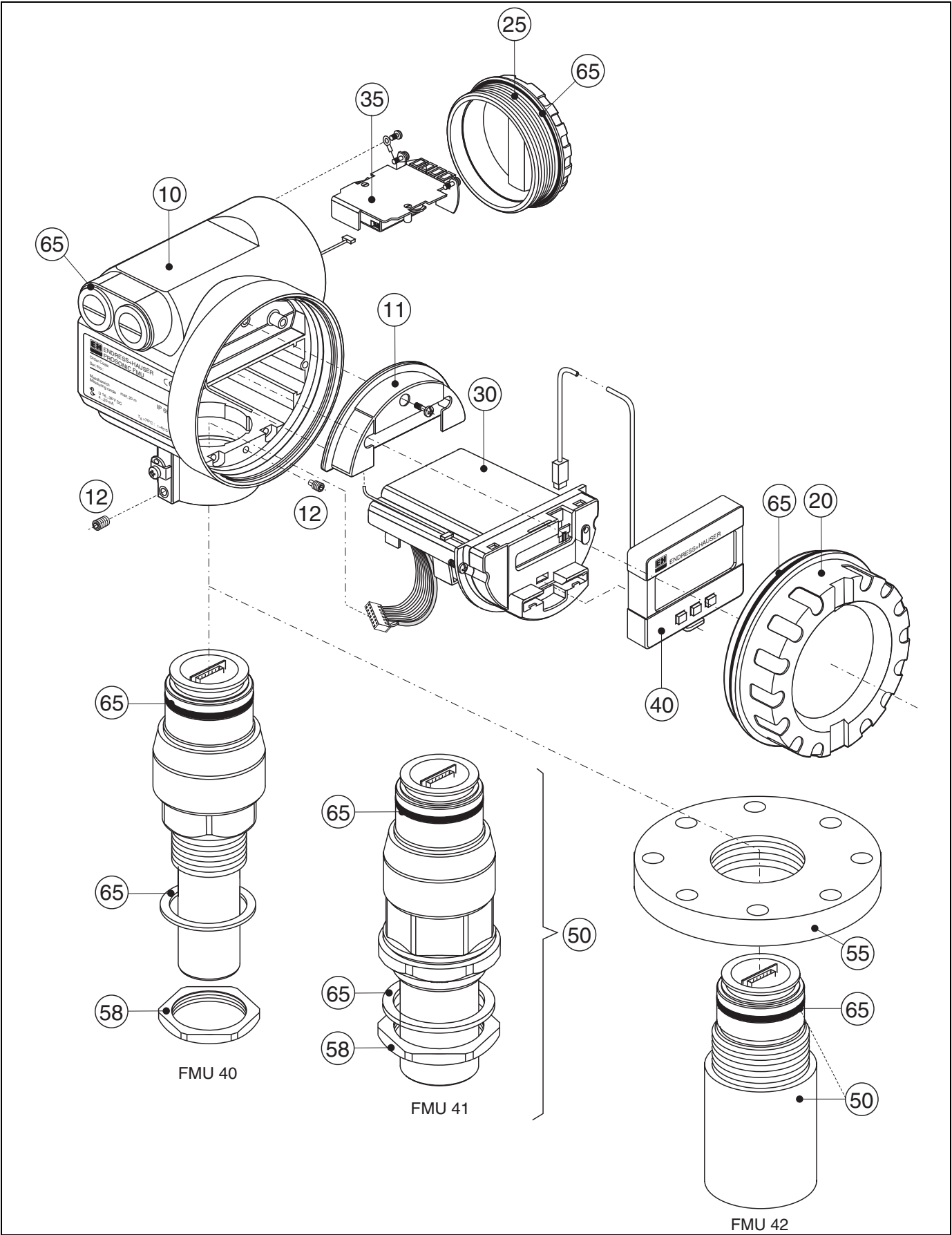
Spare parts for FHX40

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)



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

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

52005936 Cover F12/T12 aluminium, inspection glass, seal

25 Cover for the connection compartment

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

30 Electronics

52023756 Electronics Prosonic M, Ex, 2-wire, HART

52023758 Electronics Prosonic M, Ex, PA, V2.04

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

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

52000598 Hexagon nut (SW70) G2, bk, PC

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

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: ■ ToF Tool ■ Commuwin II (version 2.05.03 and higher) ■ HART Communicator DXR 275 (from OS 4.6) with Rev. 1, DD 1	
V 01.02.04/02.2004	■ FMU 42 added ■ compatible with HART Communicator DXR 375	FMU 42 added

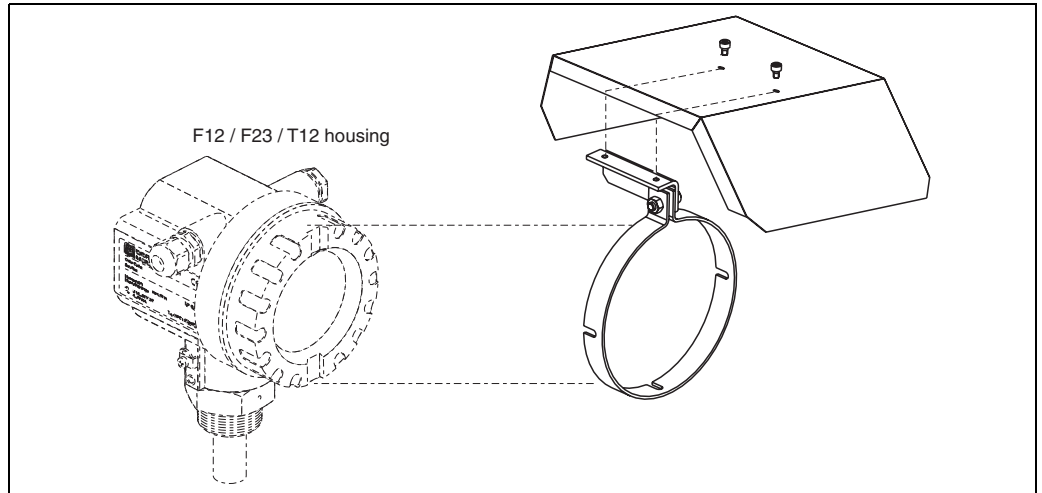
8.10 Contact addresses of Endress+Hauser

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

9 Accessories

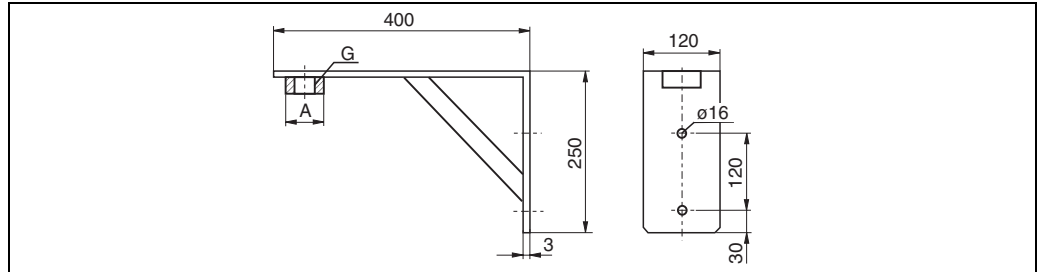
9.1 Weather protection cover

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.



L00-FMR2xxxx-00-00-06-en-001

9.2 Installation bracket for FMU 40/41

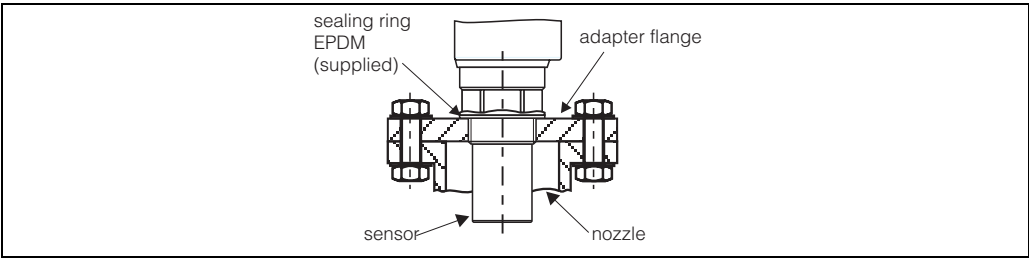


L00-FMU4x-00-00-00-de-001

- 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 for FMU 40 / FMU 41



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

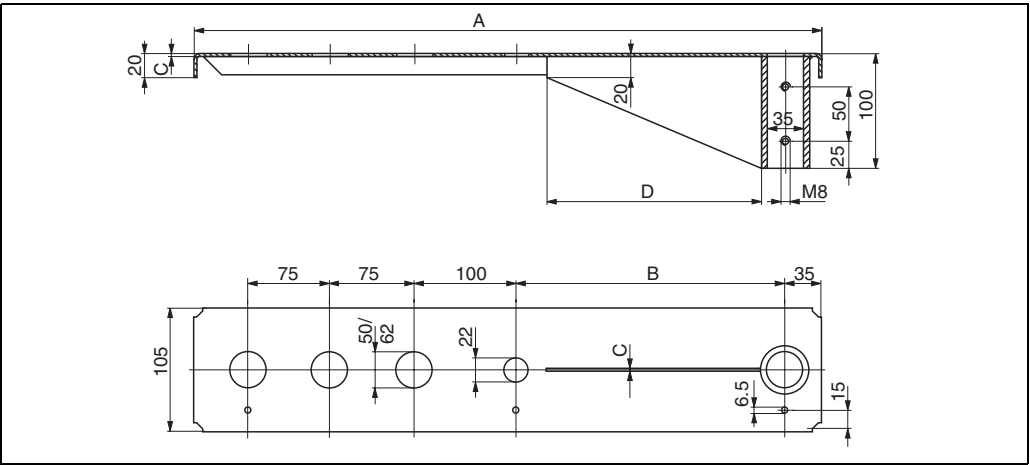
9.3.1 Version with metrical thread (FAU 70 E)

		Version	
	12	DN 50 PN 16	
	14	DN 80 PN 16	
	15	DN 100 PN 16	
		Thread	
	3	G 1½, ISO 228	
	4	G 2, ISO 228	
		Material	
	2	1.4435 (316L)	
	7	PPs (Polypropylene)	
FAU 70 E			Product designation

9.3.2 Version with conical thread(FAU 70 A)

Version			
	22	ANSI 2" 150 psi	
	24	ANSI 3" 150 psi	
	25	ANSI 4" 150 psi	
Thread			
	5	NPT 1½ - 11,5	
	6	NPT 2 - 11,5	
Material			
	2	1.4435 (316L)	
	7	PPs (Polypropylene)	
FAU 70 A			Product designation

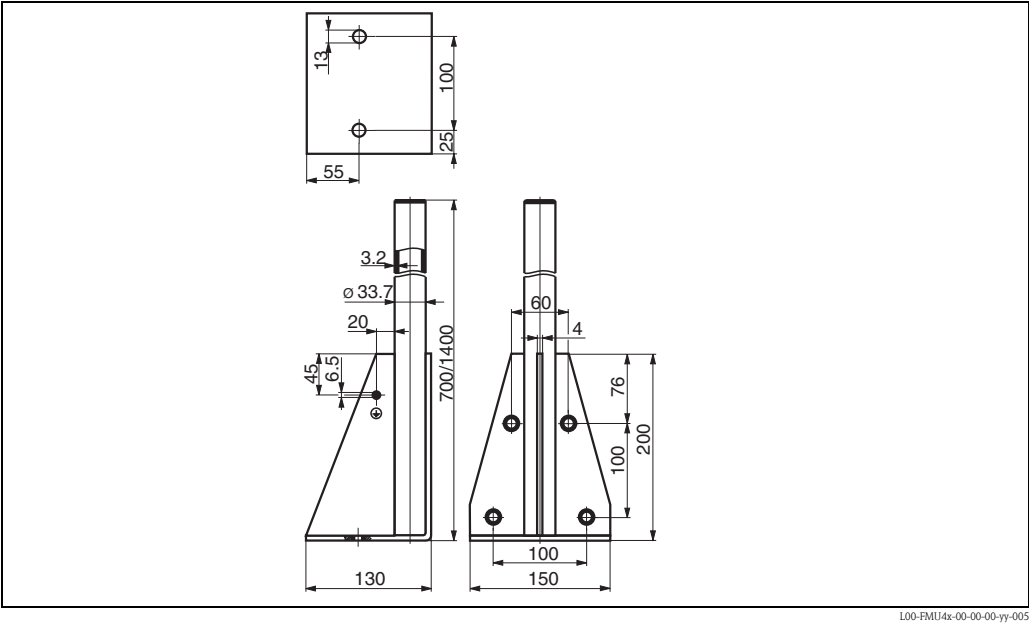
9.4 Cantilever



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

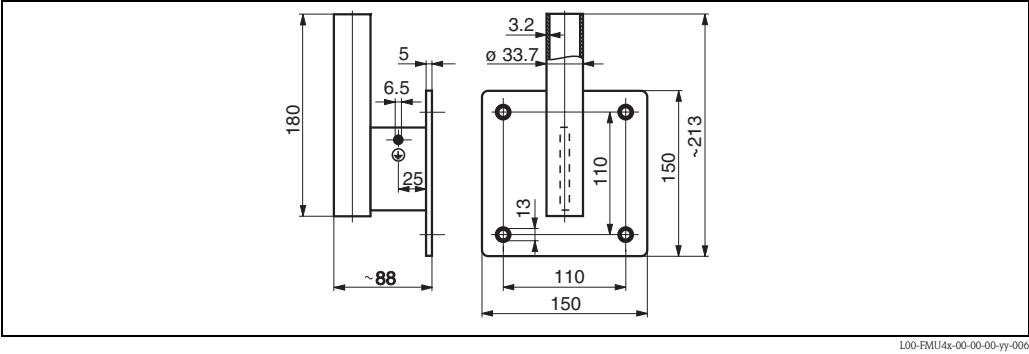
- The 50 mm or 62 mm orifices serve for the mounting of the FMU 40 or FMU 41 sensor, respectively.
- The 22 mm orifice may be used for an additional sensor.

9.5 Mounting Frame



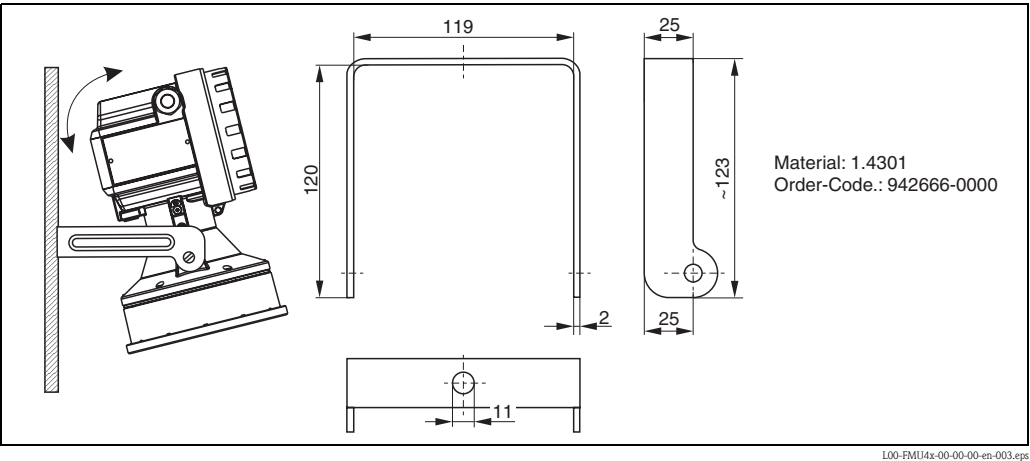
Height	Material	Order Code
700 mm	galv. steel	919791-0000
700 mm	1.4301 (AISI 304)	919791-0001
1400 mm	galv. steel	919791-0002
1400 mm	1.4301 (AISI 304)	919791-0003

9.6 Wall Bracket



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

9.7 Mounting bracket for FMU 43



9.8 Service Interface FXA193

The Service-Interface connects the Service plug of Proline and ToF instruments with the 9 pin RS 232C interface of a PC. (USB connectors must be equipped with a usual commercial USB/Serial adapter.)

9.8.1 Product structure

Approvals		
A	For use in non-hazardous areas	
B	ATEX II (1) GD	
C	CSA/FM Class I Div. 1	
D	ATEX, CSA, FM	
9	other	

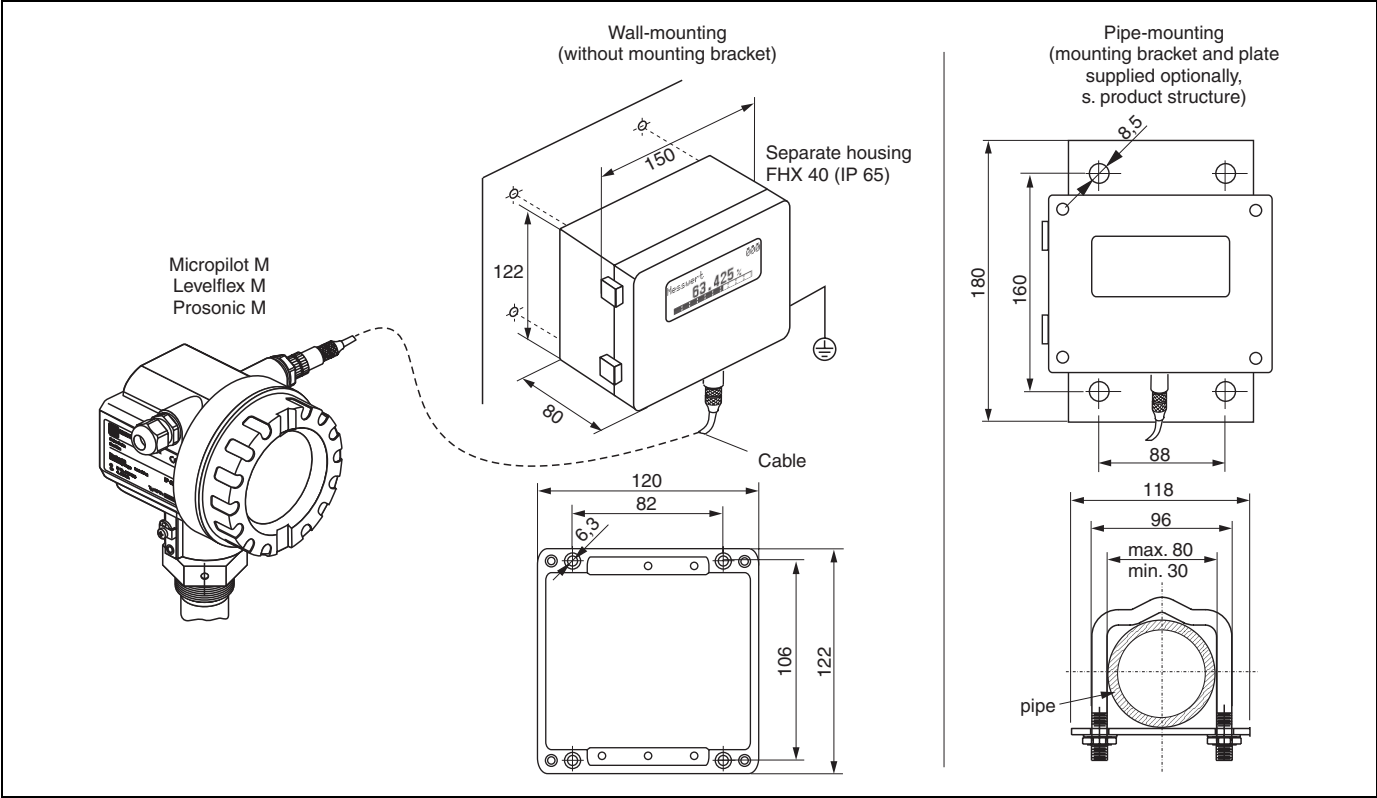
Connection cable		
B	Connection cable for ToF devices	
E	Connection cable for Proline and ToF devices	
H	Connection cable for Proline and ToF devices and Connection cable for Ex two-wire devices	
X	without connection cable	
9	others	

FXA193-			Complete product designation
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9.8.2 Associated documentation

- Technical Information: TI063D
- Safety Instructions for ATEX II (1) GD: XA077D
- Supplementary information for the cable adapters: SD092D

9.9 Remote display FHX40



100-FMxxxxx-00-00-06-es-003

9.9.1 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

		Approval:
	A	Nn-hazardous area
	I	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)
		Cable:
	1	20m/65ft; for HART
	5	20m/65ft; for PROFIBUS PA/FOUNDATION Fieldbus
		Additional option:
	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	The distance D between the sensor membrane and the product surface is measured. Using the linearisation function, the device uses D to calculate: ■ level L in any units ■ volume V in any units ■ flow Q across measuring weirs or open channels in any units
-------------------	--

Maximum range/blocking distance

Sensor	Maximum range in liquids ¹	Maximum range in solids ¹	blocking distance
FMU 40	5 m	2 m	0,25 m
FMU 41	8 m	3,5 m	0,35 m
FMU 42	10 m	5 m	0,4 m
FMU 43	15 m	7 m	0,6 m

¹The 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	Foundation Fieldbus
Signal on alarm	■ Error symbol, error code and plain text description on the on-site display ■ Status byte of the digital signal input

10.1.3 Auxiliary energy

Cable entry	■ Cable gland M20x1.5 (recommended cable diameter 6 ... 10 mm) ■ Cable entry G½ or ½ NPT ■ 7/8" Foundation Fieldbus plug
Supply voltage	9 V ... 32 V There may be additional restrictions for devices with an explosion protection certificate. Refer to the notes in the appropriate safety instructions (XA).
Current consumption	approx. 12 mA for the range of voltages given above

10.1.4 Performance characteristics

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

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
FMU 40	1 mm
FMU 41	1 mm
FMU 42	2 mm
FMU 43	2 mm

Measuring error

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

Sensor	Measuring error
FMU 40	$\pm 2\text{ mm}$ or 0.2 % of set measuring distance (empty calibration) ¹
FMU 41	$\pm 2\text{ mm}$ or 0,2% of set measuring distance (empty calibration) ¹
FMU 42	$\pm 4\text{ mm}$ or 0,2% of set measuring distance (empty calibration) ¹
FMU 43	$\pm 4\text{ mm}$ or 0,2% of set measuring distance (empty calibration) ¹

¹whichever is greater

10.1.5 Ambient conditions

Ambient temperature	-40 °C ... +80 °C The functionality of the LC display becomes restricted at $T_u < -20\text{ °C}$ and $T_u > +60\text{ °C}$. 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 ²) ² /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: 0.7 bar ... 2.5bar abs.

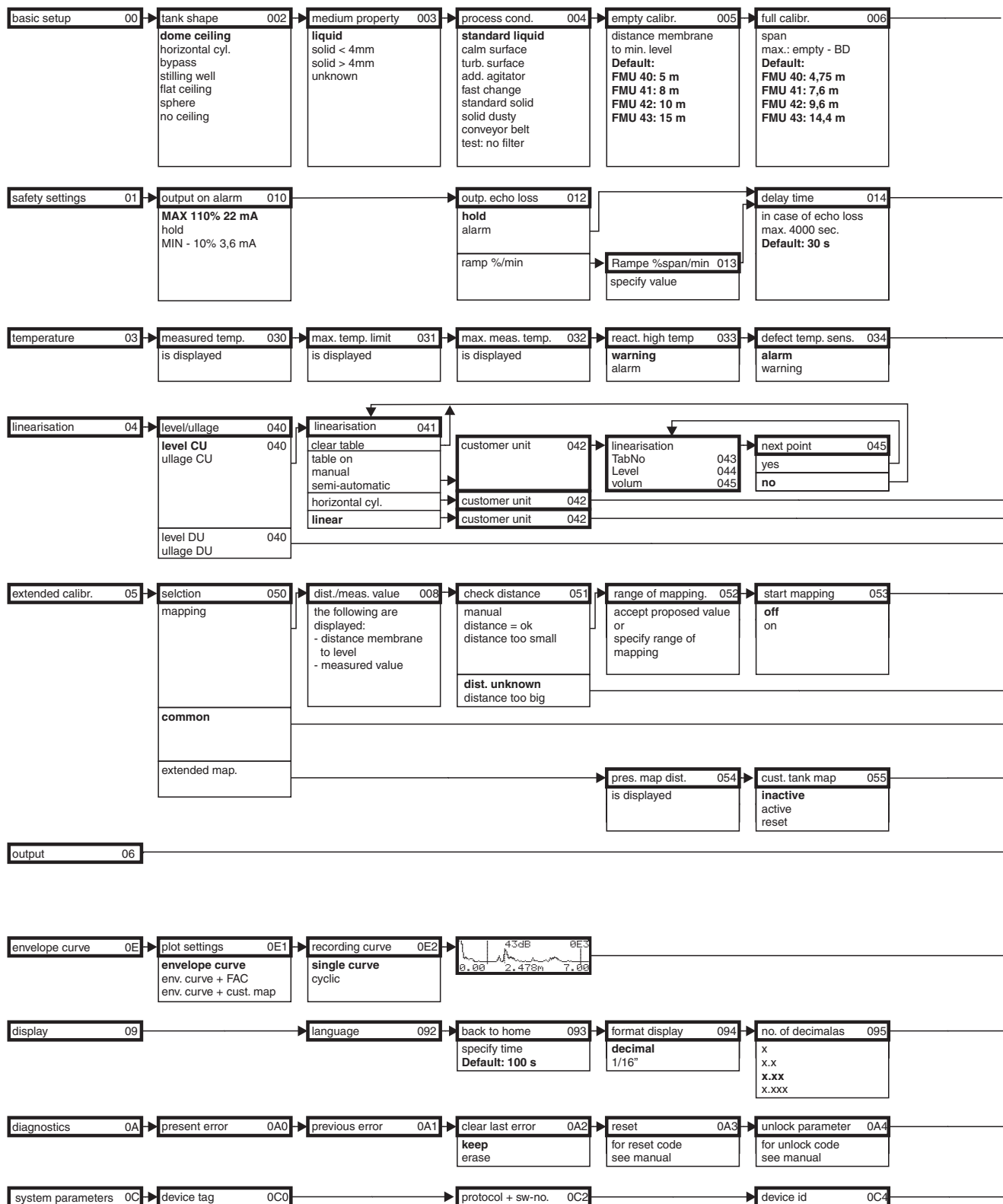


Note!

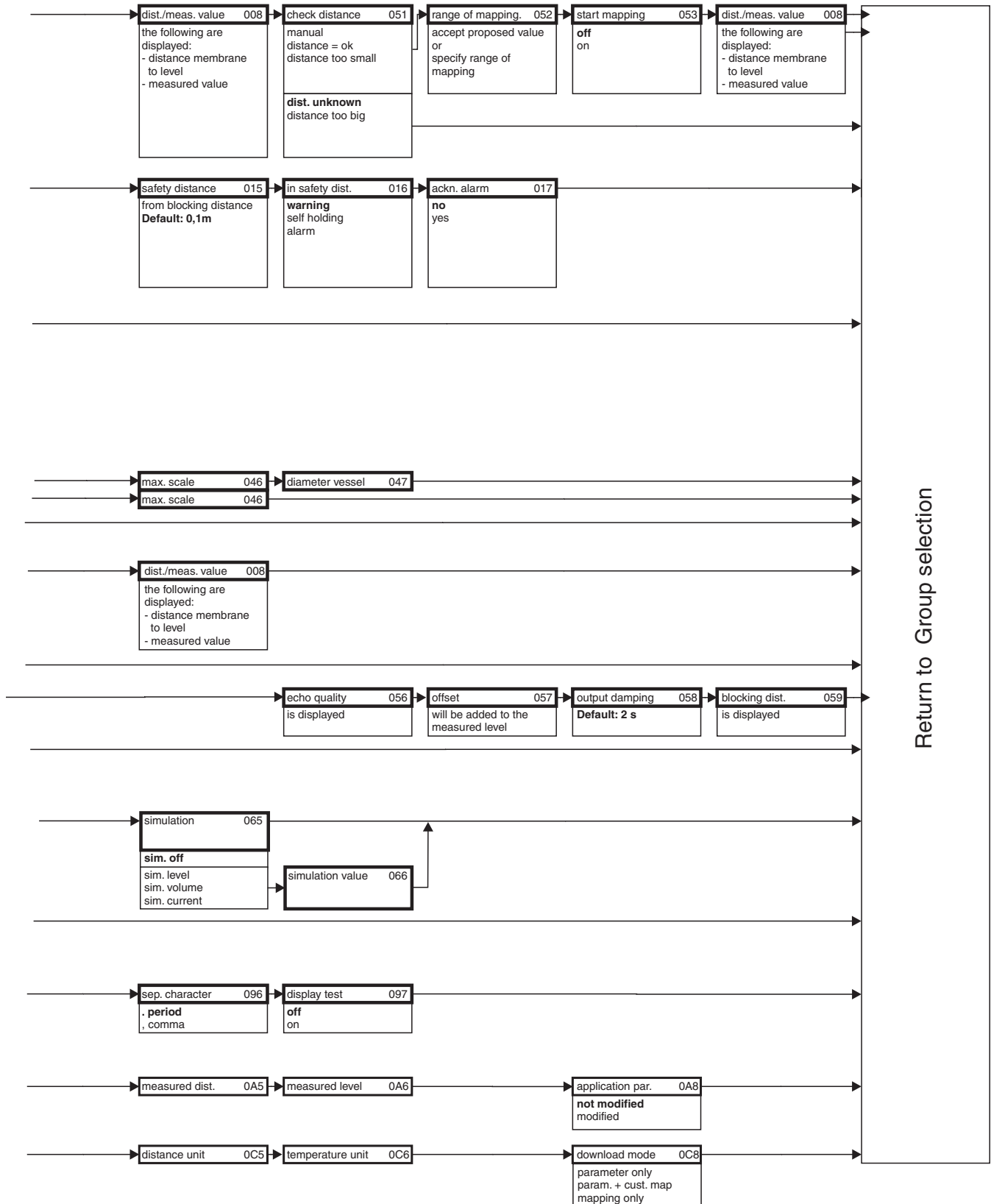
For pressures less than 0.7 bar please contact Endress+Hauser

11 Appendix

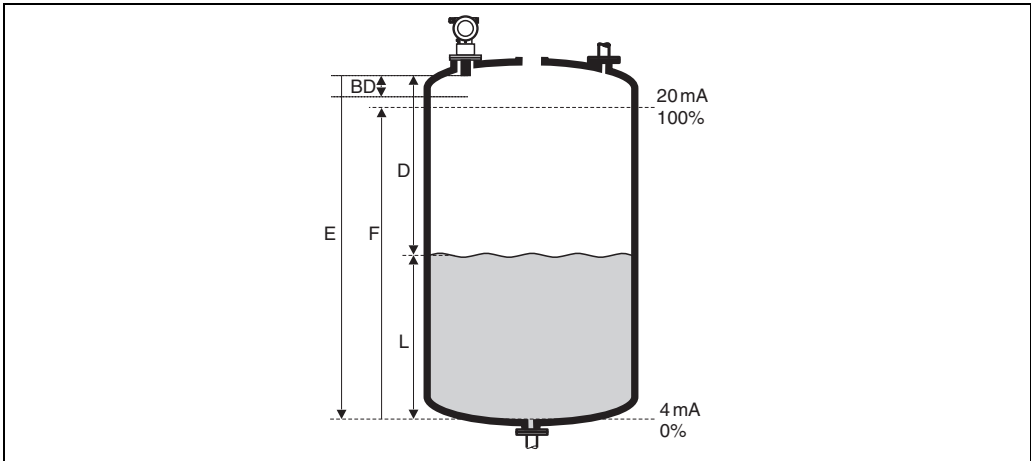
11.1 Operating menu



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
FMU 40	0.25 m	5 m	2 m
FMU 41	0.35 m	8 m	3.5 m
FMU 42	0.4 m	10 m	5 m
FMU 43	0.6 m	15 m	7 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 Contamination

Erklärung zur Kontamination

Because of legal regulations and for the safety of our employees and operating equipment, we need the "declaration of contamination", with your signature, before your order can be handled. Please make absolutely sure to include it with the shipping documents, or – even better – 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", bevor Ihr Auftrag bearbeitet werden kann. Legen Sie diese unbedingt den Versandpapieren bei oder bringen Sie sie idealerweise außen an der Verpackung an.

Type of instrument / sensor

Geräte-/Sensortyp _____

Serial number

Seriennummer _____

Process data/ Prozessdaten

Temperature / Temperatur _____ [°C] Pressure / Druck _____ [Pa]

Conductivity / Leitfähigkeit _____ [S] Viscosity / Viskosität _____ [mm²/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 security sheet and, if necessary, special handling instructions.

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

Reason for return / Grund zur Rücksendung

Company data / Angaben zum Absender

Company / Firma _____	Contact person / Ansprechpartner _____
_____	Department / Abteilung _____
Address / Adresse _____	Phone number/ Telefon _____
_____	Fax / E-Mail _____
_____	Your order No. / Ihre Auftragsnr. _____

We hereby certify that the returned parts have been carefully cleaned. To the best of our knowledge they are free from any residues in dangerous quantities.

Hiermit bestätigen wir, dass die zurückgesandten Teile sorgfältig gereinigt wurden, und nach unserem Wissen frei von Rückständen in gefährbringender Menge sind.

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Mail: Sales@ainstru.com

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