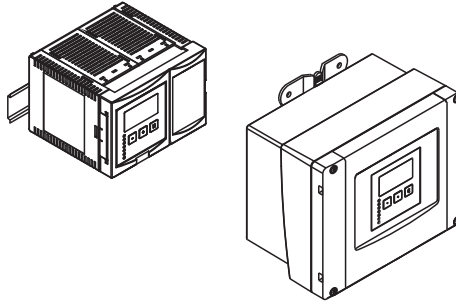# Brief Operating Instructions
Prosonic S FMU90

Level Measurement
Alternating Pump Control
Rake Control

These Instructions are Brief Operating Instructions; they are not
a substitute for the Operating Instructions pertaining to the
device.

Detailed information about the device can be found in the
Operating Instructions and the other documentation:

Available for all device versions via:
– Internet: www.endress.com/deviceviewer
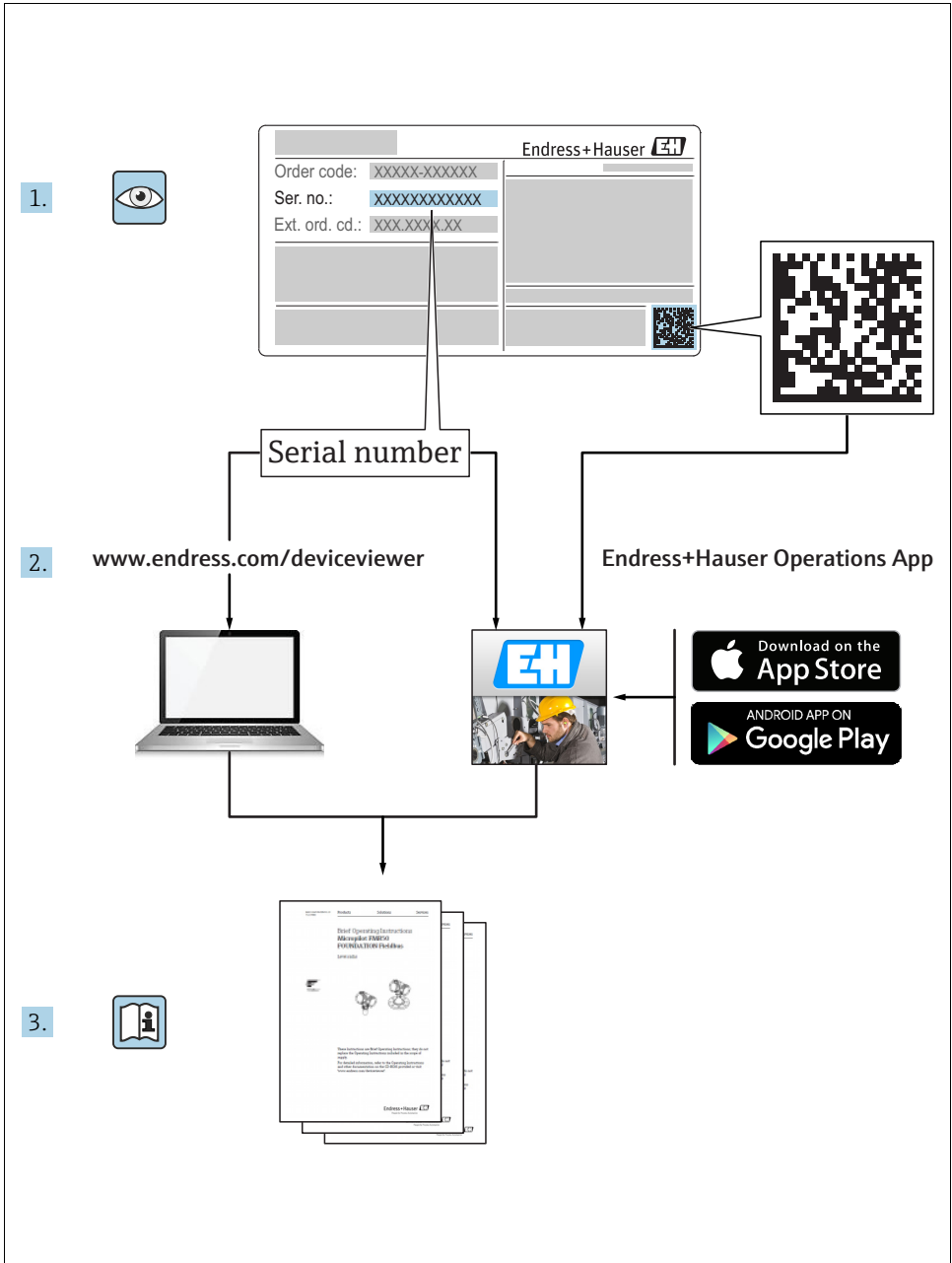– Smart phone/tablet: *Endress+Hauser Operations App*

Endress+Hauser

People for Process Automation

1.

Order code: XXXXX-XXXXXX
Ser. no.: XXXXXXXXXXXX
Ext. ord. cd.: XXX.XXXX.XX

Endress+Hauser

Serial number

2. **www.endress.com/deviceviewer**   **Endress+Hauser Operations App**

Download on the
App Store

ANDROID APP ON
Google Play

3.

A0023555

Table of contents

1   Safety Instructions

1.1   Designated use

The Prosonic S FMU90 is a transmitter for the ultrasonic sensors FDU90, FDU91, FDU91F, FDU92, FDU93 and FDU95[1]. The sensors of the class FDU8x can be connected as well.

1.2   Installation, commissioning, operation

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

1.3   Operational safety and process safety

- Alternative monitoring measures must be taken to ensure operational safety and process safety during configuration, testing and maintenance work on the device.
- The device is safely built and tested according to state-of-the-art technology and has left the factory in perfect condition as regards technical safety. The applicable regulations and European standards have been taken into account.
- Pay particular attention to the technical data on the nameplate.
- If the device is to be installed in an explosion hazardous area, then the specifications in the certificate as well as all national and local regulations must be observed. The device is accompanied by separate "Ex documentation", which is an integral part of this Operating Instructions. The installation regulations, connection values and Safety Instructions listed in this Ex document must be observed. The documentation number of the related Safety Instructions is also indicated.
- If using devices for applications with safety integrity level, the separate manual on functional safety must be observed thoroughly.

🛈   The sensors FDU83, FDU84, FDU85 and FDU86 with an ATEX, FM or CSA certificate are not certified for connection to the FMU90 transmitter.

1.4   Return

Follow the instructions on returning the device as outlined in the Operating Instructions BA00288F or on www.endress.com.

---

1)   The sensors FDU80/80F/81/81F/82/83/84/85/86/96 are not available anymore.

1.5   Safety symbols

Symbol	Meaning
DANGER A0011189-DE	**DANGER!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
WARNING A0011190-DE	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
CAUTION A0011191-DE	**CAUTION!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
NOTICE A0011192-DE	**NOTICE!** This symbol contains information on procedures and other facts which do not result in personal injury.

Explosion protection	Meaning
	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

2   Mounting

2.1   Incoming acceptance, storage

2.1.1   Incoming acceptance

Check the packing and contents for any signs of damage. Check the shipment, make sure nothing is missing and that the scope of supply matches your order.

2.1.2   Storage

Pack the measuring instrument so that is protected against impacts for storage and transport. The original packing material provides the optimum protection for this.
The permissible storage temperature is -40 to +60 °C (-40 to +140 °F).

2.2   Installation

2.2.1   Installation conditions of the field housing

Weather protection
In order to avoid excessive sunlight exposure, the instrument should be mounted in a position which is protected against direct sunlight or a protection cover should be applied.

Overvoltage protection
In order to protect the Prosonic S against overvoltage (especially if mounted outdoors), connection of an overvoltage protection is recommended.

Pipe mounting
A mounting plate is available for mounting of the field housing to 1" to 2" pipes.

Wall mounting
A mounting help for wall mounting is supplied. It also serves as drilling template. The mounting help should be mounted on a flat surface and may not become distorted.
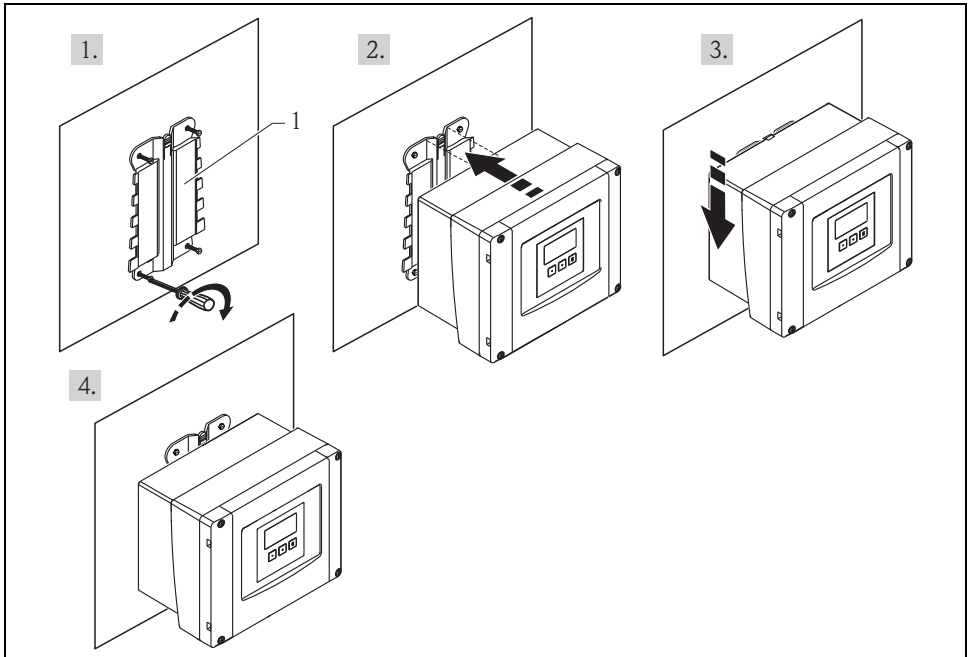
L00-FMU90xxx-17-00-00-xx-003
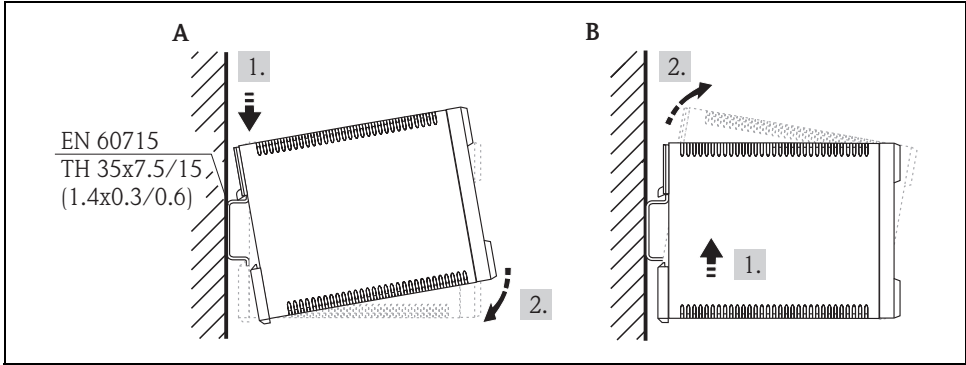
Wall mounting with mounting help (1)

ℹ️ Further information: Operating Instructions for Prosonic S FMU90, document number BA00288F.
You will find this document in the Download Area of the Endress+Hauser Internet site.

2.2.2 Installation conditions of the DIN-rail housing

- The DIN-rail housing must be mounted outside hazardous areas in a cabinet.
- The housing is mounted on a DIN rail EN 60715 TH 35 x 7.5 or TH 37 x 15.
- Do not install the instrument in the vicinity of high-voltage lines, motor lines, contactors or frequency converters. The installation regulations for high-voltage lines, motor lines, contactors or frequency converters must be observed.
- To ensure easy mounting and opening of the housing, a distance of approx. 10 mm (0.39 in) should be kept between the instruments.
- In order to avoid interference, do not route the sensor cables parallel to high-voltage or electric power lines and not close to frequency converters.

L00-FMU90xxx-17-00-00-xx-001

A   *Mounting*
B   *Demounting*

ℹ️ The dimensions are described in this document: Technical Information for Prosonic S
    FMU90, document number TI00397F.
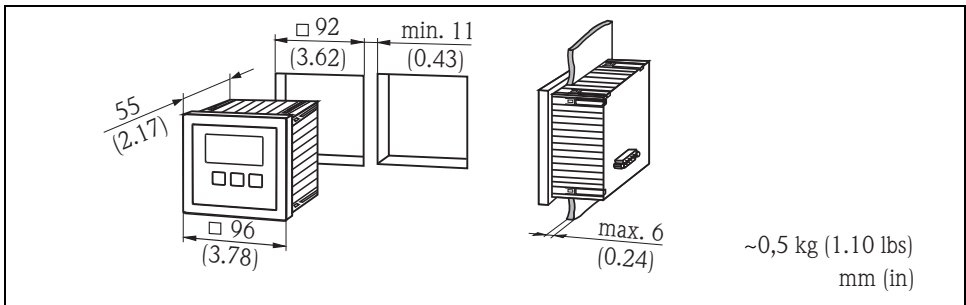   You will find this document in the Download Area of the Endress+Hauser Internet site.

2.3   Mounting the remote display and operating module

2.3.1 Scope of delivery

If the Prosonic S is ordered with the display for cabinet door mounting, the following is
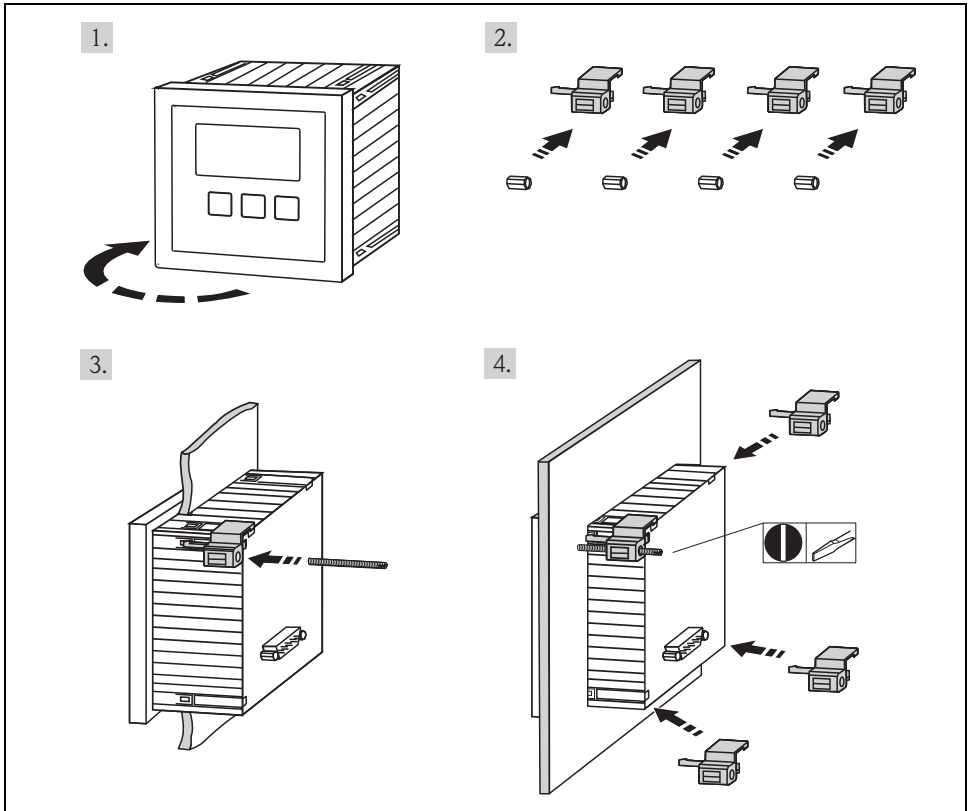contained in the scope of delivery:
- Display and operating module 96 x 96 mm (3.78 x 3.78 in)
- 4 retainers (with nuts and screws) → 🖹 9 "Mounting"
- Connection cable (3 m (9.8 ft)) for connection to the transmitter
  (preassembled with suitable plugs).

2.3.2 Dimensions

L00-FMU90xxx-06-00-00-xx-004

2.3.3 Mounting

L00-FMU90xxx-17-00-00-xx-002

ℹ️ Further information: Operating Instructions for Prosonic S FMU90, document number BA00288F.
You will find this document in the Download Area of the Endress+Hauser Internet site.

2.3.4 Adaption plate

If an opening of 138 x 138 mm (5.43 x 5.43 in) and the remote display of the Prosonic FMU860/861/862 are already present, you can use the adaption plate (Order Code: 52027441). The adapter plate can be mounted directly in the housing of the old remote display of the FMU86x series.

ℹ️ The housing of the remote display of the FMU86x is the holder for the adapter plate and the new remote display of the FMU90/FMU95 in the format 96 x 96 mm (3.78 x 3.78 in).
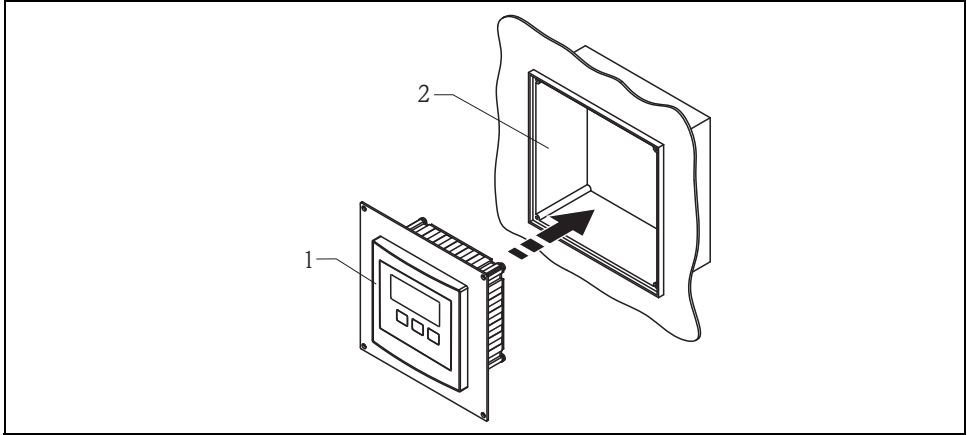
L00-FMU90xxx-06-00-00-xx-006

1   Remote display of the FMU90 with adaption plate
2   Opening of the remote display of the FMU860/861/862

2.4   Mounting of the sensors

Information on the mounting of the sensors[2] can be found in the following documents:

- Technical Information TI00189F (for FDU8x)
- Technical Information TI00396F (for FDU9x)

These documents are supplied with the sensors.

2.5   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 such as process temperature, process pressure, ambient temperature, measuring range, etc.?
- If available: Are the measuring point number and labelling correct?
- Is the instrument sufficiently protected against rainfall and direct sunlight?
- For the field housing: Are the cable glands tightened correctly?
- Is the instrument securely mounted to the DIN rail or the mounting help (visual inspection)?
- For the field housing: Are the screws of the terminal compartment cover securely tightened (visual inspection)?

---

2)   The sensors FDU80/80F/81/81F/82/83/84/85/86/96 are not available anymore.
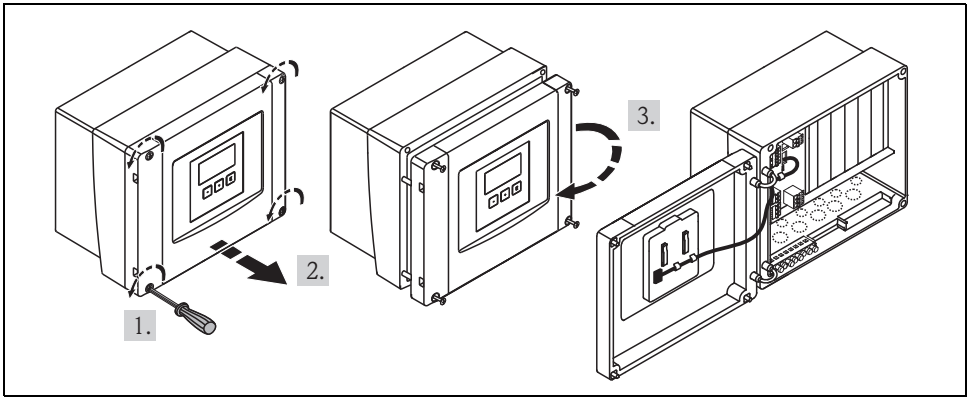
3   Wiring

⚠ WARNING

Risk of electric shock!

Voltage at the terminals.

▶ Switch off the supply voltage before connecting the device.
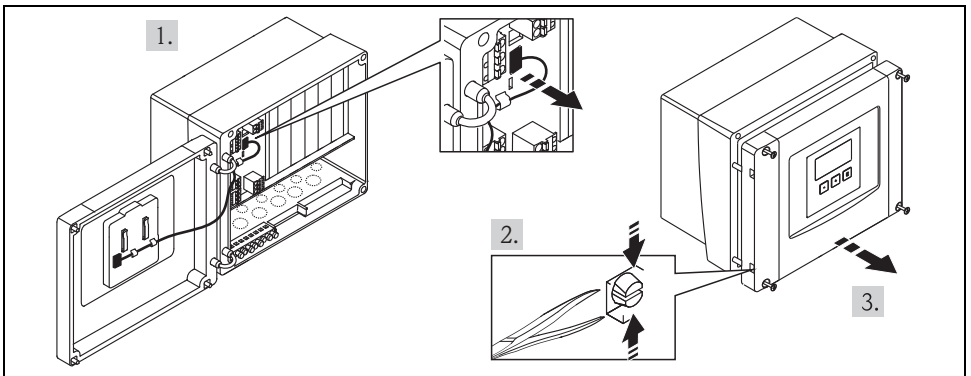▶ In a wet environment, do not open the cover if voltage is present.

3.1   Terminal compartment of the field housing

The field housing has a separate terminal compartment. It can be opened after loosening the 4 screws of the lid.

L00-FMU90xxx-04-00-00-xx-002

For easier wiring, the lid can be completely removed by unplugging the display plug and loosening the hinges:
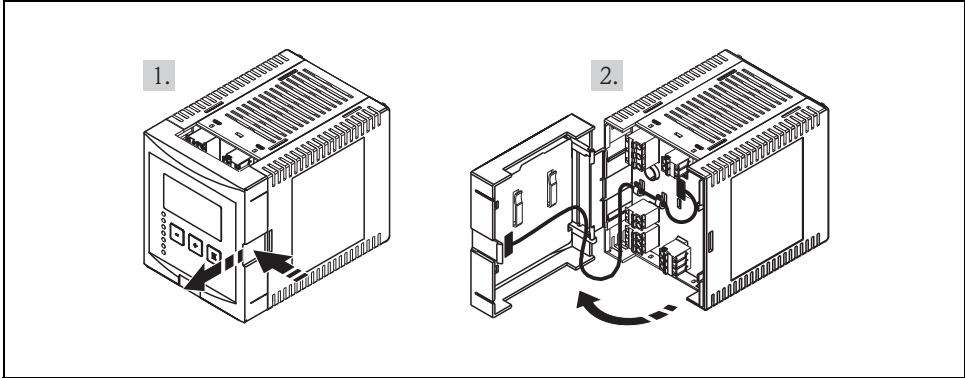

L00-FMU90xxx-04-00-00-xx-009

3.1.1 Cable entries of the field housing

The following openings for cable entries are prestamped on the bottom of the housing:
M20x1.5 (10 openings), M16x1.5 (5 openings), M25x1.5 (1 opening).
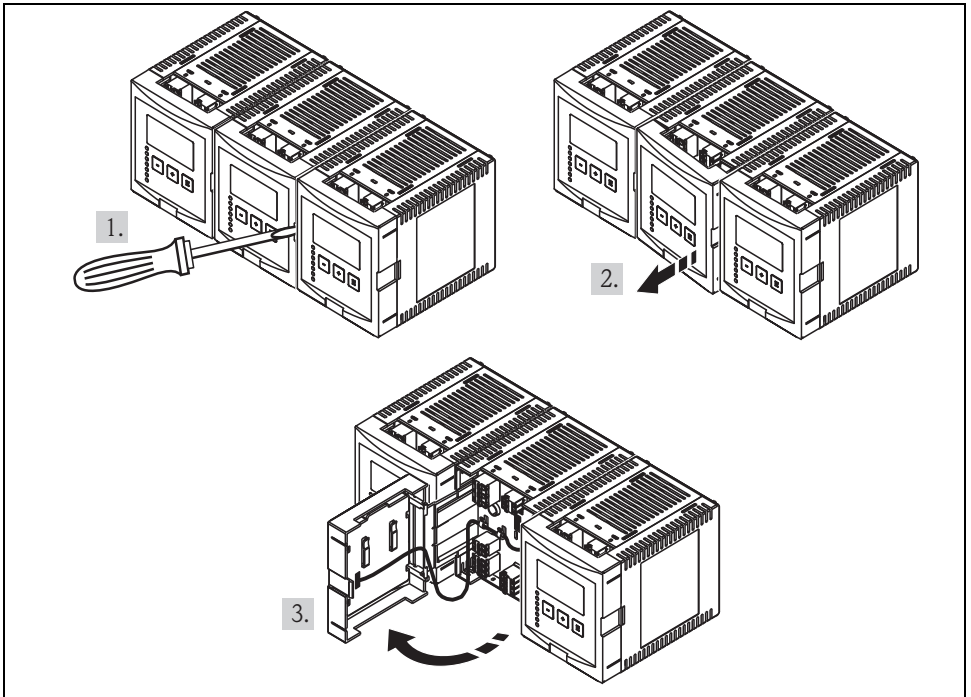The required number and types of cable entries depend on the application at hand.

3.2 Terminal compartment of the DIN-rail housing

3.2.1 Single instrument

L00-FMU90xxx-04-00-00-xx-003

3.2.2 Several instruments mounted side by side

L00-FMU90xxx-04-00-00-xx-012

- The cables can be inserted into the housing from above or from below.
- The pictures show the smallest housing version but are valid for the larger versions as well.
- If the instruments are mounted next to each other and if the sensor cables run in parallel, the synchronization terminals (39 and 40) must be interconnected (→ 🗎 14, "Terminal assignment" and → 🗎 24, "Synchronization line").

3.3   Terminal assignment

Pluggable spring-force terminals for connection of the cables are supplied in the terminal compartment. Rigid conductors or flexible conductors with cable sleeve can directly be inserted and are contacted automatically.

Feature	Value
Conductor cross section	0.2 mm^2 to 2.5 mm^2 (26 to 14 AWG)
Cable and sleeve cross section	0.25 mm^2 to 2.5 mm^2 (26 to 14 AWG)
Min. stripping length	10 mm (0.39 in)

The terminal configuration depends on the instrument version ordered. There is a basic terminal area, which is present in every instrument version. Additional optional terminal areas are only present if the respective option has been selected in the product structure.

Terminal area		present for the following instrument versions
Basic area	A	For all versions
Optional areas	B	For instrument versions with 2 sensor inputs and/or 2 analogue outputs (FMU90 - *****2****** and/or FMU90 - *******2****)
	C	For instrument versions with 3 or 6 relays (FMU90 - ******3***** or FMU90 - ******6*****)
	D	For instruments with external switch inputs and external temperature input (FMU90 - ********B***)
	E	For instrument versions with PROFIBUS DP interface (FMU90 - *******3****)
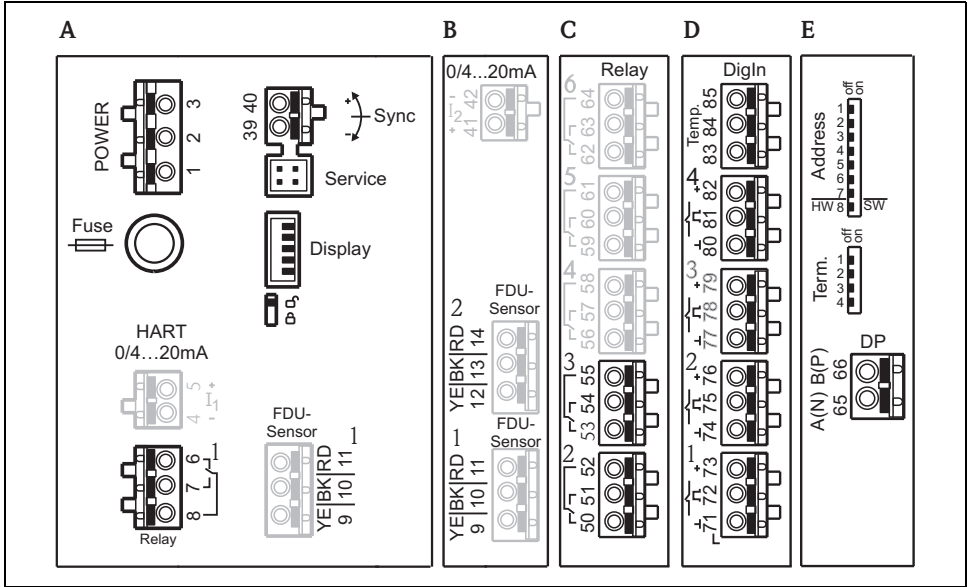
L00-FMU90xxx-04-00-00-xx-001

Terminals of the Prosonic S (the terminals depicted in grey are not present in every instrument version)

A   Basic terminal area
B-E   Optional terminal areas (present if the respective option has been selected in the product structure)

The depicted switching states of the relays refer to the de-energized state.

Terminals	Meaning	Terminal area	Remarks
Auxiliary energy			
1	• L (for AC version) • L+ (for DC version)	A	Depending on instrument version: • 90 to 253 V$_{AC}$ • 10.5 to 32 V$_{DC}$
2	• N (for AC version) • L- (for DC version)	A	
3	Potential equalization	A	
Fuse		A	Depending on instrument version: • 400 mA T (for AC) • 2 A T (for DC)
Analog outputs (not available for Profibus DP instruments)			
4, 5	Analog output 1; 4 to 20 mA with HART/ 0 to 20 mA w/o HART	A	**Not** present for the PROFIBUS DP version
41, 42	Analog output 2 (optional); 4 to 20 mA/ 0 to 20 mA	B	Only for the version with two analog outputs; no HART signal at this output
Relay outputs			
6, 7, 8	Relay 1	A	
50, 51, 52	Relay 2 (optional)	C	Only for the versions with 3 or 6 relays
53, 54, 55	Relay 3 (optional)	C	Only for the versions with 3 or 6 relays
56, 57, 58	Relay 4 (optional)	C	Only for the version with 6 relays
59, 60, 61	Relay 5 (optional)	C	Only for the version with 6 relays
62, 63, 64	Relay 6 (optional)	C	Only for the version with 6 relays
Bus communication (only available for Profibus DP instruments)			
65	PROFIBUS A (RxT/TxD - N)	D	Only for the PROFIBUS DP version
66	PROFIBUS B (RxT/TxD - P)	D	
Synchronization			
39, 40	Synchronization	A	→ 🗎 24, "Synchronization line"
Level inputs			
9 (YE), 10 (BK), 11 (RD)	Sensor 1 (FDU8x/9x) YE: yellow strand BK: black strand RD: red strand		• A: for versions with 1 sensor input • B: for versions with 2 sensor inputs[1]
12 (YE), 13 (BK), 14 (RD)	Sensor 2 (FDU8x/9x) (optional) YE: yellow strand BK: black strand RD: red strand	B	Only for the version with 2 sensor inputs

Terminals	Meaning	Terminal area	Remarks
External switch inputs			
71, 72, 73	External switch input 1	D	0: < 8 V or 72 and 73 interconnected 1: > 16 V or 72 and 73 not interconnected
74, 75, 76	External switch input 2	D	0: < 8 V or 75 and 76 interconnected 1: > 16 V or 75 and 76 not interconnected
77, 78, 79	External switch input 3	D	0: < 8 V or 78 and 79 interconnected 1: > 16 V or 78 and 79 not interconnected
80, 81, 82	External switch input 4	D	0: < 8 V or 81 and 82 interconnected 1: > 16 V or 81 and 82 not interconnected
Temperature input			
83, 84, 85	Temperature input: • PT100 • FMT131 (Endress+Hauser)	D	→ 🖹 21, "Connection of a temperature sensor"

1)   In this case, terminals 9/10/11 are not present on terminal area A.

⚠ **CAUTION**

Limitation of electrical safety.

▶ When using the public supply mains, an easily accessible power switch must be installed in the proximity of the device. The power switch must be marked as a disconnector for the device (IEC/EN 61010).

ℹ︎ In order to avoid interference, do not route the sensor cables parallel to high-voltage or electric power lines and not close to frequency converters.

Additional elements on the terminal areas

Designation	Meaning/Remarks
Fuse	Fuse: 2 A T /DC or 400 mA T/AC
Display	Connection of the display or the remote display and operating module
Service	Service interface for connection of a PC/Notebook via Commubox FXA291
🔒	Locking switch
Term.	Bus termination (only applicable for instruments with PROFIBUS interface)
Address	Bus address (only applicable for instruments with PROFIBUS interface)

⚠ WARNING

Risk of electric shock!

Voltage at the terminals.

▶ Switch off the supply voltage before connecting the device.
▶ In a wet environment, do not open the cover if voltage is present.

3.4   Sensor connection

Information on the mounting of the sensors[3] can be found in the following documents:

- Technical Information TI00189F (for FDU8x)
- Technical Information TI00396F (for FDU9x)

These documents are supplied with the sensors.

---

3)   The sensors FDU80/80F/81/81F/82/83/84/85/86/96 are not available anymore.

3.5   Connection of the sensor heater (for FDU90/FDU91)

The FDU90 and FDU91 sensors are available in a version with heater. For more information and details, see the Technical Information TI00396F that is delivered with the sensors.

3.5.1   Connection in the field housing

For the sensor with heater, a special terminal module is supplied for the connection of the supply voltage. This terminal module can be inserted into the field housing:
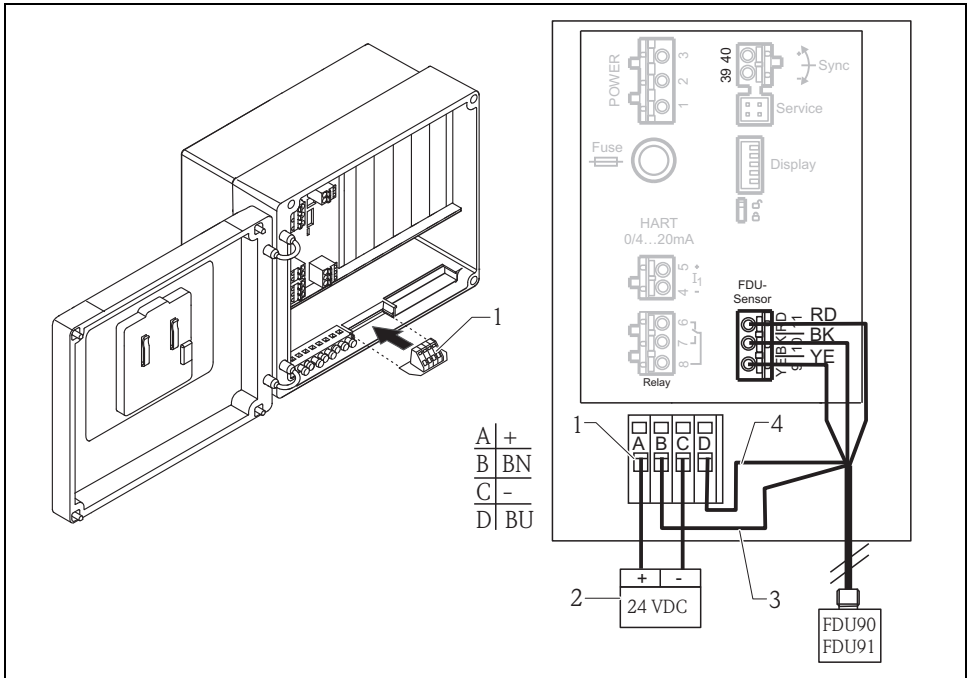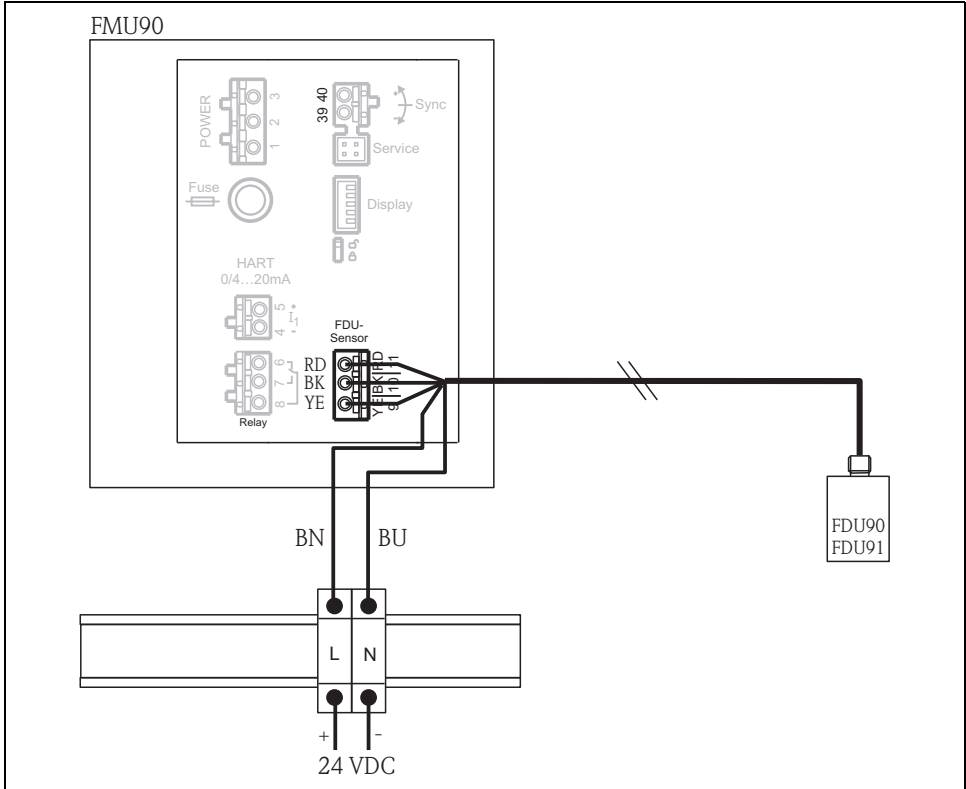

L00-FMU90xxx-04-00-00-xx-013

1   Terminal module for the sensor heater
2   External power supply unit
3   Brown strand (BN)
4   Blue strand (BU)

3.5.2 Connection in the DIN-rail housing

The supply voltage must be provided in the cabinet, e.g. by a terminal on the DIN-rail:

L00-FMU90xxx-04-00-00-xx-014

The terminal module supplied with the sensor can also be used for connection of the supply voltage. For the terminal assignment on this module see → 🗎 19.

3.6   Connection of external switches (for FMU90-********B***)
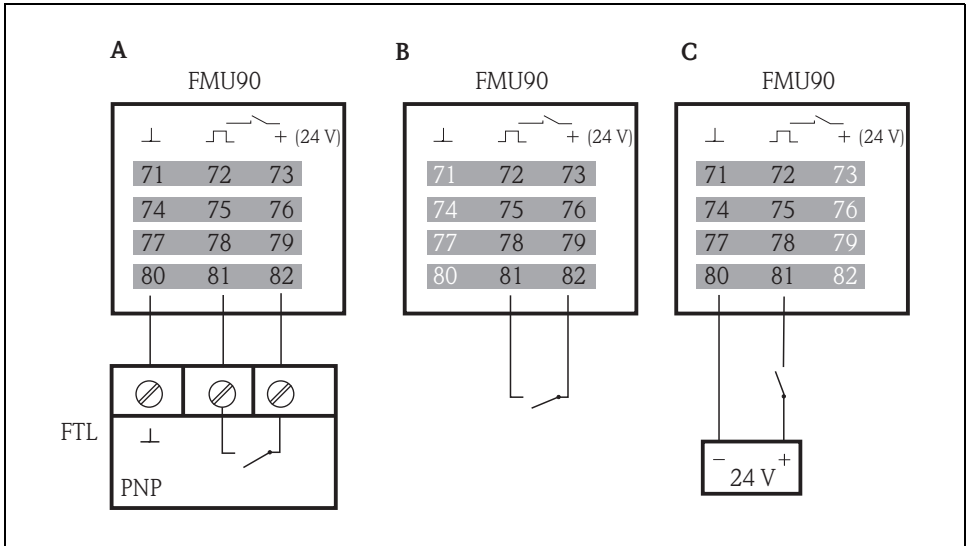
L00-FMU90xxx-04-00-00-xx-021a

A   Liquiphant
B   External switch
C   External switch with external supply voltage

The maximum short-circuit current at 24 V is 20 mA.

3.7   Connection of a temperature sensor

The Prosonic S FMU90 transmitter has an optional input for an external temperature probe (in the product structure: feature 90 "Additional input", option B). The following probes can be connected:
- A FMT131 temperature probe from Endress+Hauser
- A Pt100 temperature probe

Further information: Operating Instructions for Prosonic S FMU90, document number BA00288F.

3.7.1 FMT131 (Endress+Hauser), (connectable to FMU90-********B***)

L00-FMU90xxx-04-00-00-xx-019
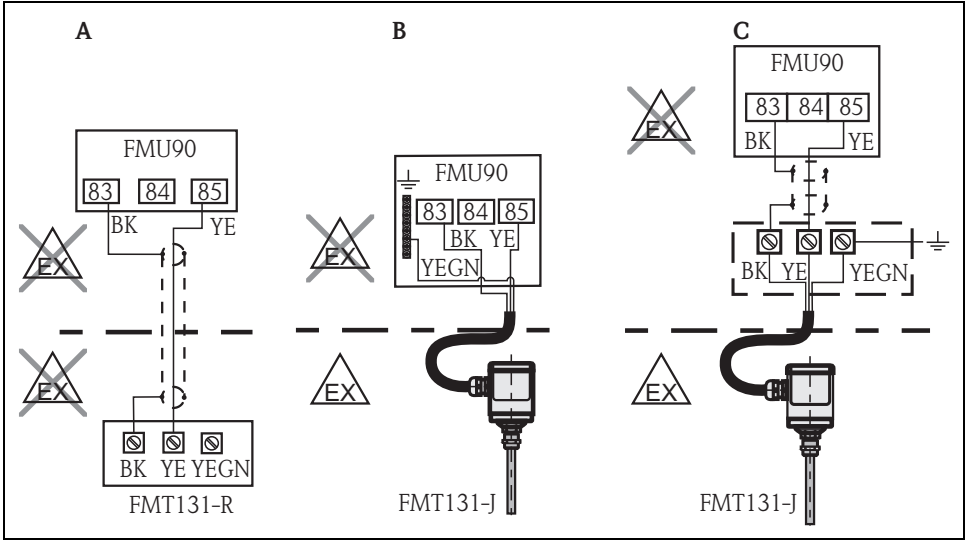
A	*Non-Ex area (FMT131-R)*	
B	*Ex area (FMT131-J) with grounding in the FMU90*	
C	*Ex area (FMT131-J) with grounding at a terminal box*	

BK	*black*
YE	*yellow*
YEGN	*yellow-green*

Further information: Operating Instructions for Temperature sensor FMT131, document number KA00019F.

3.7.2   Pt100 (connectable to FMU90-*******B***)
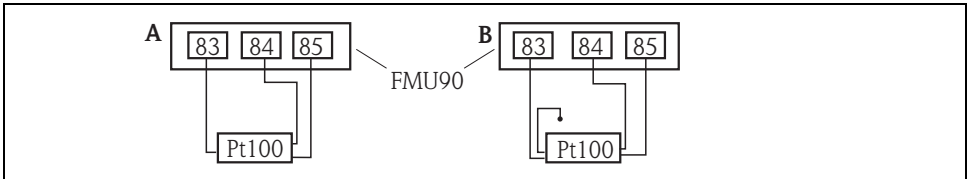
L00-FMU90xxx-04-00-00-xx-020

A   *Pt100 with 3-wire-connection*
B   *Pt100 with 4-wire-connection (one connector remains unused)*

> A Pt100 with 2-wire-connection may not be used due to its insufficient measuring accuracy.

⚠ WARNING

Explosion hazard!
A Pt100 may not be connected in explosion hazardous areas.
▶   Use an FMT131 in explosion hazardous areas.

3.8   Synchronization line

- If wiring several Prosonic S
  (FMU90/FMU95) which are mounted in a
  common cabinet and if the sensor cables
  run in parallel, the synchronization
  terminals (39 and 40) must be
  interconnected.
- Up to 20 instruments can be synchronized
  in this way.
- The synchronization causes the evaluation
  units FMU9x to send the pulses
  simultaneously. Only after all sensors have
  received their signal, new simultaneous
  pulses are sent. This prevents pulses in the
  sensor cable of one sensor from
  influencing the received signal on the
  cable of a different sensor.
- If there are more than 20 instruments,
  groups must be formed, each containing a
  maximum of 20 instruments. For the
  instruments within each group, the sensor
  cables may run in parallel. The sensor
  cables of different groups must be
  separated from each other.
- Usual commercial screened cable can be
  used for synchronization
  - max. length: 10 m (33 ft) between the
    individual instruments
  - cross section: 2 x (0.75 to 2.5 mm^2
    (18 to 14 AWG))
  - for lengths up to 1 m (3.3 ft), an
    unscreened cable can be used; for
    lenghts exceeding 1 m (3.3 ft),
    screening is required. The screen must
    be connected to ground.
- Instruments of the Prosonic FMU86x
  family can be connected to the
  synchronization line as well. In this case a
  maximum of 10 instruments can be
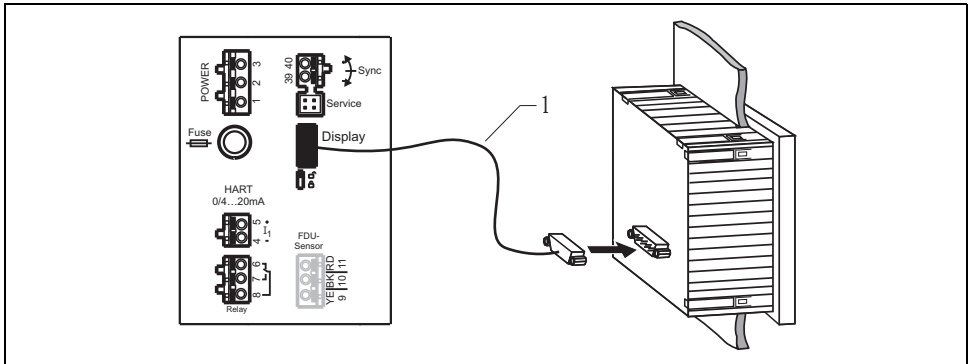 connected to each synchronisation line.
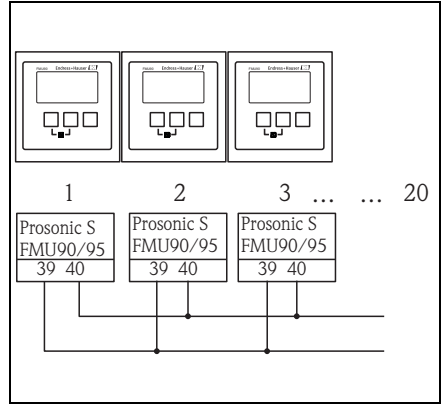
L00-FMU90xxx-04-00-00-xx-004
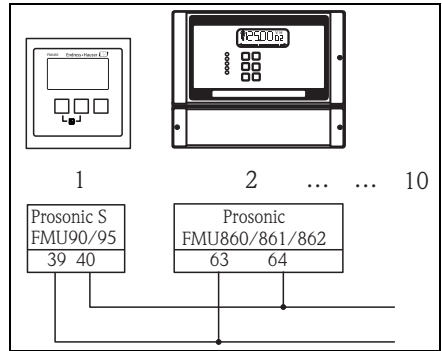
L00-FMU90xxx-04-00-00-xx-017

3.9   Connection of the separate display and operating module

1   Connection of the display plug with the cable (3 m (9.8 ft))

For the version of the Prosonic S with a separate display for panel mounting, a pre-assembled connecting cable (3 m (9.8 ft)) is supplied. The cable must be connected to the display plug of the Prosonic S.

ℹ️   Minimum diameter for cable bushing: 20 mm (0.79 in).

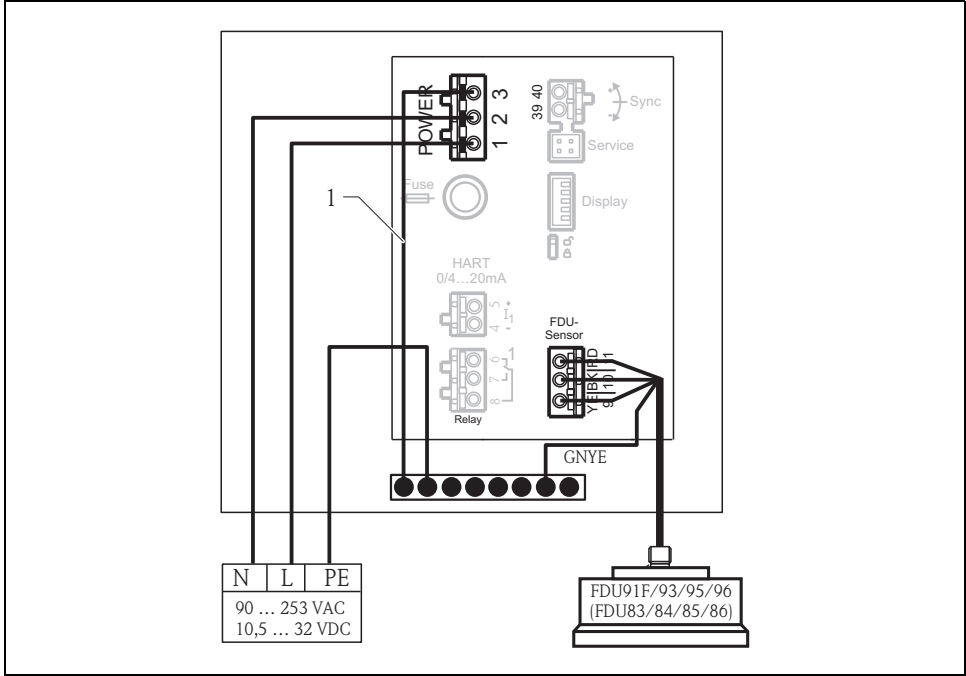## 3.10 Potential equalization

3.10.1 Potential equalization in the field housing

⚠️ **WARNING**

Limitation of electrical safety.
▶ The protective conductor (GNYE) of the sensors FDU91F/93/95/96 and FDU83/84/85/86 must be connected to the local potential equalization system **after a maximum of 30 m (98 ft)**. The metallic terminal block (1) in the field housing can be used for this.
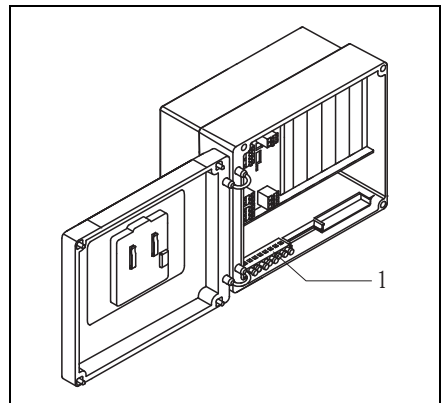
Example

L00-FMU90xxx-04-00-00-xx-007

1   The wire is already connected on delivery

3.10.2 Potential equalization for the DIN-rail housing

If the DIN-rail housing is used, the potential equalization must be connected in the cabinet, e.g. at a metallic DIN rail:

L00-FMU90xxx-04-00-00-xx-008
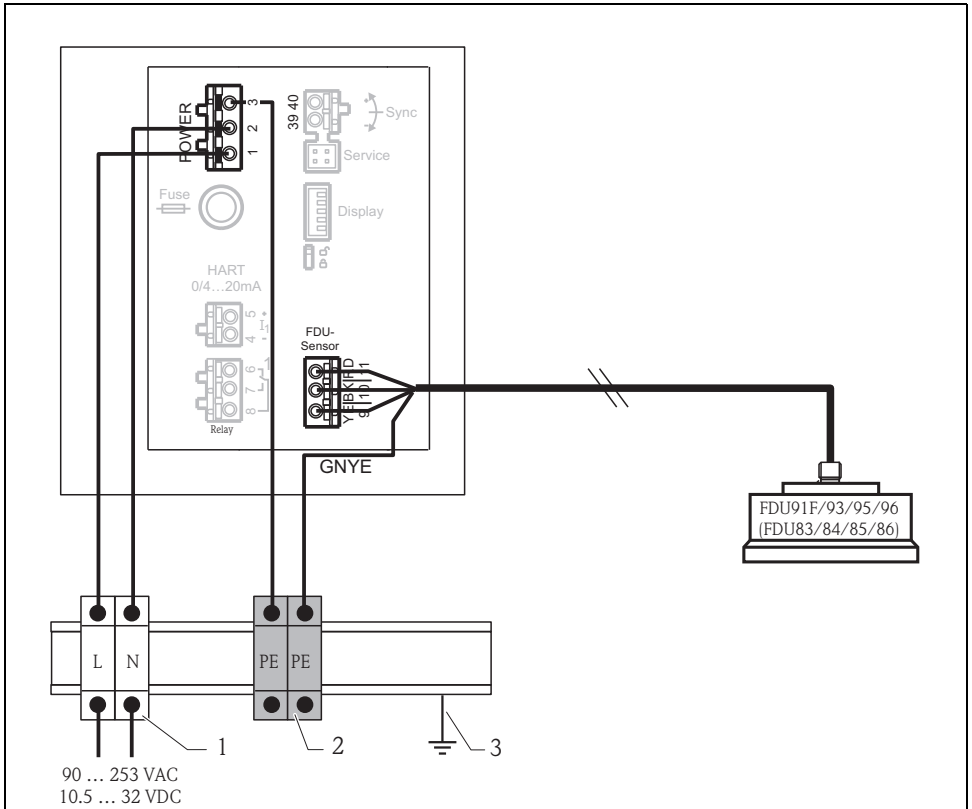
1   Terminal (isolated from the DIN rail)
2   Protective earth terminal (with contact to the DIN rail)
3   Protective ground via DIN rail

The signal evaluation electronics and its direct connections (display interface, service interface etc.) are galvanically isolated from the supply voltage and the communication signals. Their electric potential is identical to the potential of the sensor electronics.

⚠ CAUTION
Limitation of electrical safety.
▶ Pay attention to the potential difference if the sensors are connected to ground!
▶ Route the protective conductor (GNYE) in such a manner that the protective conductor will be the last to get strained when the cable is being pulled.

3.11 Post-connection check

⚠ WARNING

Risk of electric shock!

Voltage at the terminals.

▶ Switch off the supply voltage before you check the terminal assignment.
▶ In a wet environment, do not open the cover if voltage is present.

After wiring the transmitter, carry out the following checks:

- Is the terminal assignment correct?
- For the field housing: Are the cable glands tight and is the cover of the terminal compartment securely closed?
- If auxiliary energy is switched on: Does a display appear on the display module (if available) and does the green LED light up?

4 Operation

4.1 Operating options

- Via the operating- and display module at the Prosonic S (if present)
- Via the service interface of the Prosonic S with the Commubox FXA291 and the operating program "FieldCare"
- Via the HART protocol, e.g. with the Commubox FXA195 and the operating program "FieldCare"
- Via the Field Communicator 375, 475

4.2 Operation via the display and operating module

4.2.1 Display and operating elements
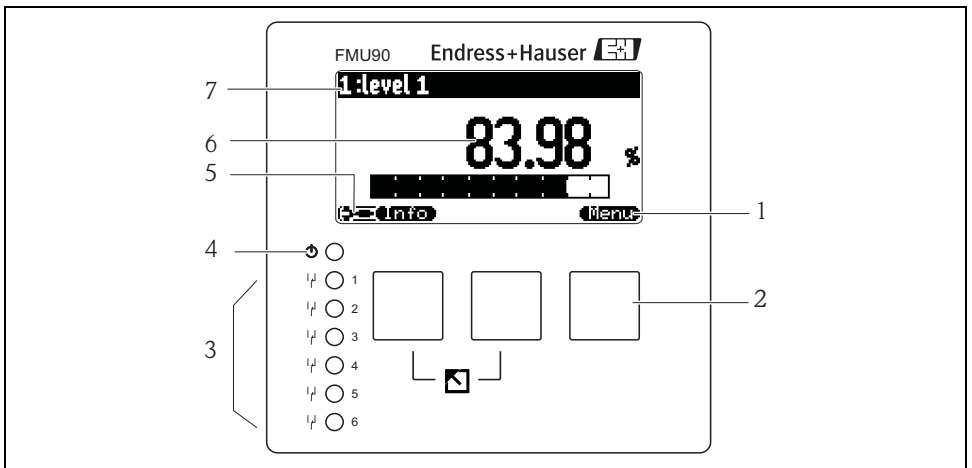
L00-FMU90xxx-07-00-00-xx-002

1   Softkey symbol
2   Key
3   LEDs indicating the switching states of the relays
4   LED indicating the operating state
5   Display symbols
6   Value of the parameter, including unit
7   Name of the parameter

Display symbols

Symbol	Meaning
Operating mode of the instrument	
	User User parameters can be edited. Service parameters are locked.
	Diagnosis The service interface is connected.
	Service User and service parameters can be edited.
	Locked All parameters are locked.
Locking state of the currently displayed parameter	
	Display parameter The parameter can **not** be edited in the current operating mode of the instrument.
	Editable parameter The parameter can be edited.
Scroll-Symbole	
	Scroll list available Indicates that the list contains more parameters than can be represented on the display. By pressing ↑ or ↓ repeatedly, all parameters of the list can be accessed.
Navigation in the envelope curve display (select plot setting "cyclic")	
	Move left
	Move right
	Zoom in
	Zoom out

Keys (softkey operation)

The function of the keys depends on the current position within the operating menu (softkey functionality). The key functions are indicated by softkey symbols in the bottom line of the display.

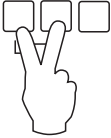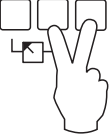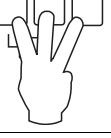| Symbol	Meaning
	Move downwards Moves the marking bar downwards within a selection list.
	Move upwards Moves the marking bar upwards within a selection list.
	Enter • Opens the marked submenu, the marked parameter set or the marked parameter • Confirms the edited parameter value
	Previous parameter set Reopens the previous parameter set within the submenu.
	Next parameter set Opens the next parameter set within the submenu.
	Confirm selection Selects the option of a selection list which is currently marked by the bar.
	Increase value Increases the active digit of an alphanumeric parameter.
	Decrease value Decreases the active digit of an alphanumeric parameter
	Error list Opens the list of all errors which are currently detected. If a warning is present, this symbol flashes. If an alarm is present, the symbol is displayed continuously.
	Change Display Change to the next page of measured values (only available if more than one pages of measured values have been defined; see "display" menu)
	Info Opens the Shortcut Menu, which contains the most important information about the current state of the instrument
	Menu Opens the Main Menu, which contains **all** parameters of the Prosonic S

General key combinations

The following key combinations do not depend on the menu position:

Key combination	Meaning
	Escape • While editing a parameter: Exit the editing mode without accepting the changes. • Within the navigation: Move upwards to the previous layer of the menu.
	Increase contrast Increases the contrast of the display module.
	Decrease contrast Decreases the contrast of the display module.
	Locking Locks the instrument against parameter changes. The instrument can only be unlocked again by the keys.

4.2.2   The operating menu

Structure of the menu

The parameters of the Prosonic S are organized in an operating menu (consisting of a main menu and several submenus). Parameters which are related to each other are comprised in a common parameter set. To simplify the navigation within the menu, a five-digit position code is displayed with each parameter set.

LVL 1 appl.para   L1004
tank shape :dome ceiling
medium property:liquid
process cond:standard liq.

$\Longrightarrow$
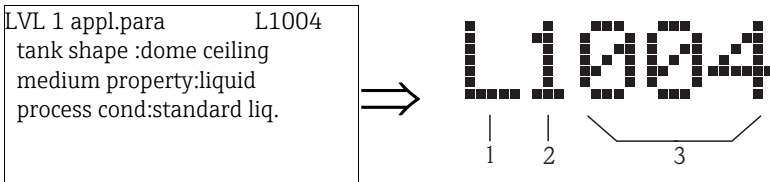
Identification of the parameter sets:

1   Submenu
2   Number of the associated input or output
3   Number of the parameter set within the submenus

> Further information: Operating Instructions for Prosonic S FMU90, document number BA00288F.

5   Commissioning

For the version with field housing:

⚠ WARNING

Risk of electric shock!
Voltage at the terminals.
▶ Do not operate the instrument if the field housing is open.
▶ Close the housing before operating the instrument.

5.1   First setup

After switching on the power supply for the first time, the instrument asks for a number of operating parameters:
- Select by ↓ or ↑
- Confirm by ↵

Step	Parameter	Remarks
1	→ Language	Select the display language.
2	→ Distance unit	Select the unit for distance measurements.
3	→ Temperature unit	Select the temperature unit
4	→ Operating mode	Select the operating mode. The available options depend on the instrument version and the installation environment. See also the Operating Instructions BA00288F.
5	→ Unit level	For level measurements: Select the control functions, which you are going to use. See also the Operating Instructions BA00288F.

ℹ️   **By pressing** 🔽 **you can return to the previous parameter** (e.g. in order to correct the value). All these parameters can also be changed at a later point of time in the "device properties/operating parameters" and "device properties/language" parameter sets.

5.2   Basic setup

After the first setup the main screen appears.
However, the displayed value does not correspond to the real level before you have performed the basic setup. To do so, enter the main menu by pressing "Menu" (right key).

Step	Parameter Set	Parameter	Remarks
1	Main menu → level	→ Level (LVL) 1 → Level (LVL) 2 [1]	Select the "level" submenu. In the following submenu select the level channel you are going to calibrate.
2	Main menu → level → level (LVL) 1	→ Basic setup	In the following submenu select "basic setup". This submenu contains all parameters needed for the basic setup.

1)   The selection "Level (LVL) 2" is only available for instruments with 2 sensor inputs or 2 current outputs.
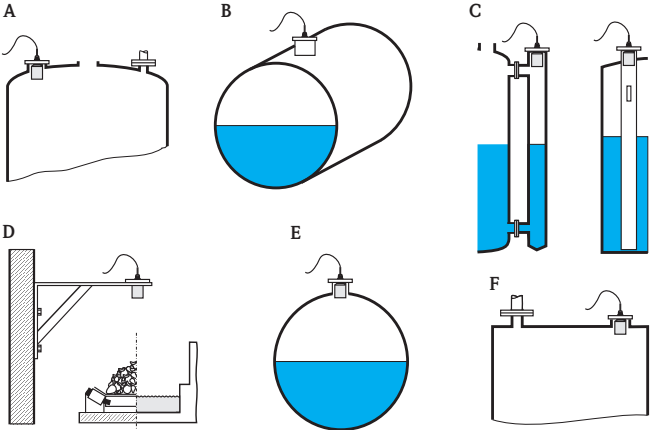
5.2.1   Overview basic setup

The following table gives an overview of the basic setup for level measurement. Detailed information on the parameters can be found in the Operating Instructions BA00288F.
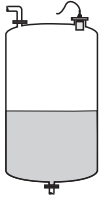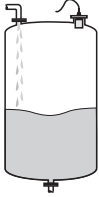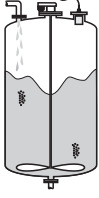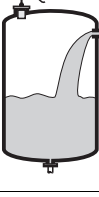
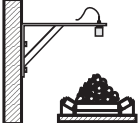| Step	Parameter set	Parameter	Remarks
Configuring the sensor (Details Section 5.2.2)			
1	→ Sensor selection	→ Input	Allocate a sensor to the channel.
		→ Sensor selection	Specify the type of sensor ("automatic" for FDU9x)
		→ Detected	Only available for "sensor selection" = "automatic"; indicates the detected type of sensor
2	→ Application parameter	→ Tank shape	Select the appropriate values for your application.
		→ Medium property	
		→ Process conditions	
Empty and full calibration (Details Section 5.2.3)			
3	→ Empty calibration	→ Empty E	Specify the distance between the reference point of the sensor and the minimum level (0%).
4	→ Full calibration	→ Full F	Specify the distance between the minimum (0%) and maximum (100%) level.
		→ Blocking distance BD	Display parameter; the maximum value for the full calibration is: $F_{max} = E - BD$

Step	Parameter set	Parameter	Remarks
5	→ Unit level	→ Unit level	Select the unit for the level measurement.
		→ Level	Displays the currently measured level.
		→ Distance	Displays the currently measured distance between the reference point of the sensor and the product level.
Linearization (Details Section 5.2.4) (if no linearization is required: continue by step 7: "distance correction")			
6	→ Linearization	→ Type	Select type of linearization (Details → "type")
		→ Mode	Specify, to which value the measurement refers: "level" or "ullage"
		→ Customer unit	Specify the unit for the linearized value; (not available for "type" = "none") (Details → "customer unit")
		→ Max. scale	Specify the maximum contents of the vessel (in customer units); (not available for "type" = "none")
		→ Diameter	Specify the diameter of the tank; (only available for "type" = "horizontal cylinder" or "sphere")
		→ Intermediate height	Specify the intermediate height of the tank or silo; (only available for "type" = "pyramid bottom", "conical bottom" oder "angled bottom")
		→ Edit	Used to enter, change or delete a linearization table; (only available for "type" = "table") Details → "edit"
		→ Status table	Enables or disables the linearization table; (only available for "type" = "table") Details → "status table"
Interference echo suppression (Details Section 5.2.5)			
7	→ distance correction	→ Act. distance 1 → Act. distance 2	Indicates the currently measured distance between the reference point of the sensor and the product surface.
		→ Check distance	Compare the indicated distance with the real value: • "Distance = ok" → "distance mapping" • "Distance too small" → "distance mapping" • "Distance too big" → Basic setup completed • "Distance unknown" → Basic setup completed • "Manual" → "distance mapping"

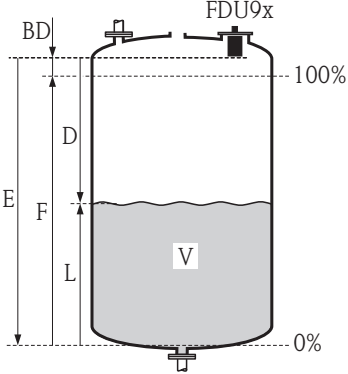| Step	Parameter set	Parameter	Remarks
8	→ Distance mapping (Details Section 5.2.5)	→ Act. distance 1 → Act. distance 2	Indicates the currently measured distance between the reference point of the sensor and the product surface.
		→ Range of mapping	Determines the range over which the mapping is recorded; confirm the predefined value or enter your own value.
		→ Start mapping	Select: ▪ No: the mapping is not recorded ▪ Yes: the mapping is recorded; after completion the "LVL 1(2) state" function appears (see below)
9	→ LVL 1(2) state	→ Level 1(2)	Indicates the currently measured level.
		→ Act. distance	Indicates the currently measured distance between the reference point of the sensor and the product surface. Check the value: ▪ Value correct: → Basic setup completed. Return to the measured value display by pressing 🖳 several times ▪ Value not incorrect: → go back to step 7 ("distance correction")
		→ Status	Used to enable, disable or delete a mapping
When using FDU90 with flooding protection tube: Parametrization of the flooding detection → Details, see "Description of Instrument Functions" BA00290F			
10	Menu: → safety settings -> safety distance	→ Safety dist. sensor 1 → Safety dist. sensor 2	In order to detect flooding reliably when using the FDU90 sensor with a flooding protection tube, a safety distance must be defined slightly below the lower edge of the flooding protection tube.
11	Menu: → relay/controls -> relay allocation		Select the relay you want to use to indicate flooding.
12	→ Relay N	→ Function	1. Select "alarm diagnostics" 2. Select "diagnostics"
		→ Allocation	Select "safety distance channel 1/2". The relay is de-energized as soon as the level rises into the safety distance.

5.2.2   Application parameters

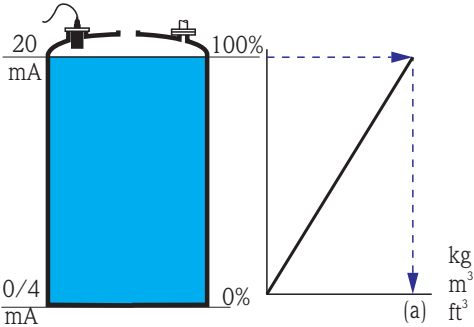| Parameter	Selection/Remarks
"tank shape"	Use this parameter to specify the tank shape of your application: **Selection:** • **dome ceiling (→ A)** • horizontal cyl. (→ B) • bypass (→ C) • stilling well (ultrasonic guide pipe) (→ C) • no ceiling (→ D) • sphere (→ E) • flat ceiling (→ F) L00-FMU30KAx-14-00-06-xx-001
"medium property"	Use this parameter to specify the type of medium. You have the following options: • **Unknown (e.g. pasty media such as greases, creams, gels etc.)** • Liquid • Solid, grain size < 4 mm (fine) • Solid, grain size > 4 mm (coarse) If the medium does not fit into one of the groups, select "Unknown".
"process conditions"	Use this parameter to specify the process conditions of your application. The filters of the signal evaluation are automatically adjusted to the selected conditions. For this function, you have the following options → see the table:

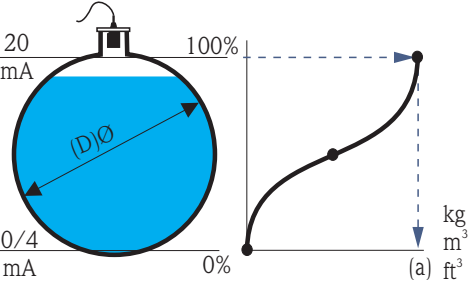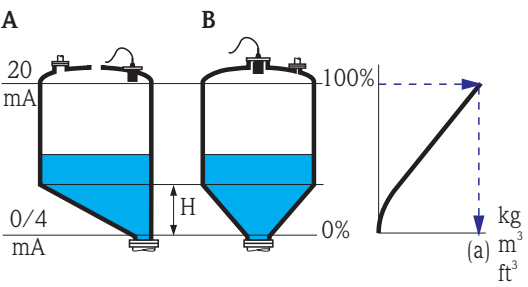| "process conditions"	for the following situations	Example	filter settings
standard liquid	for all fluid applications which do not fit in any of the following groups		The filters and output damping are set to average values.
calm surface	Storage tanks with immersion tube or bottom filling		The averaging filters and output damping are set to large values. -> stable measured value -> accurate measurement -> slow reaction time
turbulent surface	Storage/accumulation tanks with uneven surface due to free filling, mixing nozzles or small bottom stirrers		Special filters for stabilizing the input signal are activated. -> stable measured value -> medium reaction time
additional agitator	Moving surfaces (possibly with vortex formation) due to agitators		Special filters for stabilizing the input signal are set to large values. -> stable measured value -> medium reaction time
fast change	Rapid level change, particularly in small tanks		The averaging filters are set to small values. -> rapid reaction time -> possibly unstable measured value
standard solid	For all bulk solid applications which do not fit in any of the following groups.		The filter and output damping are set to average values.

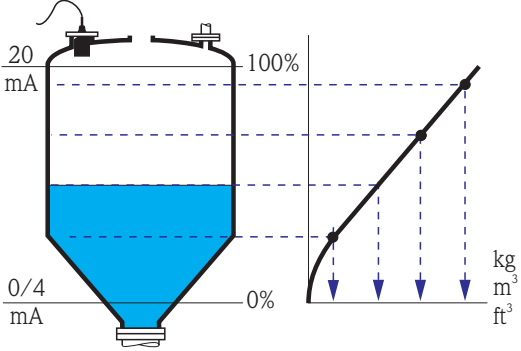| "process conditions"	for the following situations	Example	filter settings
solid dusty	Dusty bulk solids		The averaging filters are set to detect even relatively weak signals.
conveyor belt	Bulk solids with rapid level change		The averaging filters are set to small values. -> rapid reaction time -> possibly unstable measured value
test: no filter	For service and diagnosis only		All filters are switched off.

5.2.3   Empty and full calibration

Parameter	Remarks
"empty calibration"	Use this parameter to specify the empty distance E, i.e. the distance between the reference point of the sensor and the minimum level (zero point). **Notice!** Value of zero will not be displayed, if zero point is set too low. If the zero point is set below the tank bottom, a level value greater than zero is displayed even when the tank is empty. The zero point should not be deeper than the point at which the ultrasonic wave impinges on the tank bottom. *BD Blocking distance* *D Distance from reference point of the sensor to fluid surface* *E Empty distance* *F Span (full distance)* *L Level* *V Volume (or mass)*
" full calibration"	Use this parameter to specify the span F, i.e. the distance from the minimum level to the maximum level. The maximum level may not project into the blocking distance
"blocking distance"	Indicates the blocking distance of the respective sensor. The blocking distance is measured from the reference point of the respective sensor. Further information: Technical Information for Prosonic S FDU9x, document number TI00396F.

5.2.4 Linearization

Parameter	Selection/Remarks
"type"	Number and type of the parameters in this set depend on the selected linearization type. Only the parameters "type" and "mode" are always present. Select the linearization type in this parameter. **Selection** • None In this linearization type the measured level is not converted but displayed in the selected level unit (see **"unit level"**).
	Selection • Linear In this linearization type the displayed level is linear to the measured level. The following additional parameters have to be specified. • Unit for the linearized value, e.g. kg, m3, ft3, ... (**"customer unit"**) • Maximum capacity (a) of the vessel, measured in the customer unit (**"maximum scale"**).

Parameter	Selection/Remarks
"type"	In these linearization types the measured level is converted to the volume in a horizontal cylinder or a spherical tank. **Selection** • Horizontal cylinder [1] • Sphere The following additional parameters have to be specified: • Unit of the linearized value, e.g. kg, m3, ft3, ... (**"customer unit"**) • Diameter (D) of the tank (**"diameter"**) • Maximum capacity (a) of the tank, measured in the customer unit (**"maximum scale"**) In these linearization modes the measured level is converted to the volume in the respective type of vessel. **Selection** • Angled bottom (**A**) • Pyramid bottom (**B**) • Conical bottom (**B**) The following additional parameters have to be specified: • Unit for the linearized value, e.g. kg, m3, ft3, ... (**"customer unit"**) • Intermediate height H according to the diagram (**"intermediate height"**) • Maximum capacity (a) of the tank, measured in the customer unit (**"maximum scale"**).

Parameter	Selection/Remarks
"type"	In this linearization mode the measured value is calculated from a linearization table. The table may consist of up to 32 pairs of values (level - volume). The table must be monotonically increasing or decreasing. **Selection** • Table The following additional parameters have to be specified: • Unit of the linearized value, e.g. kg, m3, ft3, ... (**"customer unit"**) • Linearization table (**"edit"**)
"customer unit"	Use this parameter to select the desired unit for the linearized values (e.g. kg, m3, ft3, ...). This unit is only indicated on the display. It does not cause a conversion of the measured value. If you want to type in a unit, select the option "customer specific". The parameter "customized text" appears, where you can enter an arbitrary unit (consisting of up to 5 alphanumeric characters).
"edit"	Use this parameter to enter, change or read a linearization table. There are the following options: **Selection** • Read The table editor is opened. The existing table can be read but not changed. • Manual The table editor is opened. Table values can be entered and changed. (→ ⬚ 45, "status table"). • Semi automatic The table editor is opened. The level is automatically read by the ProsonicS. The measured value (volume, weight or flow) must be entered by the user. • Delete The linearization table is deleted.

Parameter	Selection/Remarks
The table editor	

No.	Level	Value
1	0,0000	0,0000
2	0,0000	0,0000
3	0,0000	0,0000
…	0,0000	0,0000

⬇ : go to next row
⬆ : go to previous row
⏎ : open marked row
    for editing

Return to the previous
step by this
key combination.

No.	Level	Value
1	0,0000	0,0000
2	0,0000	0,0000
3	0,0000	0,0000
…	0,0000	0,0000

⬇ ➡ : navigate within the table
⏎ : (for "Level" und "Value")
    open marked number
    for editing
⏎ : (for "No.")
    open row editor

Row function

- Delete row
- Insert row → (before current row)
- Move row → Query: new position

L00-FMU90xxx-19-00-00-en-006

"status table"	Use this parameter to enable or disable the linearization table.
	Selection
	• Enabled
	The table is used.
	• Disabled
	The table is **not** used. The measured value is transferred to the output without linearization.

1)   This option is only valid for horizontal cylinders without dome ceiling. For tanks with dome ceiling FieldCare can be used to calculate a linearization table and to upload it into the instrument.

5.2.5 Interference echo suppression: Basic principles

Parameter	Remarks
"check value" "distance mapping"	The **"check value"** and **"distance mapping"** parameters are used to configure the interference echo suppression of the Prosonic S. The following picture shows the operating principle of the interference echo suppression:

L00-FMU90xxx-19-00-00-yy-017

A   The envelope curve (a) contains the level echo and an interference echo. Without interference echo suppression, the interference echo is evaluated.

B   The interference echo suppression generates the mapping curve (b). This curve suppresses all echoes within the range of mapping (c).

C   From now on, only those echoes are evaluated, which are higher than the mapping curve. The interference echo is below the mapping curve and is therefore ignored.

In order to include all interference echoes, the interference echo suppression should be performed with the level as lpow as possible. If during commissioning the vessel can not be sufficiently emptied, it is advisable to reeat the interference echo suppression at a later point of time (as soon as the level reaches nearly 0%)

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