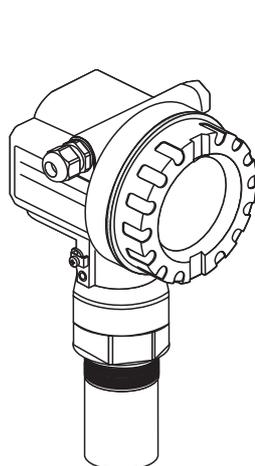


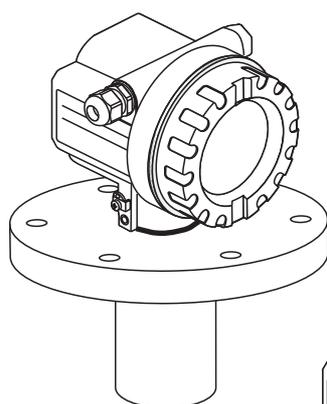
prosonic M FMU 40/41/42/43 with Foundation Fieldbus Ultrasonic Level Measurement



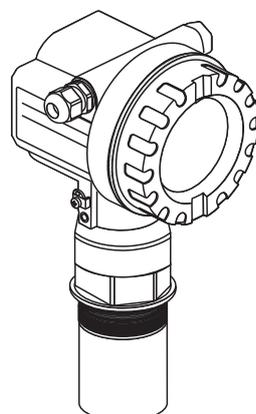
Operating Instructions



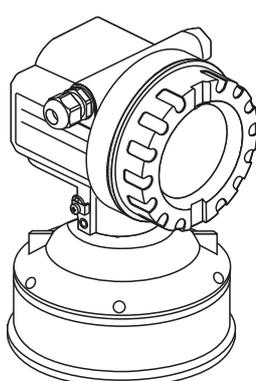
FMU 40



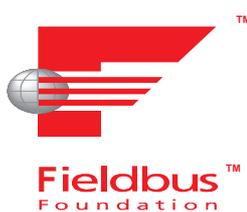
FMU 42



FMU 41



FMU 43



TM

TM

Foundation

Endress + Hauser

The Power of Know How



Short instructions

KA 183F/00/a2/02.02
52010993

Prosonic M - Quick Setup

⚠ Contrast: E + + or E + -

000 measured value

Group selection

- 00 basic setup
- 01 safety settings
- 0E temperature
- 04 linearisation
- 05 extended calibr.
- 06 output (HART, FF) profibus param.(PA)
- 0E Envelope curve
- 09 display
- 0A diagnostics
- 0C system parameter

002 tank shape

003 medium property

004 process cond.

005 empty calibr.

059 blocking distance

006 full calibr.

008 dist./ meas value

051 check distance

052 range of mapping

053 start mapping

0E1 plot settings

0E2 recording curve

092 language

0A0 present error

0A1 previous error

0C0 tag no.

008 dist./ meas value

051 check distance

052 range of mapping

053 start mapping

0A3 reset

0A4 unlock parameter

BD: blocking distance

0E1 plot settings: 25dB, 0.90

0E2 recording curve: -0.01, 2.461m, 5.00

0A3 reset: 333 (HART), 33333 (PA,FF)

0A4 unlock parameter: 100 (HART), 2457 (PA,FF)

L00-FMU4xxx-05-00-00-en-001

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.

Table of contents

1	Safety instructions	4	8.3	Repairs to Ex-approved devices	57
1.1	Designated use	4	8.4	Replacement	57
1.2	Installation, commissioning, operation	4	8.5	Spare parts (housing type F12)	58
1.3	Hazardous area	4	8.6	Spare parts (housing type T12)	59
1.4	Notes on safety conventions and symbols	5	8.7	Return	60
2	Identification	6	8.8	Disposal	60
2.1	Nameplate	6	8.9	Software history	60
2.2	Scope of delivery	6	8.10	Contact addresses of Endress+Hauser	60
2.3	Certificates and approvals	7	9	Accessories	61
2.4	Registered trademarks	7	9.1	Weather protection cover	61
3	Installation	8	9.2	Installation bracket for FMU 40/41	61
3.1	Dimensions	8	9.3	Adapter flange for FMU 40 / FMU 41	62
3.2	Installation variants	9	9.4	Cantilever	63
3.3	Installation conditions	11	9.5	Mounting Frame for Cantilever	64
3.4	Measuring range	14	9.6	Wall Bracket for Cantilever	64
3.5	Installation hint for FMU 40/41	15	9.7	Mounting bracket for FMU 43	65
3.6	Turn housing	16	9.8	Service Interface FXA 193	65
3.7	Installation check	16	9.9	Remote display FHX 40	66
4	Wiring	17	10	Technical Data	67
4.1	Electrical connection	17	10.1	Technical data at a glance	67
4.2	Terminal assignment	19	11	Appendix	70
4.3	Cable specifications Foundation Fieldbus	19	11.1	Operating menu	70
4.4	Supply voltage	19	11.2	Measuring principle	72
4.5	Recommended connection	20	Index	74	
4.6	Checking the connection	20			
5	Operation	21			
5.1	Display and operating elements	21			
5.2	Function codes	23			
5.3	Foundation Fieldbus interface	24			
5.4	Operation using the on-site display VU 331	41			
5.5	Lock/unlock configuration	42			
5.6	Resetting the customer parameters	42			
5.7	Resetting an interference echo suppression (tank map)	43			
6	Commissioning	44			
6.1	Power up instrument	44			
6.2	Basic calibration	45			
6.3	Envelope curve	50			
7	Troubleshooting	53			
7.1	System error messages	53			
7.2	Application errors	55			
8	Maintenance and repairs	57			
8.1	Exterior cleaning	57			
8.2	Repairs	57			

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 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.

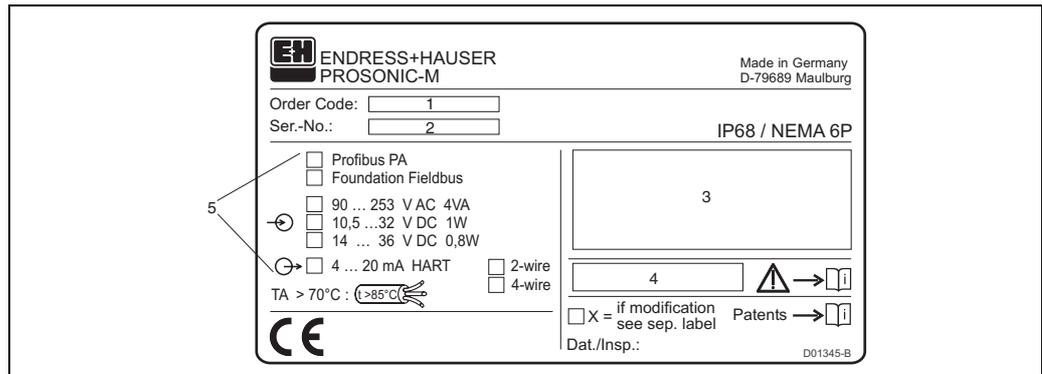
Symbol	Meaning
	Warning! A warning highlights actions or procedures which, if not performed correctly, will lead to personal injury, a safety hazard or destruction of the instrument
	Caution! Caution highlights actions or procedures which, if not performed correctly, may lead to personal injury or incorrect 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

	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

	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

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 Scope of delivery

2.2.1 Instrument and accessories

- Instrument according to the version ordered
- 2 ToF Tool - FieldTool® Package CD-Roms:
 - CD 1: ToF Tool - FieldTool® program
Program including Device Descriptions (device drivers) and documentation for all Endress+Hauser devices which can be operated by ToF Tool
 - CD 2: ToF Tool - FieldTool® Utilites
Utility programs (e.g. Adobe Acrobat Reader, MS Internet Explorer)
- for FMU 40/41 in the versions FMU 40 *R**** and FMU 41 *R****: counter nut (PA)
- for FMU 40/41: sealing ring (EPDM)

2.2.2 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 variant.

2.3 Certificates and approvals

CE mark, declaration of conformity

The instrument 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 instrument complies with the applicable standards and regulations in accordance with EN 61010 "Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures". The instrument described in this manual thus complies with the statutory requirements of the EG directives. Endress+Hauser confirms the successful testing of the instrument by affixing to it the CE mark.

2.4 Registered trademarks

ToF®

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

PulseMaster®

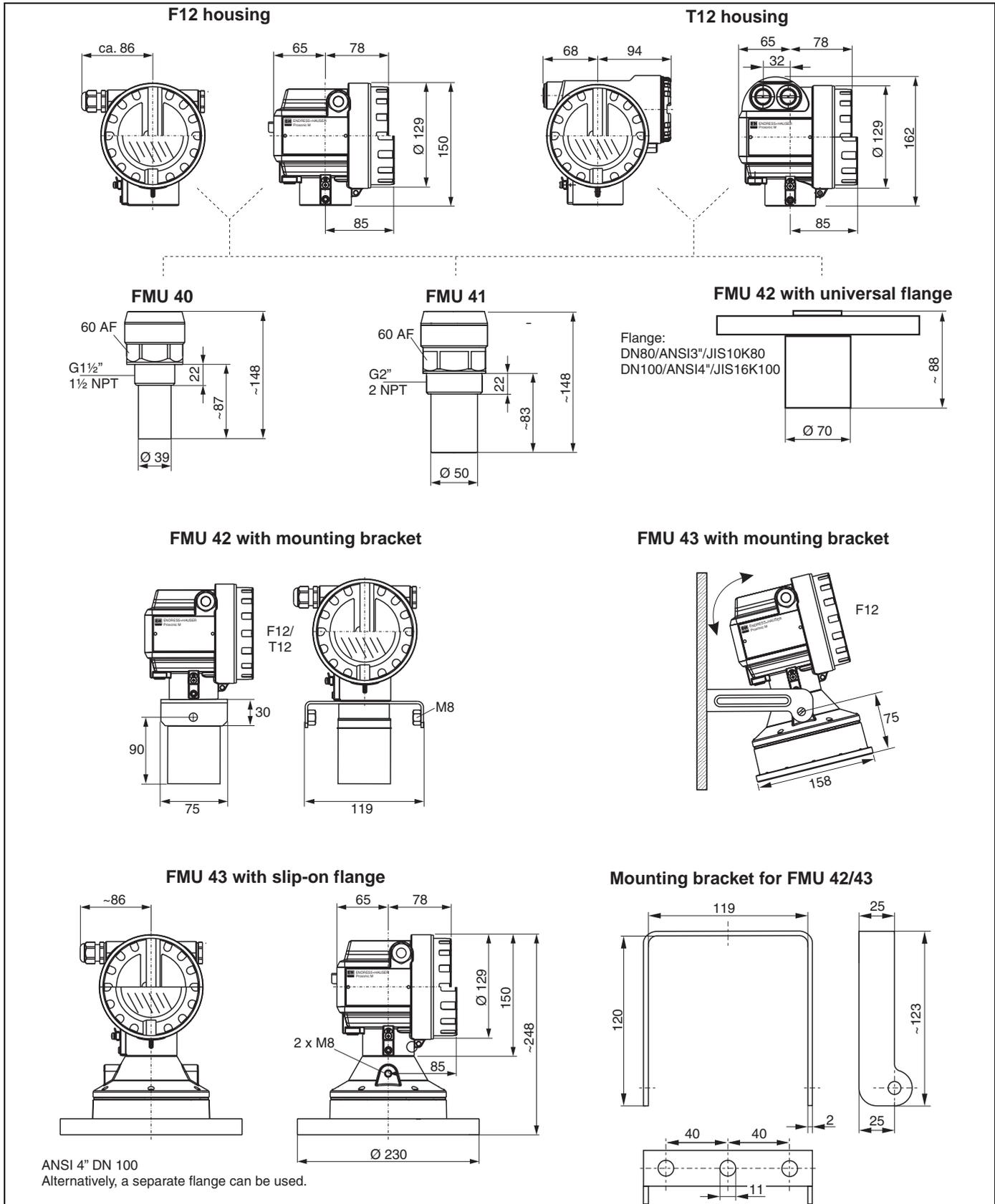
Registered trademark of the company Endress+Hauser GmbH+Co. KG, Maulburg, Germany

Foundation™ Fieldbus

Registered trademark of Fieldbus Foundation Austin, Texas, USA

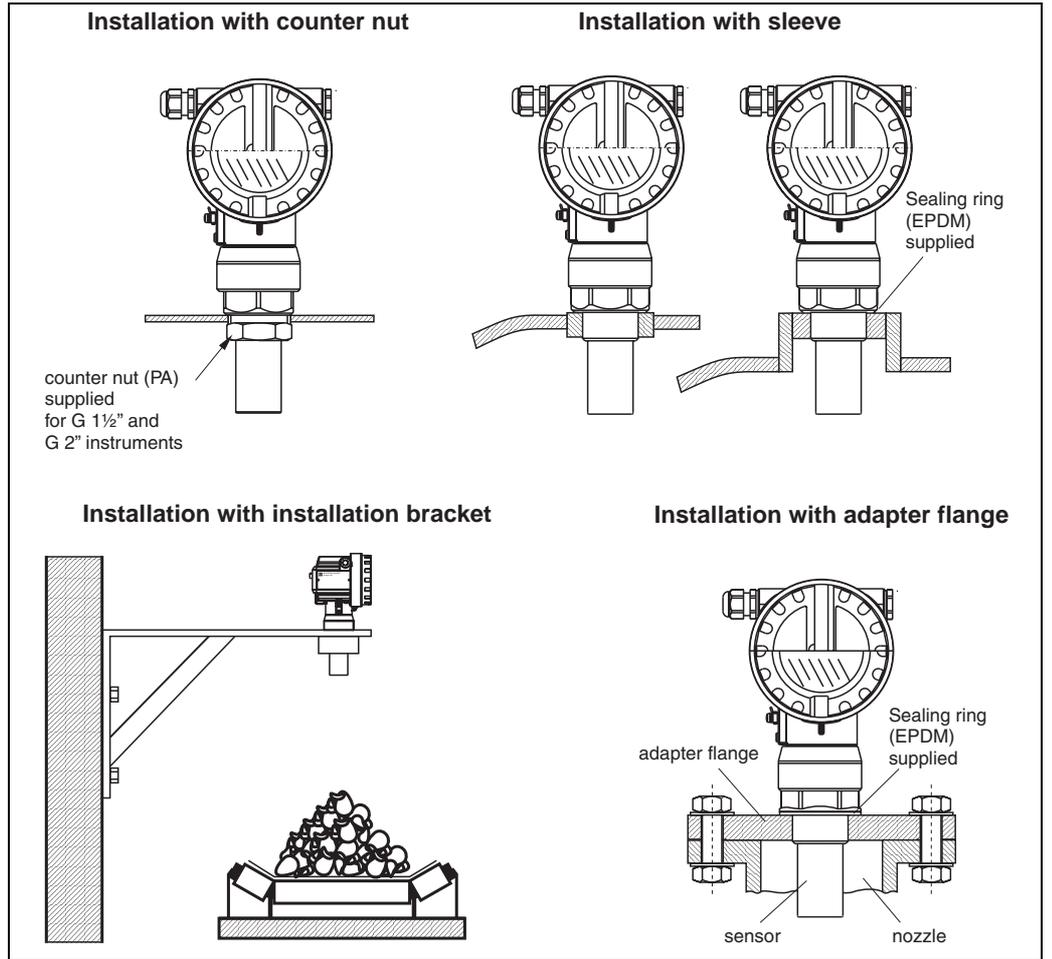
3 Installation

3.1 Dimensions



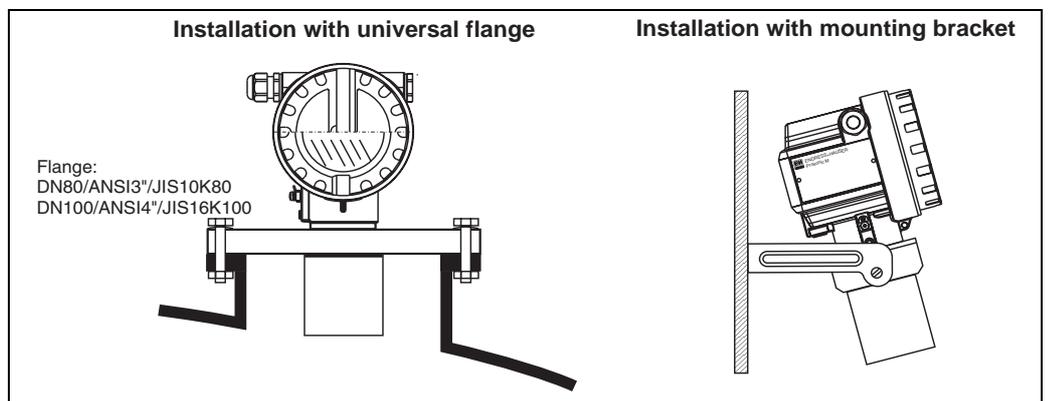
3.2 Installation variants

3.2.1 Installation variants FMU 40, FMU 41



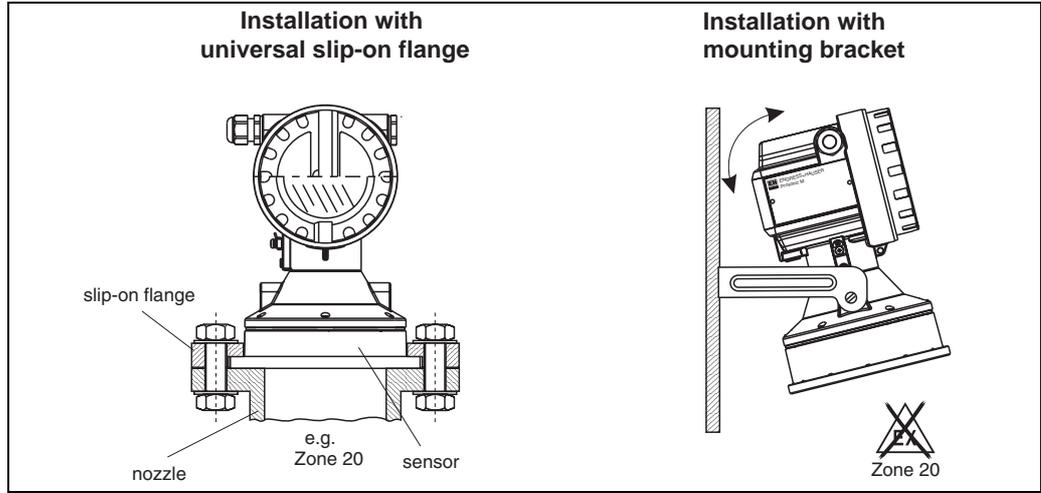
L00-FMU4xxxx-17-00-00-en-002

3.2.2 Installation variants FMU 42



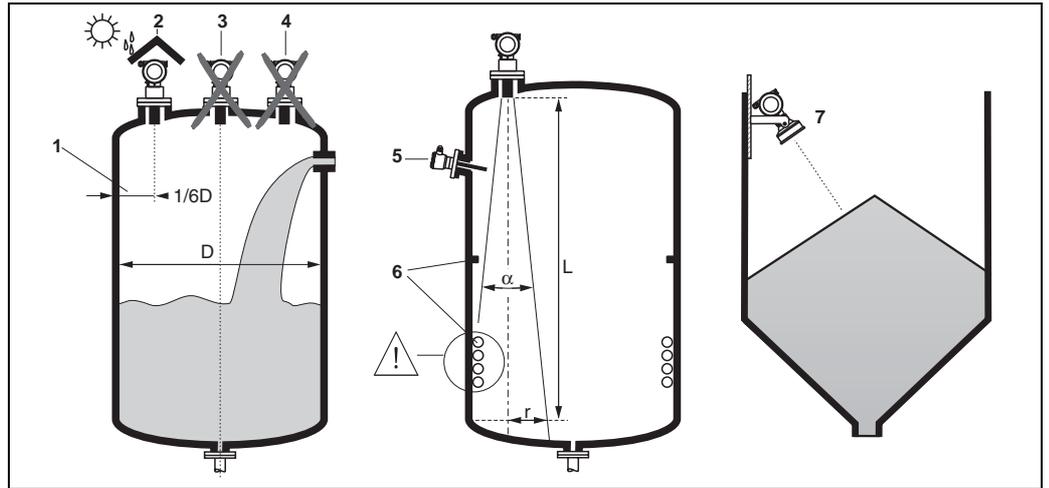
L00-FMU42xxxx-17-00-00-en-001

3.2.3 Installation variants FMU 43



3.3 Installation conditions

3.3.1 Installation conditions for level measurements



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

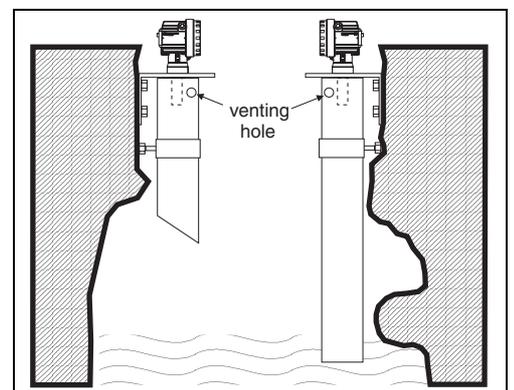
- Do not install the sensor in the middle of the tank (3). We recommend leaving a distance between the sensor and the tank wall (1) measuring 1/6 of the tank diameter.
- Use a protective cover, in order to protect the device from direct sun or rain (2).
- Avoid measurements through the filling curtain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

Sensor	α	L	r
FMU 40	11°	5 m	0,48 m
FMU 41	11°	8 m	0,77 m
FMU 42	11°	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.

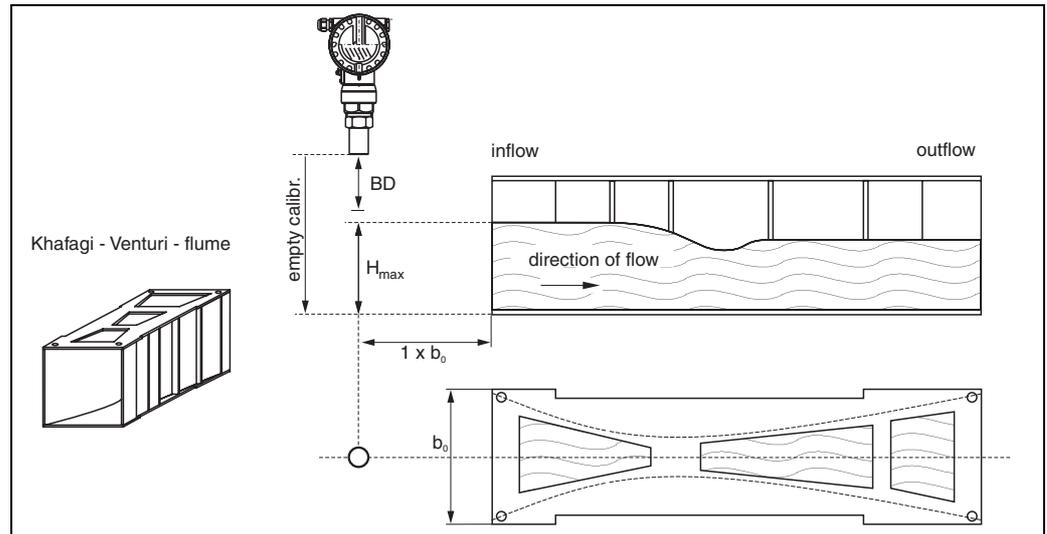


L00-FMU4xxxx-17-00-00-en-010

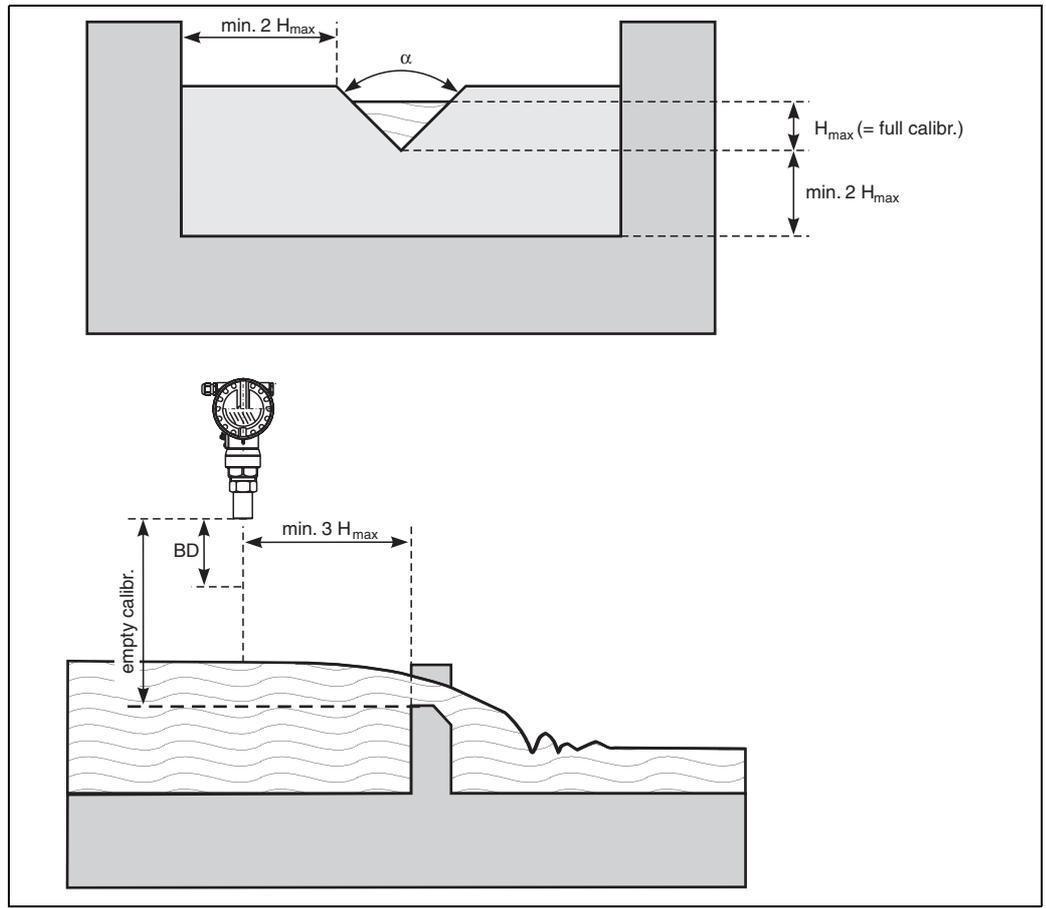
3.3.3 Installation conditions for flow measurements

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

Example: Khafagi-Venturi flume



Example: Triangular weir

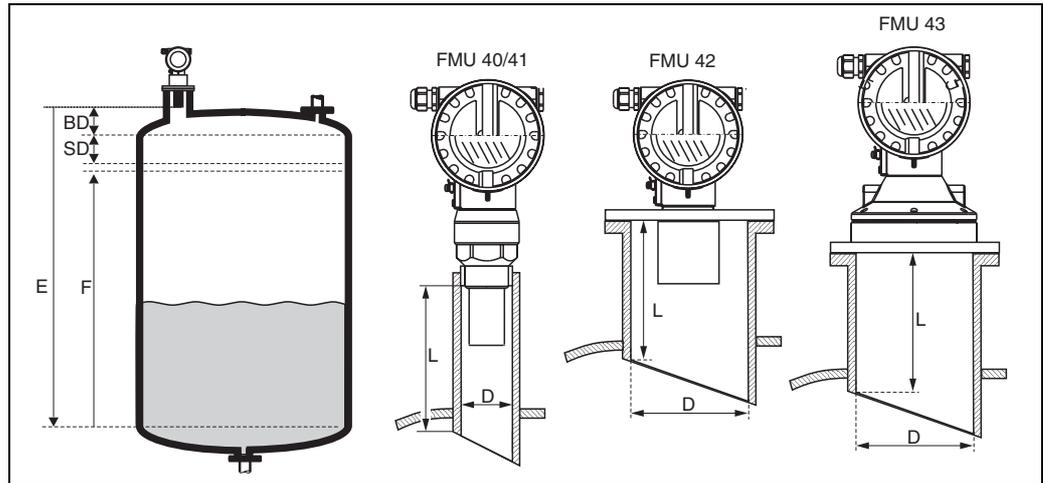


L00-FMU4xxxx-17-00-00-en-012

3.4 Measuring range

3.4.1 Blocking distance, Nozzle mounting

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



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

Sensor	BD	Max. range liquids	Max. range bulk materials	nozzle diameter	max. nozzle length
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	min. 100 mm	ca. 300 mm
FMU 43	0.6 m	15 m	7 m		



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

3.4.2 Safety distance

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

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

There are three options:

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

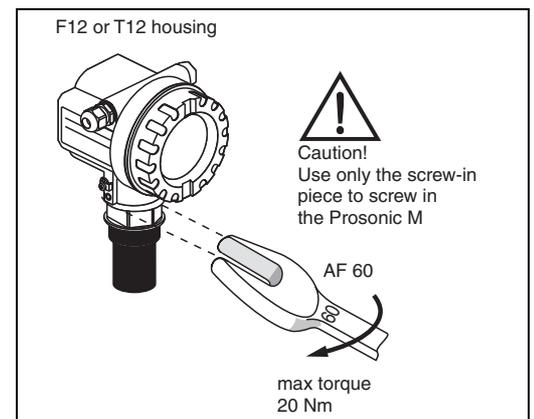
3.4.3 Range

The sensor range is dependent on the measuring conditions. Refer to Technical Information TI 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

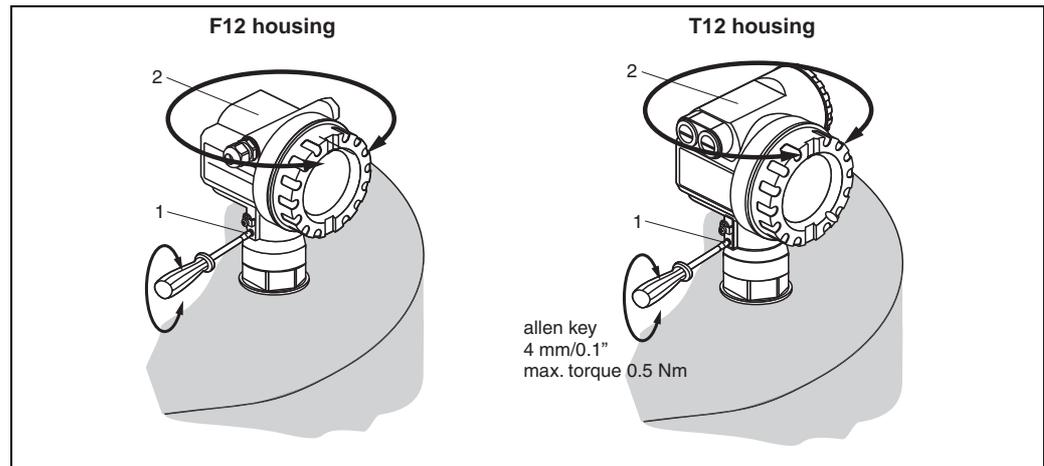
Screw the Prosonic M at the screw-in piece using an 60 AF spanner.
Maximum torque: 20 Nm.



3.6 Turn housing

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

- Undo the fixing screws (1)
- Turn the housing (2) in the required direction
- Tighten up the fixing screws (1). Maximum torque 0.5 Nm.



L00-FMU4xxxx-17-00-00-en-013

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")

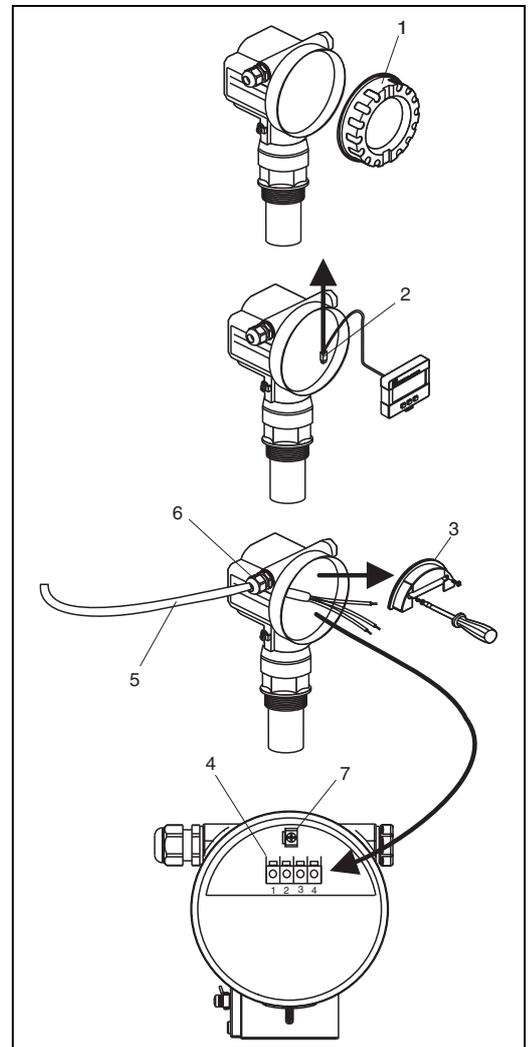


Warning!

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

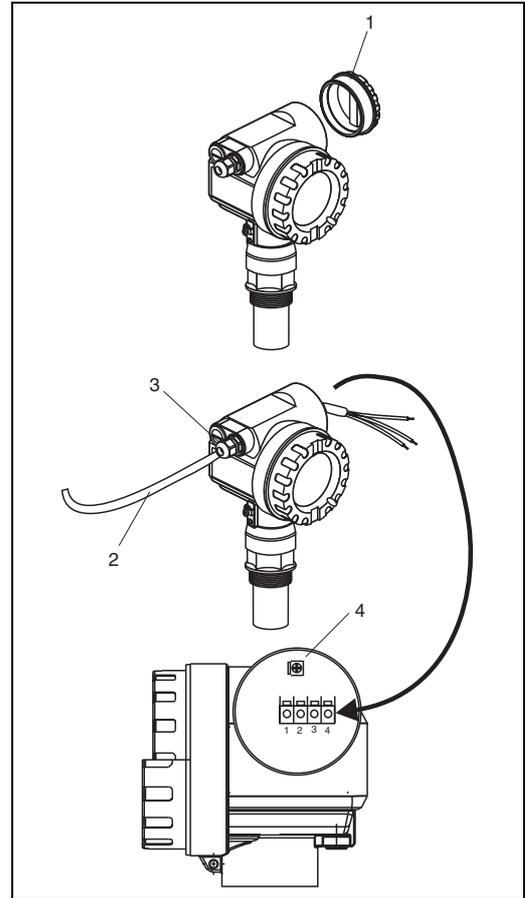
1. Unscrew housing cover (1).
2. Remove display (2) if fitted.
3. Remove cover plate (3) from terminal compartment.
4. Pull out terminal module (4) slightly using pulling loop.
5. Insert cable (5) through gland (6).
6. Connect cable screen to the grounding terminal (7) within the terminal compartment.
7. Make connection according to terminal assignment (see below).
8. Re-insert terminal module (4).
9. Tighten cable gland (6).
10. Tighten screws on cover plate (3).
11. Insert display (2) if fitted.
12. Screw on housing cover (1).
13. Switch on power supply.



L00-FMU4xxxx-04-00-00-yy-008

4.1.2 Wiring in the housing T12

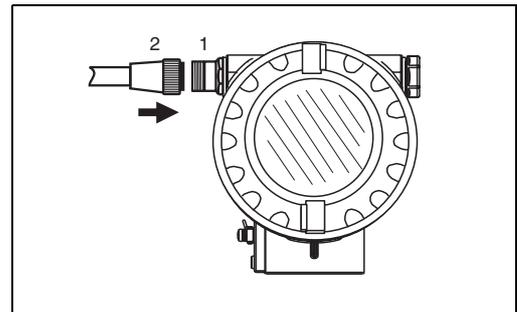
1. Unscrew the cover (1) of the separate connection room.
2. Insert cable (2) through gland (3).
3. Connect cable screen to the grounding terminal (4) within the connection room.
4. Make connection according to the terminal assignment (see below).
5. Tighten cable gland (3).
6. Screw on housing cover (1).
7. Switch on power supply.



L00-FMU4xxxx-04-00-00-yy-009

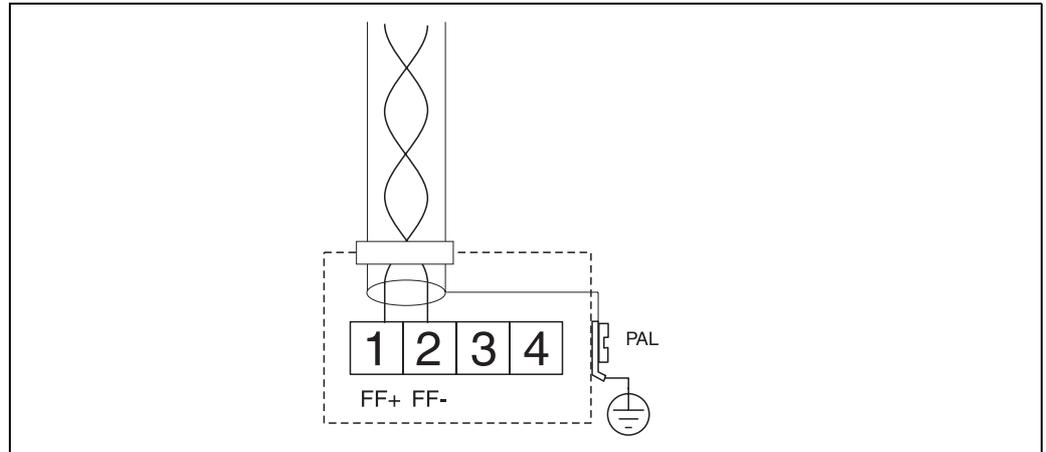
4.1.3 Wiring with Foundation Fieldbus plug

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

4.2 Terminal assignment



L00-FMR2xxxx-04-00-00-de-007

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.

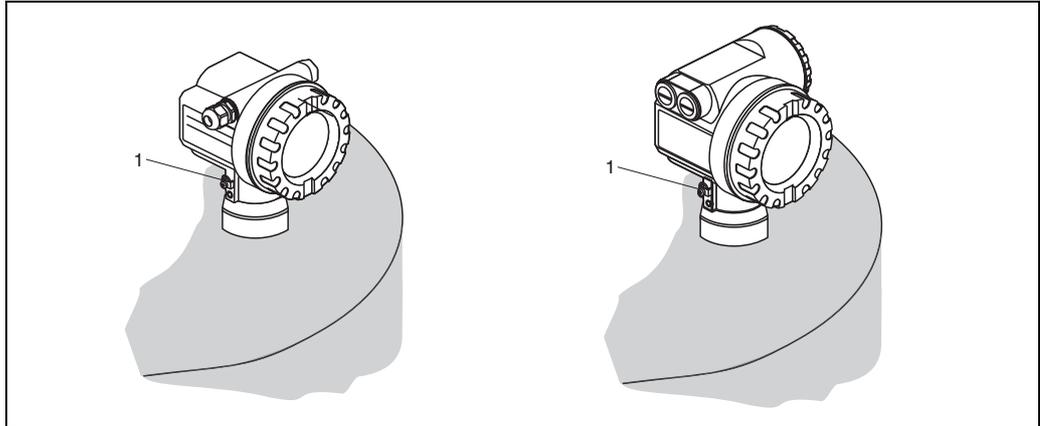
4.4 Supply voltage

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



L00-FMP4xxxx-17-00-00-yy-043

1: external ground terminal of the transmitter

For maximum EMC protection please observe the following points:

- The external ground terminal on the transmitter must be connected to ground.
- The continuity of the cable screening between tapping points must be ensured.
- If potential equalisation is present between the individual grounding points, ground the screening at each cable end or connect it to the device housing (as short as possible).
- If there are large differences in potential between grounding points, the grounding should run via a capacitor that is suitable for high frequency use (e.g. ceramic 10 nF/ 250 V~).



Caution!

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

4.6 Checking the connection

After wiring the device, carry out the following checks:

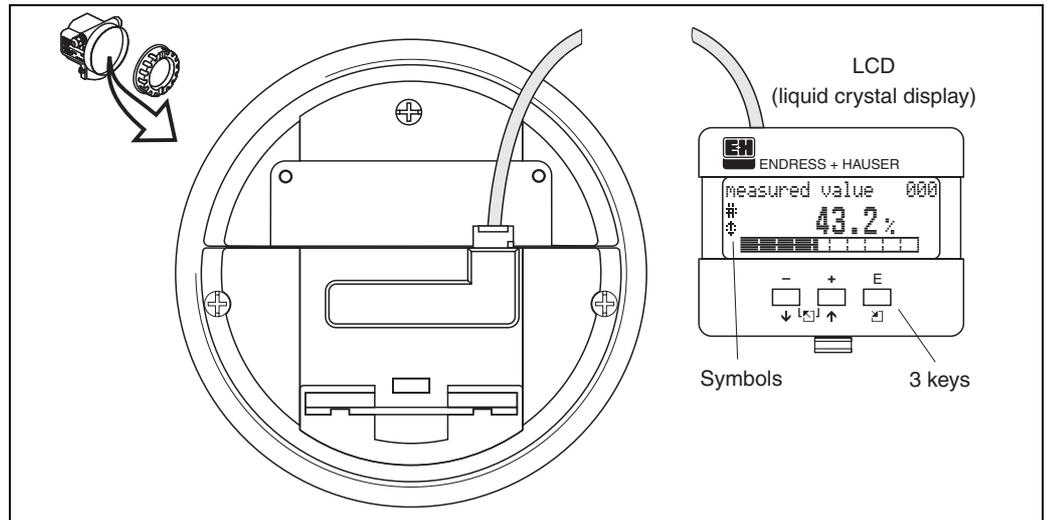
- Are the terminals correctly assigned?
- Is the cable gland tight?
- Is the Foundation Fieldbus connector screwed tight?
- Is the housing cover fully screwed on?
- If power supply available: Does a display appear on the display module?

5 Operation

5.1 Display and operating elements

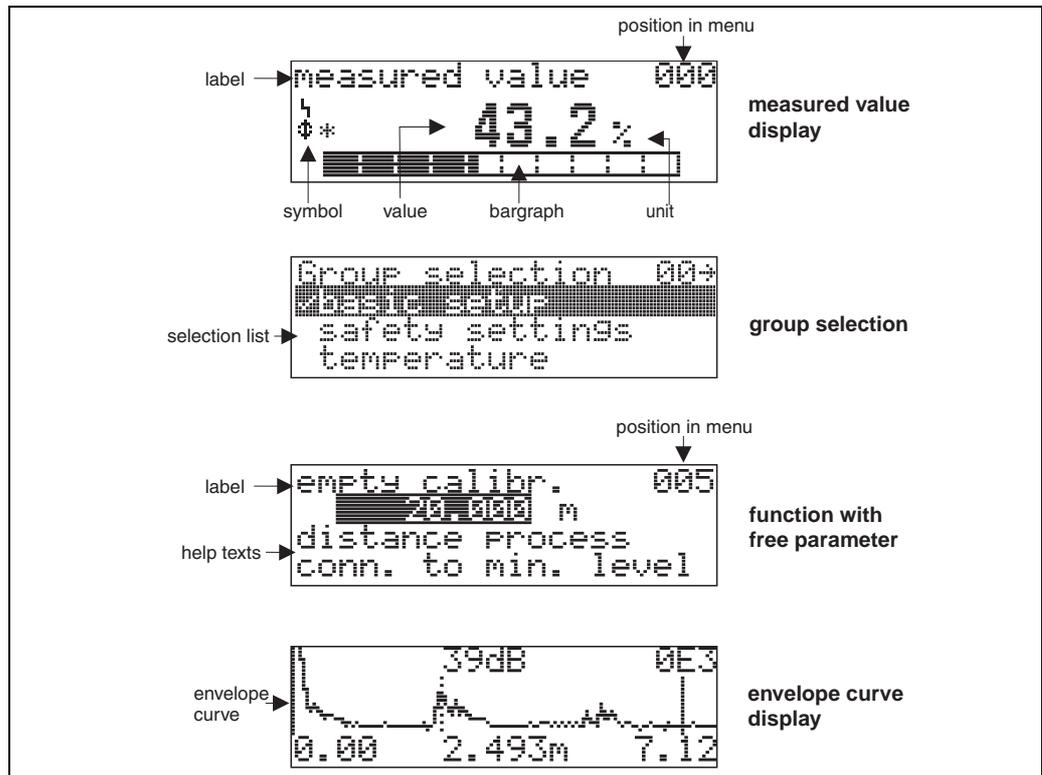
5.1.1 On-site display VU 331

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.



L00-FMxxxxxx-07-00-00-en-001

5.1.2 Display appearance



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

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

5.1.3 Display symbols

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

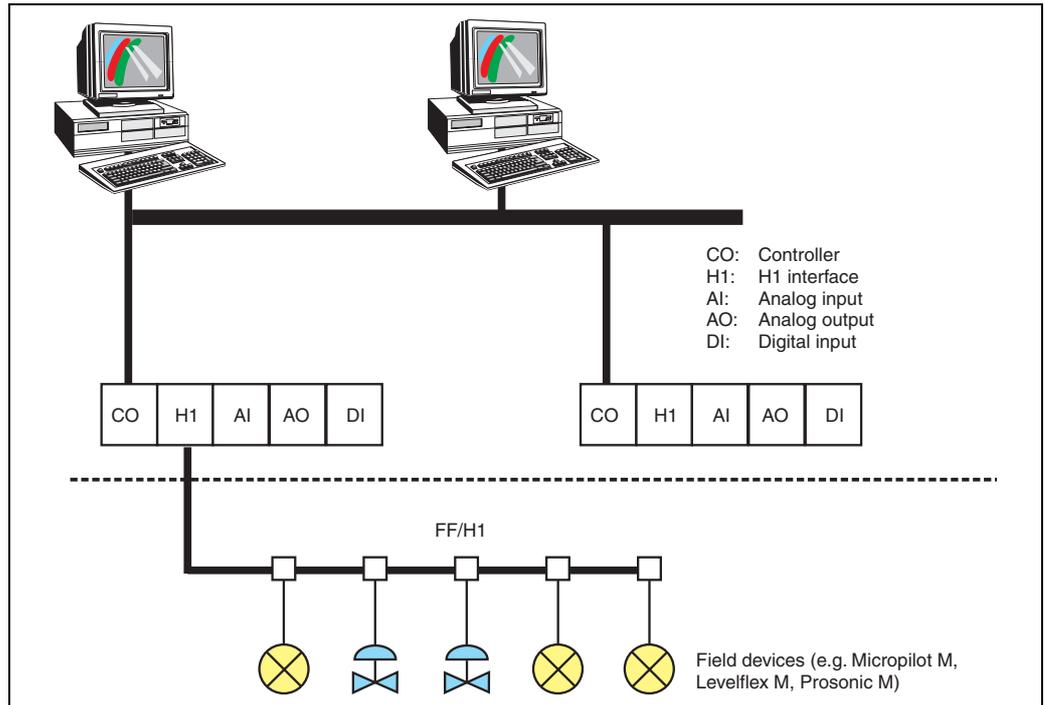
Symbol	Meaning
	ALARM_SYMBOL This alarm symbol appears when the instrument is in an alarm state. If the symbol flashes, this indicates a warning.
	LOCK_SYMBOL This lock symbol appears when the instrument is locked, i.e. if no input is possible.
	COM_SYMBOL This communication symbol appears when a data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

5.3 Foundation Fieldbus interface

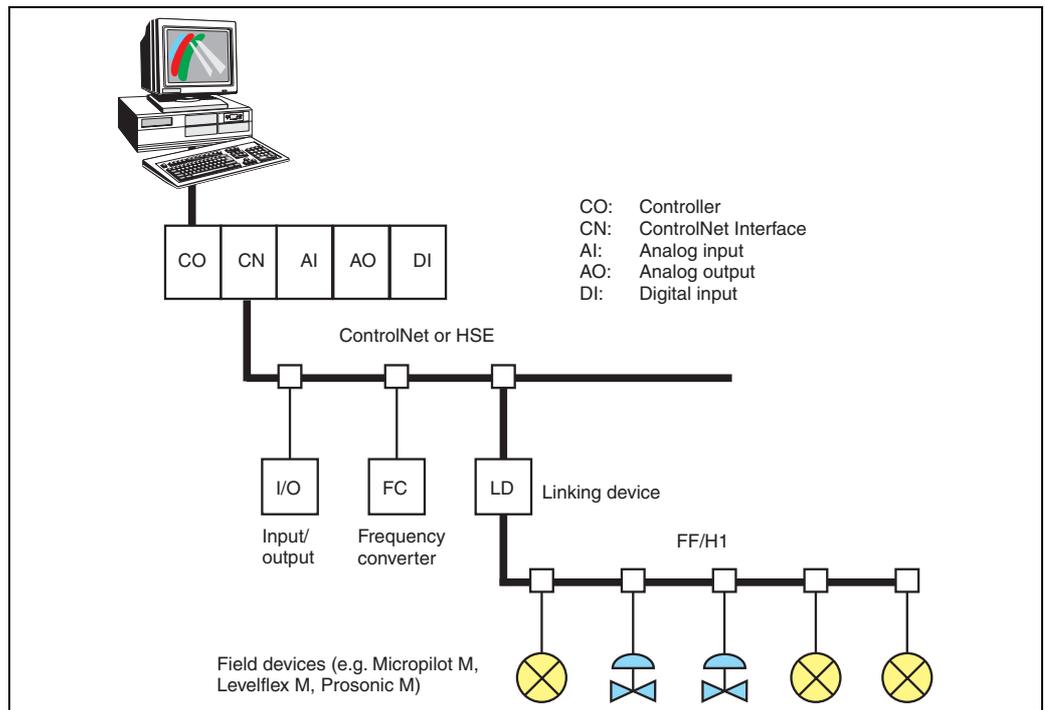
5.3.1 Synopsis

There are two possibilities of connecting up a Foundation Fieldbus:

Direct connection to a FF/H1 card



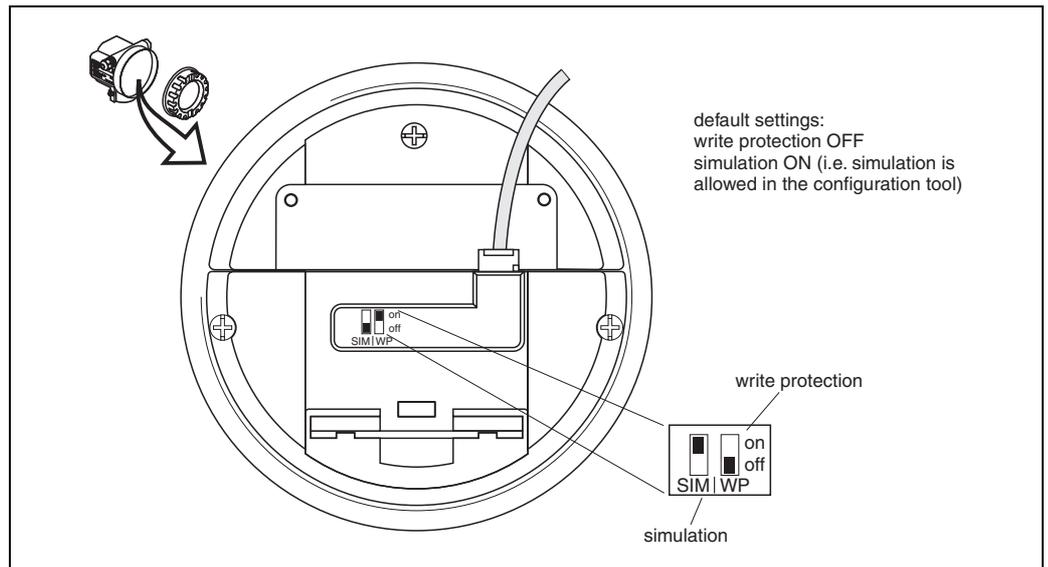
Indirect connection via a linking device



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



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_XXXXXXXX

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	the fieldbus node to which the device is connected (is automatically allocated by the Configurator)

The device ID is made up of the following components:

Device_ID = 452B48100F-XXXXXXXX

whereby:

452B48	ID code for Endress+Hauser
1011	ID code for Prosonic M
XXXXXXXX	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_XXXXXXXX
 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)

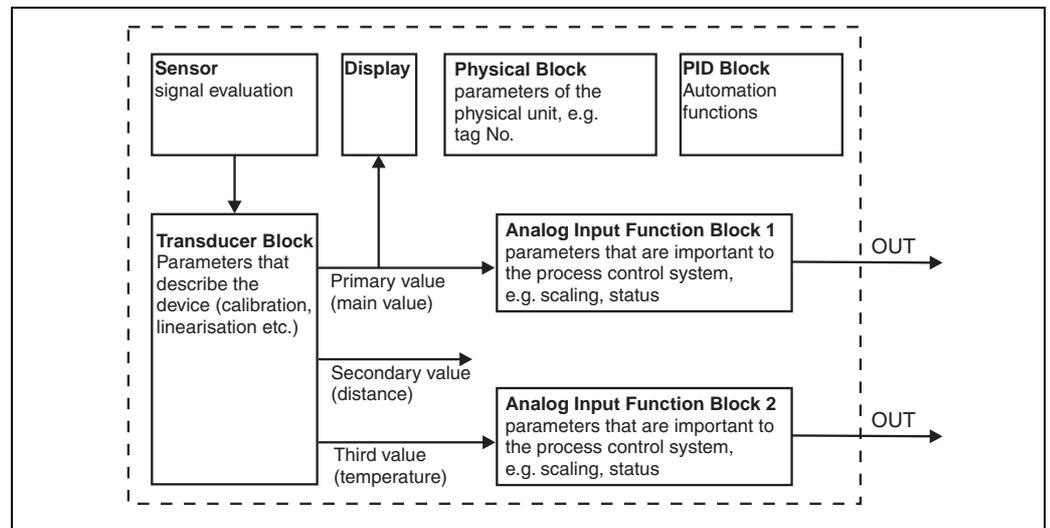
5.3.4 Block model of the Prosonic M

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 PLC
- **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.



L00-FMU4XXXX-02-00-00-en-003

5.3.5 Resource Block

E+H_PROSONIC_M_XXXXXXXX

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. <ul style="list-style-type: none"> – 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 <p>The possible operating modes of the resources block are:</p> <ul style="list-style-type: none"> – AUTO: the block is operating as normal – OOS: the block is out of service. <p>If the resource block is out of service, then all blocks within the device (resource) are forced into the same status.</p>
RS_STATE	Indicates the state of the resource block application state machine <ul style="list-style-type: none"> – On-line: block in AUTO mode – Standby: block in OOS mode
WRITE_LOCK	Indicates the status of DIP-switch WP <ul style="list-style-type: none"> – LOCKED: device data can be modified – NOT LOCKED: device data can be modified
RESTART	Allows a manual restart: <ul style="list-style-type: none"> – 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 <ul style="list-style-type: none"> – 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_XXXXXXXXX
 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 can not 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

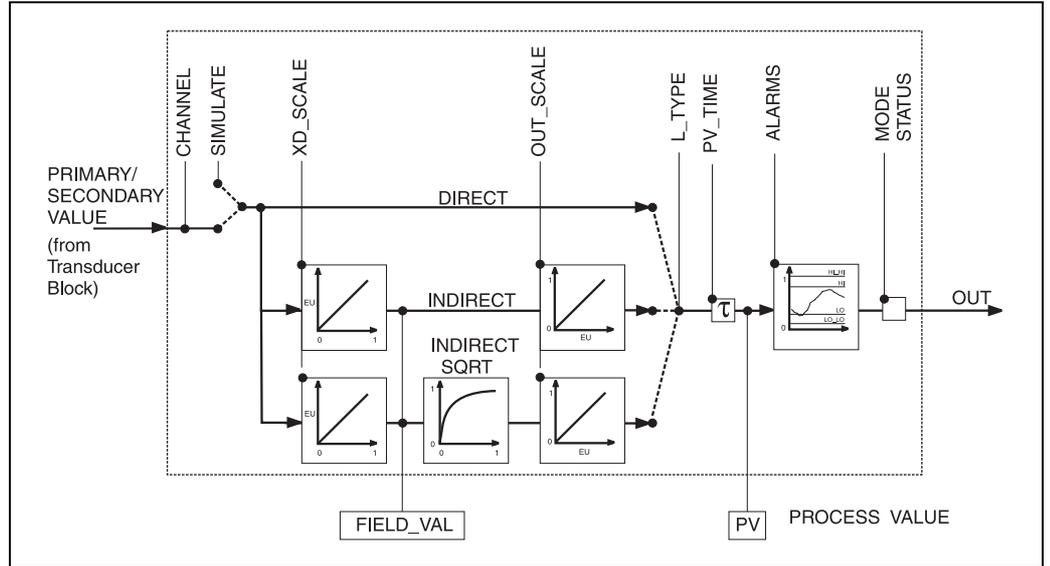
Parameter	Position Indicator	rel. Index	Variable Name	Size [bytes]	Type	Read	Write	Storage Class
		0	EH_USONICLEVEL_CAL_BASIC					
Standard Parameter								
ST_REV		1	ST_REV	2	UNSIGNED16	X		non-vol.
TAG_DESC		2	TAG_DESC	32	OCTET_STRING	X	X	static
STRATEGY		3	STRATEGY	2	UNSIGNED16	X	X	static
ALERT_KEY		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	static
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	PARPROTSOFTWAREVERSIONSTRING	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_XXXXXXXX
 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.



L00-FMR2xxxx-05-00-00-en-008

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: <ul style="list-style-type: none"> - 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 <ul style="list-style-type: none"> - 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 <ul style="list-style-type: none"> - 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: <ul style="list-style-type: none"> - DIRECT: the transducer block value bypasses the scaling functions - INDIRECT: the transducer block value is fed through the linear scaling functions - INDIRECT SQRT: the transducer block value is fed through the square root scaling functions

The relationship between the output values and scaling parameters for the Micropilot M 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: <ul style="list-style-type: none">- 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: Win95, Win98, WinNT4.0 and Win2000.

The ToF Tool supports the following functions:

- Online configuration of transmitters
- Signal analysis via envelope curve
- Loading and saving of instrument data (Upload/Download)
- Documentation of measuring point



Note!

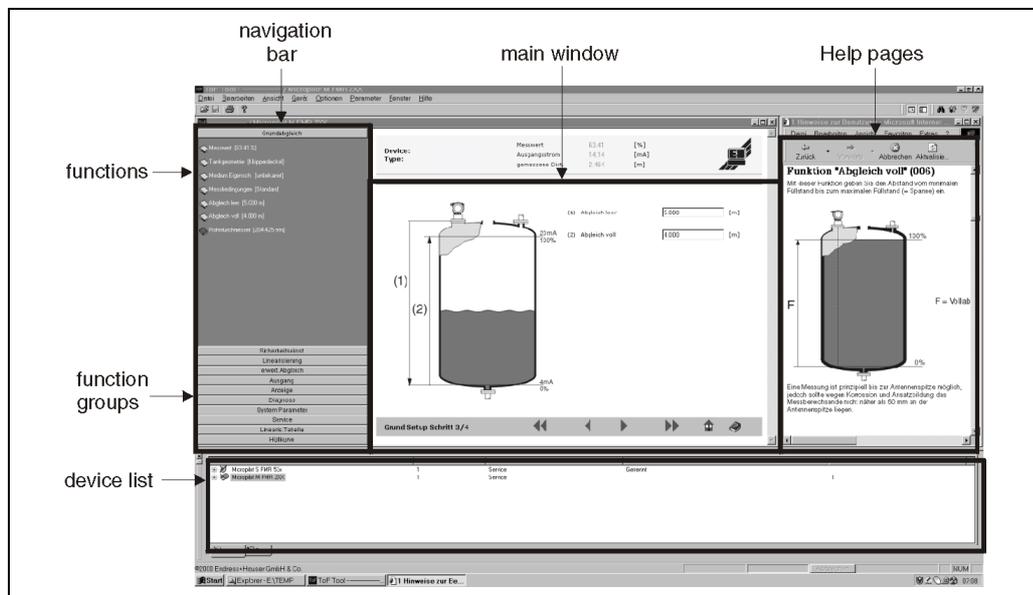
The parameters of the Analog-Input block are presently not accessible via ToF Tool.



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

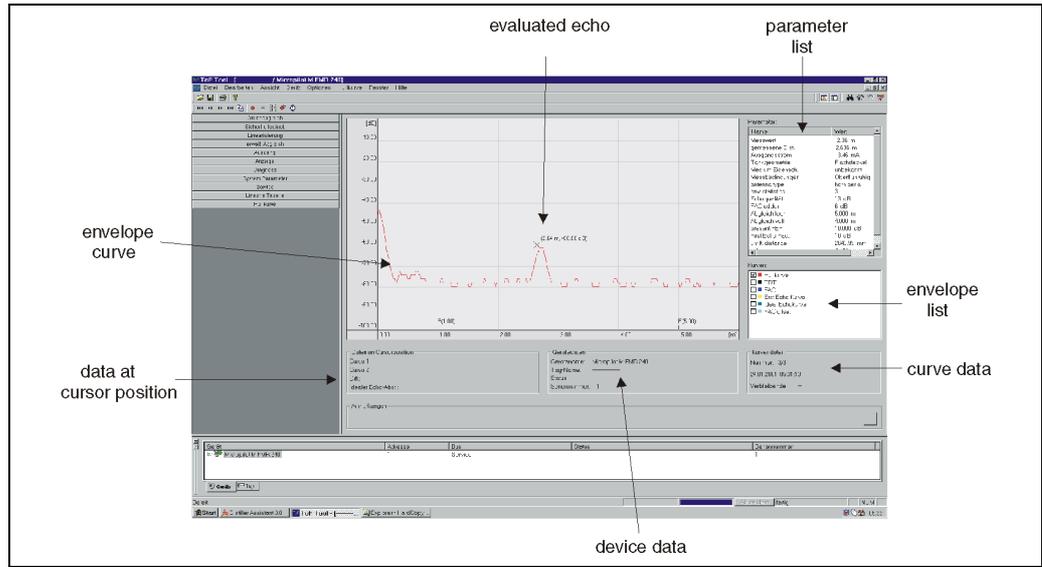


L00-FMU4xxxx-19-00-00-en-003

- 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:

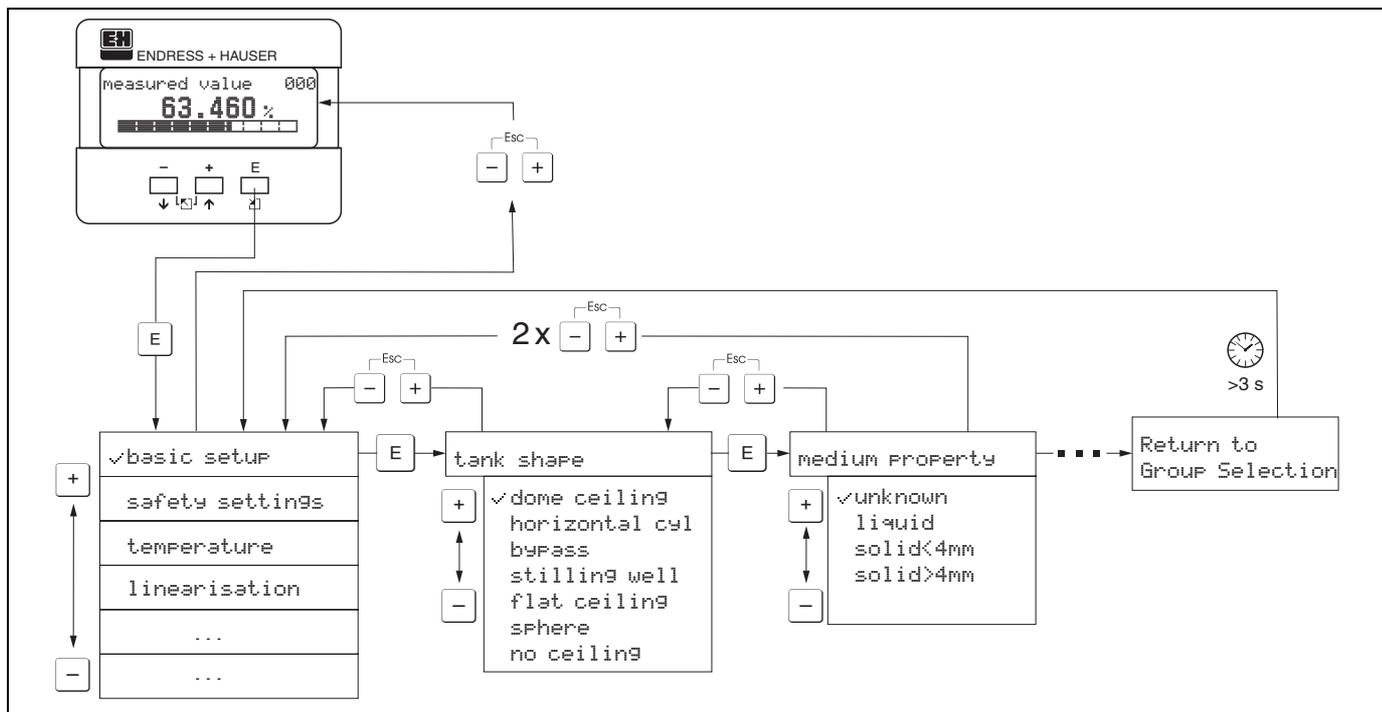


L00-FMU4xxxx-19-00-00-en-004

Connection

- Service-Interface with adapter FXA 193

5.4 Operation using the on-site display VU 331



L00-FMU4xxxx-19-00-00-en-018

1. Change from Measured Value Display to **Group Selection** by pressing \boxed{E} .
2. Press $\boxed{-}$ or $\boxed{+}$ to select the required **Function Group** and confirm by pressing \boxed{E} . The active selection is marked by a ✓ in front of the menu text.
3. Activate Edit mode with $\boxed{+}$ or $\boxed{-}$.

Selection menus

- a. Select the required **Parameter** in selected **function** with $\boxed{-}$ oder $\boxed{+}$.
- b. \boxed{E} confirms selection; ✓ appears in front of the selected parameter.
- c. \boxed{E} confirms the edited value; system quits edit mode.
- d. $\boxed{+}$ and $\boxed{-}$ (= $\boxed{\uparrow}$) interrupts selection; system quits edit mode.

Typing in numerals and text

- a. Press $\boxed{+}$ or $\boxed{-}$ to edit the first character of the **numeral / text**.
 - b. \boxed{E} positions the cursor at the next character; continue with a. until you have completed your input.
 - c. If a \downarrow symbol appears at the cursor, press \boxed{E} to accept the value entered; system quits edit mode.
 - d. If a \leftarrow symbol appears at the cursor, press \boxed{E} to return to the previous character (e.g. for correction of entries).
 - e. $\boxed{+}$ and $\boxed{-}$ (= $\boxed{\uparrow}$) interrupts selection; system quits edit mode.
4. Press \boxed{E} to select the next **function**.
 5. Press $\boxed{+}$ and $\boxed{-}$ (= $\boxed{\uparrow}$) once; return to previous **function**. Press $\boxed{+}$ and $\boxed{-}$ (= $\boxed{\uparrow}$) twice; return to **Group Selection**.
 6. Press $\boxed{+}$ and $\boxed{-}$ (= $\boxed{\uparrow}$) 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"

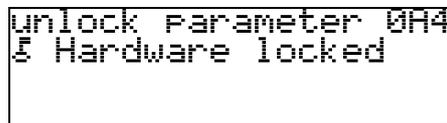
Now change the parameters.

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-fmxd0a4-20-00-00-ds-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

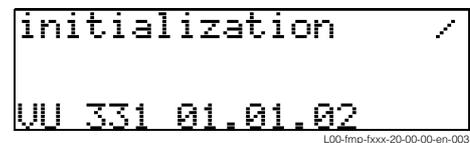
Commission the Prosonic M in the following stages:

- 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.

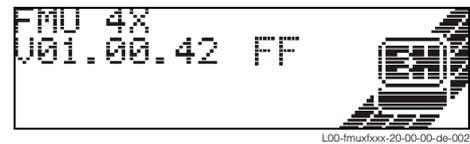
6.1 Power up instrument

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



Then the following appear for approximately five seconds:

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

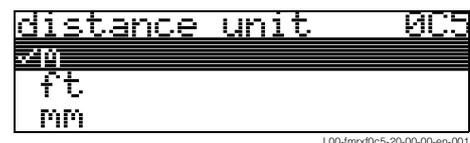


Press **[E]** to exit this display.

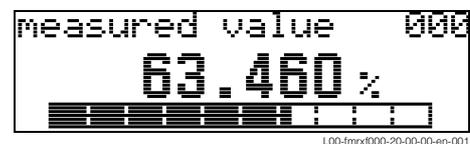
On first power-up, you are requested to select the language for the display texts.



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



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



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



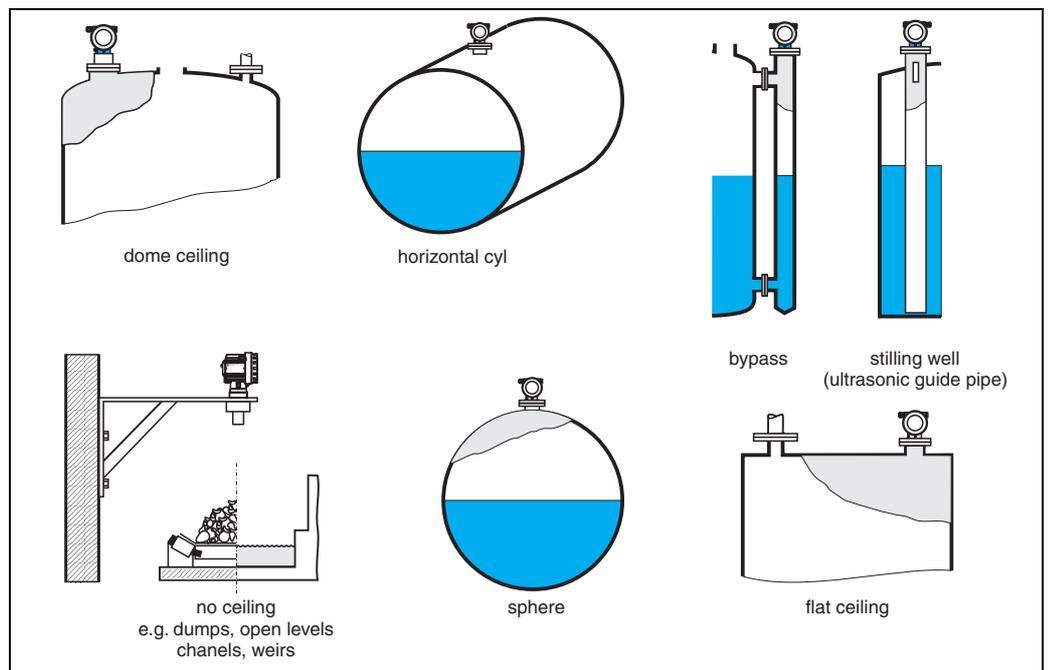
6.2 Basic calibration

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

6.2.1 Measuring point settings

Function "tank shape" (002)

In this function, select one of the following options:



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

Function "medium property" (003)

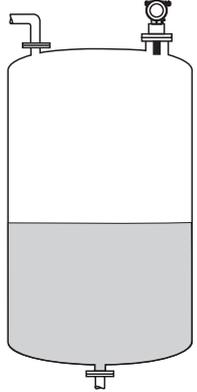
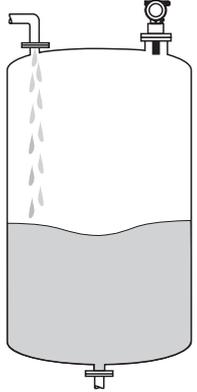
Set the medium type in this function.

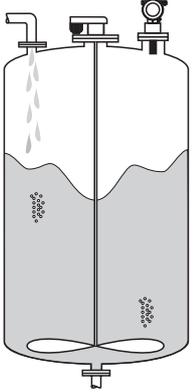
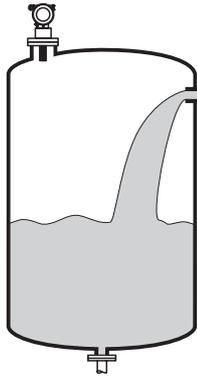
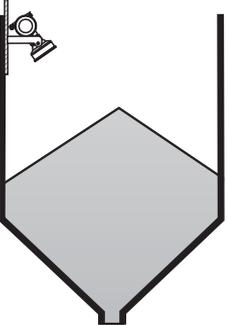
You have the following options:

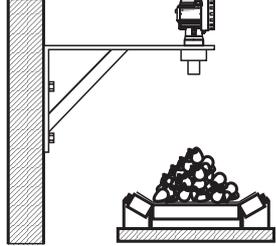
- unknown (e.g. pasty media such as greases, creams, gels etc.)
- liquid
- solid, grain size < 4mm (fine)
- solid, grain size > 4mm (coarse)

Function "process conditions" (004)

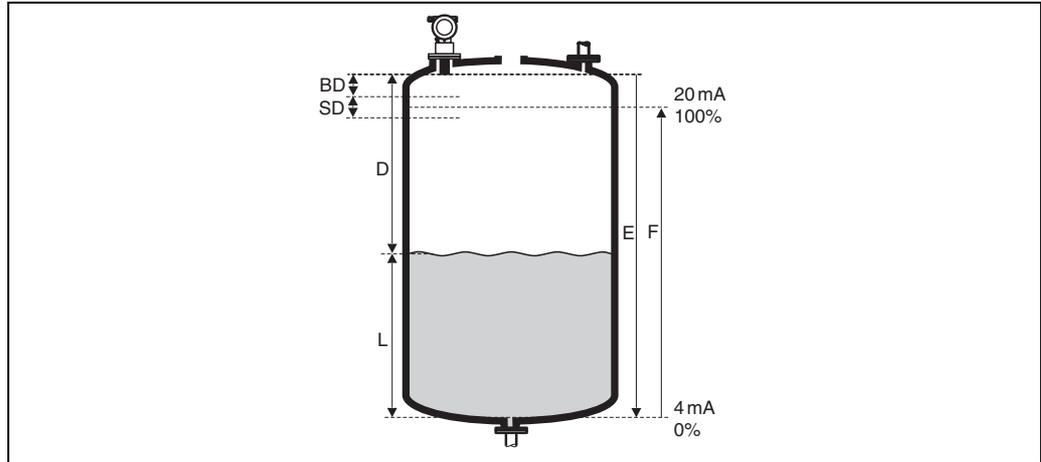
For this function, you have the following options:

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
	 <p style="text-align: center; font-size: small;">L00-FMU4xxxx-14-00-00-xx-001</p>	 <p style="text-align: center; font-size: small;">L00-FMU4xxxx-14-00-00-xx-002</p>
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.
 <p style="text-align: center; font-size: small;">L00-FMU4xxxx-14-00-00-xx-003</p>	 <p style="text-align: center; font-size: small;">L00-FMU4xxxx-14-00-00-xx-004</p>	 <p style="text-align: center; font-size: small;">L00-FMU4xxxx-14-00-00-xx-006</p>
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
<p>Dusty bulk solids</p>	<p>Bulk solids with rapid level change</p>	<p>All the filters can be switched off for purposes of service and diagnosis.</p>
 <p style="text-align: center; font-size: small;">L00-FMU4xxxx-14-00-00-xx-007</p>	 <p style="text-align: center; font-size: small;">L00-FMU4xxxx-14-00-00-xx-005</p>	
<p>The filters are set to detect even relatively weak signals.</p>	<p>The averaging filters are set to small values. -> Rapid reaction time Possibly unstable measured value</p>	<p>All filters off</p>

6.2.2 Empty and full calibration



Function "empty calibration" (005)

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



Caution!

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

Function "blocking distance" (059)

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



Caution!

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



Note!

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

Function "full calibration" (006)

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

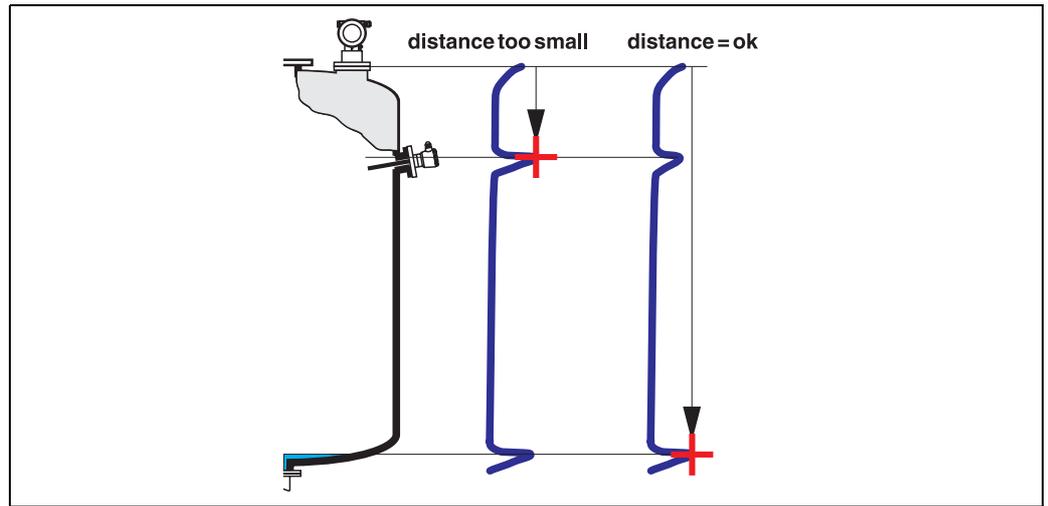
6.2.3 Interference echo suppression (tank mapping)

Function "dist./measured value" (008)

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

Function "check distance" (051)

The mapping is initialized by this function.



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

Select

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

Function "range of mapping" (052)

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



Caution!

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

Function "start mapping" (053)

You have the following options for this function:

- **off**: Nothing is suppressed.
- **on**: Starts suppression.



Note!

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

Function dist./measured value (008)

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

The following cases may occur:

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

Rücksprung zur Gruppenauswahl

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

6.3 Envelope curve

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

6.3.1 Function "plot settings" (0E1)

In this function, select whether you want to display

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



Note!

The FAC and the interference echo suppression (map) are explained in BA 240F "Prosonic M - Description of Instrument Functions"

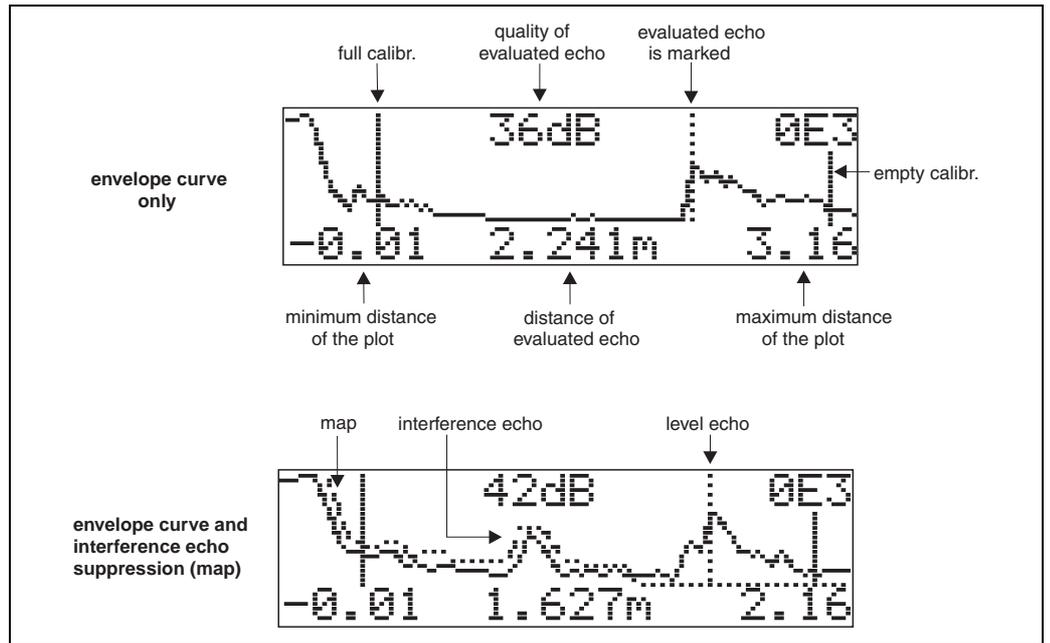
6.3.2 Function "recording curve" (0E2)

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" (OE3)

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.

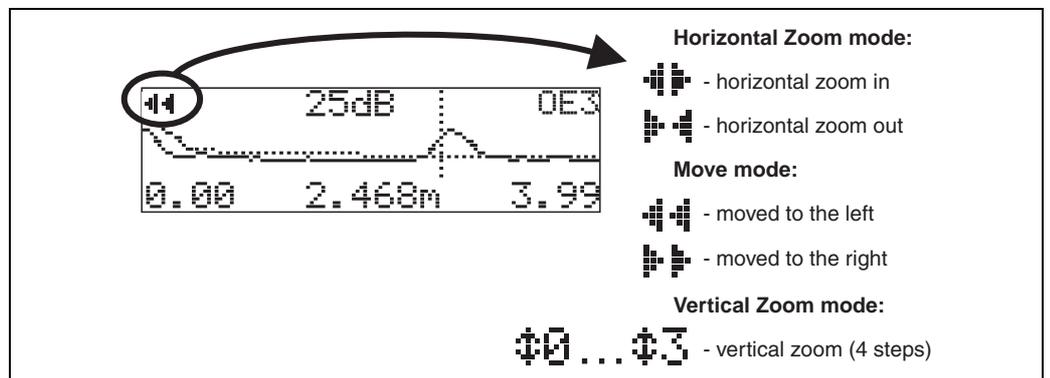


Note!

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.

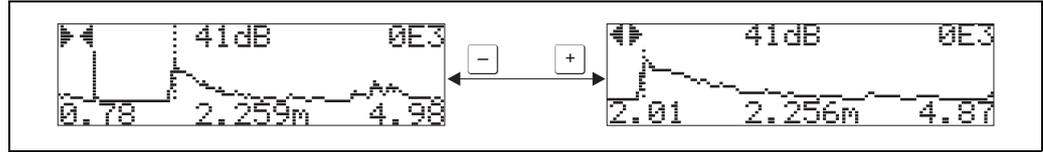


L00-FMxxxxxx-07-00-00-en-004

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 \mathbb{H} or \mathbb{H} is displayed.

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

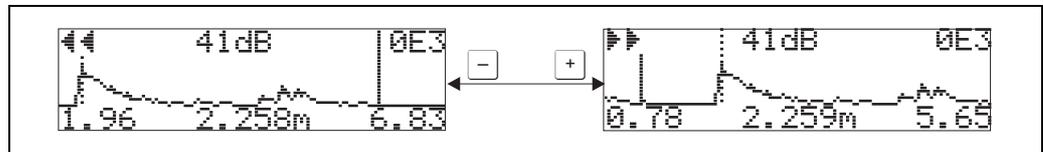


L00-FMxxxxxx-07-00-00-yy-007

Move mode

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

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



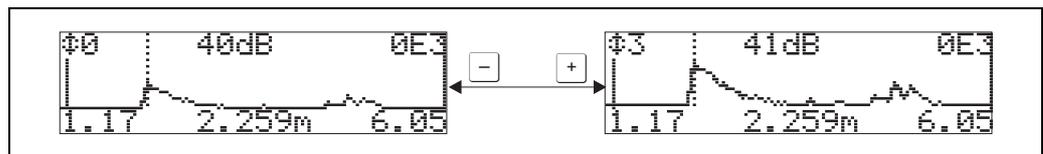
L00-FMxxxxxx-07-00-00-yy-008

Vertical Zoom mode

Press \boxed{E} once more to switch to Vertical Zoom mode. $\mathbb{1}$ 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 ($\mathbb{0}$ to $\mathbb{3}$).



L00-FMxxxxxx-07-00-00-yy-009

Exiting the navigation

- Press \boxed{E} again to run through the different modes of the envelope curve navigation.
- Press $\boxed{+}$ and $\boxed{-}$ to exit the navigation. The set increases and shifts are retained. Only when you reactivate the "recording curve" (**0E2**) function the display settings return to their standard values.

7 Troubleshooting

7.1 System error messages

7.1.1 Current error

Errors which the Prosonic M detects during commissioning or operation are displayed:

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

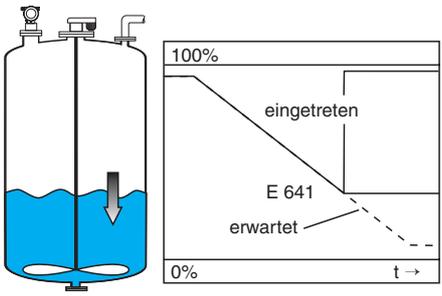
Type of error	Symbol	Meaning
Alarm (A)	 continuous	The output signal assumes a value which can be set using the "output on alarm" (010) function: <ul style="list-style-type: none"> • MAX: 110% • MIN: -10% • Hold: last value is on hold • User-specific value
Warning (W)	 flashing	The device continues measurement. 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
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 linearisation points	Enter additional value pairs
W621	simulation on	Switch simulation mode off [" output " (06) function group, " simulation " (065) function]]
E641	no usable echo	Check basic calibration
E651	level in safety distance - risk of overspill	Error disappears when the level leaves the safety distance. Possibly reset the lock. [" safety settings " (01) function group, " ackn. alarm " (017) function]]
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
<p>Measured value (00) is incorrect but measured distance (008) is correct</p>	<p>L00-FMR2xxxx-19-00-00-en-019</p>	<ol style="list-style-type: none"> 1. Check empty calibration (005) and full calibration (006). 2. Check linearisation <ul style="list-style-type: none"> - level/ullage (040) - max. scale(046) - diameter vessel(047) - linearisation table
<p>Measured value (000) and measured distance (008) are incorrect</p>	<p>L00-FMR2xxxx-19-00-00-en-019</p>	<ol style="list-style-type: none"> 1. For measurements in bypass or stilling well: Select the according option in the "tank shape" (002) function. 2. Carry out interference echo suppression.
<p>No change in measured value on filling/emptying</p>	<p>L00-FMR2xxxx-19-00-00-en-014</p>	<ol style="list-style-type: none"> 1. Carry out interference echo suppression. 2. Clean sensor if necessary 3. If necessary, select better installation position
<p>With an uneven surface (e.g. filling, emptying, running agitator) the measured value may jump sporadically to higher levels</p>	<p>L00-FMR2xxxx-19-00-00-en-015</p>	<ol style="list-style-type: none"> 1. Carry out interference echo suppression 2. Set the process cond. (004) to "calm surface" or "add. agitator" 3. Increase output damping (058). 4. If necessary, select a different installation position and/or a larger sensor
<p>On filling/emptying the measured value drops</p>	<p>L00-FMR2xxxx-19-00-00-en-016</p>	<ol style="list-style-type: none"> 1. Check tank shape (002), e.g. "dome ceiling" or "horizontal cyl." 2. If possible, do not select a central installation position 3. Possible user stilling well/echo guide pipe
<p>On filling/emptying the measured value drops</p>	<p>L00-FMR2xxxx-19-00-00-en-017</p>	<ol style="list-style-type: none"> 1. Check tank shape (002), e.g. "dome ceiling" or "horizontal cyl." 2. If possible, do not select a central installation position 3. Possible user stilling well/echo guide pipe

Error	Example	Elimination
<p>E 641 (echo loss)</p>	 <p style="text-align: center; font-size: small;">L00-FMR2xxxx-19-00-00-en-018</p>	<ol style="list-style-type: none"> 1. Check application parameters (002), (003) and (004) 2. If necessary, select a different installation position and/or a 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 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)

Housing F12

standard, complete pre-mounted, incl. nameplate, cable gland and Teflon filter

543 120 - 0022	G ½" cable gland
543 120 - 0023	NPT ½" cable gland
543 120 - 0024	M20 x 1.5 cable gland
5200 1992	M12 PROFIBUS PA plug
5200 8556	7/8 UNC Fieldbus Foundation plug
5201 3348	4-wire, G ½" cable gland
5201 3350	4-wire M20 x 1,5 cable gland

The spare parts listed are generally suitable for use in Ex-devices

Power supply for 4wire electronics
 10... 32 V DC 5201 3304
 90...253 V AC 5201 3305

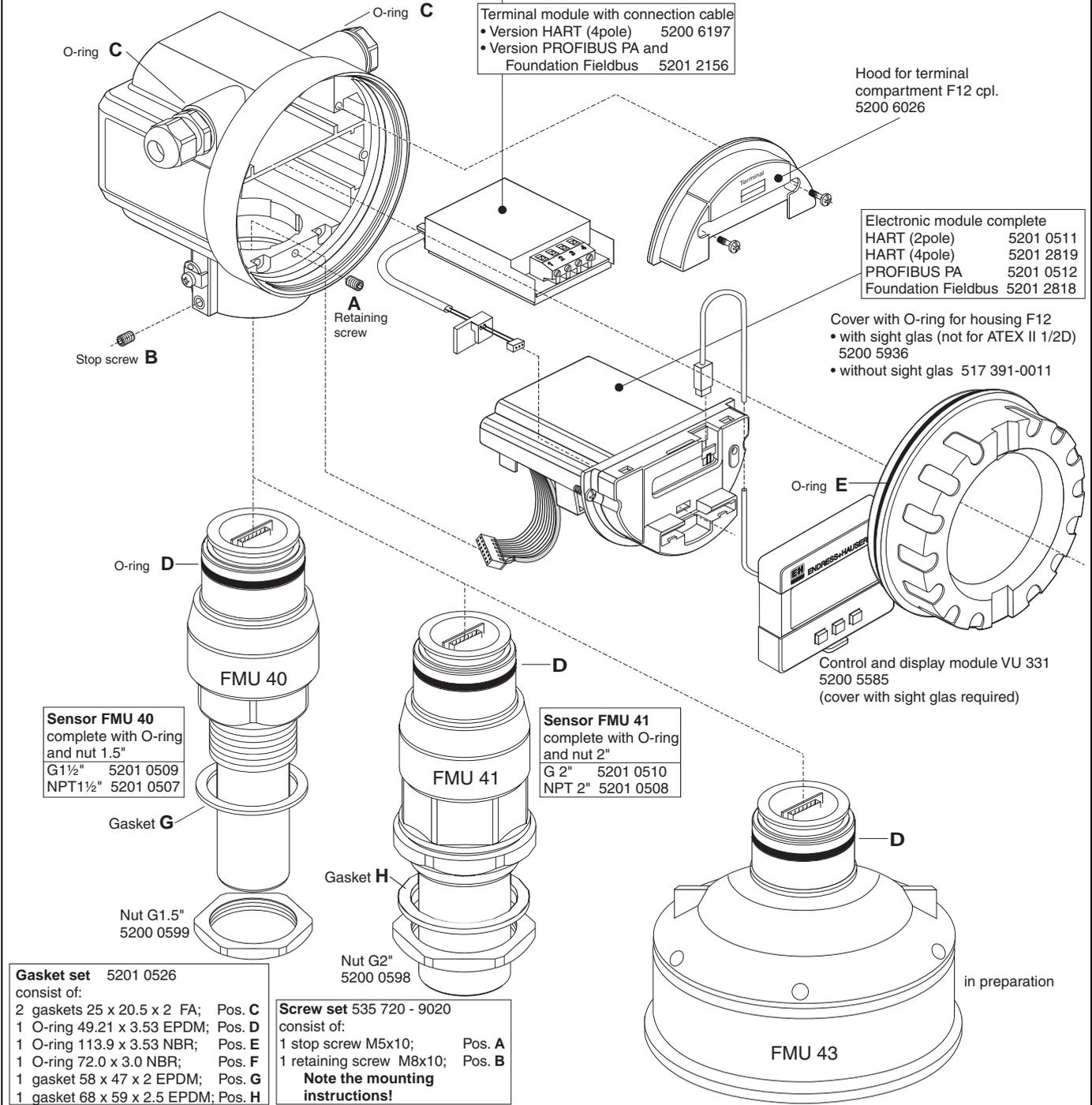
Terminal module with connection cable
 • Version HART (4pole) 5200 6197
 • Version PROFIBUS PA and Foundation Fieldbus 5201 2156

Hood for terminal compartment F12 cpl. 5200 6026

Electronic module complete
 HART (2pole) 5201 0511
 HART (4pole) 5201 2819
 PROFIBUS PA 5201 0512
 Foundation Fieldbus 5201 2818

Cover with O-ring for housing F12
 • with sight glas (not for ATEX II 1/2D) 5200 5936
 • without sight glas 517 391-0011

Control and display module VU 331 5200 5585
 (cover with sight glas required)



Sensor FMU 40
 complete with O-ring and nut 1.5"
 G1½" 5201 0509
 NPT1½" 5201 0507

Sensor FMU 41
 complete with O-ring and nut 2"
 G 2" 5201 0510
 NPT 2" 5201 0508

Gasket set 5201 0526
 consist of:
 2 gaskets 25 x 20.5 x 2 FA; Pos. C
 1 O-ring 49.21 x 3.53 EPDM; Pos. D
 1 O-ring 113.9 x 3.53 NBR; Pos. E
 1 O-ring 72.0 x 3.0 NBR; Pos. F
 1 gasket 58 x 47 x 2 EPDM; Pos. G
 1 gasket 68 x 59 x 2.5 EPDM; Pos. H

Screw set 535 720 - 9020
 consist of:
 1 stop screw M5x10; Pos. A
 1 retaining screw M8x10; Pos. B
Note the mounting instructions!

8.6 Spare parts (housing type T12)

Housing T12
complete pre-mounted with lid for terminal compartment

cable gland/entry	certificate		
	EEx d (ia)	FM XP	CSA XP
G 1/2"	5200 6204		
NPT 1/2"	543180-1023	543180-1023	543180-1023
M20 x 1.5	5200 6205		

Cable glands for Ex-devices may only be replaced with the same type (observe marking on packaging and permissible temp. range, T > 75° C).

The spare parts listed are generally suitable for use in Ex-devices

F O-ring

Cover 518 710 - 0020
(the cover is already included when ordering a housing)

Terminal module T12
HART (2-wire) 5201 3302
PA/FF 52013303

Electronic module complete
HART (2wire) 5201 0511
PA 5201 0512
FF 5201 2818

Control and display module VU 331
5200 5585
(requires lid with sight glass)

Cover plate T12
5200 5643

O-Ring **C**

Set screw **B**

Retaining screw **A**

O-ring **E**

Cover with O-ring for housing T12
• with sight glass (not for ATEX II 1/2D) 5200 5936
• without sight glass 517 391-0011

D

FMU 40

Sensor FMU 40
complete with O-ring and nut 1.5"
G 1/2" 5201 0509
NPT 1/2" 5201 0507

Gasket **G**

Nut G 1.5" 5200 0599

D

FMU 41

Sensor FMU 41
complete with O-ring and nut 2"
G 2" 5201 0510
NPT 2" 5201 0508

Gasket **H**

Nut G 2" 5200 0598

Screw set 535 720 - 9020
consist of:
1 stop screw M5x10; Pos. **A**
1 retaining screw M8x10; Pos. **B**
Note the mounting instructions!

Gasket set 5201 0526
consist of:
2 gaskets 25 x 20.5 x 2 FA; Pos. **C**
1 O-ring 49.21 x 3.53 EPDM; Pos. **D**
1 O-ring 113.9 x 3.53 NBR; Pos. **E**
1 O-ring 72.0 x 3.0 NBR; Pos. **F**
1 gasket 58 x 47 x 2 EPDM; Pos. **G**
1 gasket 68 x 59 x 2.5 EPDM; Pos. **H**

L00-FMU4xxxx-09-00-00-en-002

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: <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • FMU 42 added • compatible with HART Communicator DXR 375 	FMU 42 added

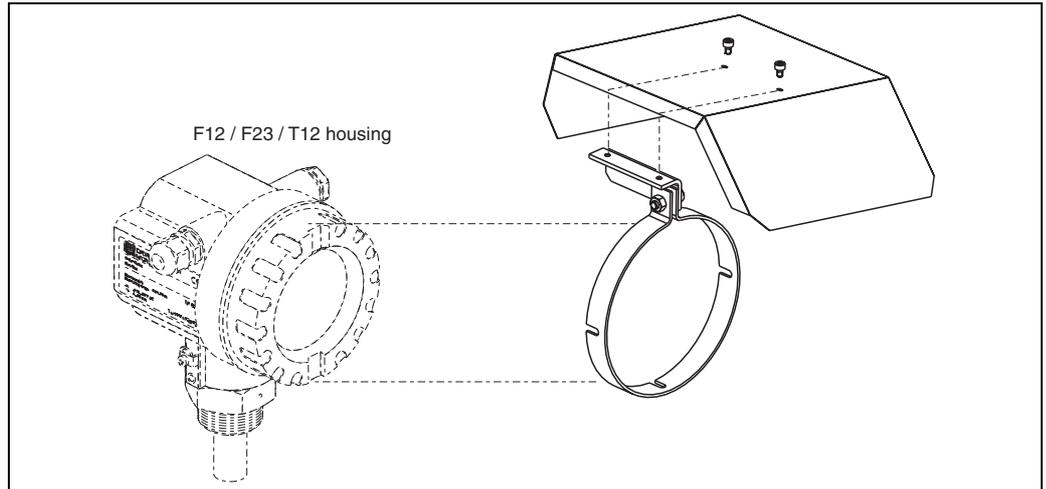
8.10 Contact addresses of Endress+Hauser

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

9 Accessories

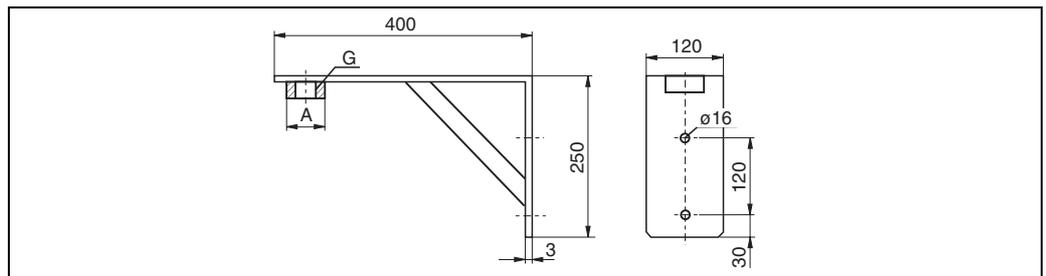
9.1 Weather protection cover

A Weather protection cover made of stainless steel is available 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

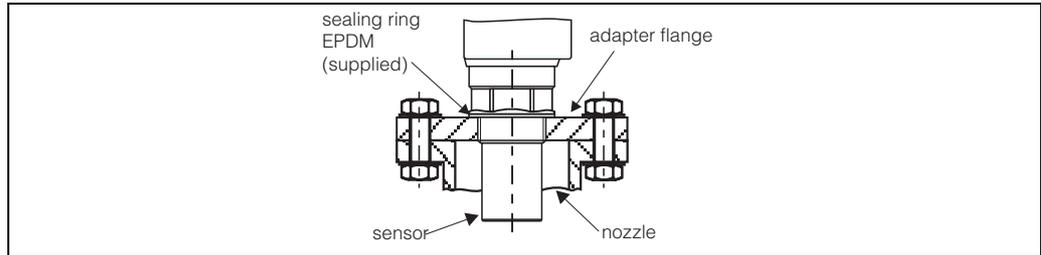


L00-FMU4x-00-00-00-de-001

- 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-FMUK3XXX-00-00-00-en-001

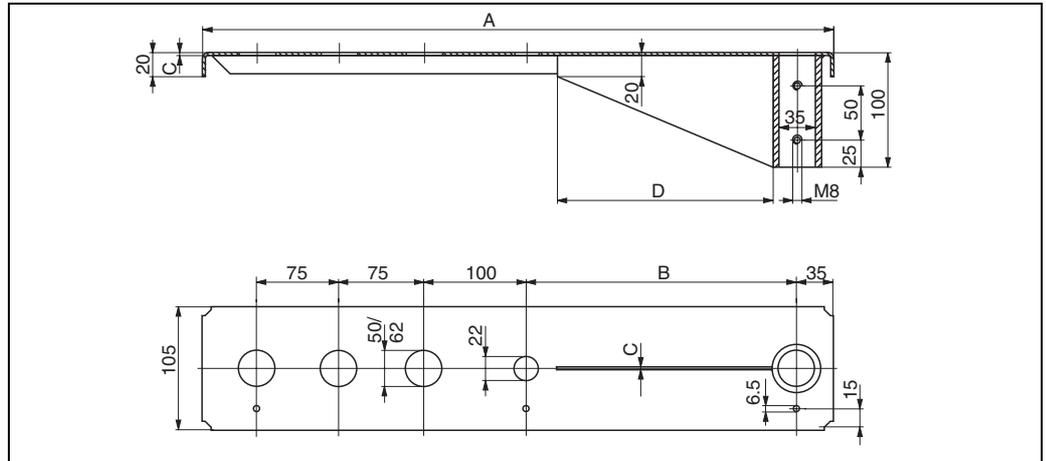
9.3.1 Version with metrical thread (FAU 70 E)

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

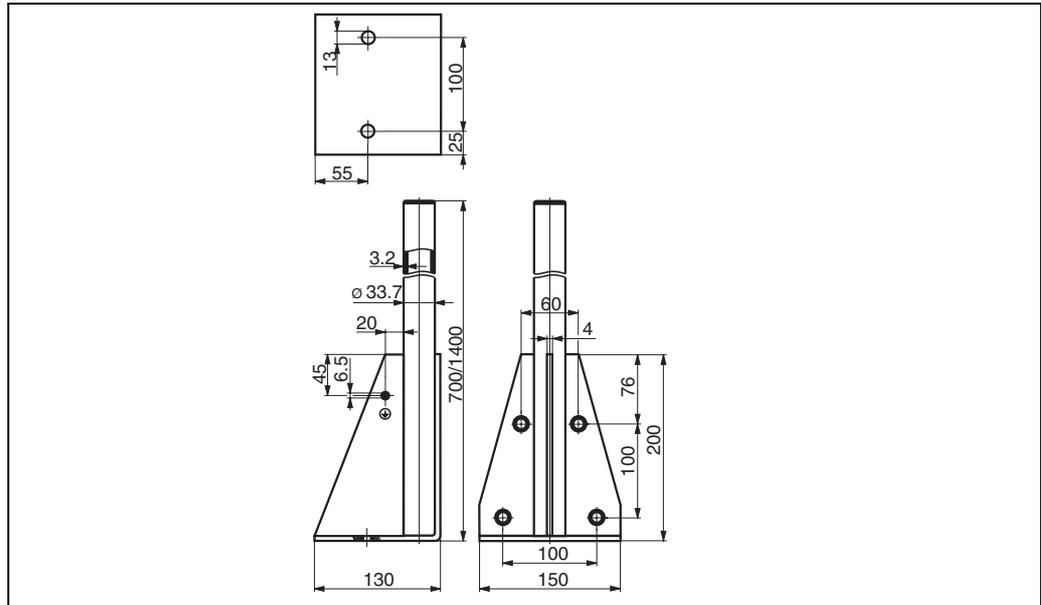


L00-FMU4xxxx-06-00-00-yy-005

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

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

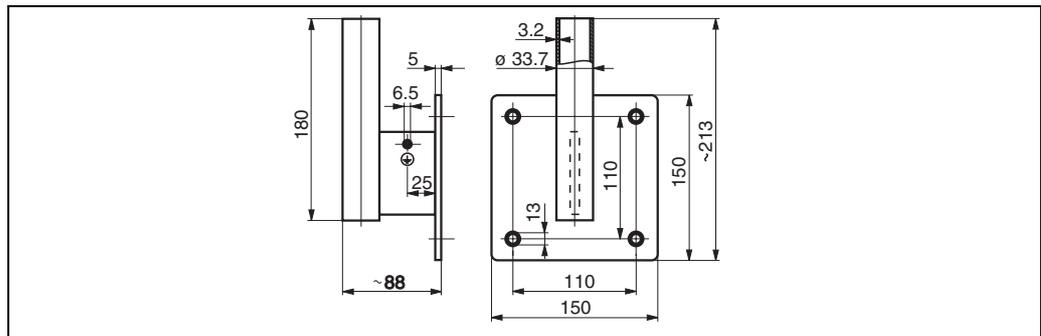
9.5 Mounting Frame for Cantilever



L00-FMU4x-00-00-00-yy-005

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

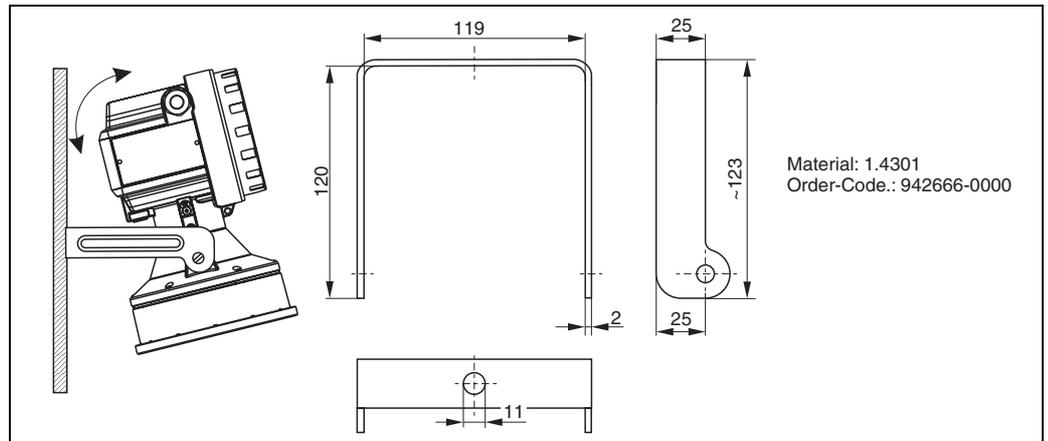
9.6 Wall Bracket for Cantilever



L00-FMU4x-00-00-00-yy-006

Material	Order Code
galv. steel	919792-0000
1.4301 (AISI 304)	919792-0001

9.7 Mounting bracket for FMU 43



9.8 Service Interface FXA 193

For communication with ToF Tool via the display connector.

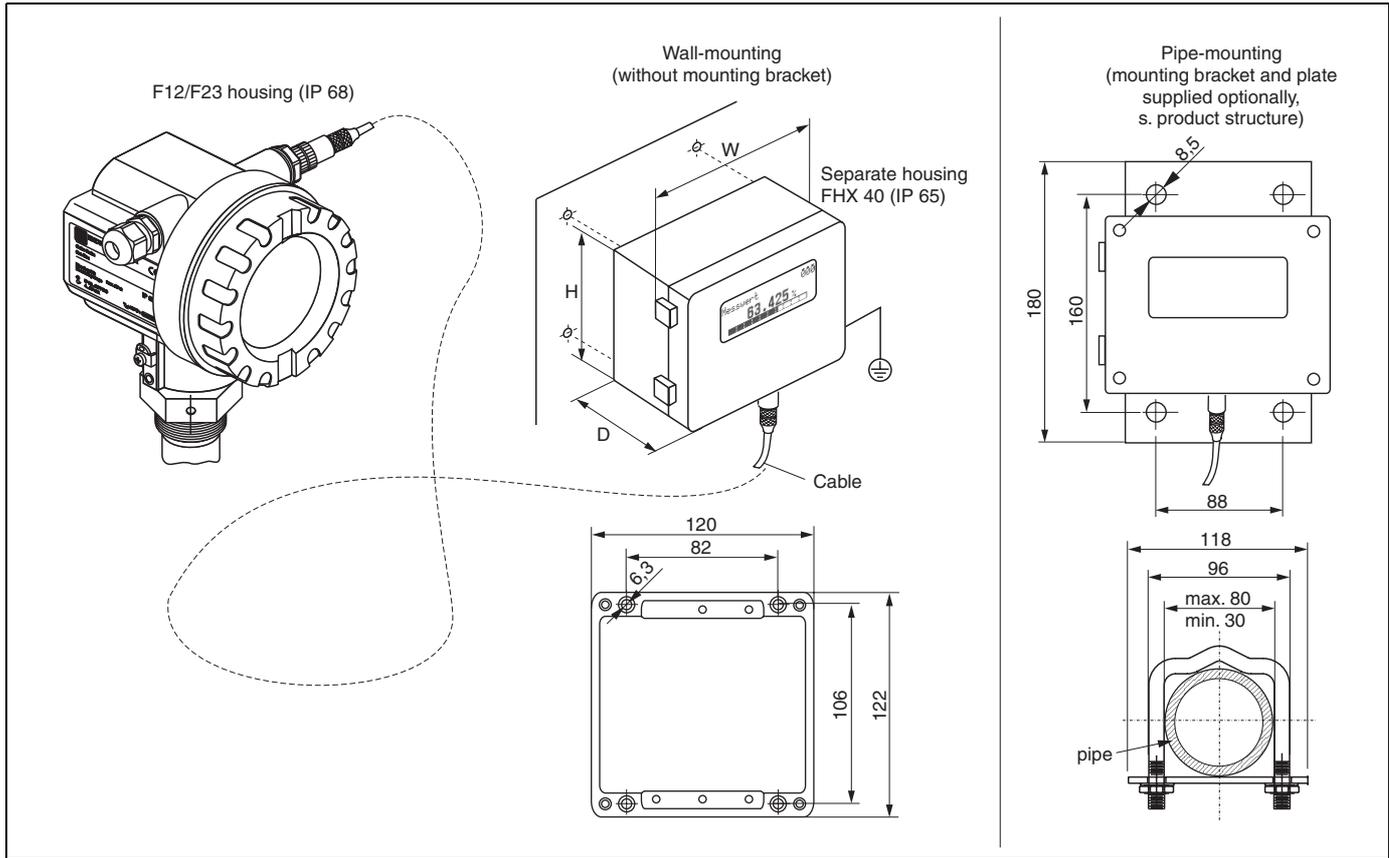
Ordering structure:

- FXA 193-A: for use in non-hazardous area
- FXA 193-B: for use in hazardous area (ATEX, CSA, FM)

The connection to a ToF device needs an additional FXA connection cable (order code.: 50101787).

9.9 Remote display FHX 40

9.9.1 Dimensions



L00-FMxxxxxx-00-00-06-en-003

9.9.2 Technical data and ordering 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)
Material for housing	Alloy of Aluminium AL Si 12
Dimensions [mm] / [inch]	122x150x80 (HxBxT) / 4.8x5.9x3.2

Certificates	
A	For non-hazardous area
1	ATEX II 2 G EEx ia IIC T6, ATEX II 3D
S	FM IS Class I Div. 1, Groups A,B,C,D
U	CSA IS Class I, Div. 1, Groups A,B,C,D
N	CSA General Purpose (in preparation)
Cable length	
1	20 m cable
Additional option	
A	Additional option not selected
B	Mounting bracket 1" or 2" pipe
FHX 40 -	Complete product designation

10 Technical Data

10.1 Technical data at a glance

10.1.1 Input

Measured variable	<p>The distance D between the sensor membrane and the product surface is measured.</p> <p>Using the linearisation function, the device uses D to calculate:</p> <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Cable gland M20x1.5 (recommended cable diameter 6 ... 10 mm) • Cable entry G$\frac{1}{2}$ or $\frac{1}{2}$ NPT • 7/8" Foundation Fieldbus plug
-------------	--

Supply voltage	<p>9 V ... 32 V</p> <p>There may be additional restrictions for devices with an explosion protection certificate. Refer to the notes in the appropriate safety instructions (XA).</p>
----------------	---

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	±2mm or 0.2% of set measuring range ¹
FMU 41	± 2 mm or 0,2% of set measuring range ¹
FMU 42	± 4 mm or 0,2% of set measuring range ¹
FMU 43	± 4 mm or 0,2% of set measuring range 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/s²)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

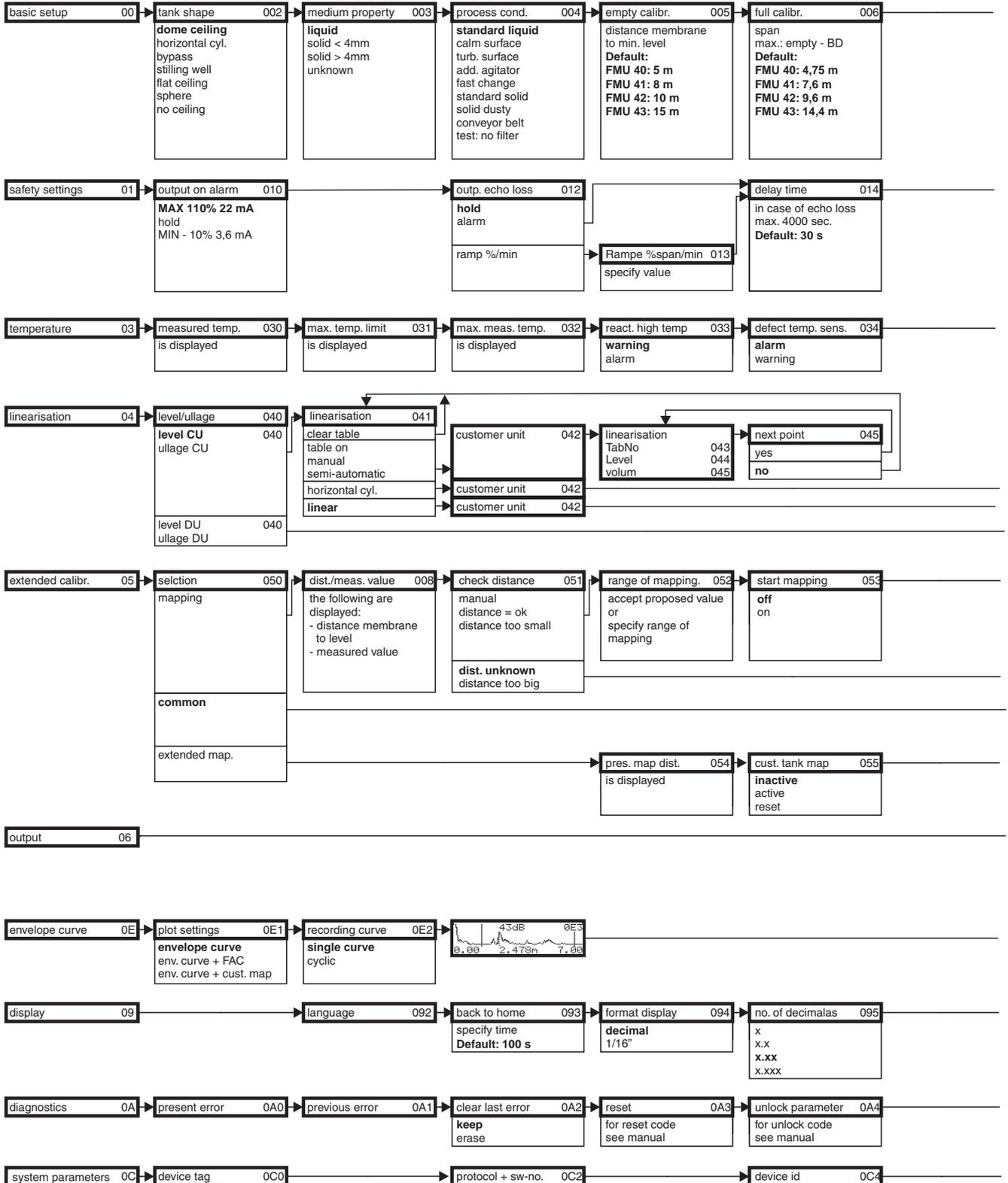
A temperature sensor is integrated in the sensor for temperature-dependent time-of-flight correction.

Process pressure

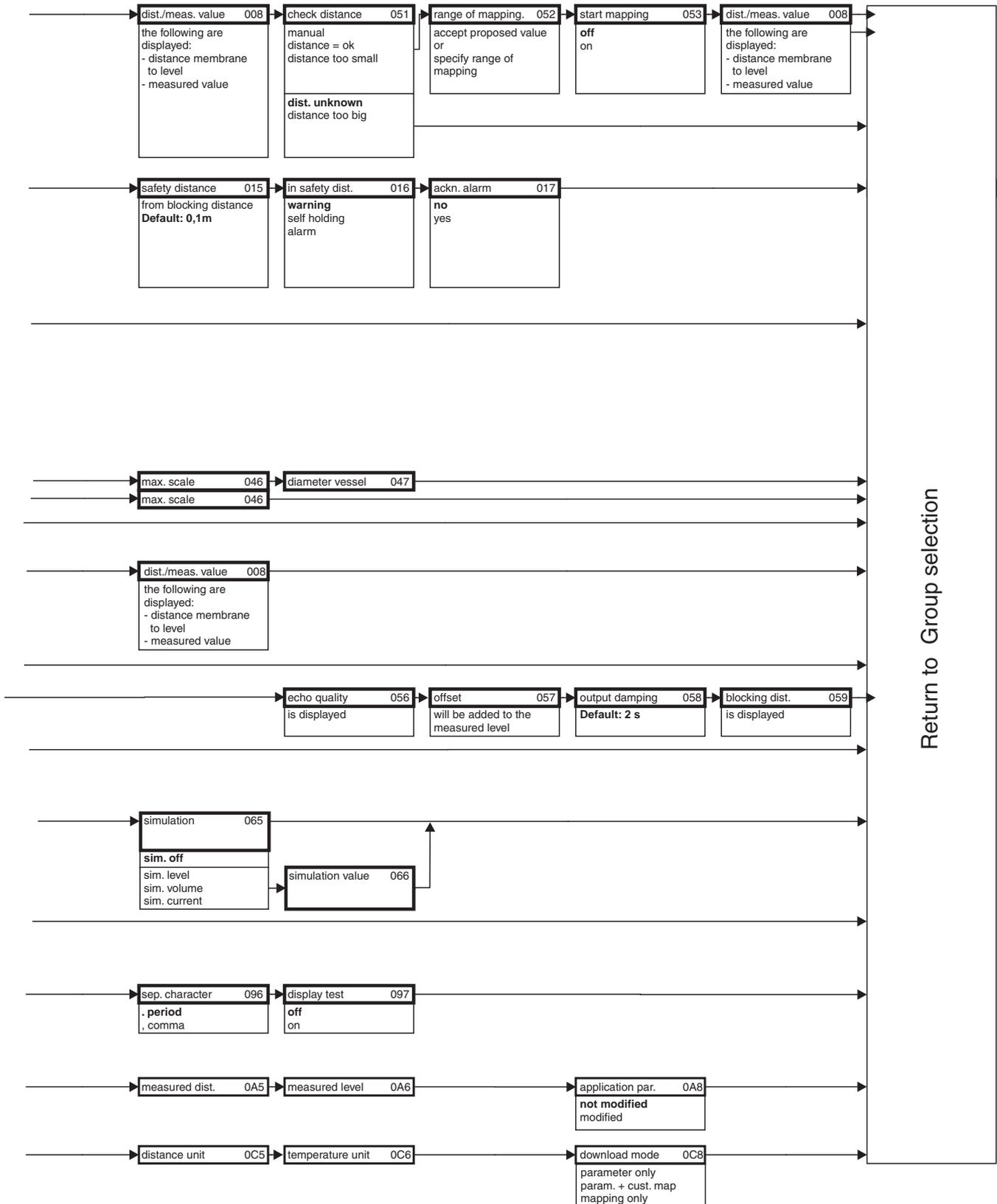
- FMU 40/41: 3bar abs.
- FMU 42/43: 2,5bar abs.

11 Appendix

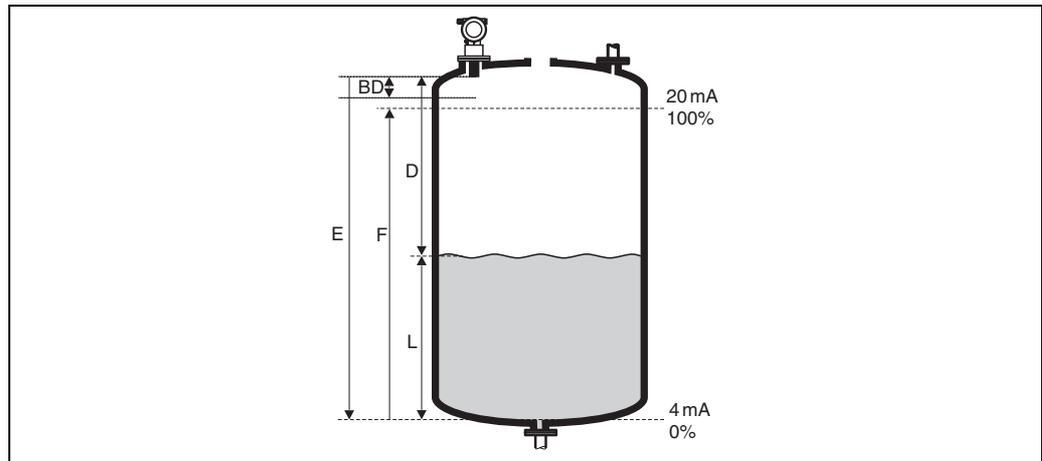
11.1 Operating menu



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



11.2 Measuring principle



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

Sensor	BD	Max. range fluids	Max. range bulk materials
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.

Index

A

adapter flange	62
alarm	53
application errors	55

B

blocking distance	14, 48
-----------------------------	--------

C

cantilever	63
CE mark	7
cleaning	57
connection	17

D

declaration of conformity	7
declaration of contamination	60
display appearance	22
display symbols	22

E

error codes	54
error messages	53

F

flow measurements	12
full calibration	48

H

hardware security locking	42
hazardous area	4

I

installation bracket	61
interference echo suppression	49

K

Khafagi-Venturi flume	12
---------------------------------	----

L

level measurements	11
------------------------------	----

M

measuring principle	72
Measuring range	14

N

nozzle	14
------------------	----

O

on-site display	41
operating menu	70

P

process conditions	46
------------------------------	----

R

range	15
-----------------	----

repairs to Ex-approved devices	57
return	60

S

service adapter FXA 193	65
shafts	11
software security locking	42

T

turn housing	16
------------------------	----

W

warning	53
weather protection cover	61

Declaration of contamination

Dear customer,

Because of legal determinations and for the safety of our employes and operating equipment we need this "Declaration of contamination" with your signature before your order can be handled. Please put the completely filled in declaration to the instrument and to the shipping documents in any case. Add also safety sheets and/or specific handling instructions if necessary.

type of instrument / sensor: _____ serial number: _____

medium / concentration: _____ temperature: _____ pressure: _____

cleaned with: _____ conductivity: _____ viscosity: _____

Warning hints for medium used:



radioactive



explosive



caustic



poisonous



harmful of
health



biological
hazardous



inflammable



safe

Please mark the appropriate warning hints.

Reason for return:

Company data:

company: _____	contact person: _____
_____	_____
_____	department: _____
address: _____	phone number: _____
_____	Fax/E-Mail: _____
_____	your order no.: _____

I hereby certify that the returned equipment has been cleaned and decontaminated acc. to good industrial practices and is in compliance with all regulations. This equipment poses no health or safety risks due to contamination.

(Date)

(company stamp and legally binding signature)

More information about services and repairs:
www.services.endress.com

Endress+Hauser
The Power of Know How



Europe

Austria – Wien

□ Endress+Hauser Ges.m.b.H.
Tel. (01) 88 05 60, Fax (01) 88 05 63 35

Belarus – Minsk

Belorgsintez
Tel. (017) 2 50 84 73, Fax (017) 2 50 85 83

Belgium / Luxembourg – Bruxelles

□ Endress+Hauser S.A. / N.V.
Tel. (02) 2 48 06 00, Fax (02) 2 48 05 53

Bulgaria – Sofia

Intertech-Automation Ltd.
Tel. (02) 9 62 71 52, Fax (02) 9 62 14 71

Croatia – Zagreb

□ Endress+Hauser GmbH+Co.
Tel. (01) 6 63 77 85, Fax (01) 6 63 78 23

Cyprus – Nicosia

I+G Electrical Services Co. Ltd.
Tel. (02) 48 47 88, Fax (02) 48 46 90

Czech Republic – Praha

□ Endress+Hauser Czech s.r.o.
Tel. (02) 66 78 42 00, Fax (026) 66 78 41 79

Denmark – Søborg

□ Endress+Hauser A/S
Tel. (70) 13 11 32, Fax (70) 13 21 33

Estonia – Tartu

Elvi-Aqua OÜ
Tel. (7) 30 27 32, Fax (7) 30 27 31

Finland – Helsinki

□ Metso Endress+Hauser Oy
Tel. (204) 8 31 60, Fax (204) 8 31 61

France – Huningue

□ Endress+Hauser S.A.
Tel. (389) 69 67 68, Fax (389) 69 48 02

Germany – Weil am Rhein

□ Endress+Hauser Messtechnik GmbH+Co. KG
Tel. (07621) 9 75 01, Fax (07621) 97 55 55

Great Britain – Manchester

□ Endress+Hauser Ltd.
Tel. (0161) 2 86 50 00, Fax (0161) 9 98 18 41

Greece – Athens

I & G Building Services Automation S.A.
Tel. (01) 9 24 15 00, Fax (01) 9 22 17 14

Hungary – Budapest

□ Endress+Hauser Magyarország
Tel. (01) 4 12 04 21, Fax (01) 4 12 04 24

Iceland – Reykjavik

Sindra-Stál hf
Tel. 5 75 00 00, Fax 5 75 00 10

Ireland – Clane / County Kildare

□ Flomeaco Endress+Hauser Ltd.
Tel. (045) 86 86 15, Fax (045) 86 81 82

Italy – Cernusco s/N, Milano

□ Endress+Hauser S.p.A.
Tel. (02) 92 19 21, Fax (02) 92 19 23 62

Latvia – Riga

Elekoms Ltd.
Tel. (07) 33 64 44, Fax (07) 33 64 48

Lithuania – Kaunas

UAB Agava Ltd.
Tel. (03) 7 20 24 10, Fax (03) 7 20 74 14

Macedonia – Beograd

Meris d.o.o.
Tel. (11) 44 42 96 6, Fax (11) 30 85 77 8

Moldavia – Chisinau

S.C. Techno Test SRL
Tel. (02) 22 61 60, Fax (02) 22 83 13

Netherlands – Naarden

□ Endress+Hauser B.V.
Tel. (035) 6 95 86 11, Fax (035) 6 95 88 25

Norway – Lierskogen

□ Endress+Hauser A/S
Tel. 32 85 98 50, Fax 32 85 98 51

Poland – Wroclaw

□ Endress+Hauser Polska Sp. z o.o.
Tel. (071) 7 80 37 00, Fax (071) 7 80 37 60

Portugal – Cacem

□ Endress+Hauser Lda
Tel. (21) 4 26 72 90, Fax (21) 4 26 72 99

Romania – Bucharest

Romconseng S.R.L.
Tel. (021) 41 12 50 1, Fax (021) 41 01 63 4

Russia – Moscow

□ Endress+Hauser GmbH+Co
Tel. (095) 78 32 85 0, Fax (095) 78 32 85 5

Slovak Republic – Bratislava

Transcom Technik s.r.o.
Tel. (2) 44 88 86 90, Fax (2) 44 88 71 12

Slovenia – Ljubljana

□ Endress+Hauser (Slovenija) D.O.O.
Tel. (01) 5 19 22 17, Fax (01) 5 19 22 98

Spain – Sant Just Desvern

□ Endress+Hauser S.A.
Tel. (93) 4 80 33 66, Fax (93) 4 73 38 39

Sweden – Sollentuna

□ Endress+Hauser AB
Tel. (08) 55 51 16 00, Fax (08) 55 51 16 55

Switzerland – Reinach/BL 1

□ Endress+Hauser Metso AG
Tel. (061) 7 15 75 75, Fax (061) 7 11 16 50

Turkey – Levent/Istanbul

Intek Endüstriyel Ölçü ve Kontrol Sistemleri
Tel. (0212) 2 75 13 55, Fax (0212) 2 66 27 75

Ukraine – Kiev

Photonika GmbH
Tel. (44) 2 68 81 02, Fax (44) 2 69 07 05

Yugoslavia Republic – Beograd

Meris d.o.o.
Tel. (11) 4 44 29 66, Fax (11) 3 08 57 78

Africa

Algeria – Annaba

Symes Systemes et Mesures
Tel. (38) 88 30 03, Fax (38) 88 30 02

Egypt – Heliopolis/Cairo

Anasia Egypt For Trading (S.A.E.)
Tel. (02) 2 68 41 59, Fax (02) 2 68 41 69

Morocco – Casablanca

Oussama S.A.
Tel. (02) 22 24 13 38, Fax (02) 2 40 26 57

Rep. South Africa – Sandton

□ Endress+Hauser (Pty.) Ltd.
Tel. (011) 2 62 80 00, Fax (011) 2 62 80 62

Tunisia – Tunis

CMR Controle, Maintenance et Regulation
Tel. (07) 17 93 07 7, Fax (07) 17 88 59 5

America

Argentina – Buenos Aires

□ Endress+Hauser Argentina S.A.
Tel. (11) 45 22 79 70, Fax (11) 45 22 79 09

Brazil – Sao Paulo

□ Samson Endress+Hauser Ltda.
Tel. (011) 50 33 43 33, Fax (011) 50 31 30 67

Canada – Burlington, Ontario

□ Endress+Hauser Canada Ltd.
Tel. (905) 68 19 29 2, Fax (905) 68 19 44 4

Chile – Santiago de Chile

□ Endress+Hauser (Chile) Ltd.
Tel. (02) 3 21 30 09, Fax (02) 3 21 30 25

Colombia – Bogota D.C.

Colsein Ltda.
Tel. (01) 2 36 76 59, Fax (01) 6 10 78 68

Costa Rica – San Jose

Euro-Tec S.A.
Tel. 2 20 28 08, Fax 2 96 15 42

Ecuador – Quito

Insetec Cia. Ltda.
Tel. (02) 2 26 91 48, Fax (02) 2 46 18 33

El Salvador – San Salvador

Automatizacion y Control Industrial de El Salvador, S.A. de C.V.
Tel. 2 60 24 24, Fax 2 60 56 77

Guatemala – Ciudad de Guatemala

Automatizacion y Control Industrial, S.A.
Tel. (03) 34 59 85, Fax (03) 32 74 31

Honduras – San Pedro Sula, Cortes

Automatizacion y Control Industrial de Honduras, S.A. de C.V.
Tel. 5 57 91 36, Fax 5 57 91 39

Mexico – México, D.F

□ Endress+Hauser (México), S.A. de C.V.
Tel. (5) 5 55 68 24 07, Fax (5) 5 55 68 74 59

Nicaragua – Managua

Automatización y Control Industrial de Nicaragua, S.A.
Tel. 2 22 61 90, Fax 2 28 70 24

Peru – Miraflores

Corsusa International
Tel. (1) 44 41 20 0, Fax (1) 44 43 66 4

USA – Greenwood, Indiana

□ Endress+Hauser Inc.
Tel. (317) 5 35 71 38, Fax (317) 5 35 84 98

USA – Norcross, Atlanta

□ Endress+Hauser Systems & Gauging Inc.
Tel. (770) 4 47 92 02, Fax (770) 4 47 57 67

Venezuela – Caracas

Controval C.A.
Tel. (212) 9 44 09 66, Fax (212) 9 44 45 54

Asia

Azerbaijan – Baku

Modoon Systems - Baku
Tel. (12) 92 98 59, Fax (12) 99 13 72

Brunei – Negara Brunei Darussalam

American International Industries (B) Sdn. Bhd.
Tel. (3) 22 37 37, Fax (3) 22 54 58

Cambodia – Khan Daun Penh, Phom Penh

Comin Khmeme Co. Ltd.
Tel. (23) 42 60 56, Fax (23) 42 66 22

China – Shanghai

□ Endress+Hauser (Shanghai)
Instrumentation Co. Ltd.
Tel. (021) 54 90 23 00, Fax (021) 54 90 23 03

China – Beijing

□ Endress+Hauser (Beijing)
Instrumentation Co. Ltd.
Tel. (010) 65 88 24 68, Fax (010) 65 88 17 25

Hong Kong – Tsimshatsui / Kowloon

□ Endress+Hauser (H.K.) Ltd.
Tel. 8 52 25 28 31 20, Fax 8 52 28 65 41 71

India – Mumbai

□ Endress+Hauser (India) Pvt. Ltd.
Tel. (022) 56 93 83 33, Fax (022) 56 93 88 330

Indonesia – Jakarta

PT Grama Bazita
Tel. (21) 7 95 50 83, Fax (21) 7 97 50 89

Iran – Tehran

Patsa Industry
Tel. (021) 8 72 68 69, Fax (021) 8 71 96 66

Israel – Netanya

Instrumetrics Industrial Control Ltd.
Tel. (09) 8 35 70 90, Fax (09) 8 35 06 19

Japan – Tokyo

□ Sakura Endress Co. Ltd.
Tel. (0422) 54 06 11, Fax (0422) 55 02 75

Jordan – Amman

A.P. Parpas Engineering S.A.
Tel. (06) 5 53 92 83, Fax (06) 5 53 92 05

Kazakhstan – Almaty

BEI Electro
Tel. (72) 30 00 28, Fax (72) 50 71 30

Korea, South – Seoul

□ Endress+Hauser (Korea) Co. Ltd.
Tel. (02) 26 58 72 00, Fax (02) 26 59 28 38

Kuwait – Safat

United Technical Services Est. For General Trading
Tel. 2 41 12 63, Fax 2 41 15 93

Lebanon – Jbeil Main Entry

Network Engineering
Tel. (3) 94 40 80, Fax (9) 54 80 38

Malaysia – Shah Alam, Selangor Darul Ehsan

□ Endress+Hauser (M) Sdn. Bhd.
Tel. (03) 78 46 48 48, Fax (03) 78 46 88 00

Pakistan – Karachi

Speedy Automation
Tel. (021) 7 72 29 53, Fax (021) 7 73 68 84

Philippines – Pasig City, Metro Manila

□ Endress+Hauser (Philippines) Inc.
Tel. (2) 6 38 18 71, Fax (2) 6 38 80 42

Saudi Arabia – Jeddah

Anasia Trading Est.
Tel. (02) 6 53 36 61, Fax (02) 6 53 35 04

Singapore – Singapore

□ Endress+Hauser (S.E.A.) Pte. Ltd.
Tel. (65) 66 82 22, Fax (65) 66 68 48

Sultanate of Oman – Ruwi

Mustafa & Sultan Sience & Industry Co. L.L.C.
Tel. 63 60 00, Fax 60 70 66

Taiwan – Taipei

Kingjari Corporation
Tel. (02) 27 18 39 38, Fax (02) 27 13 41 90

Thailand – Bangkok 10210

□ Endress+Hauser (Thailand) Ltd.
Tel. (2) 9 96 78 11-20, Fax (2) 9 96 78 10

United Arab Emirates – Dubai

Descon Trading L.L.C.
Tel. (04) 2 65 36 51, Fax (04) 2 65 32 64

Uzbekistan – Tashkent

Im Mexatronika-Tes
Tel. (71) 1 91 77 07, Fax (71) 1 91 76 94

Vietnam – Ho Chi Minh City

Tan Viet Bao Co. Ltd.
Tel. (08) 8 33 52 25, Fax (08) 8 33 52 27

Australia + New Zealand

Australia – North Ryde NSW 2113

□ Endress+Hauser Australia Pty. Ltd.
Tel. (02) 88 77 70 00, Fax (02) 88 77 70 99

New Zealand – Auckland

EMC Industrial Group Ltd.
Tel. (09) 4 15 51 10, Fax (09) 4 15 51 15

All other countries

□ Endress+Hauser GmbH+Co. KG
Instruments International
Weil am Rhein, Germany
Tel. (07621) 9 75 02, Fax (07621) 97 53 45

<http://www.endress.com>

