

# Brief Operating Instructions

## Liquiline CM44P

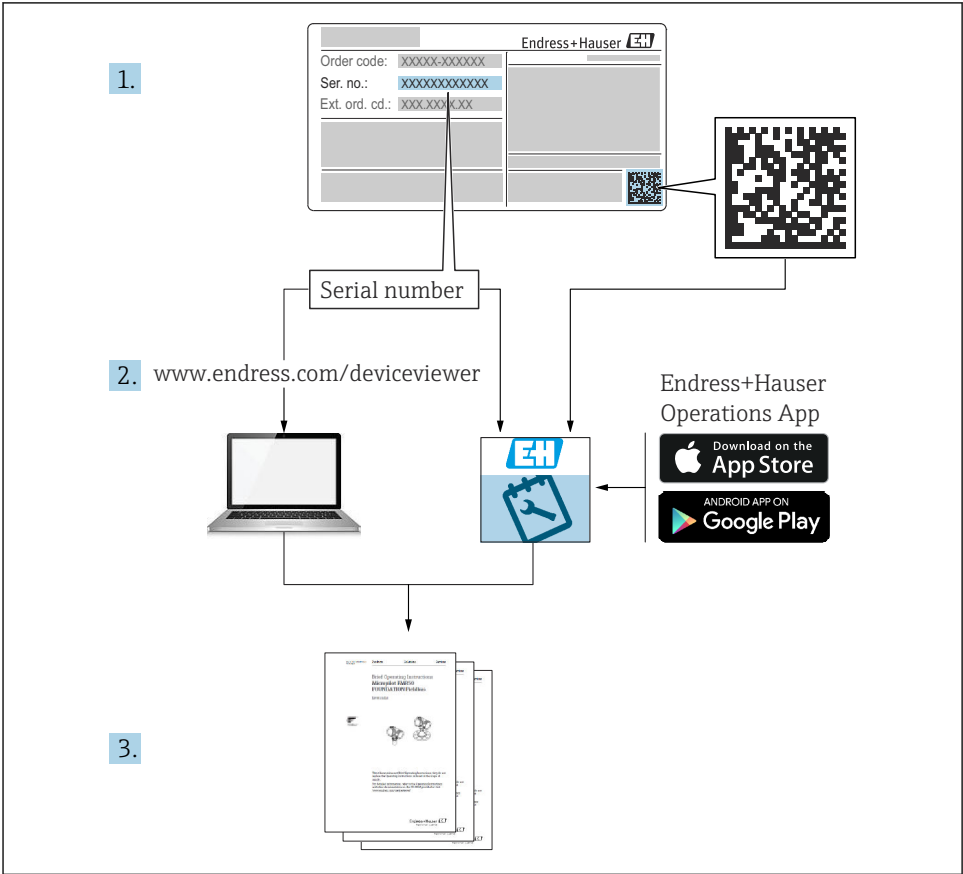
Universal four-wire multichannel controller for process spectrometers and Memosens sensors



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

Detailed information on the device can be found in the Operating Instructions and in the other documentation available at:

- [www.endress.com/device-viewer](http://www.endress.com/device-viewer)
- Smart phone/tablet: Endress+Hauser Operations App







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
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# 1 About this document

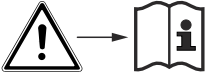

## 1.1 Warnings

Structure of information	Meaning
<div> <b>DANGER</b></div> <div><b>Causes (/consequences)</b> If necessary, Consequences of non-compliance (if applicable) ▶ Corrective action</div>	<div>This symbol alerts you to a dangerous situation. Failure to avoid the dangerous situation <b>will</b> result in a fatal or serious injury.</div>
<div> <b>WARNING</b></div> <div><b>Causes (/consequences)</b> If necessary, Consequences of non-compliance (if applicable) ▶ Corrective action</div>	<div>This symbol alerts you to a dangerous situation. Failure to avoid the dangerous situation <b>can</b> result in a fatal or serious injury.</div>
<div> <b>CAUTION</b></div> <div><b>Causes (/consequences)</b> If necessary, Consequences of non-compliance (if applicable) ▶ Corrective action</div>	<div>This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or more serious injuries.</div>
<div> <b>NOTICE</b></div> <div><b>Cause/situation</b> If necessary, Consequences of non-compliance (if applicable) ▶ Action/note</div>	<div>This symbol alerts you to situations which may result in damage to property.</div>

## 1.2 Symbols

	Additional information, tips
	Permitted or recommended
	Not permitted or not recommended
	Reference to device documentation
	Reference to page
	Reference to graphic
	Result of a step

## 1.3 Symbols on the device

Symbol	Meaning
	Reference to device documentation
	Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to the manufacturer for disposal under the applicable conditions.

## 1.4 Documentation

The following manuals complement these Brief Operating Instructions and are available on the product pages on the Internet:

- Operating Instructions for Liquiline CM44P, BA01954C
  - Device description
  - Commissioning
  - Operation
  - Software description (excluding sensor menus; these are described in a separate manual - see below)
  - Device-specific diagnostics and troubleshooting
  - Maintenance
  - Repair and spare parts
  - Accessories
  - Technical data
- Operating Instructions for Memosens, BA01245C
  - Software description for Memosens inputs
  - Calibration of Memosens sensors
  - Sensor-specific diagnostics and troubleshooting
- Operating Instructions for HART communication, BA00486C
  - Onsite settings and installation instructions for HART
  - Description of HART driver
- Guidelines for communication via fieldbus and web server
  - HART, SD01187C
  - PROFIBUS, SD01188C
  - Modbus, SD01189C
  - Web server, SD01190C
  - EtherNet/IP, SD01293C
  - PROFINET, SD02490C
- Safety instructions for electrical equipment in explosion-hazardous areas
  - ATEX & IECEx, XA02419C
  - CSA, XA02420C

## 2 Basic safety instructions

### 2.1 Requirements for the personnel

- Installation, commissioning, operation and maintenance of the measuring system may be carried out only by specially trained technical personnel.
- The technical personnel must be authorized by the plant operator to carry out the specified activities.
- The electrical connection may be performed only by an electrical technician.
- The technical personnel must have read and understood these Operating Instructions and must follow the instructions contained therein.
- Faults at the measuring point may only be rectified by authorized and specially trained personnel.



Repairs not described in the Operating Instructions provided must be carried out only directly at the manufacturer's site or by the service organization.

### 2.2 Intended use

#### 2.2.1 Non-hazardous atmosphere

Liquiline CM44P is a multichannel controller for connecting process spectrometers and digital sensors with Memosens technology in non-hazardous environments.

The device is designed for use in the following applications:

- Food and beverages
- Life science
- Power stations
- Chemical industry
- Other industrial applications

#### 2.2.2 Transmitter in non-hazardous environment with sensor communication module 2DS Ex i for sensors in hazardous environments

The installation conditions in these Brief Operating Instructions and the corresponding XA must be observed.

- ATEX & IECEX: XA02419C
- CSA: XA02420C

#### 2.2.3 Non-intended use

##### NOTICE

##### Objects stored on top of the housing

May cause short-circuits or fire or result in the failure of individual cabinet components or complete failure of the measuring point!

- ▶ Never place any objects, such as tools, cables, paper, food, liquid containers or similar, on top of the housing.
- ▶ Always observe the operator's regulations, in particular with regard to fire safety (smoking) and foodstuffs (beverages).

Use of the device for any purpose other than that described, poses a threat to the safety of people and of the entire measuring system and is therefore not permitted.

The manufacturer is not liable for damage caused by improper or non-designated use.

#### **2.2.4 Installation environment (cabinet device only)**

The device and the associated power units can be operated with 24 V AC, 24 V DC or 100 to 230 V AC and provide shock protection in accordance with IP20.

The components have been designed for pollution degree 2, and moisture must not be allowed to collect in them. The components must therefore be installed in an appropriate enclosure for protection. The ambient conditions specified in the instructions must be observed here.

### **2.3 Workplace safety**

As the user, you are responsible for complying with the following safety conditions:

- Installation guidelines
- Local standards and regulations

#### **Electromagnetic compatibility**

- The product has been tested for electromagnetic compatibility in accordance with the applicable international standards for industrial applications.
- The electromagnetic compatibility indicated applies only to a product that has been connected in accordance with these Operating Instructions.

### **2.4 Operational safety**

#### **Before commissioning the entire measuring point:**

1. Verify that all connections are correct.
2. Ensure that electrical cables and hose connections are undamaged.
3. Do not operate damaged products, and protect them against unintentional operation.
4. Label damaged products as defective.

#### **During operation:**

- If faults cannot be rectified:  
products must be taken out of service and protected against unintentional operation.

#### **⚠ CAUTION**

#### **Programs not switched off during maintenance activities.**

Risk of injury due to medium or cleaning agent!

- Quit any programs that are active.
- Switch to the service mode.
- If testing the cleaning function while cleaning is in progress, wear protective clothing, goggles and gloves or take other suitable measures to protect yourself.

## **2.5 Product safety**

### **2.5.1 State-of-the-art technology**

The product 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 relevant regulations and international standards have been observed.

### **2.5.2 IT security**

We only provide a warranty if the device is installed and used as described in the Operating Instructions. The device is equipped with security mechanisms to protect it against any inadvertent changes to the device settings.

IT security measures in line with operators' security standards and designed to provide additional protection for the device and device data transfer must be implemented by the operators themselves.



## 3 Incoming acceptance and product identification

### 3.1 Incoming acceptance

1. Verify that the packaging is undamaged.
  - ↳ Notify the supplier of any damage to the packaging.  
Keep the damaged packaging until the issue has been resolved.
2. Verify that the contents are undamaged.
  - ↳ Notify the supplier of any damage to the delivery contents.  
Keep the damaged goods until the issue has been resolved.
3. Check that the delivery is complete and nothing is missing.
  - ↳ Compare the shipping documents with your order.
4. Pack the product for storage and transportation in such a way that it is protected against impact and moisture.
  - ↳ The original packaging offers the best protection.  
Make sure to comply with the permitted ambient conditions.

If you have any questions, please contact your supplier or your local Sales Center.

### 3.2 Product identification

#### 3.2.1 Nameplate

Nameplates can be found:

- on the outside of the housing (field device)
- on the packaging (adhesive label, portrait format)
- on the inside of the display cover (field device)
- on the back of the external display (not visible when installed) (cabinet device)

The nameplate provides you with the following information on your device:

- Manufacturer identification
  - Order code
  - Extended order code
  - Serial number
  - Ambient and process conditions
  - Input and output values
  - Activation codes
  - Safety information and warnings
- Compare the information on the nameplate with the order.

### 3.2.2 Product identification

#### Product page

[www.endress.com/cm44p](http://www.endress.com/cm44p)

#### Interpreting the order code

The order code and serial number of your product can be found in the following locations:

- On the nameplate
- In the delivery papers

#### Obtaining information on the product

1. Go to [www.endress.com](http://www.endress.com).
2. Page search (magnifying glass symbol): Enter valid serial number.
3. Search (magnifying glass).
  - ↳ The product structure is displayed in a popup window.
4. Click the product overview.
  - ↳ A new window opens. Here you fill information pertaining to your device, including the product documentation.

### 3.2.3 Manufacturer address

Endress+Hauser Conducta GmbH+Co. KG

Dieselstraße 24

D-70839 Gerlingen

## 3.3 Scope of delivery

The scope of delivery comprises:

- 1 multichannel controller in the version ordered
  - 1 mounting plate
  - 1 wiring label (attached at the factory to the inside of the display cover)
  - 1 external display (if selected as an option) <sup>1)</sup>
  - 1 DIN rail power unit incl. cable (cabinet device only)
  - 1 printed copy of the Operating Instructions for the DIN rail power unit (cabinet device only)
  - 1 printed copy of the Brief Operating Instructions in the language ordered
  - Disconnection element (pre-installed on hazardous area version type 2DS Ex-i)
  - Safety instructions for the hazardous area (for hazardous area version type 2DS Ex-i)
- If you have any queries:  
Please contact your supplier or local sales center.

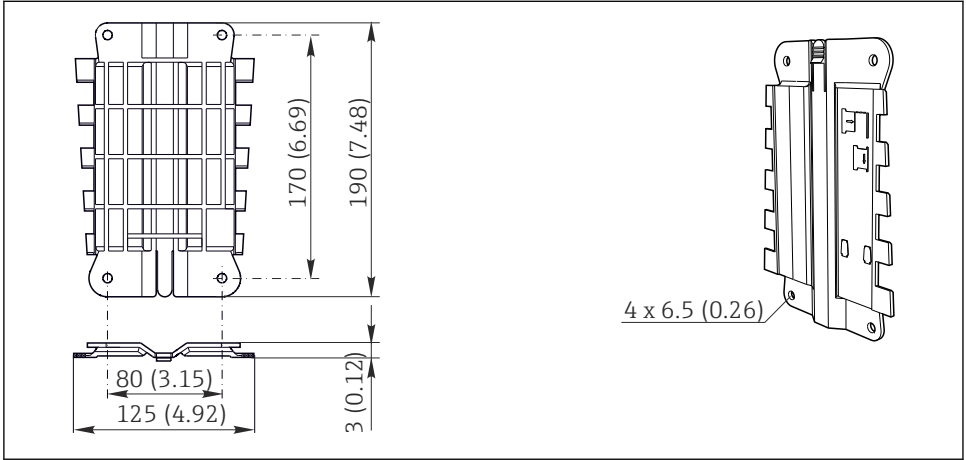
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1) The external display can be selected as an option in the order structure or ordered as an accessory at a later stage.

## 4 Mounting

### 4.1 Mounting requirements

#### 4.1.1 Mounting plate



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1 Mounting plate, Engineering unit: mm (in)

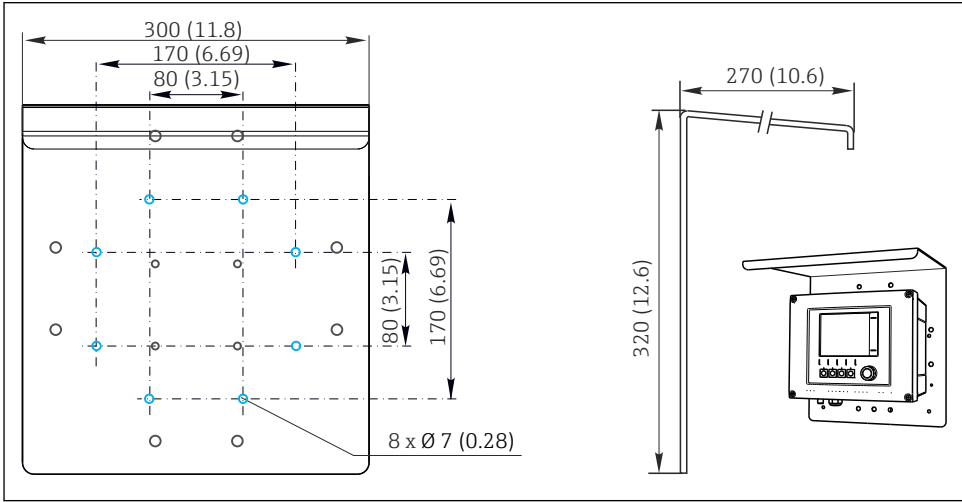
### 4.1.2 Weather protection cover

#### NOTICE

**Effect of climatic conditions (rain, snow, direct sunlight etc.)**

Impaired operation to complete transmitter failure are possible!

- Always use the weather protection cover (accessory) when installing the device outdoors.



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2 Dimensions in mm (in)

### 4.1.3 Mounting on DIN rail as per IEC 60715

#### CAUTION

**The power unit can get very hot under full load**

Burn hazard!

- Avoid touching the power unit during operation.
- The minimum distances to other devices must be observed.
- After switching off the power unit, allow it to cool down before carrying out any work on it.

#### CAUTION

**Impermissible collection of moisture in the device**

Puts the safety of the user at risk!

- The device has IP20 shock protection. Never allow moisture to collect in the device.
- Comply with the specified ambient conditions, e.g. by installing the device in an appropriate protective enclosure.

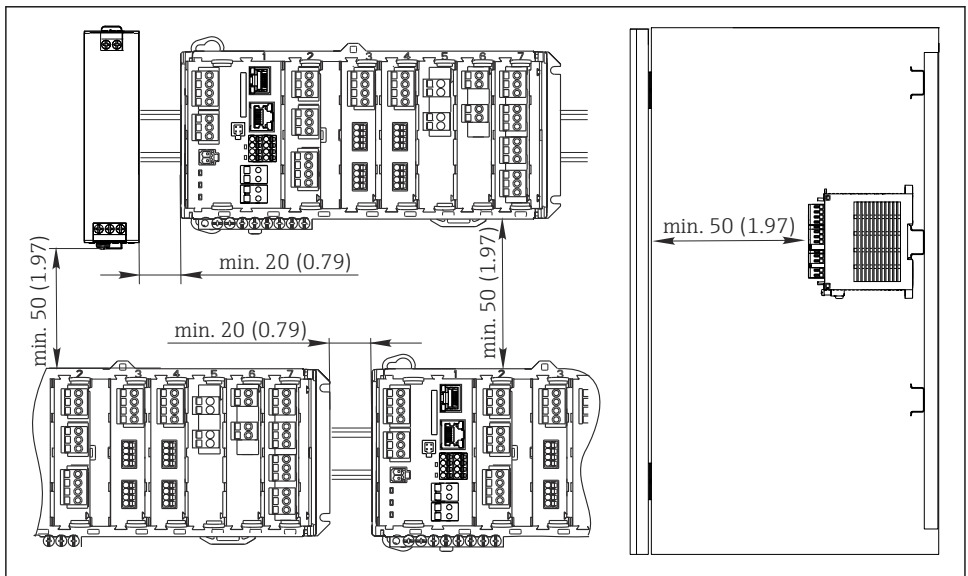
**NOTICE****Incorrect mounting location in the cabinet, spacing regulations not observed**

Possible malfunctions as a result of heat buildup and interference from neighboring devices!

- ▶ Do not position the device directly above sources of heat. The temperature specification must be observed.
- ▶ The components are designed for convection-based cooling. Avoid heat buildup. Ensure openings are not covered, e.g. by cables.
- ▶ Observe the specified distances to other devices.
- ▶ Physically separate the device from frequency converters and high-voltage devices.
- ▶ Recommended installation direction: horizontal. The specified ambient conditions, and particularly the ambient temperatures, only apply for horizontal installation.
- ▶ Vertical orientation is also possible. However, this requires additional fixing clips at the place of installation to hold the device in position on the DIN rail.
- ▶ Recommended installation of power unit: to the left of the device.

**The following minimum clearance specifications must be observed:**

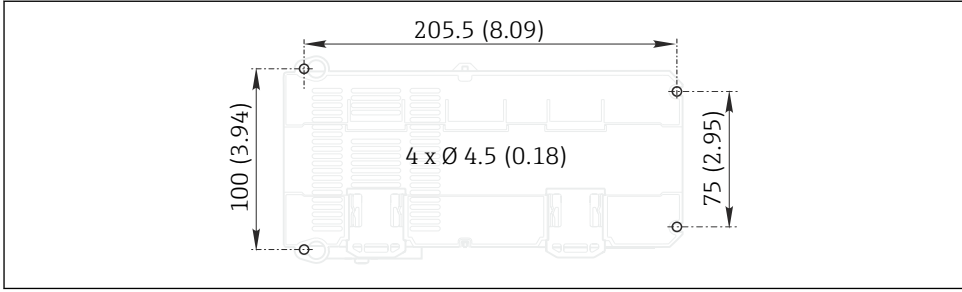
- Distances at the side in relation to other devices incl. power units and to the wall of the cabinet:  
at least 20 mm (0.79 inch)
- Distance above and below the device and depth distance (to control cabinet door or other devices installed there):  
at least 50 mm (1.97 inch)



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3 Minimum clearance in mm (in)

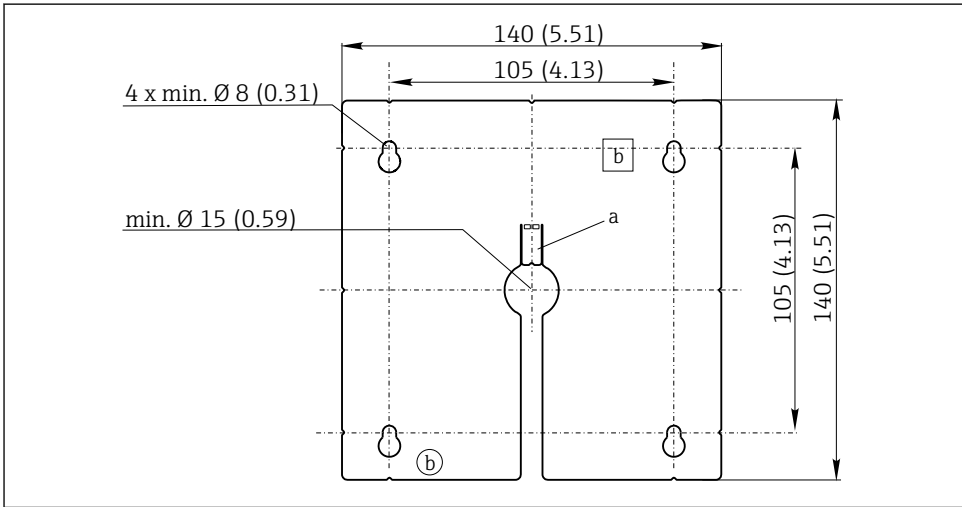
#### 4.1.4 Wall mounting



4 Drilling pattern for wall mounting in mm (in)

#### 4.1.5 Mounting the external display

**i** The mounting plate also serves as the drilling template. The marks on the side help you mark the position of the drill holes.



5 Mounting plate of external display, dimensions in mm (in)

- a Retaining tab
- b Production-related recesses, no function for the user

### 4.1.6 Cable length for optional display

**Length of display cable provided (cabinet device only):**

3 m (10 ft)

**Maximum permitted length of a display cable (cabinet device only):**

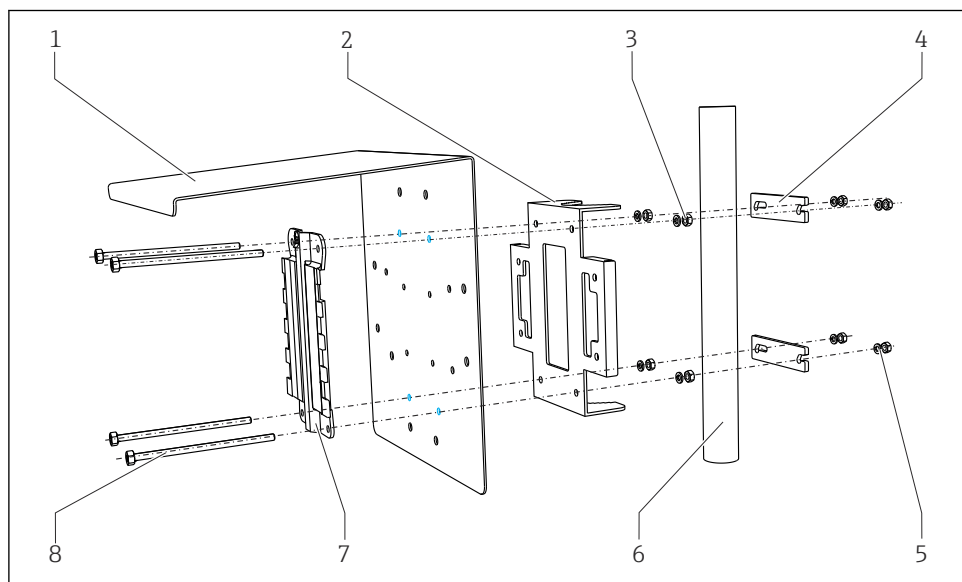
5 m (16.5 ft)

## 4.2 Mounting the measuring device (field device)

### 4.2.1 Post mounting



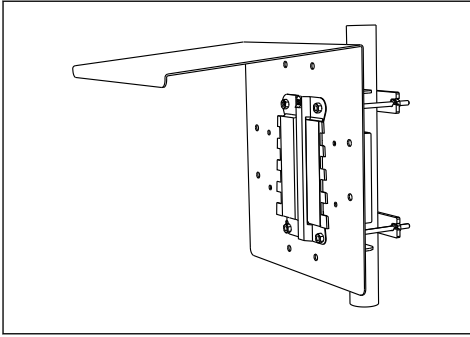
You require the post mounting kit (optional) to mount the unit on a pipe, post or railing (square or circular, clamping range 20 to 61 mm (0.79 to 2.40")).



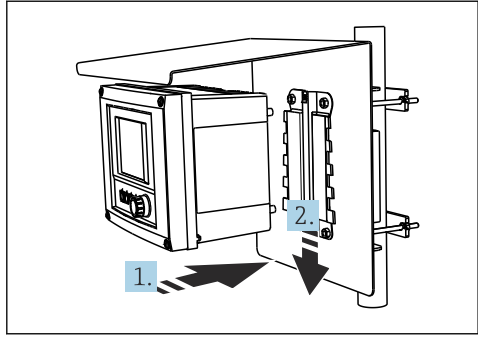
A0033044

#### 6 Post mounting

- |   |   |   |   |
|---|---|---|---|
| 1 | Weather protection cover (optional)         | 5 | Spring washers and nuts (post mounting kit) |
| 2 | Post mounting plate (post mounting kit)     | 6 | Pipe or railing (circular/square)           |
| 3 | Spring washers and nuts (post mounting kit) | 7 | Mounting plate                              |
| 4 | Pipe clamps (post mounting kit)             | 8 | Threaded rods (post mounting kit)           |



A0033045



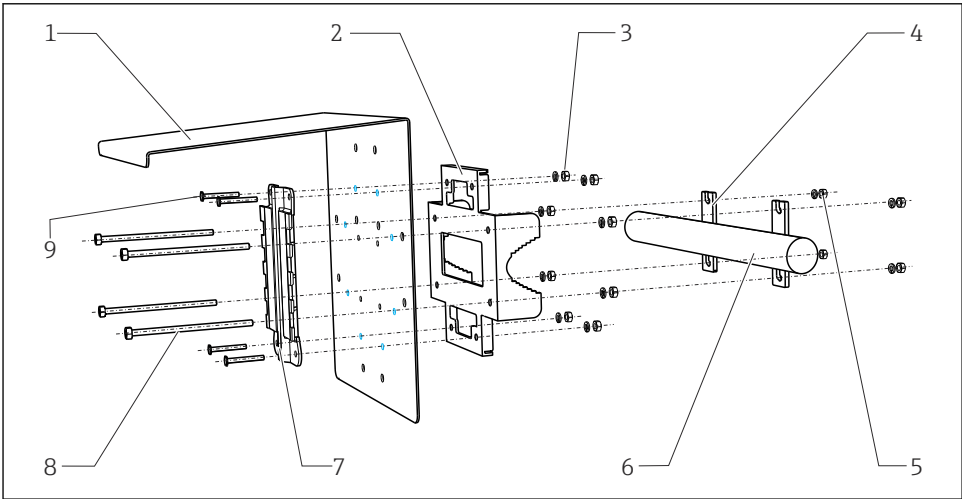
A0025885

**7 Post mounting**

**8 Attach the device and click it into place**

1. Place the device on the mounting plate.
2. Slide the device downwards in the guide on the mounting rail until it clicks into place.

**4.2.2 Rail mounting**

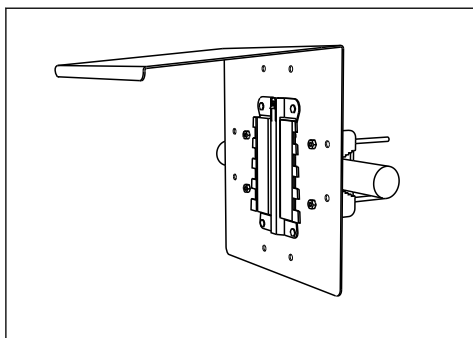


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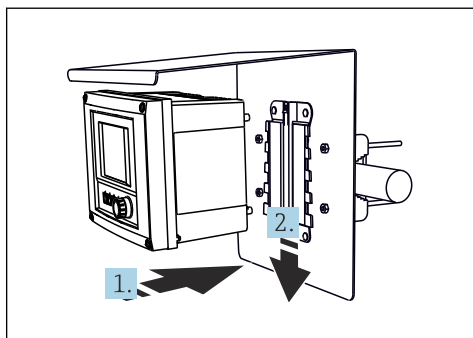
**9 Rail mounting**

- |   |   |   |                                   |
|---|---|---|-----------------------------------|
| 1 | Weather protection cover (optional)         | 6 | Pipe or railing (circular/square) |
| 2 | Post mounting plate (post mounting kit)     | 7 | Mounting plate                    |
| 3 | Spring washers and nuts (post mounting kit) | 8 | Threaded rods (post mounting kit) |
| 4 | Pipe clamps (post mounting kit)             | 9 | Screws (post mounting kit)        |
| 5 | Spring washers and nuts (post mounting kit) |   |                                   |





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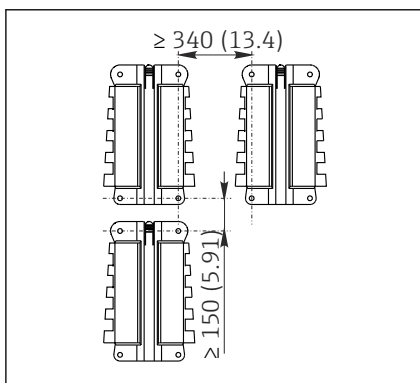
A0027803

#### 10 Rail mounting

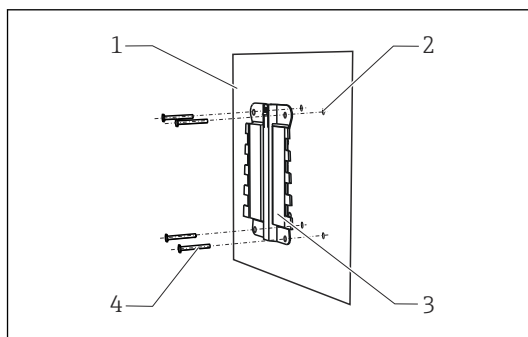
#### 11 Attach the device and click it into place

1. Place the device on the mounting plate.
2. Slide the device downwards in the guide on the mounting rail until it clicks into place.

### 4.2.3 Wall mounting



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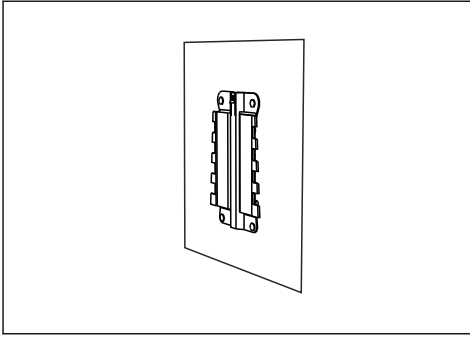
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#### 12 Installation clearance in mm (in)

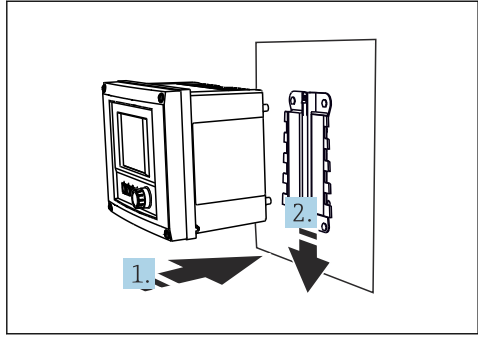
#### 13 Wall mounting

- 1 Wall
- 2 4 drill holes <sup>1)</sup>
- 3 Mounting plate
- 4 Screws Ø 6 mm (not part of scope of supply)

<sup>1)</sup>The size of the drill holes depends on the wall plugs used. The wall plugs and screws must be provided by the customer.



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A0027797

#### 14 Wall mounting

#### 15 Attach the device and click it into place

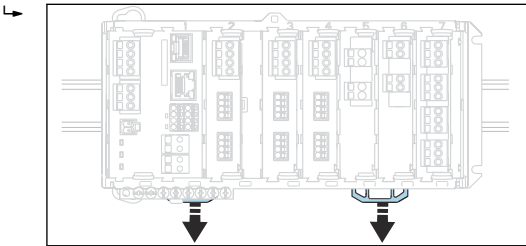
1. Place the device on the mounting plate.
2. Slide the device downwards in the guide on the mounting rail until it clicks into place.

### 4.3 Mounting the measuring device (cabinet device)

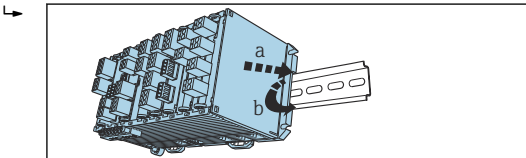
#### 4.3.1 DIN rail mounting

The mounting procedure is the same for all Liquiline devices. The example shows a CM448R.

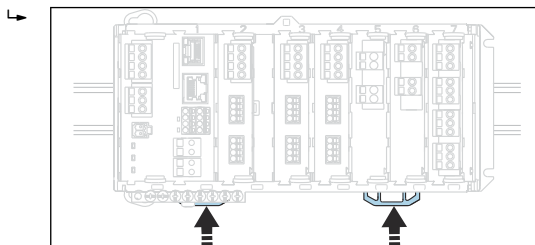
1. In the order configuration, the securing clips are "tightened" to secure the DIN rail. Release the securing clips by pulling them downwards.



2. Attach the device from the top to the DIN rail (a) and secure it by pressing down (b).



3. Slide the securing clips upwards until they click, thereby securing the device to the DIN rail.



4. Mount the external power unit in the same way.

#### 4.3.2 Wall mounting



Mounting material (screws, dowels) are not included in the scope of delivery and must be provided by the customer.

The external power unit can be mounted on a DIN rail only.

Use the back of the housing to mark the mounting holes.

1. Drill the corresponding holes and insert wall plugs if necessary.
2. Screw the housing onto the wall.

#### 4.3.3 Mounting the optional external display

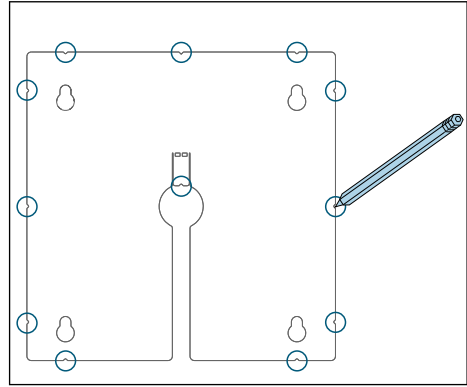
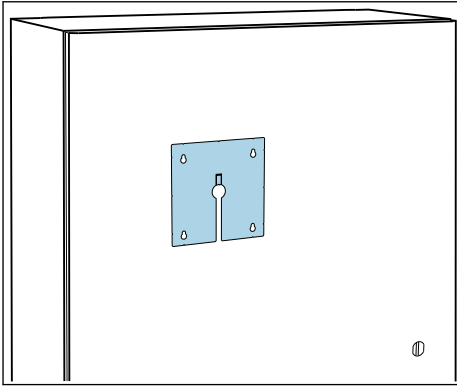


##### Sharp-edged, non-deburred drill holes

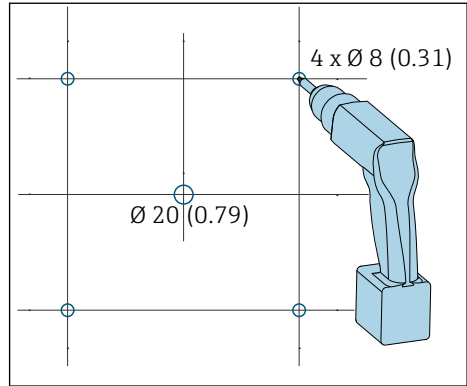
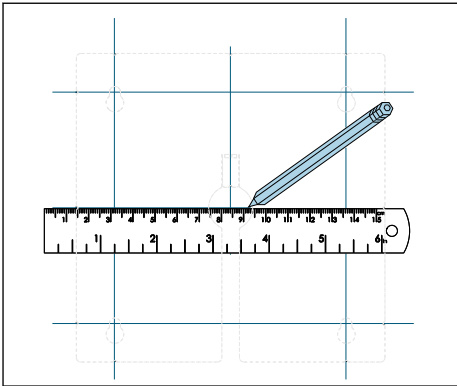
Risk of injury, display cable may get damaged!



- In particular, deburr the central drill hole for the display cable.

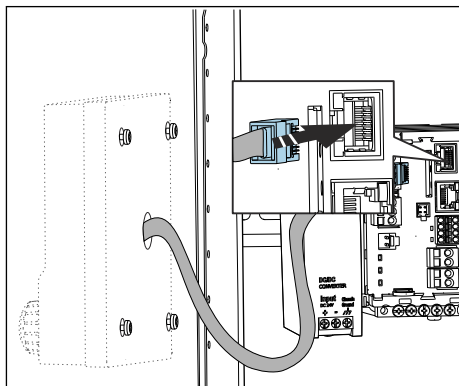
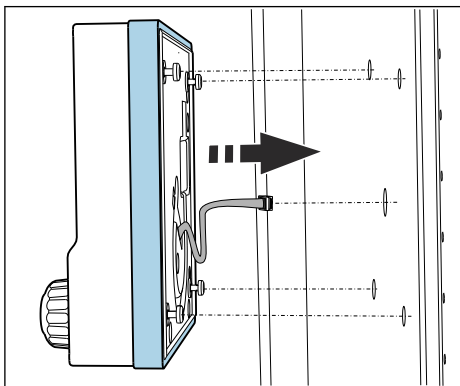
## Mounting the display on the door of the cabinet



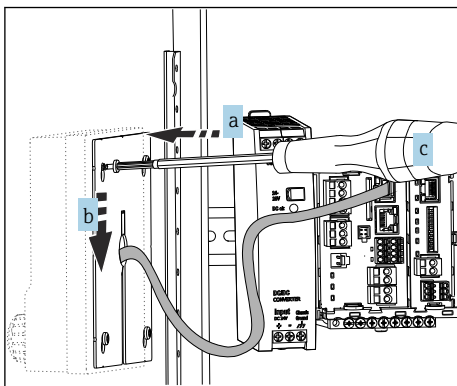
1. Hold the mounting plate from the outside against the door of the control cabinet. Choose the point at which you wish to install the display.
2. Make all the markings.



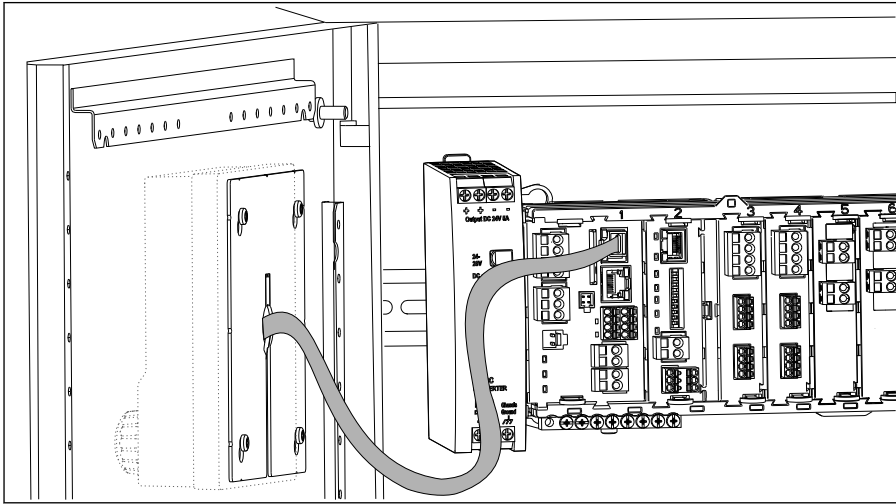
3. Draw lines to interconnect all the marks.  
↳ This will indicate the position of the five drill holes needed.
4. Drill the holes (→  5,  14).



5. Pull the display cable through the hole in the middle, and place the display from the outside through the four holes drilled for this purpose, ensuring that the torx screws have been unscrewed to the last half turn but are still in place. Ensure that the rubber frame (seal, highlighted blue) does not become damaged and is properly positioned on the surface of the door.
6. Connect the display cable to the RJ-45 socket in the base module.



7. Place the mounting plate on the inside over the screws (a), slide it down (b) and tighten the screws (c).
  - ↳ The display is now mounted and ready to use.



16 Mounted display

### NOTICE

#### Incorrect installation

Damage, e.g. to the cable, or malfunctions are possible!

- Lay cables in such a way that they do not get squashed e.g. when closing the cabinet door.
- Plug the display cable only into the RJ45 socket in the base module. Otherwise, the display will not function.

## 4.4 Post-mounting check

1. After installation, check the transmitter for damage.
2. Check whether the transmitter is protected against precipitation and direct sunlight (e.g. by the weather protection cover).
3. After mounting, check all devices (controller, power unit, display) for damage.
4. Verify that the specified installation clearances have been observed.
5. Verify that all securing clips have been snapped into place and that the components are securely positioned on the DIN rail.
6. Ensure that the temperature limits are observed at the mounting location.

## 5 Electrical connection

### 5.1 Connecting the measuring device

#### **⚠ WARNING**

##### **Device is live!**

Incorrect connection may result in injury or death!

- ▶ The electrical connection may be performed only by an electrical technician.
- ▶ The electrical technician must have read and understood these Operating Instructions and must follow the instructions contained therein.
- ▶ **Prior** to commencing connection work, ensure that no voltage is present on any cable.

#### **NOTICE**

##### **The device does not have a power switch!**

- ▶ Provide a protected circuit breaker in the vicinity of the device at the place of installation.
- ▶ The circuit breaker must be a switch or power switch, and must be labeled as the circuit breaker for the device.
- ▶ At the supply point, the power supply must be isolated from dangerous live cables by double or reinforced insulation in the case of devices with a 24 V supply voltage.

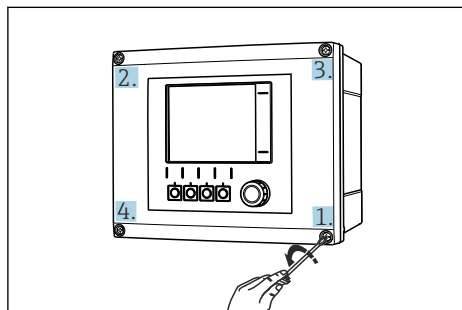
#### 5.1.1 Opening the housing

#### **NOTICE**

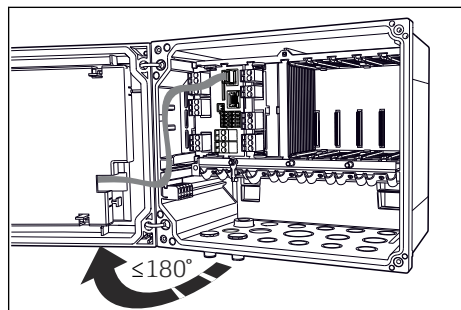
##### **Pointed or sharp tools**

The use of unsuitable tools can cause scratches on the housing or damage to the seal, and therefore negatively affect the leak-tightness of the housing!

- ▶ Do not use any sharp or pointed objects, e.g. a knife, to open the housing.
- ▶ Only use a suitable Phillips screwdriver.



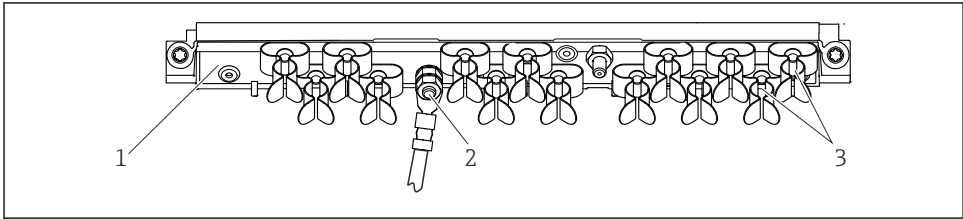
- 17 Slacken the housing screws crosswise with a Phillips head screwdriver



- 18 Opening display cover, max. opening angle 180° (depends on installation position)

1. Slacken the housing screws crosswise.
2. To close the housing: tighten the screws in a similar step-by-step, crosswise sequence.

### 5.1.2 Cable mounting rail



A0048299

#### 19 Cable mounting rail and associated function (field device)

- 1 Cable mounting rail
- 2 Threaded bolt (protective ground connection, central grounding point)
- 3 Cable clamps (fixing and grounding the sensor cables)

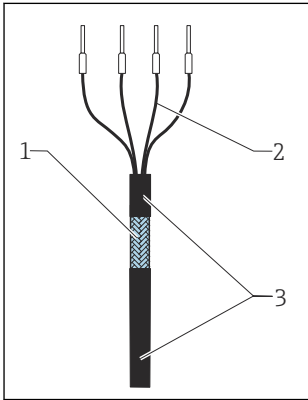
### 5.1.3 Connecting the cable shield

The sensor cable, fieldbus cable and Ethernet cable must be shielded cables.

**i** Only use terminated original cables where possible.

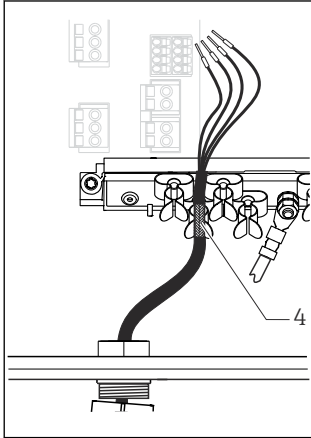
Clamping range of cable clamps: 4 to 11 mm (0.16 to 0.43 in)

Sample cable (does not necessarily correspond to the original cable supplied)



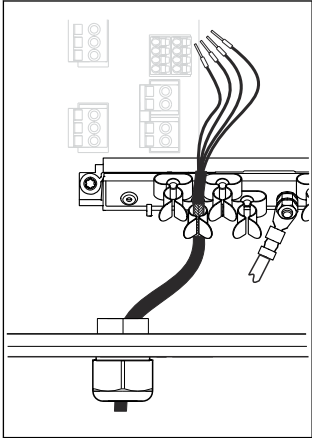
#### 20 Terminated cable

- 1 Outer shield (exposed)
- 2 Cable cores with ferrules
- 3 Cable sheath (insulation)



A0045763

- 21 Connect the cable to the grounding clamp
- 4 Grounding clamp



A0045764

- 22 Press the cable into the grounding clamp

The cable shield is grounded using the grounding clamp <sup>1)</sup>

- 1) Observe the instructions in the "Ensuring the degree of protection" section (→ **i** 41)

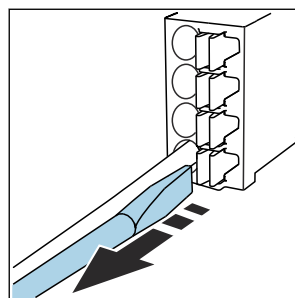
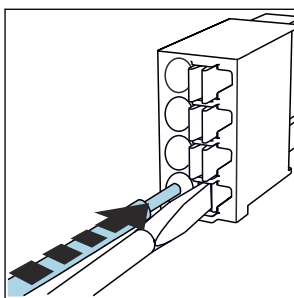
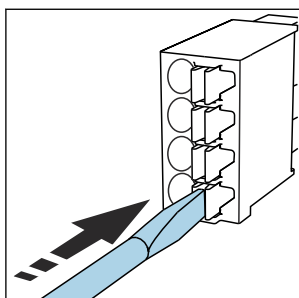
- 1. Loosen a suitable cable gland on the bottom of the housing.



2. Remove the dummy plug.
3. Attach the gland to the cable end, making sure the gland is facing the right direction.
4. Pull the cable through the gland and into the housing.
5. Route the cable in the housing in such a way that the **exposed** cable shield fits into one of the cable clamps and the cable cores can be easily routed as far as the connection plug on the electronics module.
6. Connect the cable to the cable clamp.
7. Clamp the cable.
8. Connect cable cores as per the wiring diagram.
9. Tighten the cable gland from outside.

#### 5.1.4 Cable terminals

*Plug-in terminals for Memosens and PROFIBUS/RS485 connections*

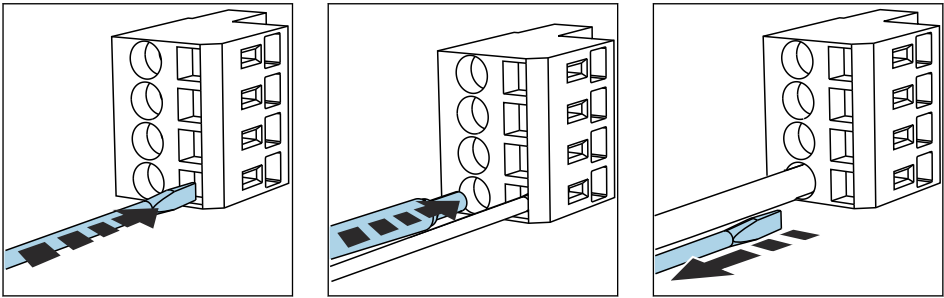


- ▶ Press the screwdriver against the clip (opens the terminal).
- ▶ Insert the cable until the limit stop.
- ▶ Remove the screwdriver (closes the terminal).



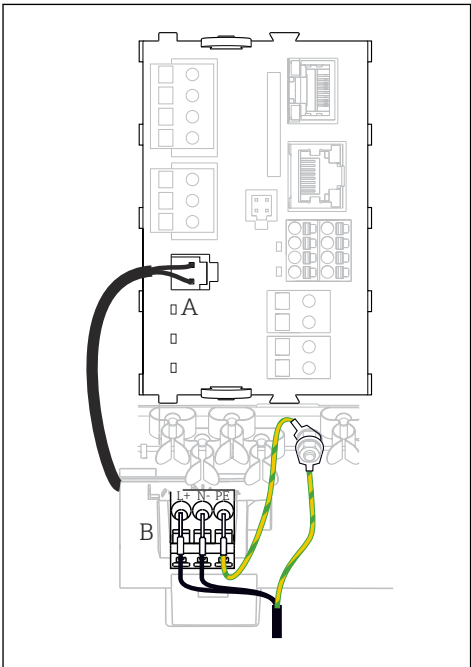
After connection, make sure that every cable end is securely in place. Terminated cable ends, in particular, tend to come loose easily if they have not been correctly inserted as far as the limit stop.

All other plug-in terminals

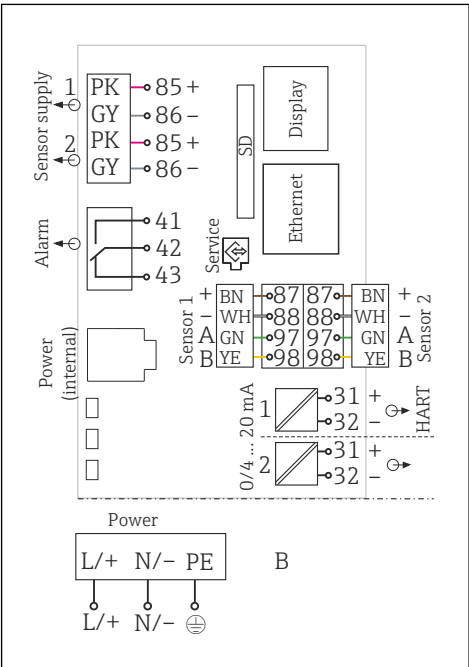


- Press the screwdriver against the clip (opens the terminal).
- Insert the cable until the limit stop.
- Remove the screwdriver (closes the terminal).

5.1.5 Connecting the supply voltage



A0039626

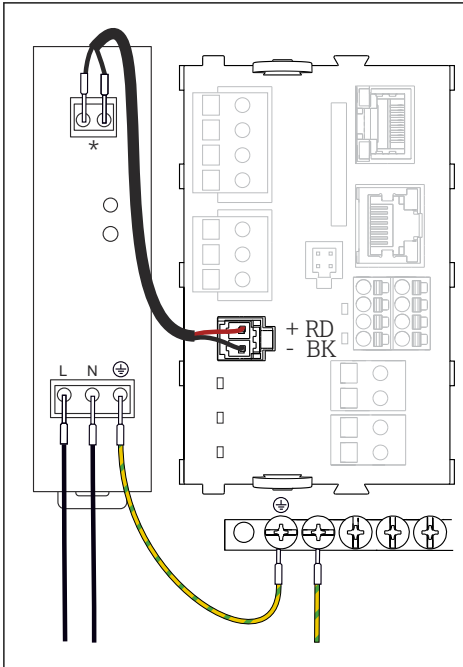


A0039624

23 Connecting the power supply using the example of the BASE2-E (field device)

- A Internal power supply cable
- B Extension power unit

24 Complete wiring diagram using the example of the BASE2-E and extension power supply unit (B)



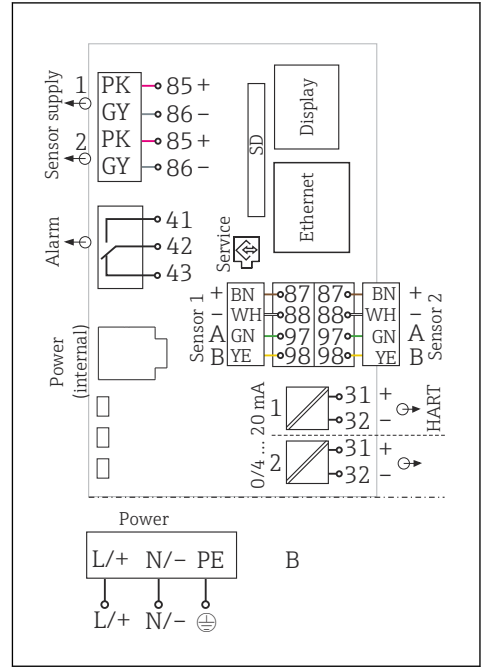
25 Connecting the power supply using the example of the BASE2-E (cabinet device)

\* Assignment depends on power supply unit; make sure it is correctly connected.

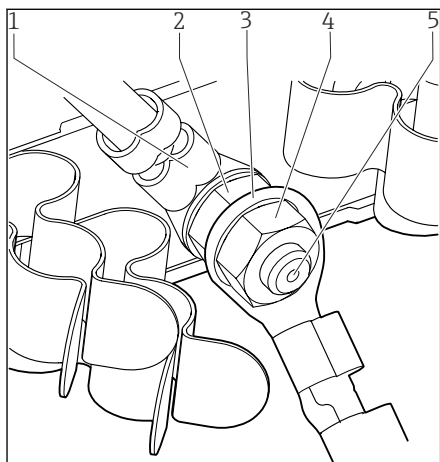
**i** The two device versions may only be operated with the power unit supplied and the power unit cable. Also pay attention to the information in the operating instructions supplied for the power unit.

### Connecting the supply voltage

1. Route the power supply cable into the housing through the suitable cable entry.
2. Connect the protective ground of the power unit to the threaded bolt specially provided on the cable mounting rail.
3. Protective ground or grounding provided at the installation location: provide a ground cable (min. 0.75 mm<sup>2</sup> (corresponding to 18 AWG))<sup>1)</sup>! Guide the ground cable also through the cable entry and connect it to the threaded bolt on the cable mounting rail.
4. Connect the cable cores L and N (100 to 230 V AC) or + and - (24 V DC) to the plug-in terminals on the power unit in accordance with the wiring diagram.



26 Complete wiring diagram using the example of the BASE2-E and external power supply unit (B)



- 1 Protective ground of power unit
- 2 Serrated washer and nut
- 3 Protective ground / ground cable, provided at the installation location (min.  $0.75 \text{ mm}^2$  ( $\approx 18 \text{ AWG}$ )) <sup>1)</sup>
- 4 Serrated washer and nut
- 5 Mounting bolts

#### 27 Protective ground or grounding connection

- 1) With a fuse with a 10 A rating. For a fuse with a rating of 16 A, the protective ground / ground cable must have a cross-sectional area of at least  $1.5 \text{ mm}^2$  ( $\approx 14 \text{ AWG}$ ).

### NOTICE

#### Protective ground/ground cable with end sleeve or open cable lug

The cable can become loose. Loss of the protective function!

- To connect the protective ground or ground cable to the threaded bolt, only use a cable with a closed cable lug as per DIN 46211, 46225, form A.
- Never connect the protective ground or ground cable to the threaded bolt with an end sleeve or an open cable lug!

### NOTICE

#### Incorrect connection and cable run not separate

Interference on signal or display cable, incorrect measured values or failure of display may occur!

- Do **not** connect the cable shield of the display cable to PE (terminal strip of device)!
- Run the signal/display cable in the control cabinet separately from live (current-carrying) cables.

## 5.2 Connecting the sensors

### 5.2.1 Sensor types for non-hazardous area

*Sensors with Memosens protocol*

Sensor types	Sensor cable	Sensors
Digital sensors <b>without</b> additional internal power supply	With plug-in connection and inductive signal transmission	<ul style="list-style-type: none"> <li>■ pH sensors</li> <li>■ ORP sensors</li> <li>■ Combined sensors</li> <li>■ Oxygen sensors (amperometric and optical)</li> <li>■ Conductivity sensors with conductive measurement of conductivity</li> <li>■ Chlorine sensors (disinfection)</li> </ul>
	Fixed cable	Conductivity sensors with inductive measurement of conductivity
Digital sensors with additional internal power supply	Fixed cable	<ul style="list-style-type: none"> <li>■ Process spectrometer</li> <li>■ Turbidity sensors</li> <li>■ Sensors for interface measurement</li> <li>■ Sensors for measuring the spectral absorption coefficient (SAC)</li> <li>■ Nitrate sensors</li> <li>■ Optical oxygen sensors</li> <li>■ Ion-sensitive sensors</li> </ul>

**The following rule applies if connecting CUS71D sensors:**

- The maximum number of Memosens inputs is limited to two.
- Any combination of CUS71D or other sensors is possible.

### 5.2.2 Sensor types for hazardous area

*Sensors with Memosens protocol*

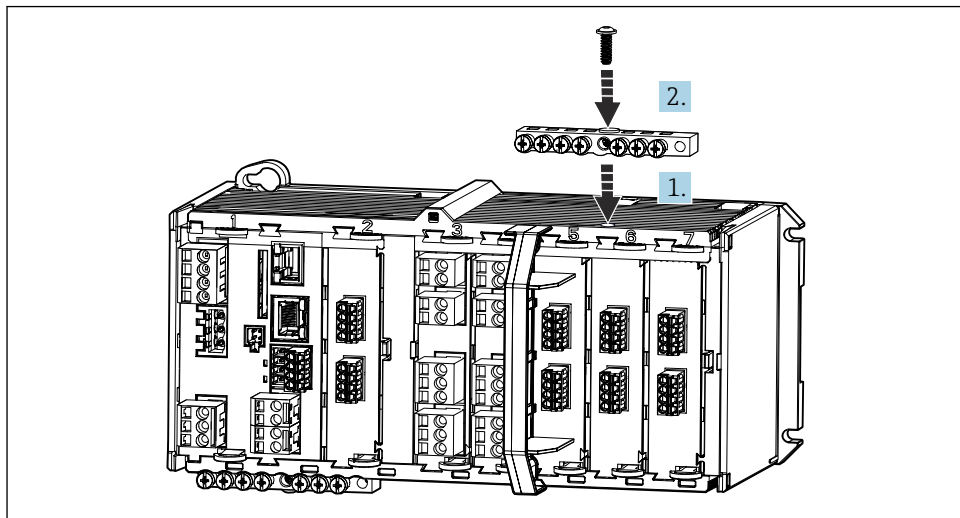
Sensor types	Sensor cable	Sensors
Digital sensors <b>without</b> additional internal power supply	With plug-in connection and inductive signal transmission	<ul style="list-style-type: none"> <li>■ pH sensors</li> <li>■ ORP sensors</li> <li>■ Combined sensors</li> <li>■ Oxygen sensors (amperometric and optical)</li> <li>■ Conductivity sensors with conductive measurement of conductivity</li> <li>■ Chlorine sensors (disinfection)</li> </ul>
	Fixed cable	Conductivity sensors with inductive measurement of conductivity



Intrinsically safe sensors for use in explosive atmospheres may only be connected to the sensor communication module type 2DS Ex-i. Only the sensors covered by the certificates may be connected (see XA).

The sensor connections for non-Ex sensors on the base module are disabled.

### 5.2.3 Mounting the terminal strip for sensor communication module 2DS Ex-i (cabinet device)

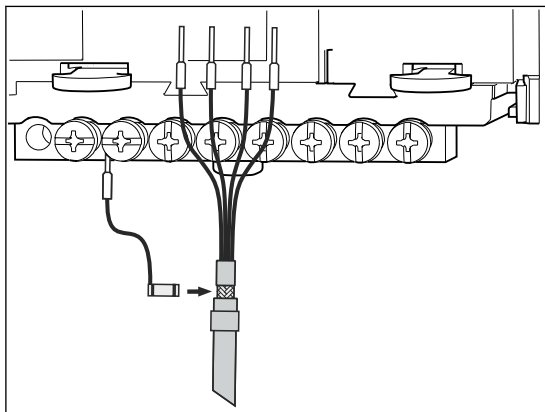


A0045451

1. Fit the cable duct with the central bore over the thread of the sensor communication module 2DS Ex-i.
2. Tighten the cable duct.
3. Establish the grounding of the cable duct (e.g. via the cable duct of the base module).

### 5.2.4 Connecting the functional ground (cabinet device)

You must always connect the terminal strip with PE from the central node in the cabinet. Use the conductor with cable clamp that is included with the Memosens cable to connect the functional earth to the terminal strip of the device.



28 Functional earth connection

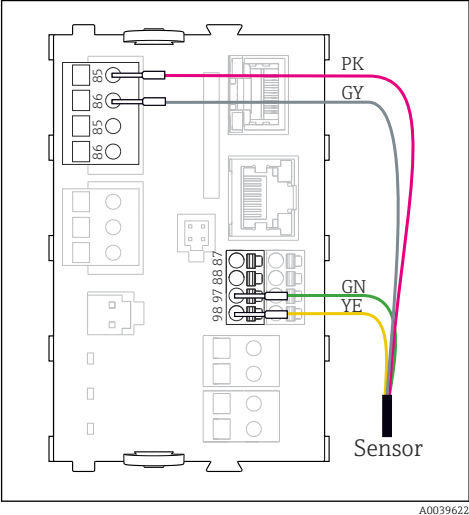
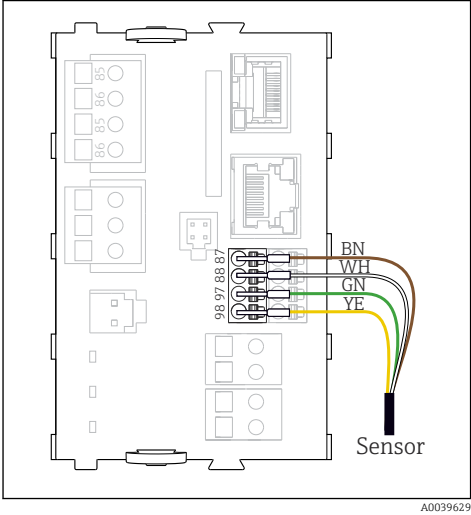
**i** You must only ever connect one functional earth to each screw in the terminal strip. Otherwise, shielding is not guaranteed.

### 5.2.5 Connecting sensors for non-hazardous area

#### Types of connection

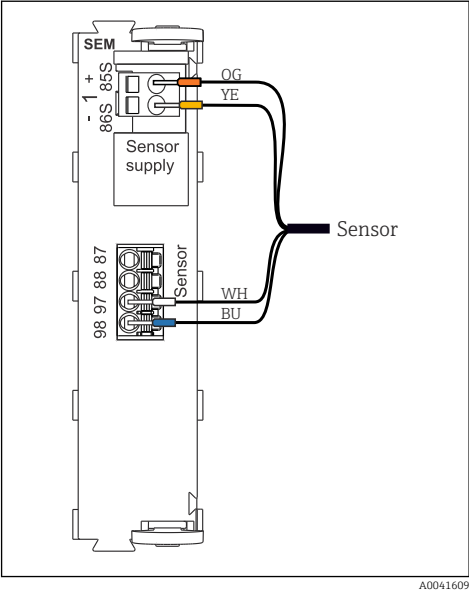
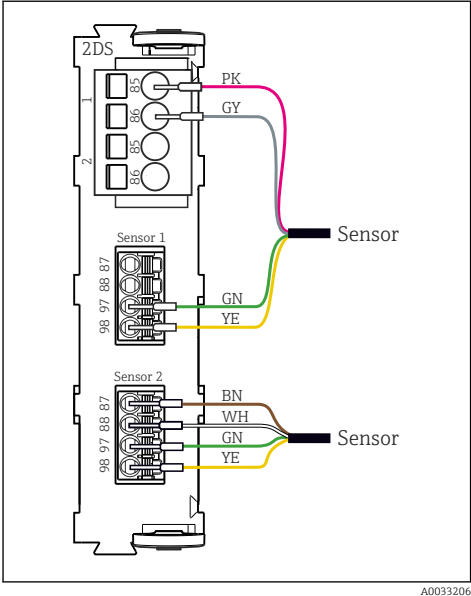
- Direct connection of the sensor cable to the terminal connector of the , 2DS Memosens module , basic module-E (→ 29 ff.)(Memosens sensors only)
- Optional for Memosens sensors: Sensor cable plug connected to the M12 sensor socket on the underside of the device (field device)  
With this type of connection, the device is already wired at the factory (→ 33).

**Sensor cable connected directly**



**29** *Memosens sensors without additional supply voltage*

**30** *Memosens sensors with additional supply voltage*



**31** *Sensors with and without additional supply voltage at sensor module 2DS*

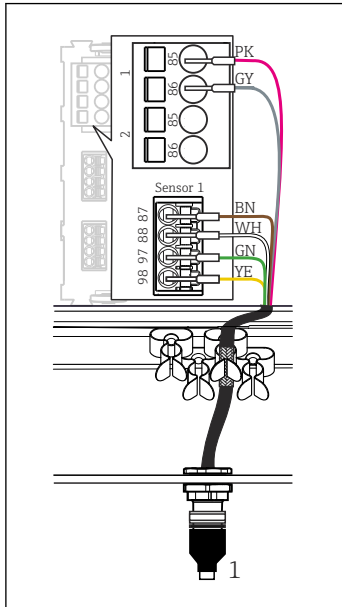
**32** *Spectrometer connection to SEM module*

**i** **In the case of a single-cannel device:**  
The left-hand Memosens input on basic module must be used!

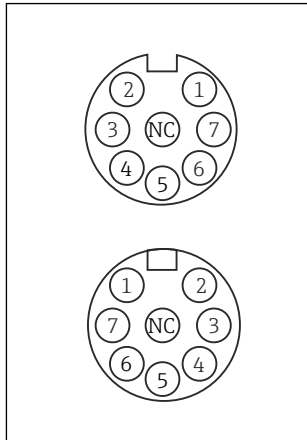


**Memosens connection via M12 connection (field device only)**

Only for connection in non-hazardous area.



A0018019

**33 M12 connection (e.g. on sensor module)****1** Sensor cable with M12 connector

A0018021

**34 M12 assignment, top: socket, bottom: connector (top view in each case)**

- 1** PK (24 V)
- 2** GY (Ground 24 V)
- 3** BN (3 V)
- 4** WH (Ground 3 V)
- 5** GN (Memosens)
- 6** YE (Memosens)
- 7, NC** Not connected

Device versions with a pre-installed M12 socket are ready-wired upon delivery.

**Version without a pre-installed M12 socket**

- 1.** Insert an M12 socket (accessory) into a suitable opening in the base of the housing.
- 2.** Connect the cable to a Memosens terminal as per the wiring diagram.

**Connecting the sensor**

- Connect the sensor cable connector (→ **33** item 1) directly to M12 socket.

Please note the following:

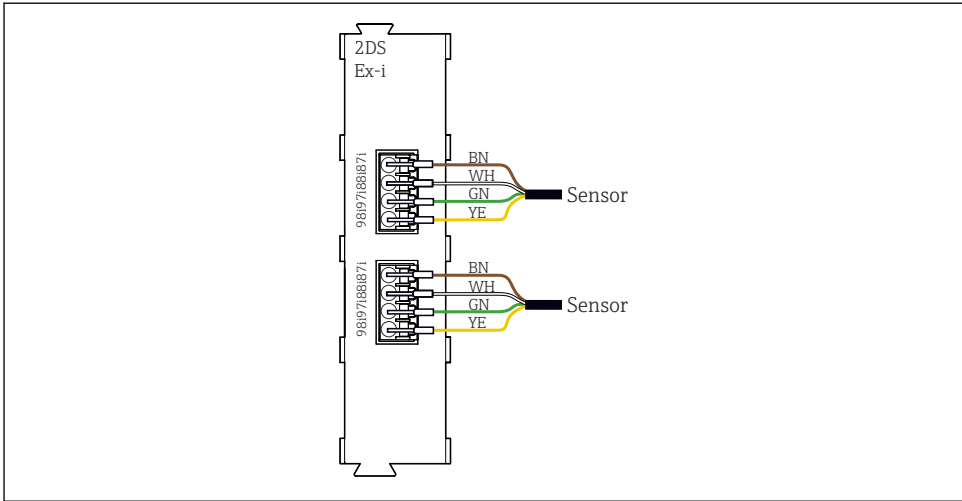
- The internal device wiring is always the same regardless of what kind of sensor you connect to the M12 socket (plug&play).
- The signal or power supply cables are assigned in the sensor head in such a way that the PK and GY power supply cables are either used (e.g. optical sensors) or not (e.g. pH or ORP sensors).

**i** When connecting intrinsically safe sensors to transmitters with sensor communication module type 2DS Ex i, the M12 plug-in connector is **not** permitted.

**5.2.6 Connecting sensors for hazardous area**

Sensor cable connected directly

- Connect the sensor cable to the terminal connector of the sensor communication module 2DS Ex-i.



A0045659

35 Sensors without additional supply voltage at sensor communication module type 2DS Ex-i

**i** Intrinsically safe sensors for use in explosive atmospheres may only be connected to the sensor communication module type 2DS Ex-i. Only the sensors covered by the certificates may be connected (see XA).

### 5.3 Connecting additional inputs, outputs or relays

#### **⚠ WARNING**

#### **Module not covered**

No shock protection. Danger of electric shock!

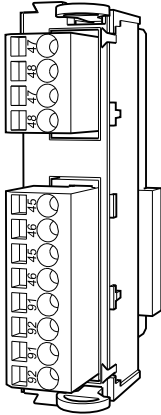
- ▶ Change or extend the hardware for the **non-hazardous area**: always fill the slots from left to right. Do not leave any gaps.
- ▶ If all of the slots are not occupied in the case of devices for the **non-hazardous area**: always insert a dummy cover or end cover in the slot to the right of the last module. This ensures that the unit is shock-protected.
- ▶ Always ensure shock protection is guaranteed particularly in the case of relay modules (2R, 4R, AOR).
- ▶ Hardware for the **hazardous area** may not be modified. Only the Manufacturer's Service Team may convert a certified device to another certified device version. This includes all modules of the transmitter with an integrated 2DS Ex-i module, as well as changes that concern non-intrinsically safe modules.

**i** The terminal strip (cabinet unit) is used to connect the cable shields.

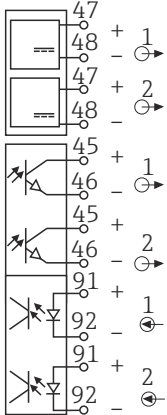
- ▶ If additional shields are required, connect them with PE centrally in the control cabinet via terminal blocks supplied by the customer.

5.3.1 Digital inputs and outputs

DIO module



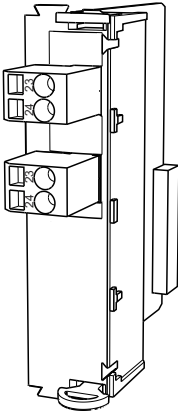
36 Module



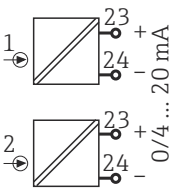
37 Wiring diagram

5.3.2 Current inputs

Module 2AI

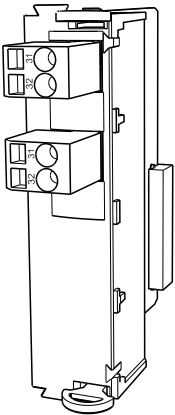
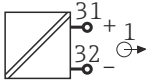
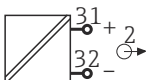
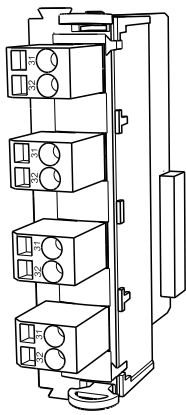
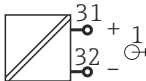
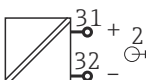
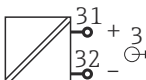
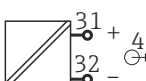






38 Module

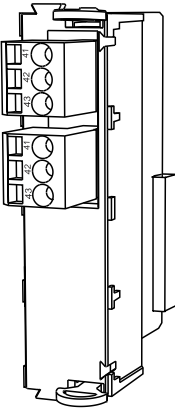
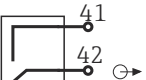
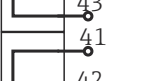
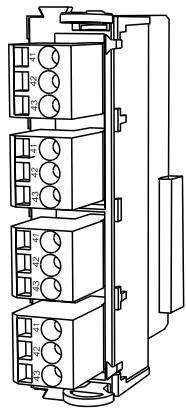
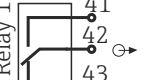
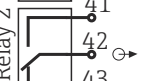
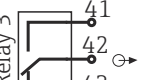
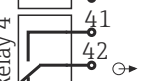






39 Wiring diagram

5.3.3 Current outputs

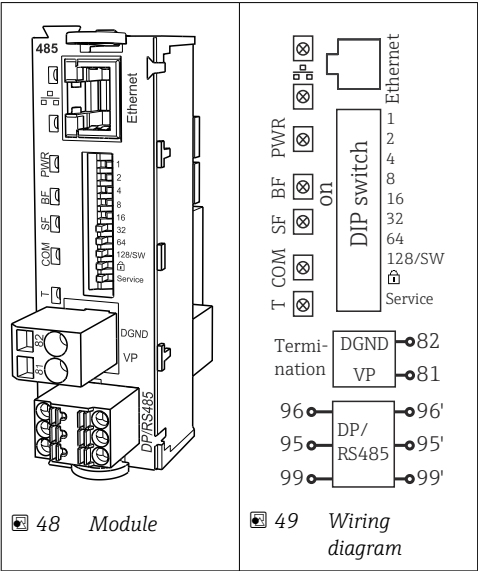
2AO		4AO	
	<p>20 mA</p>  <p>0/4 ...</p> 		<p>20 mA</p>  <p>0/4 ...</p>  <p>20 mA</p>  <p>0/4 ...</p> 
 40 Module	 41 Wiring diagram	 42 Module	 43 Wiring diagram

5.3.4 Relays

Module 2R		Module 4R	
	<p>Relay 1</p>  <p>Relay 2</p> 		<p>Relay 1</p>  <p>Relay 2</p>  <p>Relay 3</p>  <p>Relay 4</p> 
 44 Module	 45 Wiring diagram	 46 Module	 47 Wiring diagram

5.4 Connecting PROFIBUS or Modbus 485

5.4.1 Module 485




Terminal	PROFIBUS DP	Modbus RS485
95	A	B
96	B	A
99	Not connected	C
82	DGND	DGND
81	VP	VP

LEDs on front of module

LED	Identifier	Color	Description
RJ45	LNK/ACT	GN	RJ45 is disabled. Ethernet communication is via the BASE2 module
RJ45	10/100	YE	

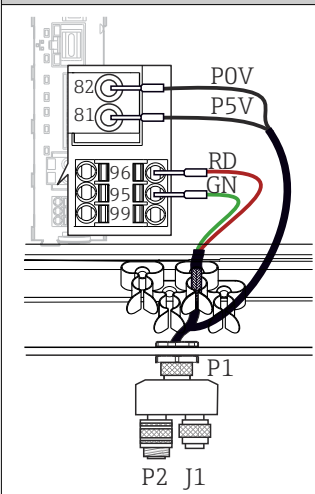
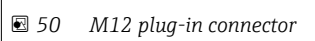
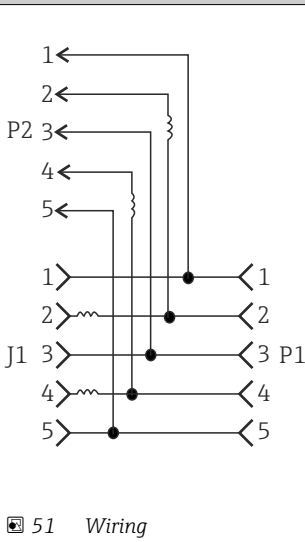
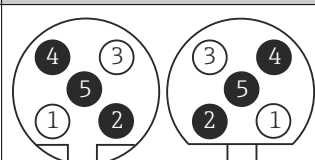
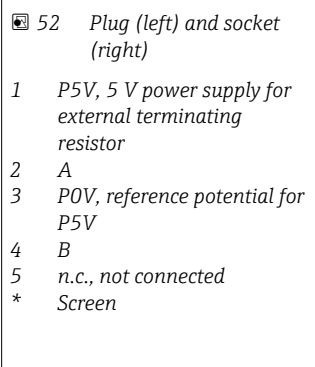
LED	Identifier	Color	Description
PWR	Power	GN	Supply voltage is applied and module is initialized
BF	Bus failure	RD	Bus failure
SF	System failure	RD	Device error
COM	Communication	YE	Modbus message sent or received
T	Bus termination	YE	<div>■ Off = No termination</div> <div>■ On = Termination is used</div>


DIP switches on front of module

DIP	Factory setting	Assignment
1-128	ON	Bus address (→ "Commissioning/communication")
	OFF	Write protection: "ON" = configuration not possible via the bus, only via local operation
Service	OFF	The switch has no function

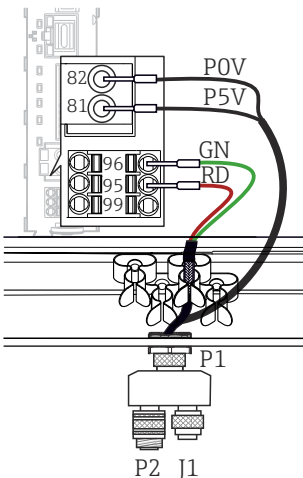
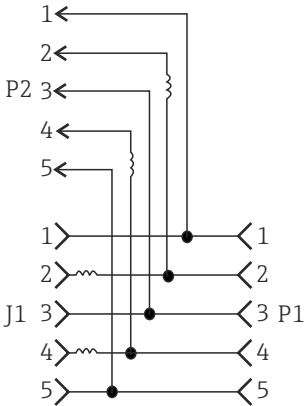
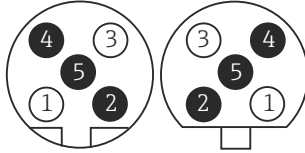
5.4.2 Connection via M12 plug (field device only)

PROFIBUS DP

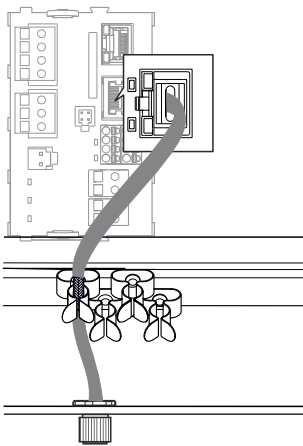
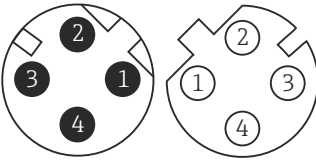
M12 Y-section	Wiring in M12 Y section	Pin assignment in plug and socket
 		 

 When using the M12 Y-section, the maximum data transfer rate is limited to 1.5 MBit/s. For direct wiring, the maximum data transfer rate is 12 MBit/s.

Modbus RS485

M12 Y-section	Wiring in M12 Y section	Pin assignment in plug and socket
 <p>53 M12 plug-in connector</p>	 <p>54 Wiring</p>	 <p>55 Plug (left) and socket (right)</p> <p>1 P5V, 5 V power supply for external terminating resistor</p> <p>2 A</p> <p>3 P0V, reference potential for P5V</p> <p>4 B</p> <p>5 n.c., not connected</p> <p>* Screen</p>

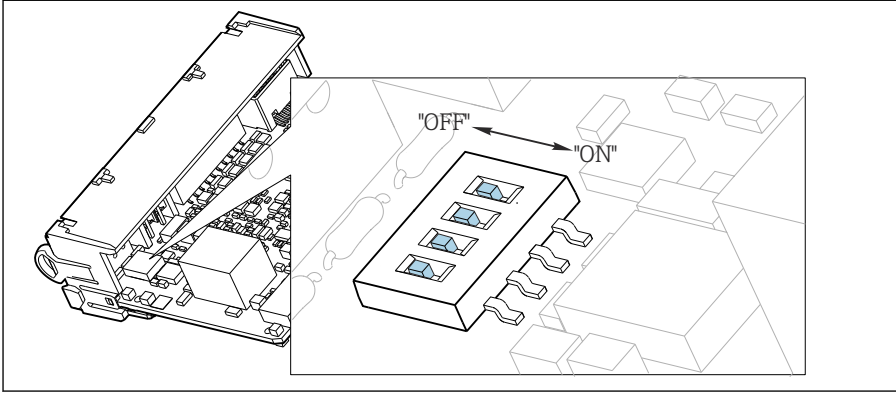
Ethernet, web server, PROFINET

Internal connection	Pin assignment in plug and socket
 <p>56 Ethernet socket</p>	 <p>57 Plug (left) and socket (right)</p> <p>1 Tx+</p> <p>2 Rx+</p> <p>3 Tx-</p> <p>4 Rx-</p> <p>Shielding (thread)</p>

### 5.4.3 Bus termination

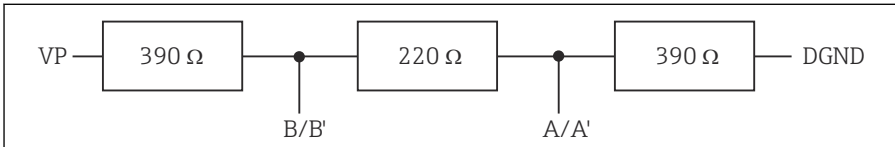
There are 2 ways to terminate the bus:

#### 1. Internal termination (via DIP switch on module board)



58 DIP switch for internal termination

- Using a suitable tool such as a tweezer, move all four DIP switches to the "ON" position.
  - ↳ The internal termination is used.



59 Structure of internal termination

#### 2. External termination

Leave the DIP switches on the module board in the "OFF" position (factory setting).

- Connect the external termination to terminals 81 and 82 on the front of module 485 for 5-V power supply.
  - ↳ The external termination is used.

## 5.5 Hardware settings

### Setting the bus address

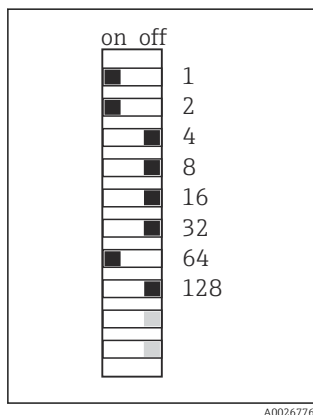
1. Open the housing.



## 2. Set the desired bus address via the DIP switches of module 485.

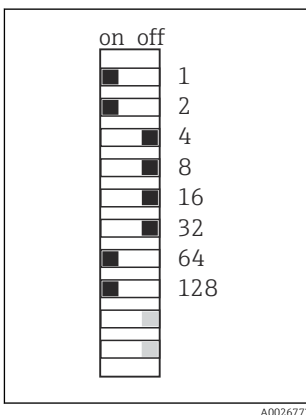


For PROFIBUS DP, valid bus addresses are anything between 1 and 126, and anything between 1 and 247 for Modbus. If you configure an invalid address, software addressing is automatically enabled via the local configuration or via the fieldbus.



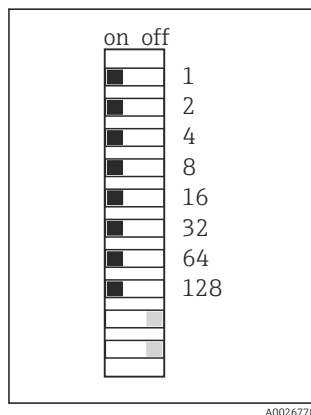
A0026776

60 Valid PROFIBUS address 67



A0026777

61 Valid Modbus address 195



A0026778

62 Invalid address 255 <sup>1)</sup>

<sup>1)</sup> Order configuration, software addressing is active, software address configured at the factory: PROFIBUS 126, Modbus 247



For detailed information on "Setting the address via software", see the Operating Instructions →

## 5.6 Ensuring the degree of protection

Only the mechanical and electrical connections which are described in these instructions and which are necessary for the required, designated use, may be carried out on the device delivered.

► Exercise care when carrying out the work.

Individual types of protection permitted for this product (impermeability (IP), electrical safety, EMC interference immunity) can no longer be guaranteed if, for example :

- Covers are left off
- Different power units to the ones supplied are used
- Cable glands are not sufficiently tightened (must be tightened with 2 Nm (1.5 lbf ft) for the permitted level of IP protection)
- Unsuitable cable diameters are used for the cable glands
- Modules are not fully secured
- The display is not fully secured (risk of moisture entering due to inadequate sealing)
- Loose or insufficiently tightened cables/cable ends
- Conductive cable strands are left in the device

## 5.7 Post-connection check

### **WARNING**

#### Connection errors

The safety of people and of the measuring point is at risk! The manufacturer does not accept any responsibility for errors that result from failure to comply with the instructions in this manual.

- ▶ Put the device into operation only if you can answer **yes** to **all** the following questions.

#### Device condition and specifications

- ▶ Are the device and all the cables free from damage on the outside?

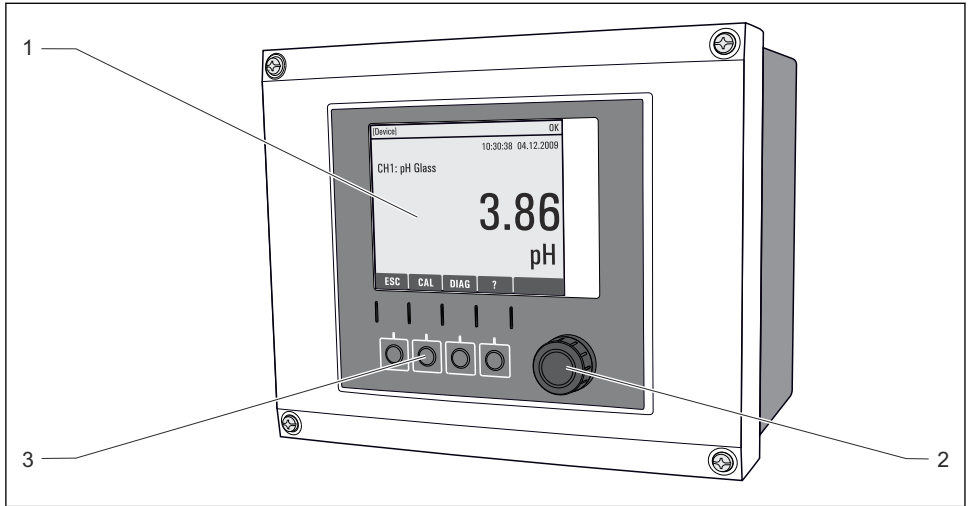
#### Electrical connection

- ▶ Are the mounted cables strain relieved?
- ▶ Are the cables routed without loops and cross-overs?
- ▶ Are the signal cables correctly connected as per the wiring diagram?
- ▶ Have all the other connections been established correctly?
- ▶ Are unused connection wires connected to the protective ground connection?
- ▶ Are all plug-in terminals securely engaged?
- ▶ Are all the connection wires securely positioned in the cable terminals?
- ▶ Are all cable entries mounted, tightened and leak-tight?
- ▶ Does the supply voltage match the voltage indicated on the nameplate?

## 6 Operation options

### 6.1 Overview

#### 6.1.1 Display and operating elements

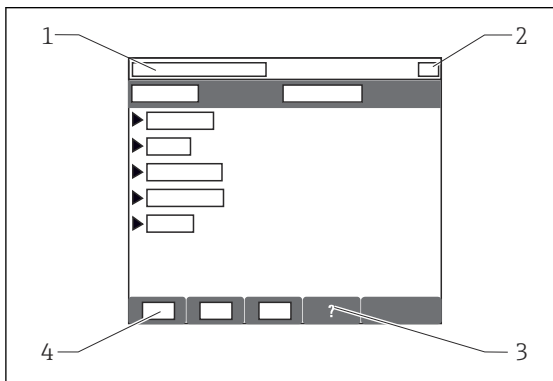


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63 Overview of operation (using the example of the field device)

- 1 Display (with red display background in alarm condition)
- 2 Navigator (jog/shuttle and press/hold function)
- 3 Soft keys (function depends on menu)

#### 6.1.2 Display

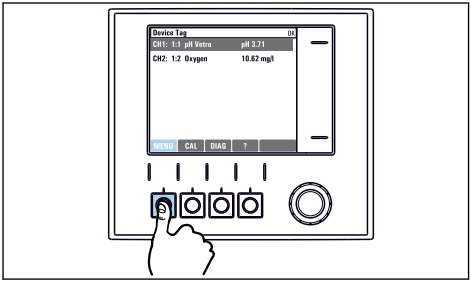


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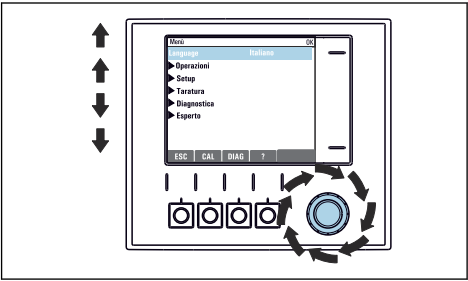
- 1 Menu path and/or device designation
- 2 Status display
- 3 Help if available
- 4 Assignment of the soft keys

# 6.2 Access to the operating menu via the local display

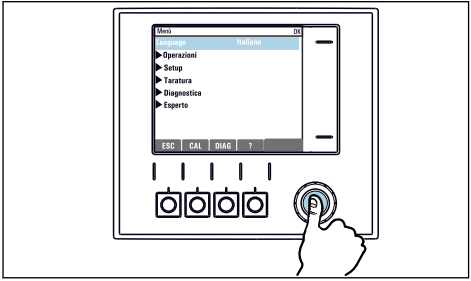
## 6.2.1 Operating concept



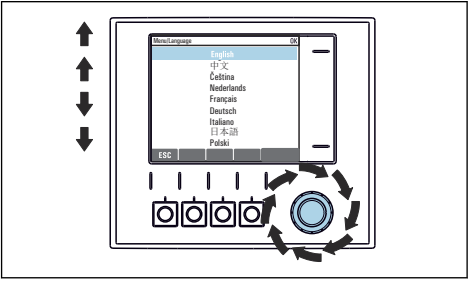
► Pressing the soft key: selecting the menu directly



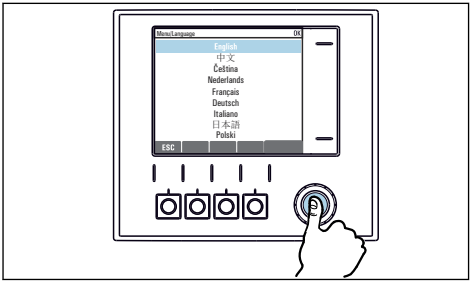
► Turning the navigator: moving the cursor in the menu



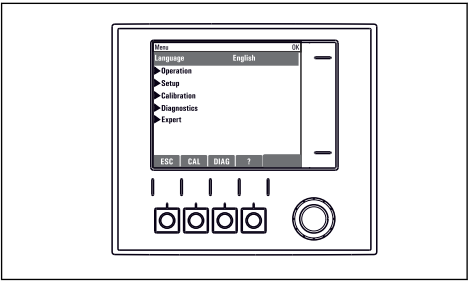
► Pressing the navigator: launching a function



► Turning the navigator: selecting a value (e.g. from a list)




► Pressing the navigator: accepting the new value



↳ New setting is accepted

### 6.2.2 Locking or unlocking operating keys


#### Locking operating keys

1. Press the navigator for longer than 2 s.
  - ↳ A context menu for locking the operating keys is displayed. You have the choice of locking the keys with or without password protection. "With password" means that you can only unlock the keys again by entering the correct password. Set this password here: **Menu/Setup/General settings/Extended setup/Data management/Change key lock password.**
2. Select whether to lock keys with or without a password.
  - ↳ The keys are locked. No more entries can be made. In the soft key bar, you will see the  symbol.



The password is 0000 when the device is delivered from the factory. **Make sure to note down any changes to the password**, as otherwise you will not be able to unlock the keypad yourself.

#### Unlocking operating keys

1. Press the navigator for longer than 2 s.
  - ↳ A context menu for unlocking the operating keys is displayed.
2. **Key unlock .**
  - ↳ The keys are unlocked immediately if you did not choose to lock with a password. Otherwise you are asked to enter your password.
3. Only if keypad is password-protected: enter the right password.
  - ↳ The keys are unlocked. It is possible to access the entire onsite operation again. The  symbol is no longer visible on the display.

## 7 Commissioning

### 7.1 Function check

#### WARNING

#### Incorrect connection, incorrect supply voltage

Safety risks for staff and device malfunctions!

- ▶ Check that all connections have been established correctly in accordance with the wiring diagram.
- ▶ Ensure that the supply voltage matches the voltage indicated on the nameplate.

### 7.2 Switching on



During the device startup phase, the relays and current outputs have an undefined status for a few seconds prior to initialization. Watch out for possible effects on any actuators which may be connected.

### 7.2.1 Setting the operating language

#### Configuring the language

If you have not already done so, close the housing cover and screw the device closed.

1. Switch on the supply voltage.
  - ↳ Wait for the initialization to finish.
2. Press the soft key: **MENU**.
3. Set your language in the top menu item.
  - ↳ The device can now be operated in your chosen language.

## 7.3 Basic setup

#### Making basic settings

1. Switch to the **Setup/Basic setup** menu.
  - ↳ Make the following settings.
2. **Device tag**: Give your device any name of your choice (max. 32 characters).
3. **Set date**: Correct the set date if necessary.
4. **Set time**: Correct the set time if necessary.
  - ↳ For quick commissioning, you can ignore the additional settings for outputs, relays etc. You can make these settings later in the specific menus.
5. To return to the measuring mode: press the soft key for **ESC** for at least one second.
  - ↳ Your controller now works with your basic settings. The sensors connected use the factory settings of the sensor type in question and the individual calibration settings that were last saved.

If you wish to configure your most important input and output parameters in the **Basic setup** :

- ▶ Configure the current outputs, relays, limit switches, controllers, device diagnostics and cleaning cycles with the submenus which follow the time setting.

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