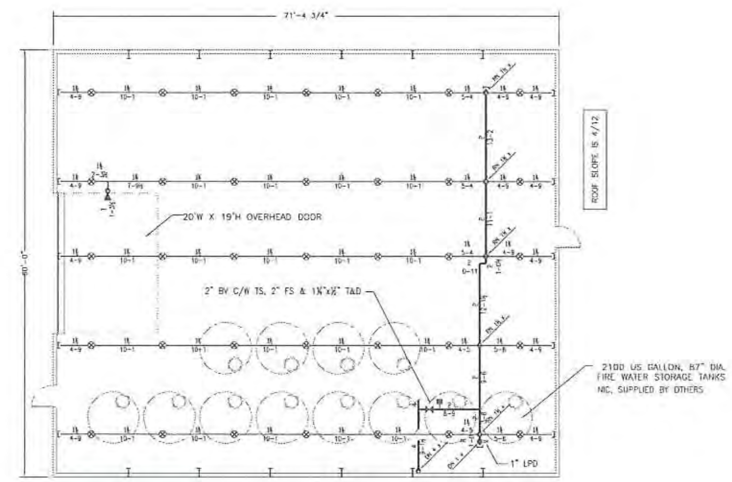
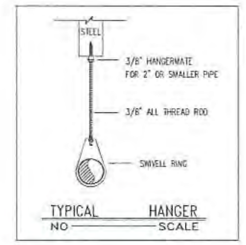
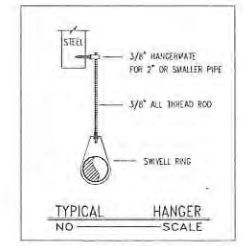


MILNE PORT WATER TREATMENT BUILDING PLAN
1/8"=1'-0"





NOTES:

1. LINES TO BE SCH.10 BLK. PIPE (GRVD. ENDS) C/W SNAPLETS FOR HEADS, JOINED WITH GROOVED FITTINGS
2. MAINS TO BE SCH.10 BLK. PIPE (GRVD. ENDS) C/W GROOVED MECH TEES FOR LINES, JOINED WITH GROOVED FITTINGS

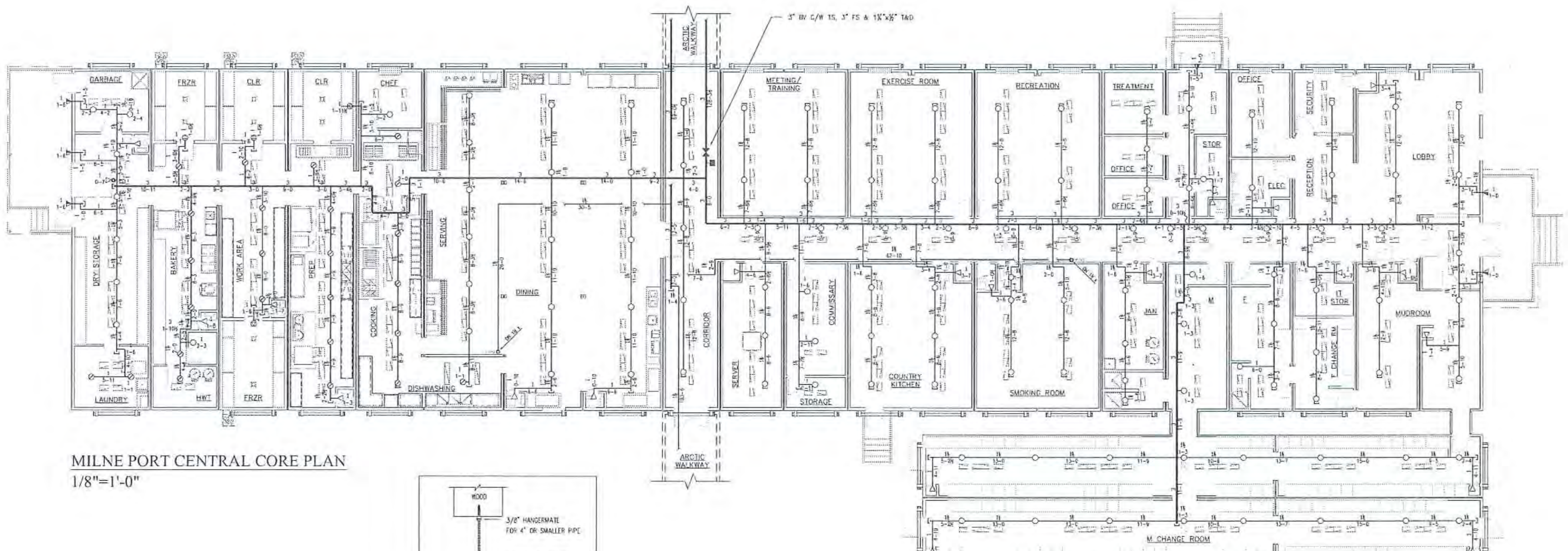
HATCH — VENDOR DATA REVIEW

Doc Number	E349000-TX001-60-042-0002	Sub	01
Date Received	18 JULY 13		

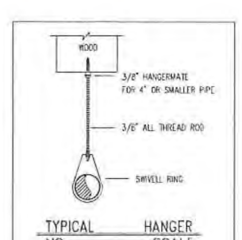
Review Grade	Next Submittal Status
☑ C1 – Proceed to next submission & status	☐ Internal Review ☑ Certified Final ☐ Final ☐ As-Built
☐ C2 – Proceed with exceptions as noted to next submission & status	Next Submittal Date:
☐ C3 – Do not proceed, revise as noted & resubmit	8 AUG 13
☐ C4 - No further submission required - Complete ☐ / No further submission required - Cancelled ☐ / No further submission required - Superseded ☐	

Package Coordinator: Name, signature and Date: M Buyke [signature] 1 AUG 13

REVIEWED ONLY FOR GENERAL CONFORMITY WITH THE SPECIFICATIONS. ACCEPTANCE BY THE ENGINEER DOES NOT WARRANT OR REPRESENT THAT THE INFORMATION CONTAINED ON THIS DRAWING/DOCUMENT IS EITHER ACCURATE OR COMPLETE. THE SOLE RESPONSIBILITY FOR CORRECT DESIGN, DETAILS & DIMENSIONS SHALL REMAIN WITH THE PARTY SUBMITTING THE DRAWING/DOCUMENT.



MILNE PORT CENTRAL CORE PLAN
1/8"=1'-0"



NOTES:

1. LINES TO BE SCH.10 BLK. PIPE (GRVD. ENDS) C/W SNAPLETS FOR HEADS, JOINED WITH GROOVED FITTINGS
2. MAINS TO BE SCH.10 BLK. PIPE (GRVD. ENDS) C/W GROOVED MECH TEES FOR LINES, JOINED WITH GROOVED FITTINGS

VIKING FIRE PROTECTION INC

BAFFINLAND
MILNE PORT SITE
PROJECT: BAFFIN ISLAND, NUNAVUT
SUBJECT: SPRINKLER PLAN FOR MILNE PORT
CONTRACT: HORIZON NORTH MANUFACTURING

Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

Cerabar T PMC131, PMP131, PMP135

Process pressure measurement
Pressure transducer with ceramic and metallic sensors
For absolute pressure and gauge pressure measurement up to 400 bar (6000 psi); Extremely stable, overload-resistant and reliable

Application
The Cerabar T is a pressure transducer for measuring absolute pressure and gauge pressure in gases, vapors, liquids and dusts.
Hygienic and threaded connections are available as process connections.

Your benefits
This compact pressure transducer impresses with its well-engineered construction:

- High reproducibility and long-term stability.
- Finely graduated measuring ranges from vacuum up to 400 bar (6000 psi)
- Ceraphire® ceramic sensor: corrosion-proof, abrasion-proof and extremely overload-resistant
- Deployed for pressure monitoring up to SIL 2 as per IEC 61508/IEC 61511-1
- Sensors
  - Dry capacitance ceramic sensor (Ceraphire®) for measuring ranges up to 40 bar (600 psi): overload-resistant, vacuum-proof, stable against alternating load
  - Piezoresistive sensor with metallic process isolating diaphragm for measuring ranges up to 400 bar (6000 psi)

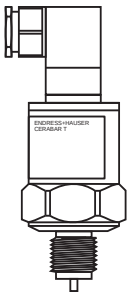
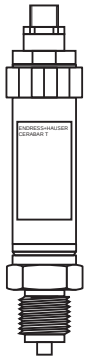
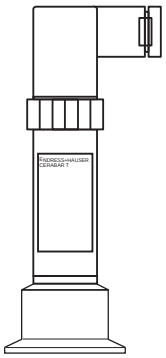
TI00415P/00/EN/16.12
No. 71197544

Endress+Hauser
People for Process Automation

Table of contents

Function and system design

Device selection

Cerabar T – Product family	PMC131	PMP131	PMP135
	 P01-PMC131xx-14-xx-xx-xx-000	 P01-PMP131xx-14-xx-xx-xx-000	 P01-PMP135xx-14-xx-xx-xx-000
	With capacitive measuring cell and ceramic process isolating diaphragm (Ceraphire®)	With piezoresistive measuring cell and metallic process isolating diaphragm	With piezoresistive measuring cell and metallic process isolating diaphragm for hygienic applications
Field of application	Absolute pressure and gauge pressure	Absolute pressure and gauge pressure	Absolute pressure and gauge pressure in hygienic processes
Output	– Current output 4 to 20 mA	– Current output 4 to 20 mA – Voltage output 0 to 10 V – Switch output PNP	– Current output 4 to 20 mA – Switch output PNP
Process connections	Thread: – G ½ – ½ MNPT and ¼ FNPT – G ½, bore 11 mm (0.43 in)	Thread: – G ½ – ½ MNPT and ¼ FNPT – ½ MNPT, bore 4 mm (0.16 in) – G ¼ – ¼ MNPT, bore 3.5 mm (0.14 in) – M 20 x 1.5	Hygiene: – Clamp DN 22 (¾") – Tri-Clamp DN 25 to 38 (1" to 1½") – Tri-Clamp DN 40 to 51 (2") – G 1 – SMS 1½"
Measuring ranges	from –1 to 0 bar (–15 to 0 psi) / –100 to 0 kPa up to 0 to 40 bar (0 to 600 psi) / 0 to 4 MPa	0 to 1 bar (0 to 15 psi) / 0 to 100 kPa up to 0 to 400 bar (0 to 6000 psi) / 0 to 40 MPa	0 to 1 bar (0 to 15 psi)/0 to 100 kPa up to 0 to 40 bar (0 to 600 psi) / 0...4 MPa
Process temperature range	–20 to +100 °C (-4 to +212 °F)	–25 °C to +70 °C (-13 to +158 °F)	–25 to +100 °C (-13 to +212 °F), +135 °C (275 °F) for max. 1 hour

Measuring principle

PMC131

The process pressure causes a slight deflection of the ceramic process isolating diaphragm of the sensor. The pressure-proportional change in capacitance is measured at the electrodes of the ceramic sensor. The ceramic sensor is a dry sensor, i.e. no fill fluid is required for the pressure transfer. This makes the sensor completely suitable for vacuums. Extremely high stability, comparable with the material Alloy, is achieved by using ultrapure Ceraphire® as the ceramic.

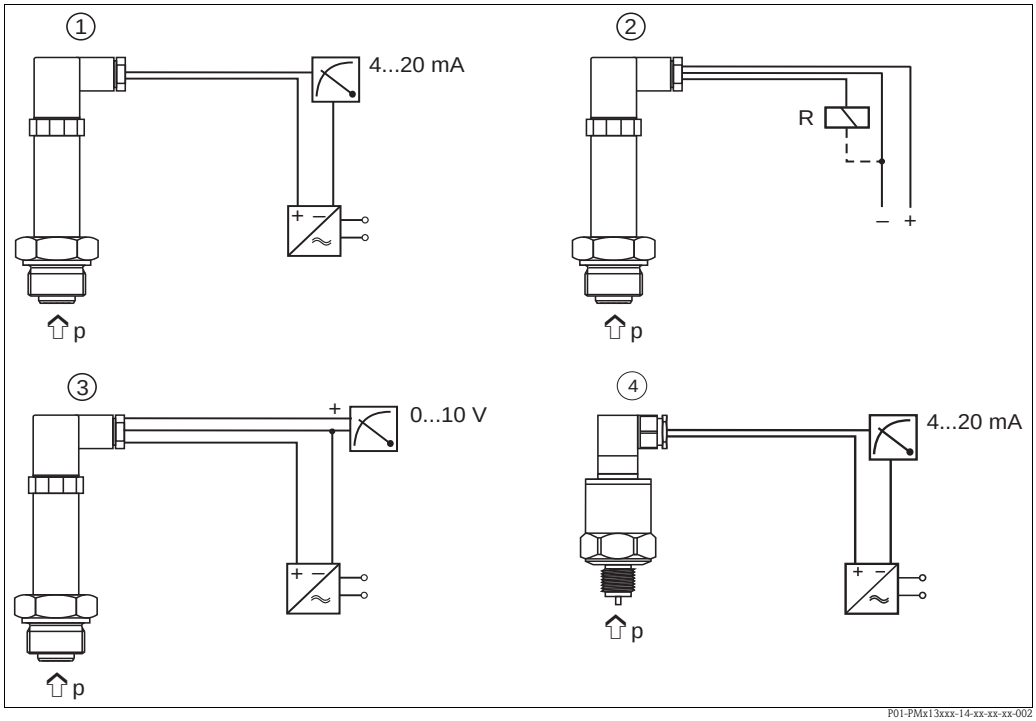
PMP131 and PMP135 with analog output

The process pressure acting upon the metallic process isolating diaphragm of the sensor is transmitted to a resistance bridge via a fluid. The pressure-proportional change of the bridge output voltage is measured and processed further.

PMP131 and PMP135 with switch output

The process pressure acting upon the metallic process isolating diaphragm of the sensor is transmitted to a resistance bridge via a fluid. A differential amplifier creates a standard signal from the pressure-proportional change in output voltage of the bridge. A comparator with an adjustable hysteresis compares this signal with the pre-set switch point and then activates the transistor output.

Measuring system



1 PMP131, PMP135: current output with transmitter power supply unit, e.g. RN 221N from Endress+Hauser
2 PMP131, PMP135: switch output with load, e.g. PLC, DCS, relay
3 PMC131: voltage output with transmitter power supply unit, e.g. RIA452 from Endress+Hauser
4 PMC131: current output with transmitter power supply unit, e.g. RN 221N from Endress+Hauser

Input

Measured variable

Absolute pressure or gauge pressure

Measuring range

up to 400 bar (6000 psi), → 🖹 20, "Ordering information" section

Output

Analog output (PMC131, PMP131, PMP135)

Output signal

Current output 4...20 mA, 2-wire version (PMC131, PMP131, PMP135)
Voltage output 0...10 V, 3-wire version (PMP131)

Load

PMC131
R_{Lmax} [Ω] ≤ (U_S – 11 V) / 0.02 A

PMP131 and PMP135 (current output)
R_{Lmax} [Ω] ≤ (U_S – 12 V) / 0.02 A (R_{Lmax}: Maximum load resistance, U_S: Supply voltage)

PMP131 (voltage output)
Load resistance RLmax ≥5 kΩ, current consumption ≤6 mA

Switch output (PMP131, PMP135)

Output signal

PNP switch output (positive voltage signal), rate depends on power supply voltage

Output current

- Switch status ON: I_a ≤ 500 mA

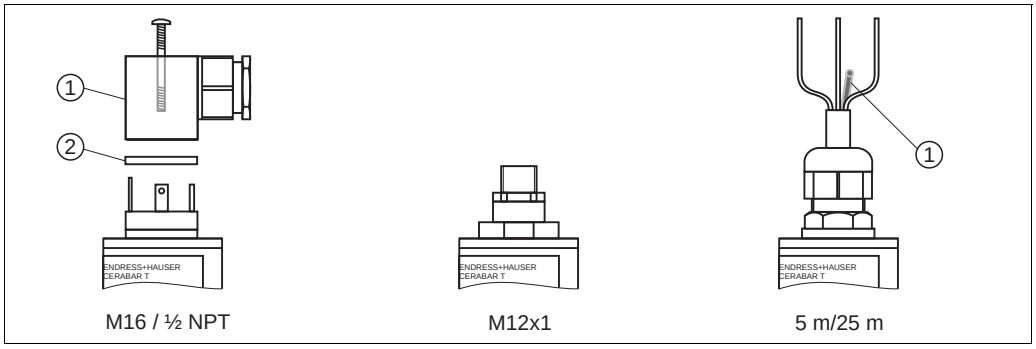
■ Switch status OFF: $I_a \leq 1$ mA

Power	max. 6 W
Switch frequency	max. 10 Hz
Input PLC	■ Input resistance $R_i \leq 2$ kΩ ■ Input current $I_i \geq 10$ mA
Inductive loads	To prevent electrical interference, only operate an inductive load (relays, contactors, solenoid valves) when directly connected to a protective circuit (free-wheeling diode or capacitor).

Power supply

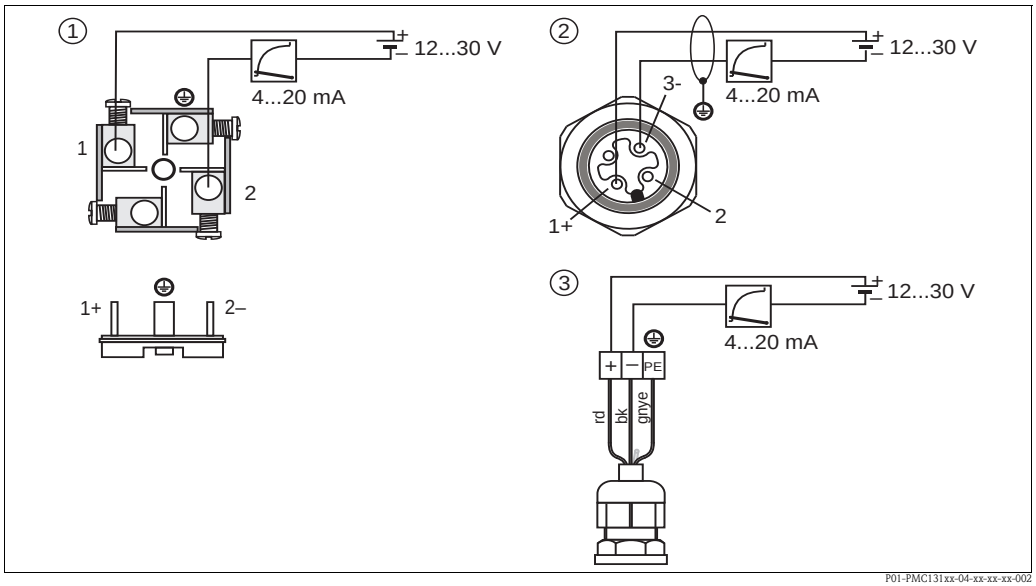
PMC131

Plug/cable connection



Plug M 16 x 1.5 (DIN 43650/A), ½ NPT	Plug M 12x1	5 m (16 ft) / 25 m (82 ft) cable
① Plug-in housing		① Reference pressure line
② Gasket		

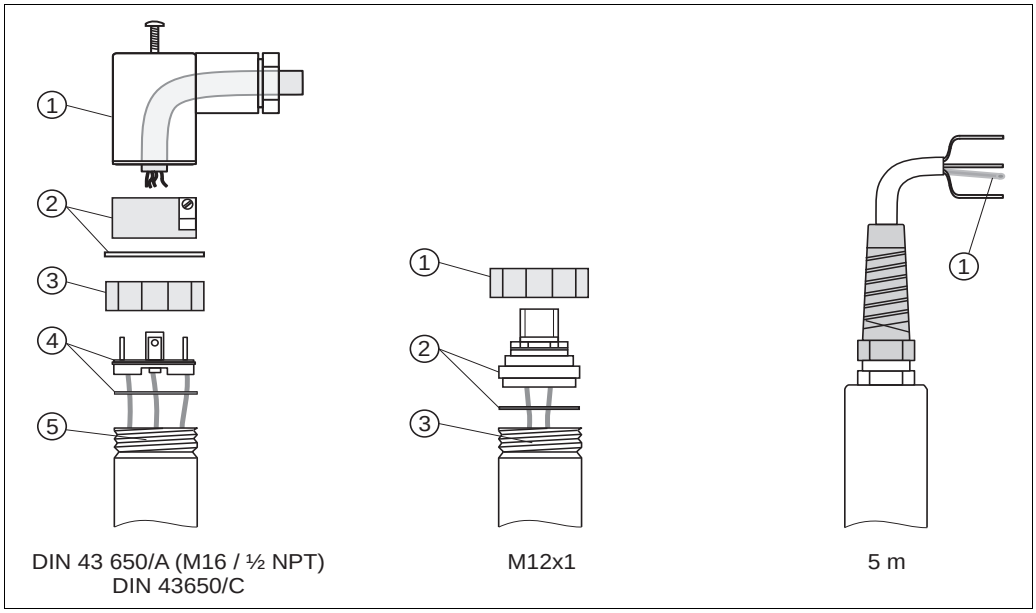
Electrical connection: Analog/current output



1 Plug M 16 x 1.5 (DIN 43650/A), ½ NPT
2 Plug M 12 x 1
3 Cable (rd = red, bk = black, gnye = green-yellow)

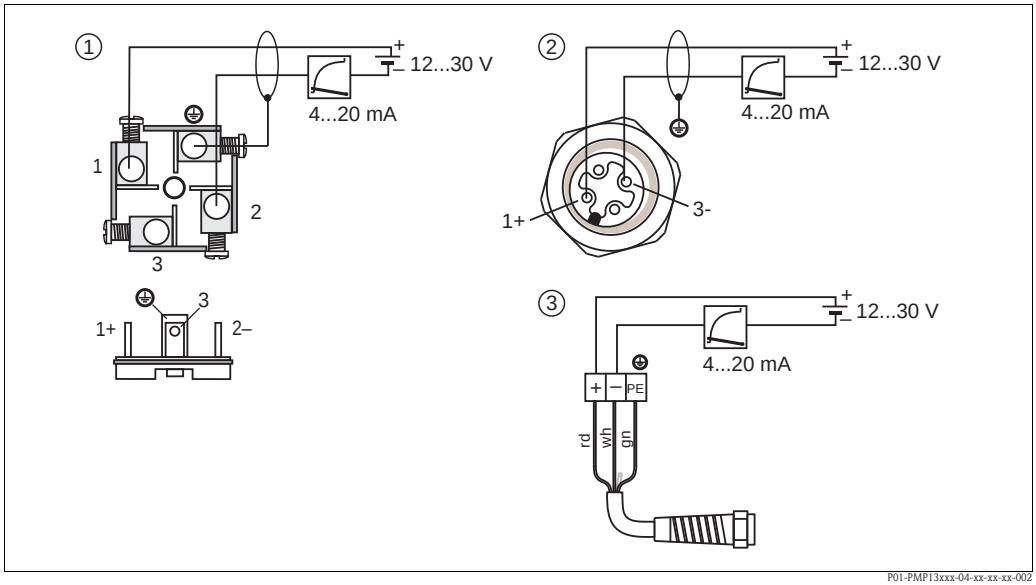
PMP131 and PMP135

Plug/cable connection



Plug M 16 x 1.5 (DIN 43650/A), ½ NPT Plug DIN 43650/C	Plug M 12x1	5 m (16 ft) cable, only analog output
① Plug-in housing	① Coupling nut	① Reference pressure line
② Plug-in jack with gasket	② Connector with gasket	
③ Coupling nut	③ Operating potentiometer (inner)	
④ Plug with O-ring		
⑤ Operating potentiometer (inner)		

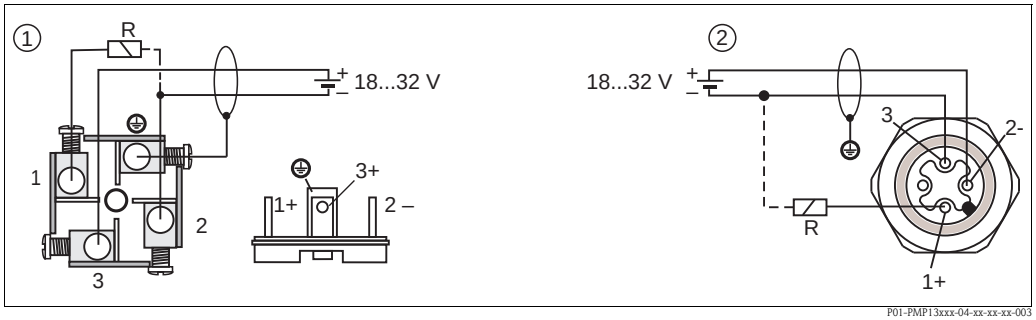
Electrical connection: Analog/current output



1 Plug M 16 x 1.5 (DIN 43650/A), ½ NPT and plug DIN 43650/C
2 Plug M 12 x 1
3 Cable (rd = red, wh = white, gn = green)

For electrical connection provided by customer use only shielded cable

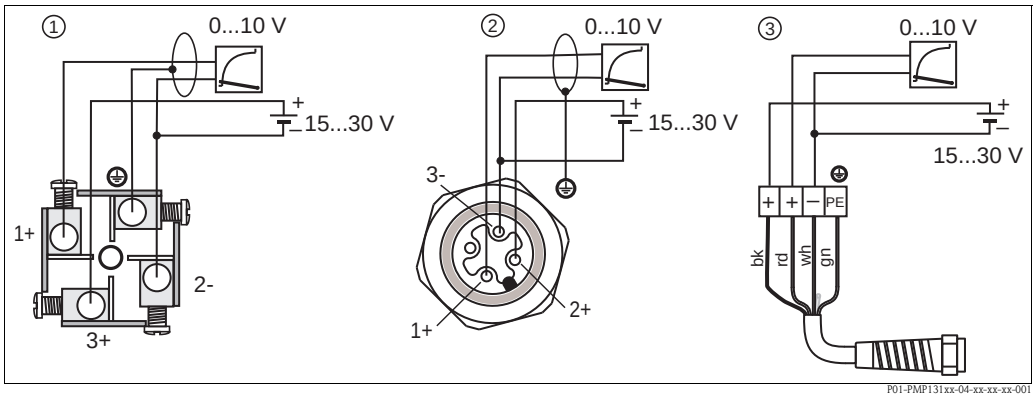
Electrical connection (switch output)



1 Plug M 16 x 1.5 (DIN 43650/A), ½ NPT
2 Plug M 12 x 1
R External load, e.g. relay, programmable logic controller, distributed control system

For electrical connection provided by customer use only shielded cable

PMP131 Electrical connection: Analog-/voltage output



1 Plug M 16 x 1,5 (DIN 43650/A), ½ NPT and plug DIN 43 650/C
2 Plug M 12 x 1
3 Cable (rd = red, wh = white, gn = green)

For electrical connection provided by customer use only shielded cable

Supply voltage

PMC131
11 to 30 V DC

PMP131 and PMP135 (current output, 2-wire version)

- For non-hazardous areas: 12 to 30 V DC
- Ex i: no-load voltage ≤ 26 V DC, short-circuit current ≤ 100 mA, power consumption ≤ 0.8 W

PMP131 (voltage output, 3-wire version)

- 15...30 V DC

PMP131 and PMP135 (switch output)

- 18 to 32 V DC, current consumption without load < 20 mA, with reverse polarity protection

Residual ripple

- Analog output: max. 5 % of supply voltage
- Switch output: max. 10 % of supply voltage

Cable entry

→ 📄 20, "Ordering information" section.

Performance characteristics

Reference operating conditions

as per DIN IEC 60770, T_U = 25 °C (77 °F)

Long-term stability

≤ 0.15 % of URL per year

Reference accuracy
Analog output

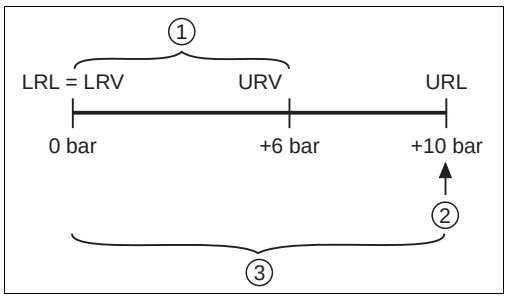
The reference accuracy comprises the non-linearity according to limit point setting, hysteresisand non-reproducibility as per IEC 60770.

PMC131

- ≤ 0.5 % of nominal value x TD
  (extended specifications apply to customer-specific measuring ranges)

Example: PMC131 version "A1R"
- Nominal value = 10 bar (150 psi)
- Upper range value (URV) = 6 bar (90 psi)
- Lower range value (LRV) = 0 bar

Turn down (is set at factory):
- Nominal value / (URV – LRV) | =
  10 bar (150 psi)/6 bar (90 psi) = 10:6



P01-PMx13xxx-05-xx-xx-xx-001

Example: PMC131 version "A1R"
set span: 0 to 6 bar (0 to 90 psi);
nominal value = 10 bar (150 psi)

1 Span set and calibrated at the factory (measuring range)
2 Nominal value ≙ Upper Range Limit (URL)
3 Sensor measuring range
LRL Lower Range Limit
URL Upper Range Limit
LRV Lower Range Value
URV Upper Range Value

PMP131 and PMP135

- ≤ 0.5 % of URL

Switch point

PMP131 and PMP135

- Deviation: ≤ 1 % of URL
- Non-reproducibility: ≤ 0.5 % of URL

Rise time (T90)

PMC131
20 ms

PMP131 and PMP135
2 to 5 ms

Thermal change in the zero output and the output span

PMC131

For customer-specific measuring-ranges: values are doubled

Zero output, –20 to +85 °C (-4 to +185 °F):
- typically 1.5 % of nominal value

Output span, –20 to +85 °C (-4 to +185 °F):
- Nominal value 0.4 to 40 bar (6 to 600 psi): typically 0.8 % of nominal value
- Nominal value 0.1 to 0.2 bar (1.5 to 3 psi): typically 1.0 % of nominal value

Temperature coefficient (T_K) for lower range value and span

PMP131 and PMP135 (analog output)

Zero output:
- typically: 0.2 % of URL/10 K
- max.: 0.5 % of URL/10 K
- Nominal value ≤ 6 bar (90 psi): by 0.1 % of URL/10 K higher

Output signal:
- typically: 0.2 % of URL/10 K
- max.: 0.5 % of URL/10 K

PMP131 and PMP135 (switch output)

Switch point:
- typically: 0.2 % of URL/10 K
- max.: 0.5 % of URL/10 K

Operating conditions (installation)

Orientation

anywhere

Installation instructions

PMP131
Process connection G ½ flush-mounted, max. torque 40 Nm (29.5 lbf ft)

Location dependence

PMC131
without influence

PMP131 and PMP135
Position-dependent zero point shift can be corrected by potentiometer setting, → 🖹 17.

Operating conditions (environment)

Ambient temperature range

PMC131
–20 to +85 °C (-4 to +185 °F)

PMP131 and PMP135

- For non-hazardous areas: –25 to +70 °C (-13 to +158 °F)
- Ex i: –25 to +65 °C (-13 to +149 °F)

Storage temperature range

PMC131
–50 to +100 °C (-58 to +212 °F)

PMP131 and PMP135
–40 to +85 °C (-40 to +185 °F)

Climate class

PMC131
4K4H as per DIN EN 60721-3

PMP131 and PMP135
4Z
with Z = 70 °C (158 °F) as per VDI/VDE 3540

Degree of protection

PMC131
- Plug M 16 x 1,5 (DIN 43650/A), ½ NPT: IP 65/NEMA 4X
- Plug M12x1: IP 65/ NEMA 4
- Cable: IP 68/NEMA 6P (1 mWS/24 h)

PMP131 and PMP135
- Plug M 16 x 1,5 (DIN 43650/A), ½ NPT: IP 65/NEMA 4X
- Plug M 12x1 and gauge pressure sensors: IP 65/NEMA 4X
- Plug M 12x1 and absolute pressure sensors: IP 68/NEMA 6P (1 mWS/24 h)
- Cable: IP 68/NEMA 6P (1 mWS/24 h)

Vibration resistance

4M5 as per DIN EN 60721-3

Electromagnetic compatibility

EMC in accordance with all the relevant requirements of the EN 61326 series. Details are provided in the Declaration of Conformity.

Operating conditions (process)

Process temperature range

PMC131

- –20 to +100 °C (-4 to 212 °F)
- Devices for oxygen application: –10 to +60 °C (14 to 140 °F)
  (Version "S" for feature 30 "Sensor gasket")

PMP131
–25 to +70 °C (-13 to +158 °F)

PMP135
–25 to +100 °C (-13 to 212 °F), +135 °C (275 °F) for max. 1 hour

Extreme jumps in temperature can result in temporary measuring errors. Temperature compensation takes effect after several minutes. Internal temperature compensation is faster the smaller the temperature jump and the longer the time interval.

Overload resistance

→ 📄 20, "Ordering information" section.

Vacuum resistance

PMC131
- with URV > 200 mbar (3 psi)/> 80 inH_2O/> 1.5 psi (100 mbar): 0 $mbar_{abs}$
- with URV = 200 mbar (3 psi)/= 50 inH_2O or 80 inH_2O: 500 $mbar_{abs}$ (7.5 psi_{abs})
  (Versions "D12", "D38", "W6O", "S4N")
- with URV = 20 mbar (0.3 psi) or 100 mbar (1.5 psi)/=1.5 psi (100 mbar)/=15 inH_2O or 30 inH_2O: 700 $mbar_{abs}$ (10.5 psi_{abs})
  (Versions "D10", "D3W", "D31", "Q4D", "V6F", "W6N", "W6R")

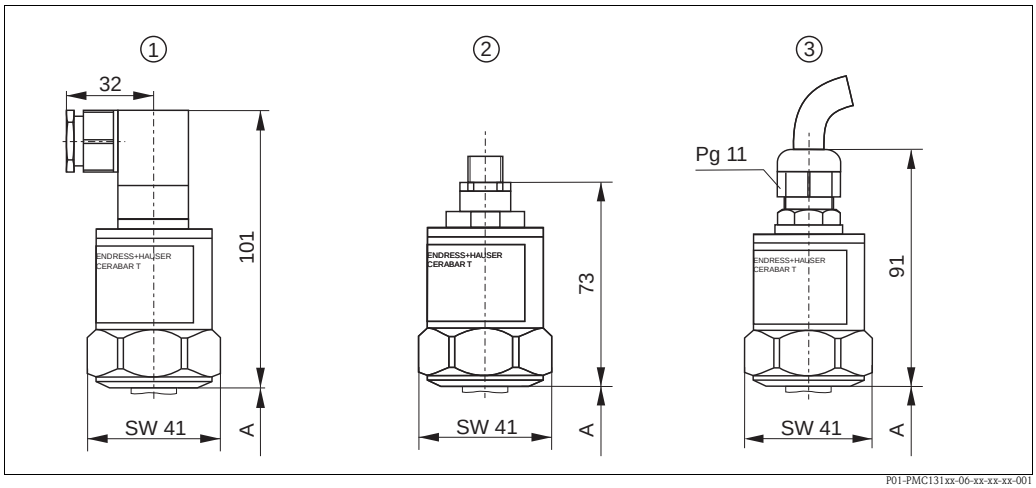
PMP131 and PMP135
10 $mbar_{abs}$ (0.15 psi_{abs})

Pressure specifications

- The MWP (maximum working pressure) of the device is specified on the nameplate. It depends on the weakest element, with regard to pressure, of the selected components. See the following sections:
  – → 📄 20 ff, "Ordering information" section, feature 50 "Measuring range; MWP; Nominal value; OPL" or "Sensor range; MWP; OPL".
  – → 📄 12 ff, "Mechanical construction" section.
  The MWP specification on the nameplate is based on a reference temperature of +20 °C (68 °F) and can be present over an unlimited period of time.
- The test pressure corresponds to the overload limit of the measuring device (Over Pressure Limit OPL) and must only be present for a limited period of time.

Mechanical construction

PMC131 Housing

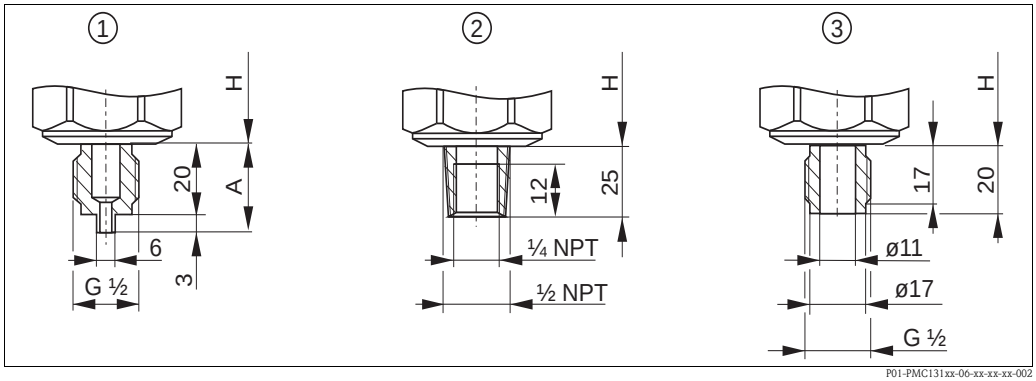


Housing PMC131; Material AISI 304 (1.4301)

1 Versions A1, A2, B1, C1, C2: Plug M 16 or ½ NPT (ISO 4400), IP 65
2 Versions A5, B5, C5: Plug M 12, IP 65
3 Versions A3, A4, B3, C3: 5 m (16 ft) or 25 m (82 ft) cable, IP 68

→ See the following diagram for the height of process connection A

PMC131 Process connections

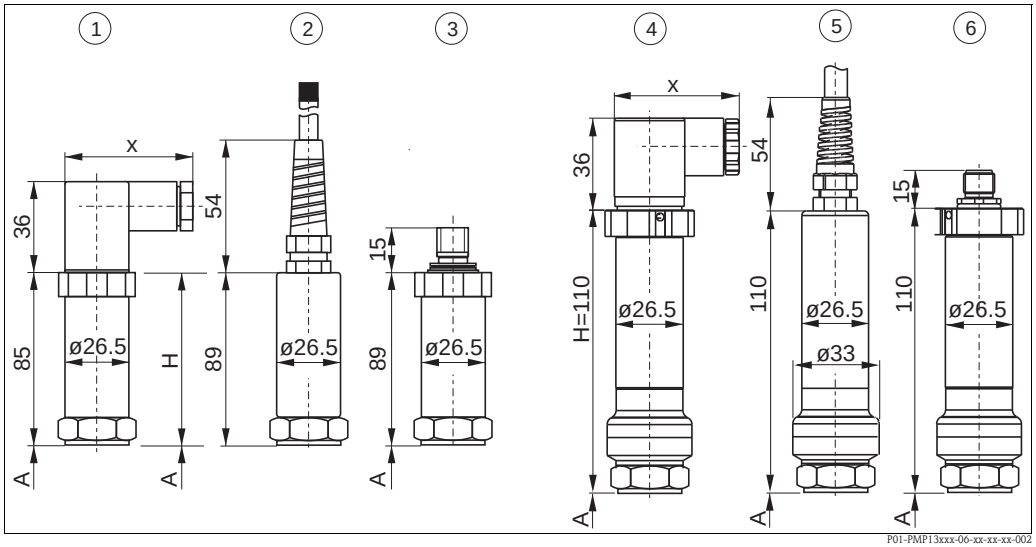


Process connections PMC131; Material AISI 304 (1.4301)

1 Version 1: Thread ISO 228 G ½
2 Version 2: Thread ANSI ½ MNPT ¼ FNPT
3 Version 5: Thread ISO 228 G ½, bore 11 mm (0.43 in)

→ See respective housing for installation height H (previous figure)

PMP131 and PMP135 Housings

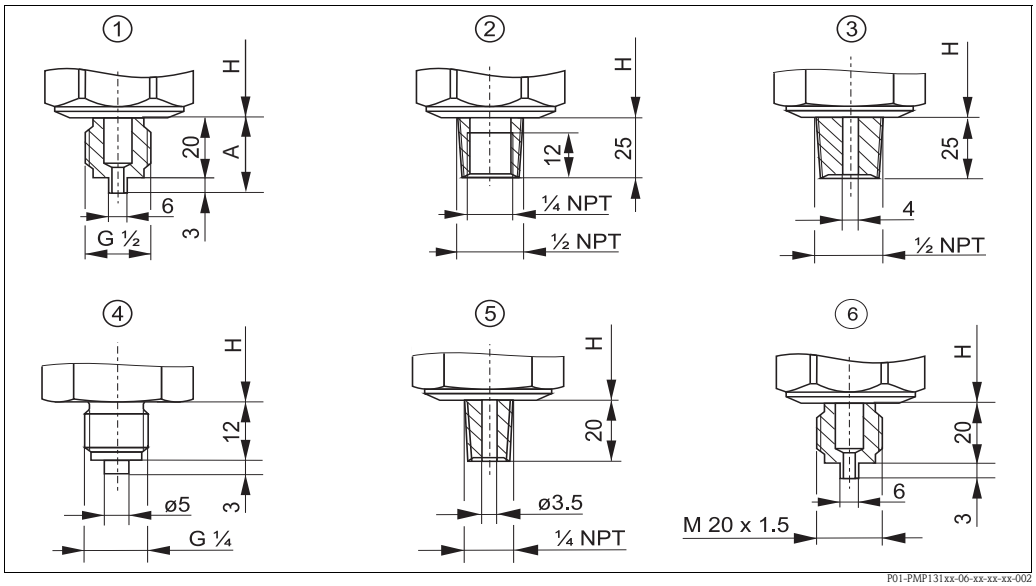


Housings PMP131 and PMP135; Material AISI 304 (1.4301)

1...3 PMP131 and PMP135 with sensor range up to 60 bar (900 psi)
4...6 PMP131 with sensor range up to 400 bar (6000 psi)
1 + 4 Versions A1, A2: Plug M 16 (DIN 43650/A) or ½ NPT (ISO 4400), IP 65; dimension x = 52 mm (2.05 in)
Version A5: Plug DIN 43650/C, IP 65; dimension x = 42 mm (1.65 in)
2 + 5 Version A3: 5 m (16 ft) cable, IP 68
3 + 6 Version A4: Plug M 12, IP 65

→ *See the following figure for the dimensions of process connection A*

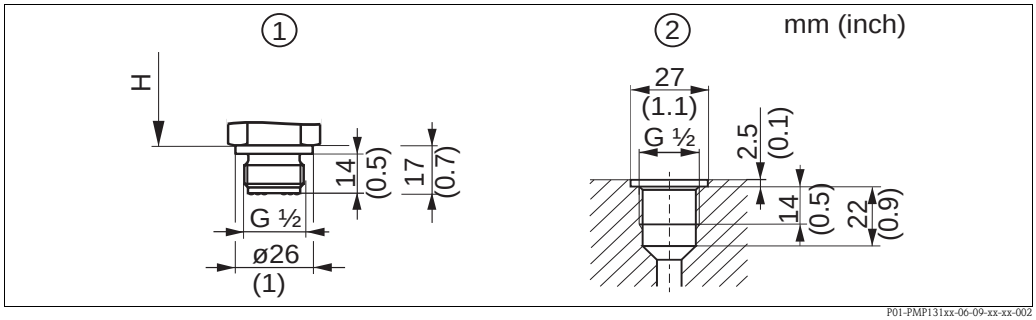
PMP131 Process connections



Process connections PMP131; Material AISI 304 (1.4301)

1 Version 1: Thread ISO 228 G ½
2 Version 2: Thread ANSI ½ MNPT ¼ FNPT
3 Version 3: Thread ANSI ½ MNPT, bore 4 mm (0.16 in) female
4 Version 4: Thread ISO 228 G ¼
5 Version 5: Thread ANSI ¼ MNPT, bore 3.5 mm (0.14 in) female
6 Version 6: Thread M 20 x 1.5

→ *See respective housing for installation height H (figure above)*
→ *Process connections with AF 27 mm*

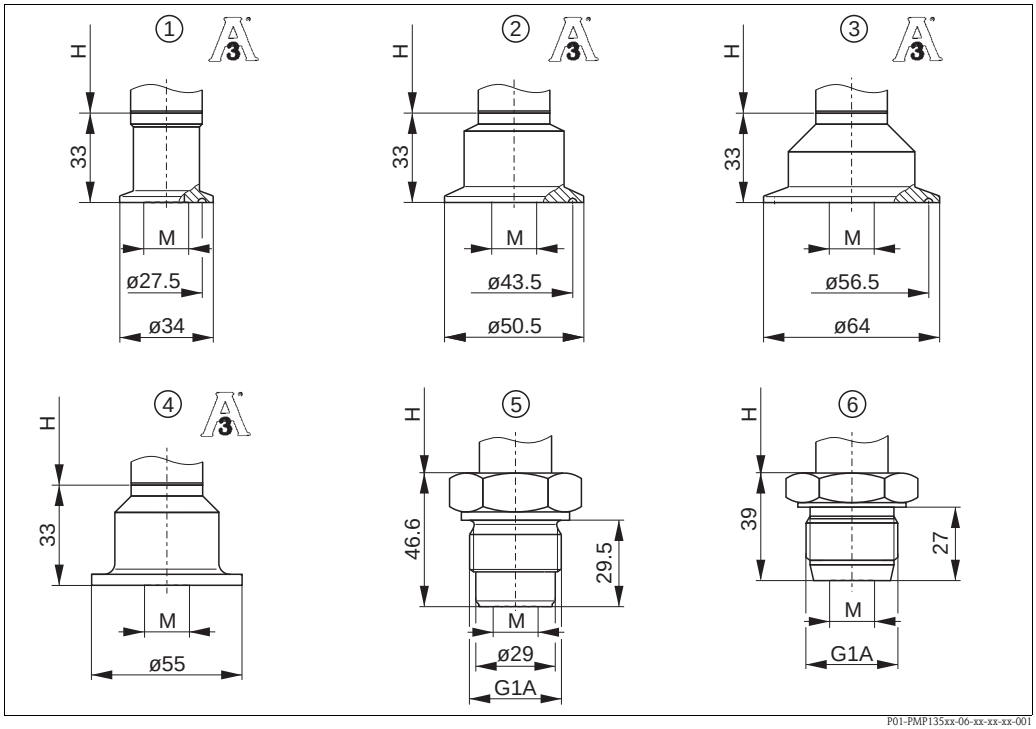


Process connection PMP131; Material AISI 304 (1.4301)

1 Version B: Thread ISO 228 G ½, Seal seat as per DIN 3852-A, AISI 304, flush-mounted
2 Dimensions for tapped hole G ½ as per DIN 3852-11 form X

→ See respective housing for installation height H

PMP135 Process connections



Process connections PMP135; Material AISI 316L (1.4435); Surface roughness of the surfaces in contact with the media $R_a \leq 0.8 \mu m$
M = Diaphragm diameter 17.2 mm (0.68 in)

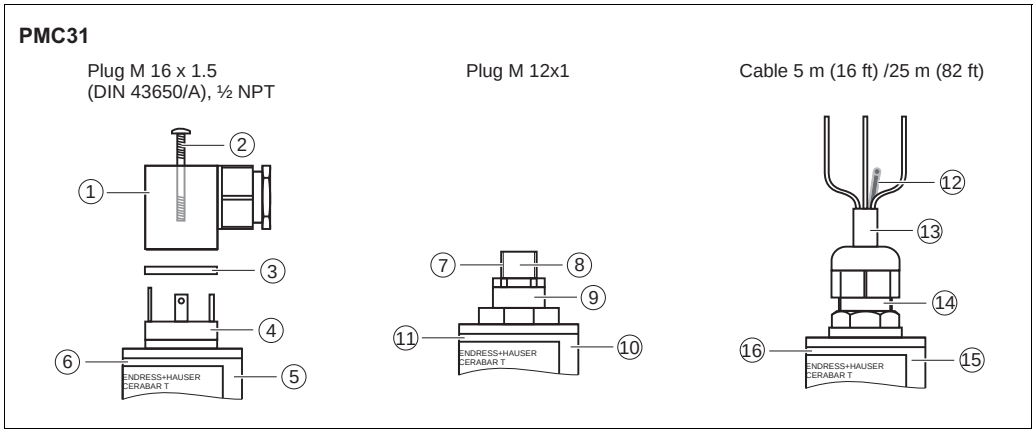
1 Version F: Clamp ¾" (ISO 2852) or DN 20 (DIN 32676), 3A
2 Version G: Tri-Clamp 1" to 1½" (ISO 2852) or DN 25 to DN 40 (DIN 32676), 3A
3 Version H: Tri-Clamp 2" (ISO 2852) or DN 50 (DIN 32676), 3A
4 Version S: SMS 1½" PN 25, 3A
5 Version N : G1A (ISO 228), with sealing surface for flush-mounted installation
6 Version M: G1A (ISO 228), with metallic sealing taper, flush-mounted

→ See respective housing for installation height H

Weights

- PMC131: approx. 0.32 kg (0.71 lbs)
- PMP131:
  approx. 0.24 kg (0.53 lbs) up to 60 bar (870 psi),
  approx. 0.32 kg (0.71 lbs) up to 400 bar (5800 psi)
- PMP135: approx. 0.34 kg (0.75 lbs)

Material (not wetted) **Housing**



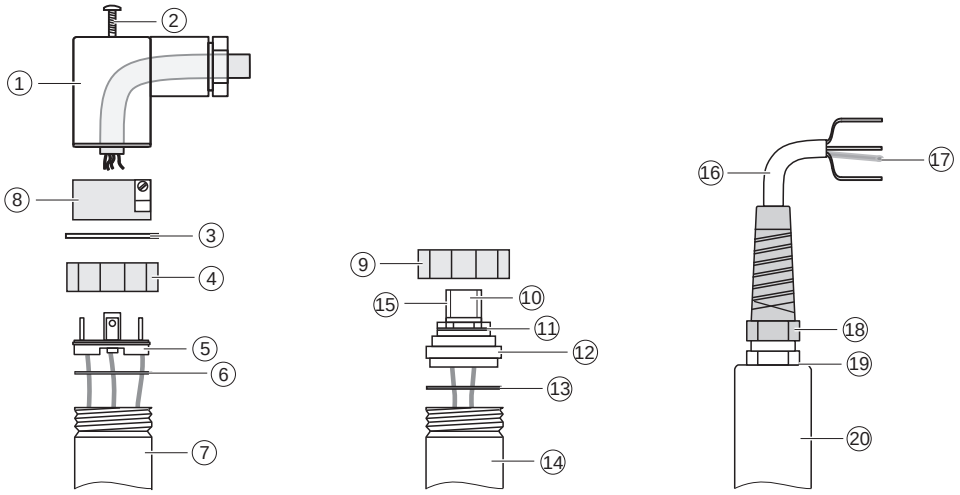
Item number	Component part	Material
1	Plug housing	PA6 GF
2	Flat sealing	NBR
3	Screw M3 x 35	A2
4	Connection cover	PBT-FR
5	O-ring	NBR
6	Housing	1.4301
7	O-ring for connector	FKM
8	Inner connector	PA
9	M12 connector	GD-Zn, nickel-plated
10	O-ring	NBR
11	Housing	1.4301
12	Hose	PA
13	Cable	PE
14	Gland	PBT
15	O-ring	NBR
16	Housing	1.4301

PMP131 / PMP135

Plug M 16 x 1.5 (DIN 43650/A), ½ NPT
Plug DIN 43650/C

Plug M 12x1

5 m (16 ft) cable,
only analog output



P01-PMx3xxxx-06-xx-xx-en-003

Item number	Component part	Material
1	Plug housing	PA6 GF
2	Screw M3 x 35	A2
3	Flat sealing	NBR
4	Coupling nut	PA
5	Cover plug	PA66 GF
6	O-ring	NBR
7	Housing	1.4301
8	Plug	PA66 GF
9	Coupling nut	PA
10	Inner connector	PA
11	O-ring	NBR
12	M12 connector	GD-Zn, nickel-plated
13	O-ring	NBR
14	Housing	1.4301
15	O-ring for connector	FKM
16	Cable	PUR
17	Hose	PA
18	Anti-jackknife	PA
19	O-ring	NBR
20	Housing	1.4301

Fill oil:

- PMP131: Tegiloxan 3
- PMP135: Mineral oil, FDA number 21-CFR 172.882

Material (wetted)

Note!
The wetted device components are listed in the "Mechanical construction" (→ 12 ff) and "Ordering information" (→ 20 ff) sections.

Process connection

- PMC131/PMP131: AISI 304 (1.4301)
- PMP135: AISI 316L (1.4435)

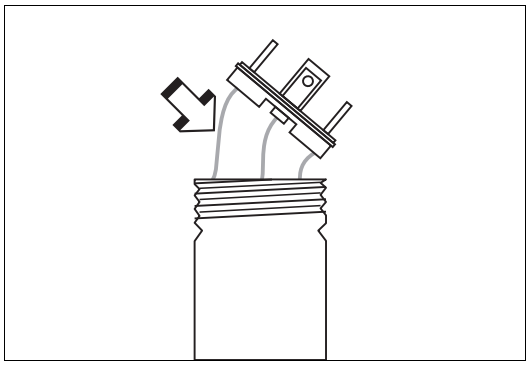
Process isolating diaphragm

- PMC131: Ceraphire® (99,9 % Al_2O_3), FDA number 21-CFR 186.1256
- PMP131, PMP135: AISI 316L (1.4435)

Operating elements

Operating elements

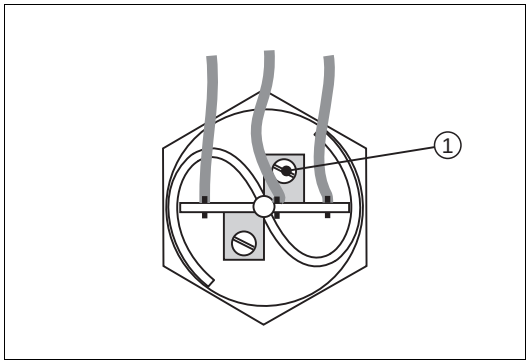
Position of operating elements



P01-PMx13xxx-19-xx-xx-xx-003

The potentiometer for operating the Cerabar T PMP131 and PMP135 with analog or switch output is located below the base of the plug.

Analog output: Zero point adjustment

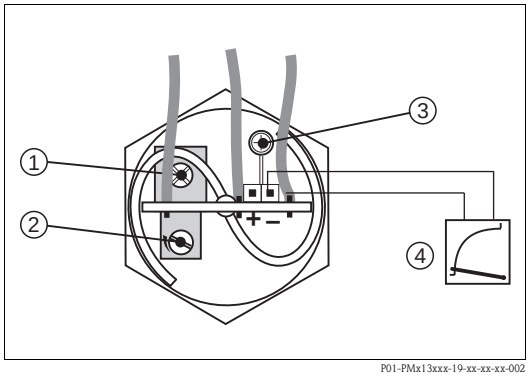


P01-PMx13xxx-19-xx-xx-xx-001

The zero point can be corrected for the Cerabar T PMP131 and PMP135 with analog output and plug version.

1 Potentiometer for zero point correction by ±5 % of URL

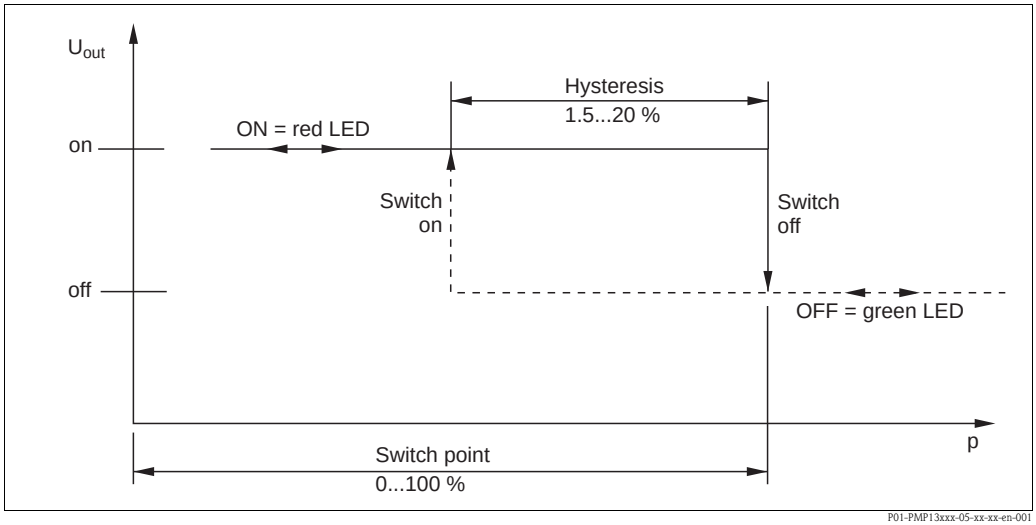
Switch output: Switch point and hysteresis adjustment



P01-PMx13xxx-19-xx-xx-xx-002

For the Cerabar T PMP131 and PMP135 with switch output, both the switch point and hysteresis can be adjusted.
This can also be carried out at atmospheric pressure using the enclosed test cable and a voltmeter.

1 Hysteresis adjustment 1.5 to 20 % of URL; Factory setting 10 % of URL
2 Switch point adjustment 0 to 100 % of URL; Factory setting 50 % of URL
3 LED color code for checking the switch status: green = off; red = on
4 Connect voltmeter to test pins: 0 to 1 V corresponds to 0 to 100 % of URL



Instructions for switch point and hysteresis (the percentage values refer to the URL)

U_a Output voltage
p Acting pressure

Certificates and approvals

CE mark

The device meets the legal requirements of the EC directives. Endress+Hauser confirms that the device has been successfully tested by applying the CE mark.

Ex approvals

All explosion protection data are given in separate documentation which is available upon request. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas.
See also → 📄 26, "Safety Instructions" section.

Pressure Equipment Directive (PED)

This measuring device corresponds to Article 3 (3) of the EC directive 97/23/EC (Pressure Equipment Directive) and has been designed and manufactured according to good engineering practice.

Functional safety SIL 2

The Cerabar T PMP131 and PMP135 pressure transducers with 4 to 20 mA electronics have been assessed by an independent body according to the standards IEC 61508/IEC 61511-1. These devices can be used for monitoring process pressure up to SIL 2.
→ For a detailed description of safety functions with Cerabar T, settings and characteristic quantities for functional safety, see the "Functional Safety Manual – Cerabar T SD00160P".

Suitability for hygenic processes

The Cerabar T PMP135 is suitable for the employment in hygenic processes.
An overview of permitted process connections → 📄 12 ff.
Many versions meet the requirements of 3A-Sanitary Standard No. 74 and are certified by the EHEDG.
Suitable fittings and seals must be used for hygienic design in accordance with 3A and EHEDG specifications.

Note!
The gap-free connections can be cleaned without residue using the usual cleaning methods.

TSE Certificate of Suitability

Cerabar T PMP135
The following applies to wetted device components: They do not contain any materials derived from animals. No auxiliaries or operating materials derived from animals are used in production or processing. Process wetted device components are listed in the “Mechanical construction” and “Ordering information” sections.

Standards and guidelines

DIN EN 60770 (IEC 60770):
Transmitters for controlling in systems used in industrial process technology
Part 1: Methods for evaluating the operating behavior.

DIN EN 61003-1, Edition:1993-12
Systems used in industrial process technology;
Devices with analog inputs and two-point or multi-point behavior;
Part 1: Methods for evaluating the operating behavior.

DIN 16086:
Electrical pressure measuring devices, pressure sensors, transmitters, pressure measuring devices
Terms, specifications in data sheets.

IEC 60529
Degrees of protection provided by enclosures (IP-Code).

EN 61326:
Electrical equipment for control technology and laboratory application – EMC requirements.

IEC 61010
Safety requirements for electrical equipment for measurement, control and laboratory use.

NAMUR
Association for Standards for Control and Regulation in the Chemical Industry.

Registered trademarks

Ceraphire®
Registered trademark of Endress+Hauser GmbH+Co. KG, Maulburg, Germany
(→ see also www.endress.com/ceraphire)

Ordering information

PMC131

This overview does not mark options which are mutually exclusive.

10	Electrical connection:
	A1 Plug ISO 4400, M 16, IP 65/NEMA 4X
	A2 Plug ISO 4400, ½ NPT, IP 65/NEMA 4X
	A3 5 m cable, IP 68/NEMA 6P
	A4 25 m cable, IP 68/NEMA 6P
	A5 Plug M 12, IP 65/NEMA 4
	B1 Plug ISO 4400, M 16, IP 65, ATEX II 3 G Ex nA II T4
	B3 5 m cable, IP 68, ATEX II 3 G Ex nA II T4
	B5 Plug M 12, IP 65, ATEX II 3 G Ex nA II T4
	C1 Plug ISO 4400, M 16, NEMA 4X, CSA GP
	C2 Plug ISO 4400, ½ NPT, NEMA 4X, CSA GP
	C3 5m cable, IP 68/NEMA 6P, CSA GP
	C5 Plug M12, IP 65/NEMA 4, CSA GP

20		Process connection:
	1	Thread ISO 228 G ½, AISI 304
	2	Thread ANSI ½ MNPT ¼ FNPT, AISI 304
	5	Thread ISO 228 G ½ bore 11 mm, AISI 304

30		Sensor seal:
	E	EPDM
	F	FKM Viton
	S	FKM Viton, oxygen application

40		Additional options:
	1	Without additional equipment
	S	GL (German Lloyd) marine certificate
	2	Final inspection report

50		Measuring range; MWP; Nominal value; OPL:			
		Measuring range	**MWP (Maximum Working Pressure)**	**Nominal value**	**OPL (Over Pressure Limit)**
		Sensors for gauge pressure			
	A1G	0 to 1 bar / 0 to 100 kPa	6.7 bar	1 bar	10 bar / 1 MPa
	A1H [1)]	0 to 1.6 bar / 0 to 160 kPa	12 bar	2 bar	18 bar / 1.8 MPa
	A1K	0 to 2 bar / 0 to 200 kPa	12 bar	2 bar	18 bar / 1.8 MPa
	A1Q	0 to 4 bar / 0 to 400 kPa	16.7 bar	4 bar	25 bar / 2.5 MPa
	A1R 1)	0 to 6 bar / 0 to 600 kPa	26.7 bar	10 bar	40 bar / 4 MPa
	A1S	0 to 10 bar / 0 to 1 MPa	26.7 bar	10 bar	40 bar / 4 MPa
	A1T 1)	0 to 16 bar / 0 to 1.6 MPa	26.7 bar	20 bar	40 bar / 4 MPa
	A1V	0 to 20 bar / 0 to 2 MPa	26.7 bar	20 bar	40 bar / 4 MPa
	A1W 1)	0 to 25 bar / 0 to 2.5 MPa	40 bar	40 bar	60 bar / 6 MPa
	A1X	0 to 40 bar / 0 to 4 MPa	40 bar	40 bar	60 bar / 6 MPa
	A3C 1)	–1 to 0 bar / –100 to 0 kPa	6.7 bar	2 bar	10 bar / 1 MPa
	A3E 1)	–1 to 1 bar / –100 to 100 kPa	6.7 bar	2 bar	10 bar / 1 MPa
	A3G 1)	–1 to 3 bar / –100 to 300 kPa	16.7 bar	4 bar	25 bar / 2.5 MPa
	A3K 1)	–1 to 9 bar / –100 to 900 kPa	26.7 bar	10 bar	40 bar / 4 MPa
	A3N 1)	–1 to 15 bar / –0.1 to 1.5 MPa	26.7 bar	20 bar	40 bar / 4 MPa
	D10	0 to 100 mbar / 0 to 10 kPa	2.7 bar	0.1 bar	4 bar / 400 kPa
	D12 1)	0 to 200 mbar / 0 to 20 kPa	3.3 bar	0.2 bar	5 bar / 500 kPa
	D14	0 to 400 mbar / 0 to 40 kPa	5.3 bar	0.4 bar	8 bar / 800 kPa
	D3W	–20 to 20 mbar / –2 to 2 kPa	2.7 bar	0.2 bar	4 bar / 400 kPa
	D31 1)	–100 to 100 mbar / –10 to 10 kPa	3.3 bar	0.2 bar	5 bar / 500 kPa
	D38 1)	–200 to 200 mbar / –20 to 20 kPa	3.3 bar	0.4 bar	5 bar / 500 kPa
	D39 1)	–300 to 300 mbar / –30 to 30 kPa	5.3 bar	1 bar	8 bar / 800 kPa

PMC131						Order code

→ For continuation of ordering information of PMC131, see the following page.

1) Span set and calibrated at the factory

PMC131 (continued)

50	Measuring range; MWP; Nominal value; OPL:			
	Measuring range	**MWP (Maximum Working Pressure)**	**Nominal value**	**OPL (Over Pressure Limit)**
	Sensors for gauge pressure			
Q4D	0 to 1.5 psi	40 psi	1.5 psi	60 psi
Q4F 1)	0 to 5 psi	80 psi	6 psi	120 psi
Q4H	0 to 15 psi	100 psi	15 psi	150 psi
Q4K	0 to 30 psi	180 psi	30 psi	270 psi
Q4N 1)	0 to 50 psi	250 psi	60 psi	375 psi
Q4R	0 to 150 psi	400 psi	150 psi	600 psi
Q4S	0 to 300 psi	400 psi	300 psi	600 psi
Q4T 1)	0 to 500 psi	600 psi	600 psi	900 psi
V6F 1)	–1.5 to 1.5 psi	50 psi	3 psi	75 psi
V6N 1)	–15 to 15 psi	100 psi	30 psi	150 psi
V6R 1)	–15 to 30 psi	250 psi	60 psi	375 psi
V6S	–15 to 60 psi	250 psi	60 psi	375 psi
V6V	–15 to 150 psi	400 psi	150 psi	600 psi
S4N 1)	0 to 50 inH_2O	50 psi	3 psi	75 psi
S4Q 1)	0 to 100 inH_2O	80 psi	6 psi	120 psi
W6N 1)	–15 to 15 inH_2O	40 psi	3 psi	60 psi
W6O 1)	–80 to 80 inH_2O	50 psi	6 psi	75 psi
W6R 1)	–15 to 30 inH_2O	50 psi	3 psi	75 psi
	Sensors for absolute pressure			
A2G	0 to 1 bar / 0 to 100 kPa	6.7 bar	1 bar	10 bar / 1 MPa
A2H 1)	0 to 1.6 bar / 0 to 160 kPa	12 bar	2 bar	18 bar / 1.8 MPa
A2K	0 to 2 bar / 0 to 200 kPa	12 bar	2 bar	18 bar / 1.8 MPa
A2Q	0 to 4 bar / 0 to 400 kPa	16.7 bar	4 bar	25 bar / 2.5 MPa
A2R 1)	0 to 6 bar / 0 to 600 kPa	26.7 bar	10 bar	40 bar / 4 MPa
A2S	0 to 10 bar / 0 to 1 MPa	26.7 bar	10 bar	40 bar / 4 MPa
A2T 1)	0 to 16 bar / 0 to 1.6 MPa	26.7 bar	20 bar	40 bar / 4 MPa
A2V	0 to 20 bar / 0 to 2 MPa	26.7 bar	20 bar	40 bar / 4 MPa
A2W 1)	0 to 25 bar / 0 to 2.5 MPa	40 bar	40 bar	60 bar / 6 MPa
A2X	0 to 40 bar / 0 to 4 MPa	40 bar	40 bar	60 bar / 6 MPa
D20 1)	0 to 100 mbar / 0 to 10 kPa	3.3 bar	0.2 bar	5 bar / 500 kPa
D22	0 to 200 mbar / 0 to 20 kPa	3.3 bar	0.2 bar	5 bar / 500 kPa
D24	0 to 400 mbar / 0 to 40 kPa	5.3 bar	0.4 bar	8 bar / 800 kPa
R4D 1)	0 to 1.5 psi	50 psi	3 psi	75 psi
R4F 1)	0 to 5 psi	80 psi	6 psi	120 psi
R4H	0 to 15 psi	100 psi	15 psi	150 psi
R4K	0 to 30 psi	180 psi	30 psi	270 psi
R4N 1)	0 to 50 psi	250 psi	60 psi	375 psi
R4R	0 to 150 psi	400 psi	150 psi	600 psi
R4S	0 to 300 psi	400 psi	300 psi	600 psi
R4T 1)	0 to 500 psi	600 psi	600 psi	900 psi

995	Marking	
	1	Tagging (TAG), see additional spec.

PMC131		Complete order code

1) Span set and calibrated at the factory

PMP131

This overview does not mark options which are mutually exclusive.

10	Electrical connection:
A1	Plug ISO 4400, M 16, IP 65/NEMA 4X (DIN 43650/A)
A2	Plug ISO 4400, ½ NPT, IP 65/NEMA 4X
A3	5 m cable, IP 68/NEMA 6P
A4	Plug M 12, IP 65/NEMA 4X
A5	Plug DIN 43650/C, IP65, NEMA 4X

20	Process connection:
B	Thread ISO 228 G ½, Seal seat as per DIN 3852, AISI 304, flush-mounted
1	Thread ISO 228 G ½, AISI 304
2	Thread ANSI ½ MNPT ¼ FNPT, AISI 304
3	Thread ANSI ½ MNPT bore 4 mm, AISI 304
4	Thread ISO 228 G ¼, AISI 304
5	Thread ANSI ¼ MNPT bore 3.5 mm, AISI 304
6	Thread M 20 x 1.5

30	Output:
0	Analog current output 4 to 20 mA, SIL
D	Analog current output 4 to 20 mA, SIL, ATEX II 1/2 G Ex ib IIC T6
1	Analog current output 4 to 20 mA, SIL, ATEX II 2 G Ex ib IIC T6
5	Analog current output 4 to 20 mA, SIL, ATEX II 3 G Ex nA II T6
2	Switch output PNP, 3-wire
3	Switch output PNP, 3-wire, ATEX II 3 G Ex nA II T6
6	Analog voltage output 0...10 V

40	Additional options:
1	Without additional equipment
S	GL/RINA marine approval
2	Final inspection report

50	Sensor range; MWP; OPL:		
	Sensor range	**MWP (maximum working pressure)**	**OPL (over pressure limit)**
	Sensors for gauge pressure		
A1G	0 to 1 bar / 0 to 100 kPa	2.7 bar	4 bar / 400 kPa
A1H	0 to 1.6 bar / 0 to 160 kPa	4 bar	6.4 bar / 640 kPa
A1N	0 to 2.5 bar / 0 to 250 kPa	6.7 bar	10 bar / 1 MPa
A1Q	0 to 4 bar / 0 to 400 kPa	10.7 bar	16 bar / 1.6 MPa
A1R	0 to 6 bar / 0 to 600 kPa	16 bar	24 bar / 2.4 MPa
A1S	0 to 10 bar / 0 to 1 MPa	25 bar	40 bar / 4 MPa
A1T	0 to 16 bar / 0 to 1.6 MPa	25 bar	64 bar / 6.4 MPa
A1W	0 to 25 bar / 0 to 2.5 MPa	25 bar	100 bar / 10 MPa
A1X	0 to 40 bar / 0 to 4 MPa	60 bar	160 bar / 16 MPa
A1Z	0 to 60 bar / 0 to 6 MPa	60 bar	240 bar / 24 MPa
A70	0 to 100 bar / 0 to 10 MPa	100 bar	400 bar / 40 MPa
A71	0 to 160 bar / 0 to 16 MPa	160 bar	600 bar / 60 MPa
A73	0 to 250 bar / 0 to 25 MPa	250 bar	600 bar / 60 MPa
A74	0 to 400 bar / 0 to 40 MPa	400 bar	600 bar / 60 MPa
Q4H	0 to 15 psi	40 psi	60 psi
Q4K	0 to 30 psi	100 psi	150 psi
Q4N	0 to 50 psi	160 psi	240 psi
Q4R	0 to 150 psi	400 psi	600 psi
Q4S	0 to 300 psi	400 psi	1500 psi
Q4T	0 to 500 psi	1000 psi	2400 psi
Q4V	0 to 1000 psi	1000 psi	3600 psi
Q70	0 to 1500 psi	1500 psi	6000 psi
Q73	0 to 3000 psi	3000 psi	9000 psi
Q74	0 to 6000 psi	6000 psi	9000 psi

PMP131	Order code

→ For continuation of ordering information of PMP131, see the following page.

PMP131 (continued)

50	Sensor range; MWP; OPL:		
	Sensor range **Sensors for absolute pressure**	**MWP (maximum working pressure)**	**OPL (over pressure limit)**
A2G	0 to 1 bar / 0 to 100 kPa	2.7 bar	4 bar / 400 kPa
A2H	0 to 1.6 bar / 0 to 160 kPa	4 bar	6.4 bar / 640 kPa
A2N	0 to 2.5 bar / 0 to 250 kPa	6.7 bar	10 bar / 1 MPa
A2Q	0 to 4 bar / 0 to 400 kPa	10.7 bar	16 bar / 1.6 MPa
A2R	0 to 6 bar / 0 to 600 kPa	16 bar	24 bar / 2.4 MPa
A2S	0 to 10 bar / 0 to 1 MPa	25 bar	40 bar / 4 MPa
A2T	0 to 16 bar / 0 to 1.6 MPa	25 bar	64 bar / 6.4 MPa
A2W	0 to 25 bar / 0 to 2.5 MPa	25 bar	100 bar / 10 MPa
A2X	0 to 40 bar / 0 to 4 MPa	60 bar	160 bar / 16 MPa
A2Z	0 to 60 bar / 0 to 6 MPa	60 bar	240 bar / 24 MPa
B70	0 to 100 bar / 0 to 10 MPa	100 bar	400 bar / 40 MPa
B71	0 to 160 bar / 0 to 16 MPa	160 bar	600 bar / 60 MPa
B73	0 to 250 bar / 0 to 25 MPa	250 bar	600 bar / 60 MPa
B74	0 to 400 bar / 0 to 40 MPa	400 bar	600 bar / 60 MPa
R4H	0 to 15 psi	40 psi	60 psi
R4K	0 to 30 psi	100 psi	150 psi
R4N	0 to 50 psi	160 psi	240 psi
R4R	0 to 150 psi	400 psi	600 psi
R4S	0 to 300 psi	400 psi	1500 psi
R4T	0 to 500 psi	1000 psi	2400 psi
R4V	0 to 1000 psi	1000 psi	3600 psi
R70	0 to 1500 psi	1500 psi	6000 psi
R73	0 to 3000 psi	3000 psi	9000 psi
R74	0 to 6000 psi	6000 psi	9000 psi

995	Marking	
	1	Tagging (TAG), see additional spec.

PMP131		Complete order code

PMP135

This overview does not mark options which are mutually exclusive.

10	**Electrical connection:**	
	A1	Plug ISO 4400, M 16, IP 65/NEMA 4X
	A2	Plug ISO 4400, ½ NPT, IP 65/NEMA 4X
	A3	5 m cable, IP 68/NEMA 6P
	A4	Plug M 12, IP 65/NEMA 4X

20	**Process connection:**	
	F	Clamp ISO 2852, DN 22 (¾"), AISI 316L, 3A, DIN 32676 DN 20, EHEDG
	G	Tri-Clamp ISO 2852, DN 25 to 38 (1" to 1½"), AISI 316L, 3A, DIN 32676 DN 25 to 40, EHEDG
	H	Tri-Clamp ISO 2852, DN 40 to 51 (2"), AISI 316L, 3A, DIN 32676 DN 50, EHEDG
	M	Thread ISO 228, G 1, with metallic sealing taper, AISI 316L, flush-mounted, adapter 52005087
	N	Thread ISO 228, G 1, with sealing surface for flush-mounted installation, AISI 316L, adapter 52001051
	S	SMS 1½", PN 25, AISI 316L, 3A, EHEDG

30	**Output:**	
	0	Analog 4 to 20 mA, SIL
	D	Analog 4 to 20 mA, SIL, ATEX II 1/2 G Ex ib IIC T6
	1	Analog 4 to 20 mA, SIL, ATEX II 2 G Ex ib IIC T6
	5	Analog 4 to 20 mA, SIL, ATEX II 3 G Ex nA II T6
	2	Switch output PNP, 3-wire
	3	Switch output PNP, ATEX II 3 G Ex nA II T6

40	**Additional options:**	
	1	Basic version
	C	EN10204-3.1 material (wetted parts) inspection certificate
	D	Final inspection report + EN10204-3.1 material (wetted parts) inspection certificate
	2	Final inspection report

50	**Sensor range; MWP; OPL:**			
		Sensor range	**MWP (maximum working pressure)**	**OPL (over pressure limit)**
		Sensors for gauge pressure		
	A1G	0 to 1 bar / 0 to 100 kPa	2.7 bar	4 bar / 400 kPa
	A1H	0 to 1.6 bar / 0 to 160 kPa	4 bar	6.4 bar / 640 kPa
	A1N	0 to 2.5 bar / 0 to 250 kPa	6.7 bar	10 bar / 1 MPa
	A1Q	0 to 4 bar / 0 to 400 kPa	10.7 bar	16 bar / 1.6 MPa
	A1R	0 to 6 bar / 0 to 600 kPa	16 bar	24 bar / 2.4 MPa
	A1S	0 to 10 bar / 0 to 1 MPa	25 bar	40 bar / 4 MPa
	A1T	0 to 16 bar / 0 to 1.6 MPa	25 bar	64 bar / 6.4 MPa
	A1W	0 to 25 bar / 0 to 2.5 MPa	25 bar	100 bar / 10 MPa
	A1X	0 to 40 bar / 0 to 4 MPa	60 bar	160 bar / 16 MPa
	Q4H	0 to 15 psi	40 psi	60 psi
	Q4K	0 to 30 psi	100 psi	150 psi
	Q4N	0 to 50 psi	160 psi	240 psi
	Q4R	0 to 150 psi	400 psi	600 psi
	Q4S	0 to 300 psi	400 psi	1500 psi
	Q4T	0 to 500 psi	1000 psi	2400 psi
		Sensors for absolute pressure		
	A2G	0 to 1 bar / 0 to 100 kPa	2.7 bar	4 bar / 400 kPa
	A2H	0 to 1.6 bar / 0 to 160 kPa	4 bar	6.4 bar / 640 kPa
	A2N	0 to 2.5 bar / 0 to 250 kPa	6.7 bar	10 bar / 1 MPa
	A2Q	0 to 4 bar / 0 to 400 kPa	10.7 bar	16 bar / 1.6 MPa
	A2R	0 to 6 bar / 0 to 600 kPa	16 bar	24 bar / 2.4 MPa
	A2S	0 to 10 bar / 0 to 1 MPa	25 bar	40 bar / 4 MPa
	A2T	0 to 16 bar / 0 to 1.6 MPa	25 bar	64 bar / 6.4 MPa
	A2W	0 to 25 bar / 0 to 2.5 MPa	25 bar	100 bar / 10 MPa
	A2X	0 to 40 bar / 0 to 4 MPa	60 bar	160 bar / 16 MPa
	R4H	0 to 15 psi	40 psi	60 psi
	R4K	0 to 30 psi	100 psi	150 psi
	R4N	0 to 50 psi	160 psi	240 psi
	R4R	0 to 150 psi	400 psi	600 psi
	R4S	0 to 300 psi	400 psi	1500 psi
	R4T	0 to 500 psi	1000 psi	2400 psi

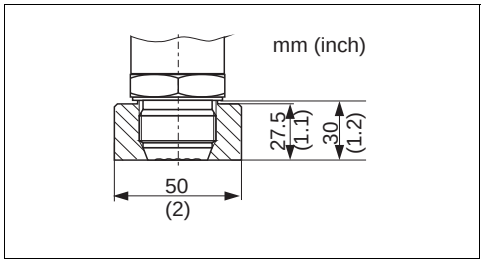
995	**Marking**	
	1	Tagging (TAG), see additional spec.

PMP135		Complete order code

Accessories

Welding neck with sealing taper

- Welding neck for flush-mounted installation of the process connection G1 A with metallic sealing taper (PMP135, version M)
  Material: AISI 316L (1.4435)
  Order number: 52005087
- with inspection certificate 3.1
  Order number: 52010171

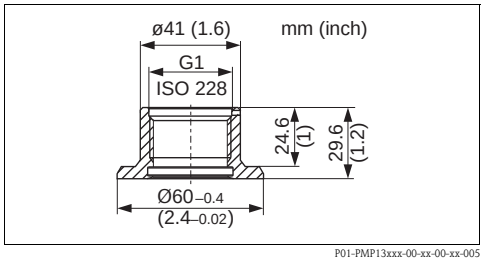


P01-PMP135xx-00-xx-00-xx-002

- Pressure sensor dummy for welding the welding neck without any problems with order number 52005087 or 52010171
  Material: CuZn
  Order number: 52005272

Welding neck with sealing surface

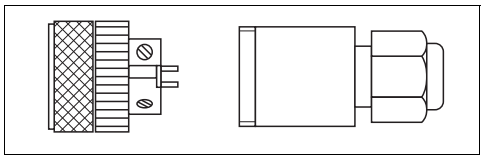
- Welding neck for flush-mounted installation of the process connection G1 A with sealing surface (PMP135, version N)
  Material: AISI 316L (1.4435)
  Gasket (enclosed): silicone O-ring
  Order number: 52001051
- Optional with inspection certificate 3.1
  Order number: 52011896



P01-PMP13xxx-00-xx-00-xx-005

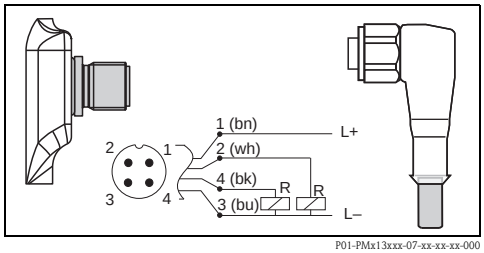
Plug-in jack

- Plug-in jack M 12x1, straight
  Self-made connection to M 12x1 housing plug
  Material: Handle body PA; Coupling nut CuZn, nickel-plated, degree of protection (inserted): IP 67
  Order number: 52006263


P01-PMP13xxx-00-xx-00-xx-003

Connecting cable

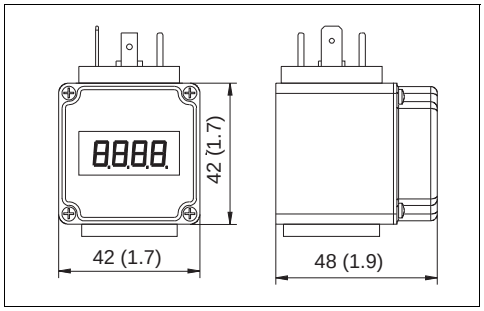
- Cable, 4 x 0.34 mm² (AWG 21) with M12 socket, elbowed, screw plug, length 5 m (16 ft), sprayed cable
  Materials: Body PUR
  Coupling nut: Cu Zn/Ni, brass, nickeled
  Cable: PVC
  Protection: IP 67 (fully locked)
  order number: 52010285



P01-PMx13xxx-07-xx-xx-xx-000

Plug-on display PHX20/PHX21

- Plug-on display for electrical connections
  – PMC131 version A1, A2, B1, C1, C2
  – PMP131/135 version A1, A2.
  4-digit red LED display for looping into 4 to 20 mA circuit via elbow plug ISO4400, rotatable in 90° steps, programmable via 2 keys
  Display range: –1999 to +9999
  Degree of protection: IP 65
  Material: Housing Pa6 GF30, front screen PMMA
  Voltage drop: ≤5 V (corresponds to max. 250 Ω load)
  Approval for PHX21: ATEX II 2G
  Order number PHX20: 52022914
  Order number PHX21: 52022915



P01-PHX2xxxx-06-xx-xx-xx-002

Documentation

Field of Activities

- Pressure measurement, powerful measuring devices for process pressure, differential pressure, level and flow: FA00004P/00/EN

Technical Information

- EMC test procedures: TI00241F/00/EN

Operating Instructions

- Cerabar T PMC131: KA00085P/00/A3
- Cerabar T PMP131: KA00103P/00/A3
- Cerabar T PMP135: KA00198P/00/A3

Functional Safety Manual (SIL)

- Cerabar T PMP131, PMP135: SD00160P/00/EN

Safety Instructions

Certificate/Type of protection	Device	Documentation	Version in the order code
ATEX II 3 G Ex nA II T4 [1]	PMC131	– XA00191P	B1, B3, B5
ATEX II 1/2 G Ex ib IIC T6 ATEX II 2 G Ex ib IIC T6 ATEX II 3 G Ex nA II T6 [1]	PMP131, PMP135	– XA00142P – XA00191P	D 1 3, 5

1) In the event of applications in a Zone 2 explosive atmosphere (Ex nA explosion protection) protect the housing from impact.

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Endress+Hauser

People for Process Automation

TI00415P/00/EN/16.12
71197544
CCS/FM+SGML 9.0

71197544

Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

Liquiline M CM42

Two-wire transmitter for Ex and non-Ex areas
Analog sensors: pH/ORP / Conductivity / Concentration / Resistivity
Digital sensors: pH/ORP / Oxygen / Conductivity

Application

Liquiline M CM42 is a modular two-wire transmitter for all areas of process engineering.
Depending on the ordered version, Liquiline has one or two analog current outputs or it can be connected to field buses as per FOUNDATION Fieldbus, PROFIBUS PA and HART protocol.
The transmitter is suitable for pollution degree 3.

The extremely robust, corrosion-resistant plastic version and the hygienic stainless steel version are designed for the following applications:
- Chemical processes
- Pharmaceuticals industry
- Foodstuff technology
- Applications in hazardous locations

Your benefits

- Cost-saving:
  - Simple commissioning with Quick Setup and Navigator (multifunction button)
  - Memosens: Plug & play of laboratory calibrated sensors
  - Predictive maintenance system detects when a sensor has to be cleaned, calibrated or replaced
  - Less storage thanks to modular design
  - Effective asset management thanks to Fieldcare and W@M
- Safe:
  - Memosens: Active display of cable interruption
  - User-guided commissioning, graphic display and plain text guidance
  - Approvals: ATEX, FM, CSA, NEPSI, TIIS
  - Code-protected commissioning and calibration
  - SIL2 measuring point: TÜV approval for pH glass with Memosens

TI381C/07/EN/13.10
71122183

Endress+Hauser
People for Process Automation

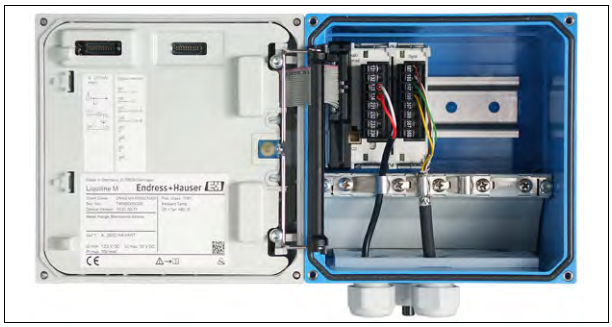
Table of contents

General features

Memosens

Memosens makes your measuring point safer and more reliable:
- Non-contact, digital signal transmission enables optimum galvanic isolation
- No galvanic corrosion
- Completely watertight
- Laboratory sensor calibration possible, thus increasing measured value availability
- Predictive maintenance thanks to recording of sensor data, e.g.:
  - Total hours of operation
  - Hours of operation with very high or very low measured values
  - Hours of operation with high temperatures
  - Number of steam sterilizations
  - Sensor condition

Modular design



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Inside Liquiline (version with sensor module, without wiring)

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CPU and sensor module

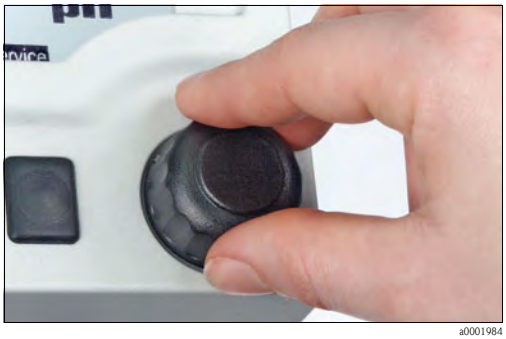
Quick setup

To the first measuring value within 1 minute

After setting up the few parameters in the Quick Setup menu, the measuring point is ready to measure. The first measured value is reliably displayed.

Navigator and plain text

The unique operating concept sets new standards:
- Fewer user errors thanks to very easy operation
- Quick configuration with the Navigator.
- Intuitive configuration and diagnosis due to plain text display



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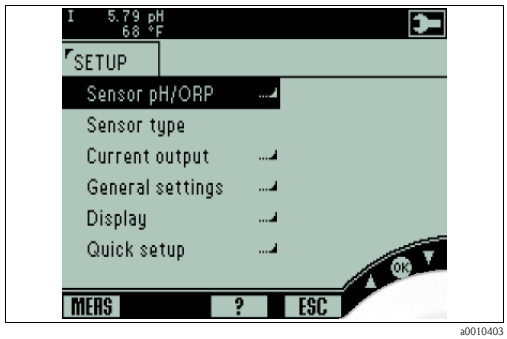
Navigator



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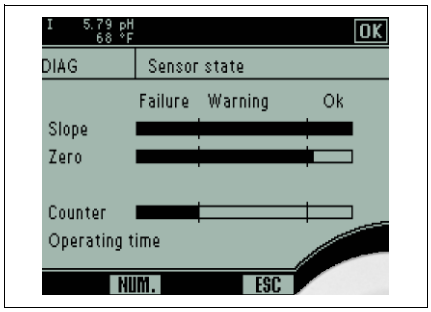
Plain text display

Sensor monitor

You can find the sensor monitor in the DIAG menu. Important sensor data, incl. warning and alarm limits, are displayed either graphically or numerically.



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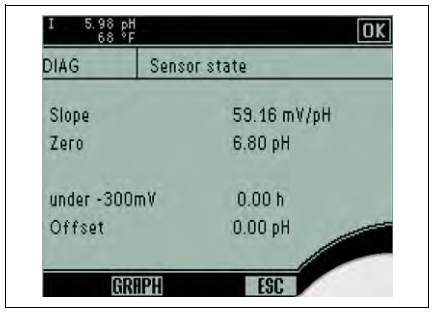
Sensor monitor (example)



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Sensor monitor (example)

Software packages

You can choose from the following from these software packages:

- Basic:
  Standard application for the most common measuring points
- Advanced:
  Highest degree of accuracy (medium compensation) and safety (Cal-Timer) in critical applications

Software package	Features		
	pH /ORP	**Conductivity**	**Dissolved oxygen**
Basic	**Analog sensors** – Offset and two-point calibration – Sample calibration – Calibration with standard buffers – Manual buffer – Temperature compensation – Temperature adjustment – Isotherm intersection – Simulation of current output – Self-diagnosis – Calibration stability settings – Clock **Memosens sensors** features like analog sensors plus: – Sensor information – Sensor monitoring	**Analog sensors** – Sample calibration – Temperature calibration: one-point – Temperature compensation: linear, NaCl, Ultrapure water (NaCl, HCl) – Simulation of current output – Self-diagnosis – Concentration measurement – Clock **Memosens sensors** features like analog sensors plus: – Sensor information – Sensor monitoring	**Memosens sensors** – Slope calibration – in air (100% rH) – in water (100% air saturated) – in air (with input of the absolute air pressure und of the relative humidity) – Zero point calibration – Sample calibration – Temperature adjustment – Simulation of current output – Self-diagnosis – Clock – Sensor information – Sensor monitoring
Advanced	**Software package "Basic" and also:**		
	Analog sensors – Medium compensation – Calibration timer – Sensor statistics – Logbooks – Data logbook **Memosens sensors** features like analog sensors plus: – Operating hours counter – Sterilizations counter	**Analog sensors** – Logbooks – Data logbook – Calibration with separate installation factor (inductive measurement only) – Polarization detection (conductive measurement only) – Temperature compensation via user table – Two-point temperature adjustment: offset and slope **Memosens sensors** features like analog sensors plus: – Operating hours counter – Sterilizations counter – USP alarm and pre-alarm	**Memosens sensors** – Polarization voltage setting – Medium compensation – Calibration stability settings – Calibration timer – Sensor statistics – Logbooks – Data logbook – Operating hours counter – Sterilizations counter

DAT memory modules

There are 3 different types of DAT module

- **SystemDAT**
  - For changing the sensor type, software updates (more recent software version) and changing the language package
  - Part of the scope of delivery of the version ordered and available as an accessory
  - Optional accessory
- **FunctionDAT**
  - For software upgrades (additional functionality)
  - Extending the function scope (2nd current output)
  - Optional accessory
- **CopyDAT**
  - Memory for own configuration settings
  - Optional accessory

A FunctionDAT is never available for a SIL device since the device already has all the possible functions and its functions can therefore not be extended.
A SystemDAT is also not available for the SIL device since it would not be possible to ensure the "functional safety" otherwise.

Safety

Code protection

The device has a user administration function in order to avoid unscheduled changes to the measuring point.

Two different modes are available in the Advanced version:

- Standard
  - There are 3 fixed user roles (Operator, Maintenance, Expert).
  - Each role has its own individual password. This password can be changed.
  - No other user roles can be created.
- Advanced
  - You can create and manage a maximum of 15 user accounts. You need to be logged on as the expert to do so.
  - You can assign each user one of 3 user roles (Operator, Maintenance, Expert).
  - Several "Experts" are possible.
  - One user ("Administrator") is already created at the factory (password: 4685).

SIL

A TÜV approved SIL2 version of Liquiline M CM42 is available (CM42-M* only).

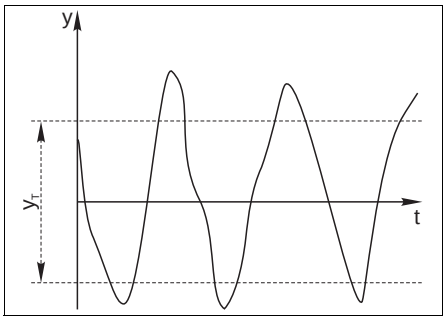
Safety functions:

- Safe output of the digitalized value at the current output
- Monitoring of the measured value for leaving a defined interval
- Safe calibration and justage

You can get more information and safety manuals via:
www.endress.com/SIL

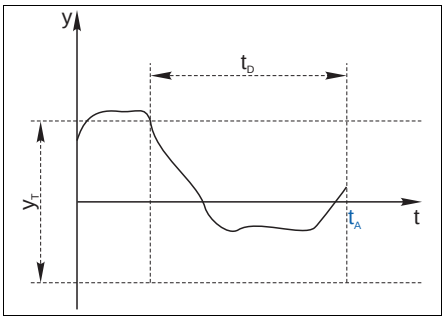
PCS: Live check

The process check system (PCS) checks the measuring signal for stagnation. An alarm is triggered if the measuring signal does not change over a certain period (several measured values).



Normal measuring signal, no alarm

y Measuring signal
y_T Fixed value for minimum signal fluctuation



Stagnating signal, alarm is triggered

t_D Set value for time interval
t_A Time when the alarm is triggered

Reordering validated software

You can order new devices with older, validated software so you do not have to constantly validate new software versions of new devices. This is possible as long as allowed by the hardware version.

Special features

pH / ORP

Suitable sensors

- Analog and Memosens glass electrodes
- Analog and Memosens ISFET sensors
- Analog and Memosens ORP sensors
- Analog and Memosens Pfaudler electrodes
- Analog single electrodes (glass or antimony)

Sensor Condition Check (SCC)

Sensor condition check (SCC) monitors the electrode status and the degree of electrode aging. The status is displayed with the messages "Electrode OK", "Low abrasion" or "Change electrode". An error message is also output for the message "Change electrode". The electrode status is updated after every calibration.

Sensor Check System (SCS)

The sensor check system alerts to deviations of the pH glass impedance or reference impedance (analog sensors only) from the normal range, thus indicating possible failure due to pH electrode blocking or damage.
In addition, the SCS detects glass breakage of glass electrodes and leakages of ISFET sensors.

Conductivity

Suitable sensors

Connection of all types of conductivity sensors:
- Analog and Memosens conductive sensors:
  - Two-electrode sensors
  - Four-electrode sensors
- Analog inductive sensors

Polarization monitoring

Polarization effects in the boundary layer between the sensor and the solution to be measured limit the measuring range of conductive conductivity sensors.
The transmitter can detect and indicate polarization effects using an innovative, intelligent signal evaluation process.

United States Pharmacopeia (USP) and European Pharmacopoeia (EP)

The requirements on ultrapure water in the pharmaceutical industry are specified by the American USP and the European EP.

The transmitter meets the USP/EP requirements on conductivity measuring systems:
- Precise temperature measurement at point of conductivity measurement
- Simultaneous display of uncompensated conductivity values and temperature possible
- Display resolution 0.01 µS/cm
- Exact adjustment of the transmitter in the factory with traceable precision resistances (optional)
- Exact adjustment of the sensors in the factory in accordance with ASTM D 1125-9 resp. ASTM D 5391-99 (optional)
- Temperature-dependent measured value monitoring acc. to USP and EP.

The "Advanced" software package provides the limit value functions for pharmaceutical waters acc. to USP and EP:
- Water for Injection (WFI) acc. to USP <645> and EP
- Highly purified water (HPW) acc. to EP
- Purified water (PW) acc. to EP

The uncompensated conductivity value and the temperature are measured with the USP and EP limit value functions. The measured values are compared with the tables described in the standards. If a limit value is exceeded, an alarm is displayed. Additionally, a pre-alarm can be defined to indicate undesired operation states before they occur.

Oxygen

Suitable sensors

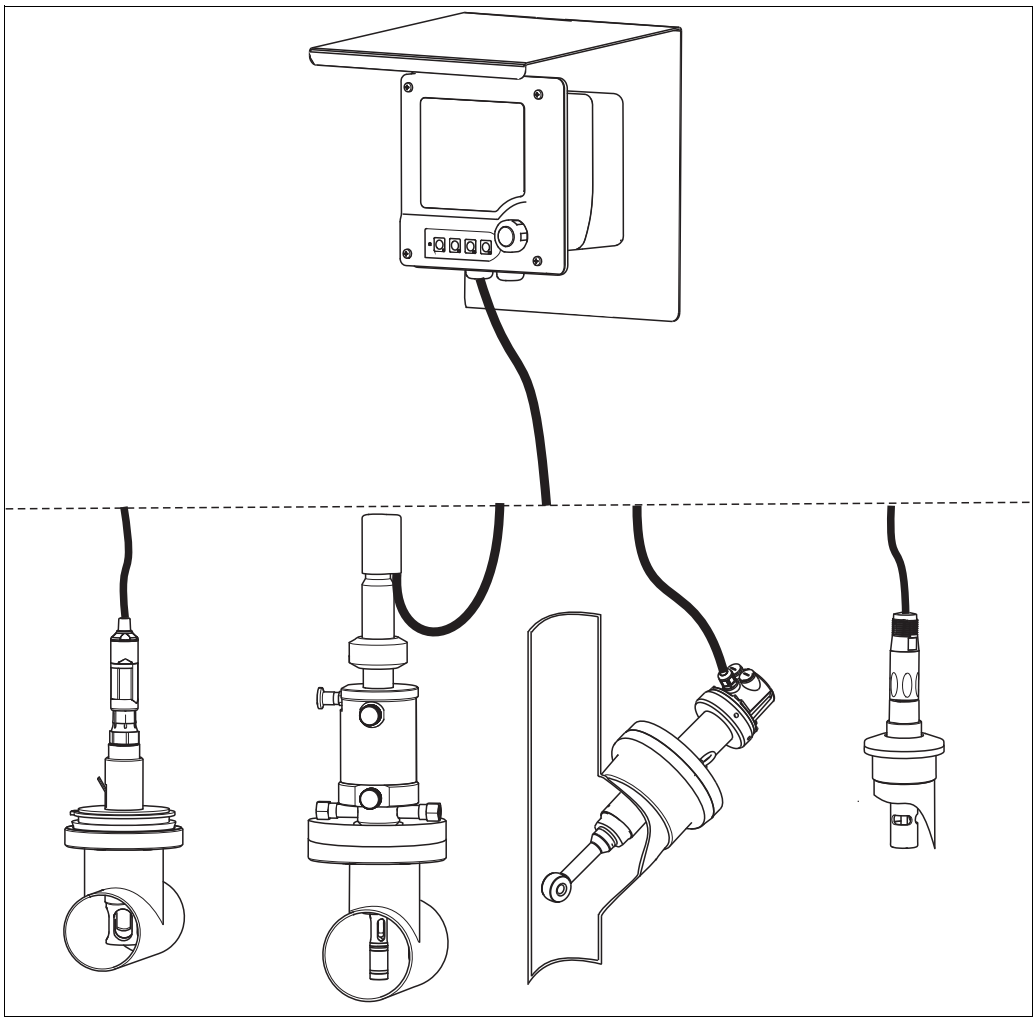
Amperometric sensors:
- with Memosens technology
- 12 and 40 mm design

Aplication-optimized calibration models

The transmitter offers separate functions for zero-point calibration and slope calibration. This allows for optimum adaption to the process.
The calibration models range from simple slope calibration in vapour-saturated air to slope calibration with indication of absolute air pressure and relative humidity at measuring place.
The latter model allows you to calibrate during operation as well as during sterilization or cleaning.
The transmitter has individual calibrations and sterilizations counters for sensor and membrane cap. The counter for the membrane cap can be reset after each cap replacement.

Measuring system

A complete measuring system comprises:
- Liquiline M CM42 transmitter with mounting plate (e.g. for wall mounting)
- Sensor and matching cable
- Fitting assembly (optional)
- Post mounting kit (optional)
- Weather protection cover (optional)



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Measuring system: Examples

pH / ORP (analog sensor)
- CM42-P/R...
- Measuring cable CPK9
- Assembly Cleanfit CPA471
- Sensor Orbisint CPS11

Conductivity, inductive measurement (analog)
- CM42-I...
- Assembly Dipfit CLA111
- Sensor Indumax CLS50

Conductivity, conductive measurement (analog)
- CM42-C...
- Measuring cable CPK9
- Sensor Condumax CLS16

Memosens (digital sensor)
- CM42-K/M/N/O...
- Measuring cable CYK10
- (Assembly Unifit CPA442)
- Sensor CPS11D (pH: glass)/ CPS471D (pH: ISFET)/ COS22D/51D (oxygen) / CLS15D/16D/21D (conductivity, cond. meas.)

You can select from a wide variety of assemblies and sensors to set up your measuring point. You can find the corresponding information in the chapter "Accessories" resp. in the referenced documentations.

NOTICE

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

Impaired operation to complete transmitter failure

► When installing outside, always use the weather protection cover (accessory).

Input

Binary input (Memosens): pH/ORP, Oxygen, Conductivity

Measured variable

—> Documentation of the connected sensor

Measuring range

—> Documentation of the connected sensor

Cable specification

With Memosens	100 m (330 ft) max. cable length

Ex specification

Intrinsically safe sensor circuit with type of protection: Ex ia IIC[1)] Power limited sensor circuit with type of protection: Ex nL IIC[2)]	
Max. output voltage U_o Max. output current I_o Max. output P_o	5.04 V 80 mA 112 mW
For connection to the special measuring cable CYK10	

1) CM42-*G*********, CM42-*X*********, CM42-*Z*********

2) CM42-*V*********

Analog input: pH / ORP

Measured variable

—> Documentation of the connected sensor

Measuring range

—> Documentation of the connected sensor

Cable specification

Without SCS	50 m (160 ft) max. cable length
With SCS	20 m (65 ft) max. cable length

Applicable temperature sensors

- Pt100
- Pt1000
- NTC 30K

Ex specification

Intrinsically safe sensor circuit with type of protection: Ex ia IIC[1)] Power limited sensor circuit with type of protection: Ex nL IIC[2)]		
	Glass electrode	**ISFET**
Max. output voltage U_o Max. output current I_o Max. output P_o Max. external inductance L_o Max. external capacity C_o	10.08 V 4.1 mA 10.2 mW 1 mH 250 nF	10.08 V 50.7 mA 128 mW 1 mH 250 nF
Connection class acc. to NE116[3)]	SensISCO1X	-

1) CM42-*G*********, CM42-*X*********, CM42-*Z*********

2) CM42-*V*********

3) CM42-*G*********

When pH/ORP glass electrodes are connected to terminals 317, 318, 320, 111, 112 and 113, the device corresponds to connection class 1 as per NAMUR Recommendation NE116 (SensISCO). Terminals 315 and 316 may not be connected for this categorization.
The device is labeled SensISCO1X.

Input impedance

> $1*10^{12}$ Ω (at nominal operating conditions)

Input leakage current

< $1*10^{-13}$ A (at nominal operating conditions)

Analog input: Conductivity

Measured variable

—> Documentation of the connected sensor

Measuring range

—> Documentation of the connected sensor

Cable specification

Conductivity/resistivity, conductively measured[1)] Two-electrode sensor 10 µS·k to 20 mS·k / 0.1 MΩ/k to 50 Ω/k 5 µS·k to 20 mS·k / 0.2 MΩ/k to 50 Ω/k 0.1 µS·k to 20 mS·k / 20 MΩ/k to 50 Ω/k	 100 m (330 ft) max. cable length 50 m (160 ft) max. cable length 15 m (50 ft) max. cable length
Conductivity, conductively measured Four-electrode sensor 10 µS·k to 1.5 S·k 0.1 µS·k to 20 mS·k	 100 m (330 ft) max. cable length 15 m (50 ft) max. cable length
Conductivity, inductively measured[2)]	55 m (180 ft) max. cable length

1) with CYK71 or CPK9 cables or sensor fixed cable

2) with CLK5 cable or sensor fixed cable

Temperature sensor

- Pt100
- Pt1000

Ex specification, conductive sensors

⟨Ex⟩ Intrinsically safe sensor circuit with type of protection: Ex ia IIC[1)] Power limited sensor circuit with type of protection: Ex nL IIC[2)]	
Max. output voltage U_o Max. output current I_o Max. output P_o Max. external inductance L_o Max. external capacity C_o	10.08 V 23 mA 57 mW 300 µH 50 nF

1) CM42-*G*********, CM42-*X*********, CM42-*Z*********

2) CM42-*V*********

Ex specification, inductive sensors

⟨Ex⟩ Intrinsically safe sensor circuit with type of protection: Ex ia IIC[1)] Power limited sensor circuit with type of protection: Ex nL IIC[2)]	
Max. output voltage U_o Max. output current I_o Max. external P_o	10.08 V 64 mA 128 mW
For connection of the inductive sensors CLS50, CLS54	

1) CM42-*G*********, CM42-*X*********, CM42-*Z*********

2) CM42-*V*********

Output

Output signal

1x 4 to 20 mA, potentially isolated against sensor circuit[1)]
2x 4 to 20 mA, potentially isolated against sensor circuit[2)]
PROFIBUS PA[3)]
FOUNDATION Fieldbus[4)]

Signal on alarm

3.6 to 22.0 mA (3.6 mA fixed value when using HART communication)
digital via field bus[5)]

Load

Max. load with an supply voltage of 24 V: 500 Ω
Max. load with an supply voltage of 30 V: 750 Ω

Output signal range

3.6 to 22.0 mA

Ex specification current output 4/20 mA

⟨Ex⟩ Intrinsically safe supply and signal circuits, passive	
Max. input voltage U_i	30 V
Max. input current I_i	100 mA
Max. input P_i	750 mW
Max. internal inductivity L_i	29 µH (output 1) 24 µH (output 2)
Max. internal capacity C_i	1.2 nF (output 1) 0.2 nF (output 2)

Ex specification PROFIBUS PA and FOUNDATION Fieldbus

⟨Ex⟩ Suitable for use as a field device in a FISCO system	
Max. input voltage U_i	17.5 V
Max. input current I_i	380 mA
Max. input P_i	5.32 W
Max. internal inductivity L_i	< 10 µH
Max. internal capacity C_i	< 5 nF

1) current output 1, potential isolation with Memosens: in sensor plug
2) current output 1 and current output 2 (optional)
3) for version with PROFIBUS PA
4) for version with FOUNDATION Fieldbus
5) with Profibus PA or FOUNDATION Fieldbus only

Current output, passive

Signal range	3.6 to 22.0 mA
Signal characteristics	Linear
Cable specification	Type: shielded cable, Ø 2.5 mm (14 AWG)

Wiring

Housing grounding

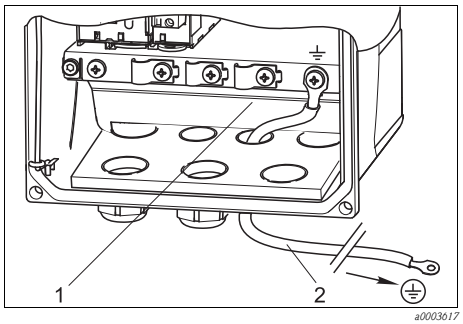
Plastic housing

⚠ WARNING

Electric voltage at ungrounded cable mounting rail

Not safe to touch

► Connect the cable mounting rail to the foundation ground with a separate functional ground ≥ 2.5 mm² (14 AWG).



Housing grounding

1 Fixing plate
2 ≥2.5 mm² (≙14 AWG) functional ground

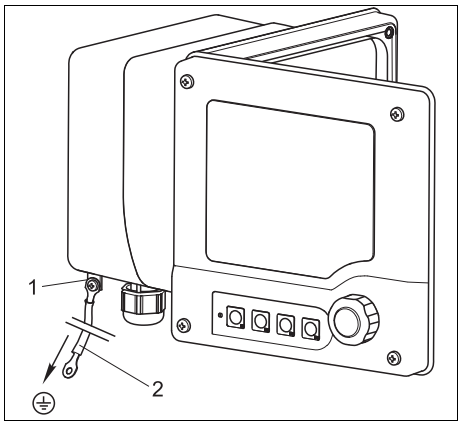
Stainless steel housing

⚠ WARNING

Electric voltage at ungrounded housing

Not safe to touch

► Connect the outer ground connection of the housing to the foundation ground with a separate wire (GN/YE) (≥2.5 mm² ≙14 AWG).



Housing grounding

1 Outer ground connection
2 ≥2.5 mm² (≙14 AWG) line (GN/YE)

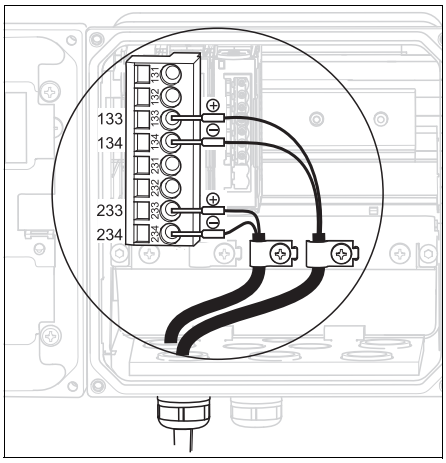
Supply and signal circuit

4 ... 20 mA

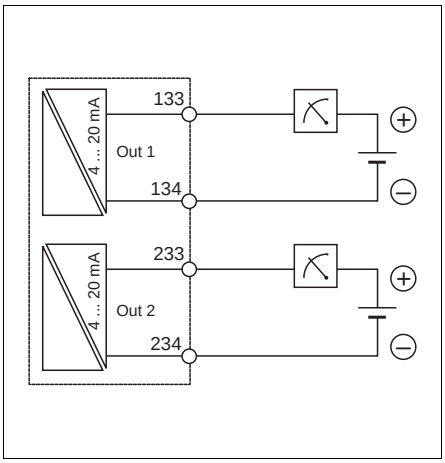
Connect the transmitter via a two-wire cable.

How the shield is connected depends on the interference influence expected. To suppress electrical fields, it suffices to ground the shield at one end. If you also want to suppress interference from a magnetic alternating field, you must ground the shield at both ends.

The second current output is an option (see "Ordering information").



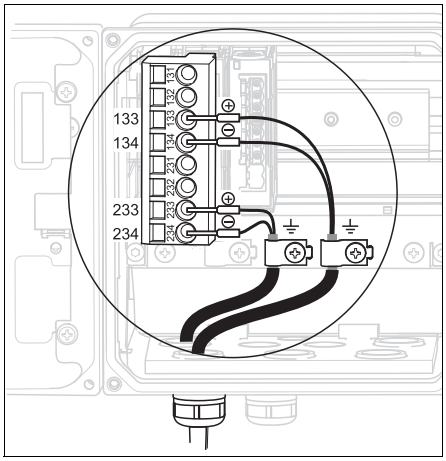
View in device (CPU module)



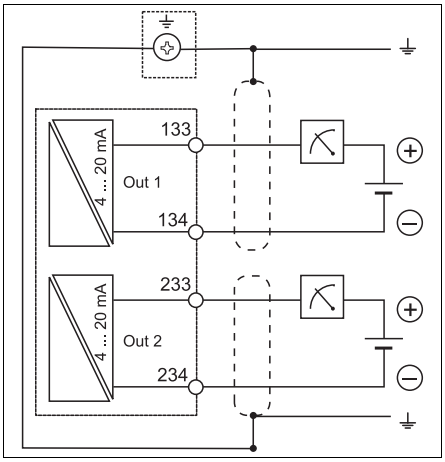
Wiring diagram

4 ... 20 mA / Hart®

For safe communication via the HART protocol and for compliance with the NAMUR NE 21, use a two-wire cable shielded on each end.



View in device (CPU module)



Wiring diagram

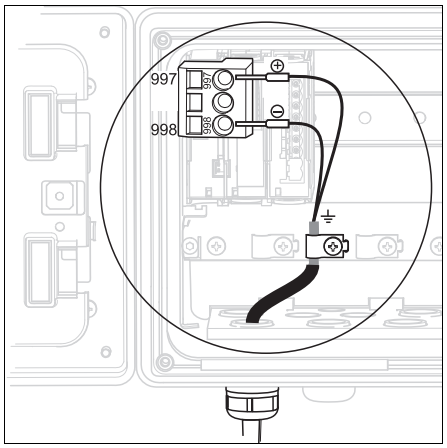
PROFIBUS PA and FOUNDATION Fieldbus

Always use a fieldbus cable that is grounded on both sides (device **and** PCS).

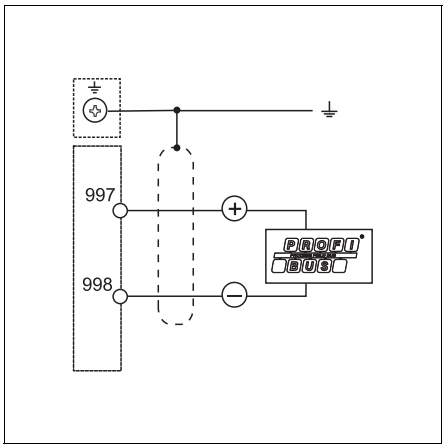
You can connect Profibus and FOUNDATION Fieldbus devices in various ways:

1. Shielded two-wire cable, "Hard grounding"
   (generally to be preferred to capacitive grounding)
2. Shielded two-wire cable, "Capacitive grounding" (shield grounded in device via a capacitor, accessory "C module" necessary)
   Use it, if there is a risk of high equalizing currents. **Not applicable for Ex versions!**
3. Using the fieldbus connection socket (accessories)

"Hard grounding"
- Place the cable shield on the "Fixing plate".
- Connect the cable wires as per the assignment.

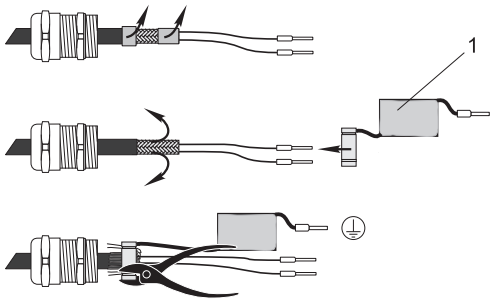


View in device (CPU module)

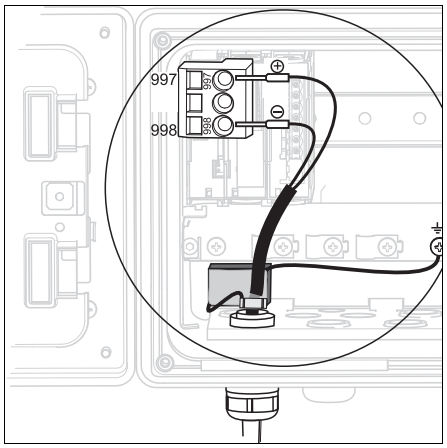


Wiring diagram

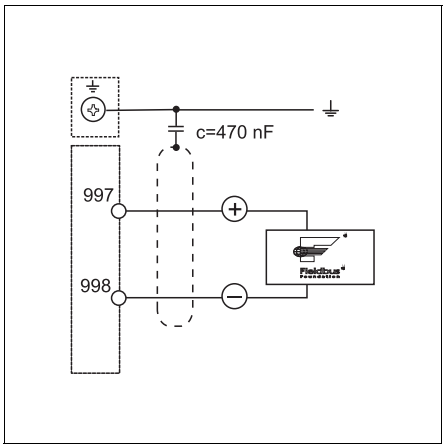
"Capacitive grounding"
- Strip back the shield braiding, push the extension wire of the C module (pos. 1) onto the exposed shield and fasten the clip:



- Place the extension wire on the "Fixing plate".
- Connect the cable wires as per the assignment.

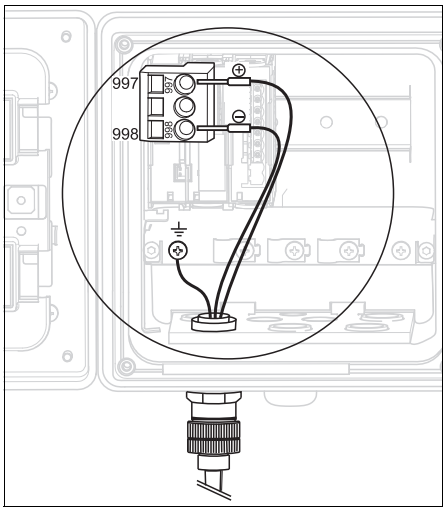


View in device (CPU module)

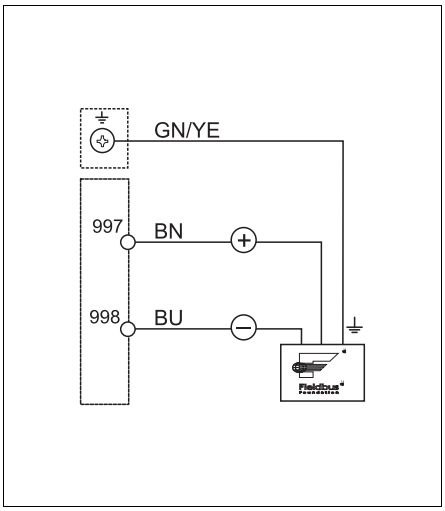


Wiring diagram

"Fieldbus connection socket"
- Screw the fieldbus connection socket (accessories) into the housing bushing.
- Trim the connection cores of the socket to approx. 15 cm (5.9 ").
- Connect the cable cores as per the assignment. In doing so, you must place the cable shield (GN/YE) on the "Fixing plate".



View in device (CPU module)

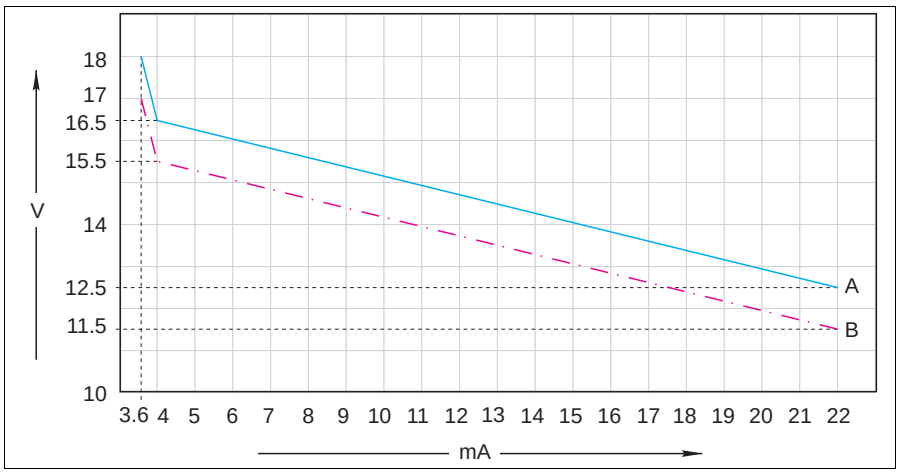


Wiring diagram

Cable specification

Max. cable cross-section: 2.5 mm^2 (≙14 AWG), GND 4 mm^2 (≙12 AWG)

Supply voltage



Minimum supply voltage at transmitter to output current

A with HART communication
B without HART communication

PROFIBUS / FOUNDATION Fieldbus:	9 to 32 V DC (non-hazardous location) 9 to 17.5 V DC (hazardous location)
Power consumption of the fieldbus:	22 mA

Sensor connection

Explanation of abbreviations in the following diagrams:

Abbreviation	Meaning
pH	Signal from pH membrane glass
Ref	Signal from reference electrode
Src	Source
Drn	Drain
PM	Potential matching
U_+	Digital sensor supply
U_	
Com A	Digital sensor communication
Com B	
ϑ	Temperature signal
d.n.c.	Do not connect!

NOTICE

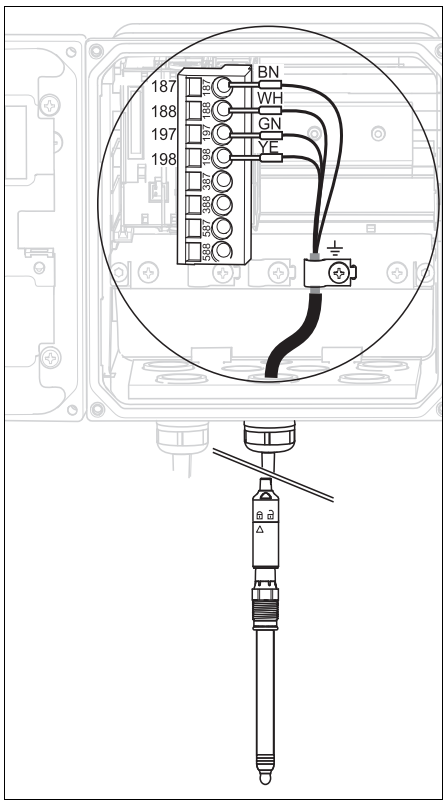
No shielding against electrical and magnetic interference

Interference can cause incorrect measurement results

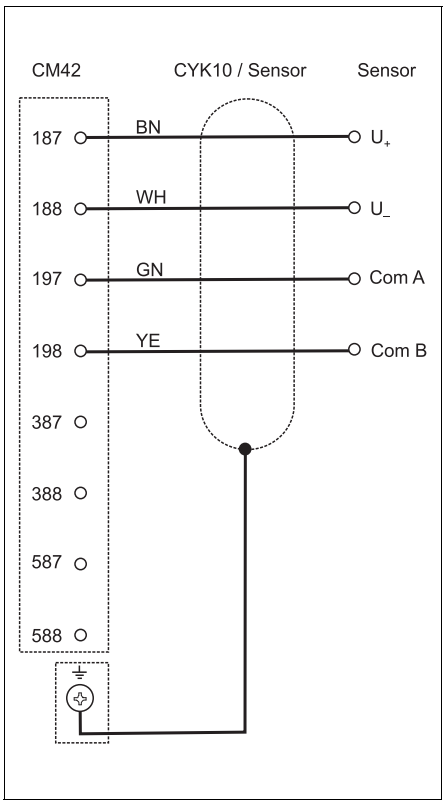
- ► You must connect shielded connections and terminals with functional earth (⏚) (there is no protective earth (⏚) for plastic housings).
- ► Since inductive conductivity sensors work with magnetic fields, avoid any magnetic interferences.

Cable colors indicated as per IEC 757 (see CD-ROM).

Sensor connection: digital sensors (Memosens) pH/ORP/ISFET/Oxygen/ Conductivity



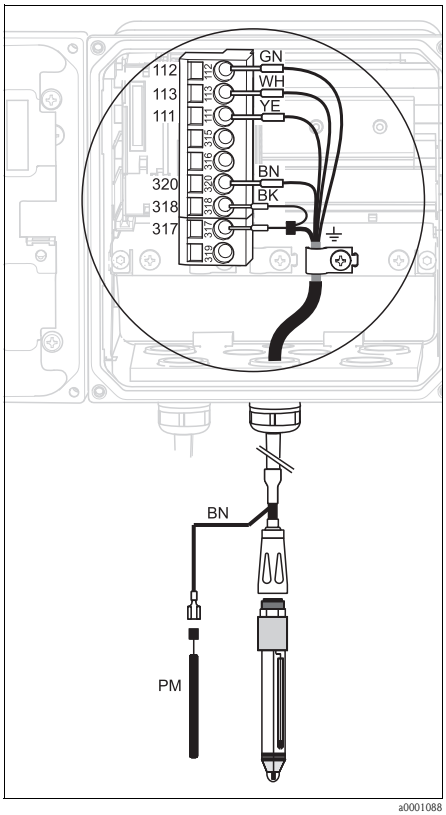
View in device



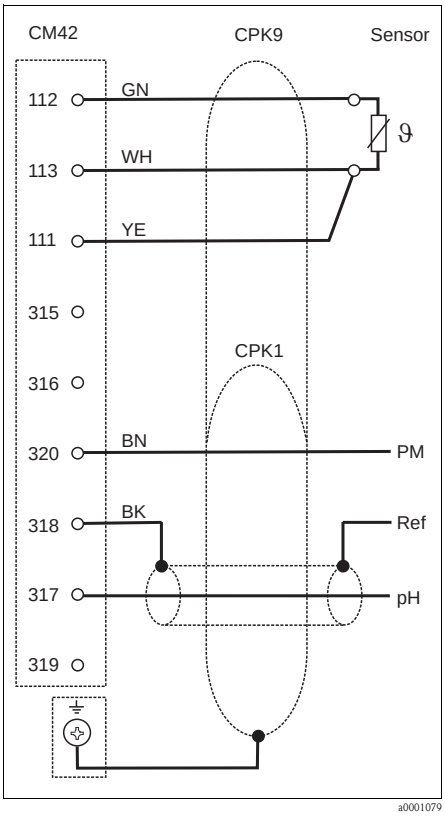
Wiring diagram

Sensor connection: analog pH / ORP sensors

Glass electrodes with PML (symmetrical)

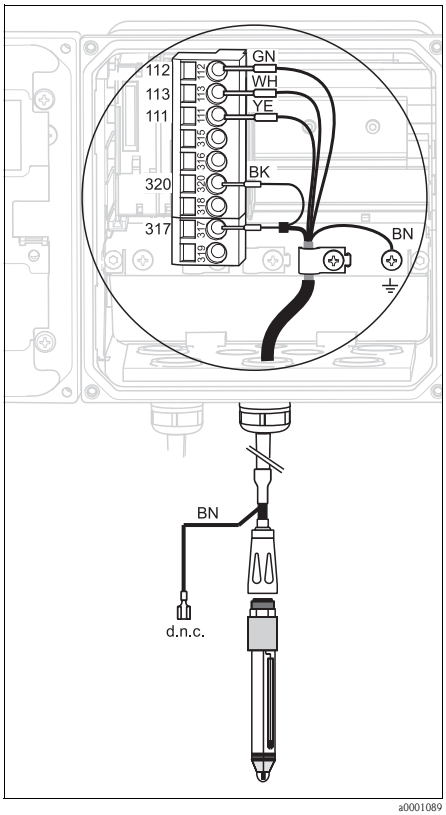


View in device

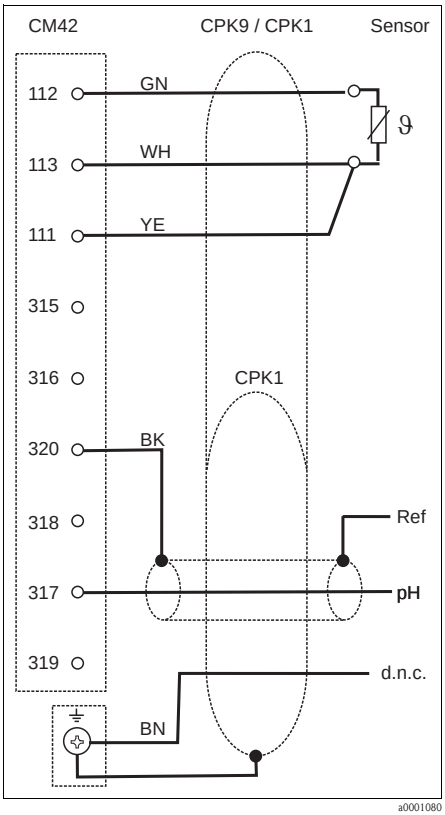


Wiring diagram

Glass electrodes without PML (asymmetrical)

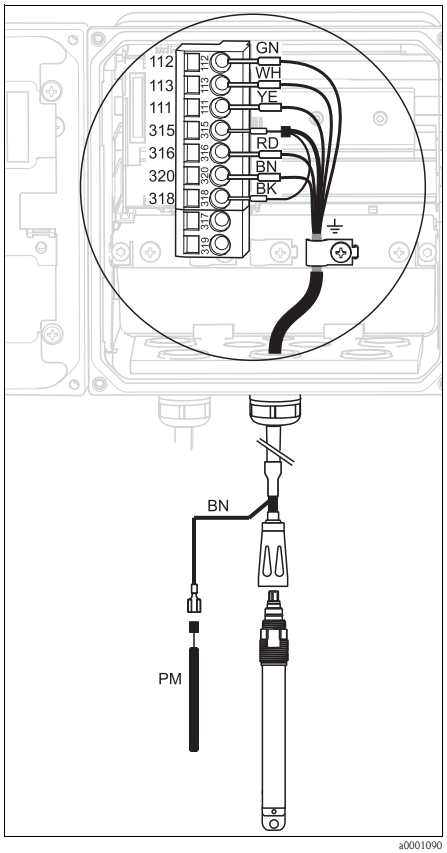


View in device

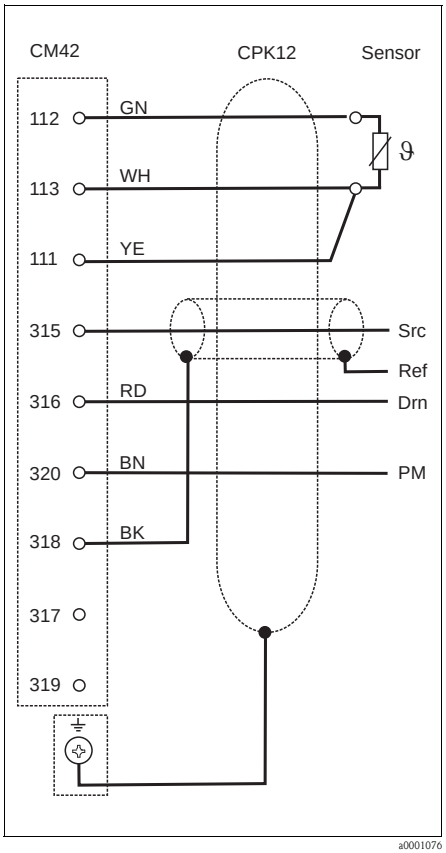


Wiring diagram

ISFET sensors with PML (symmetrical)

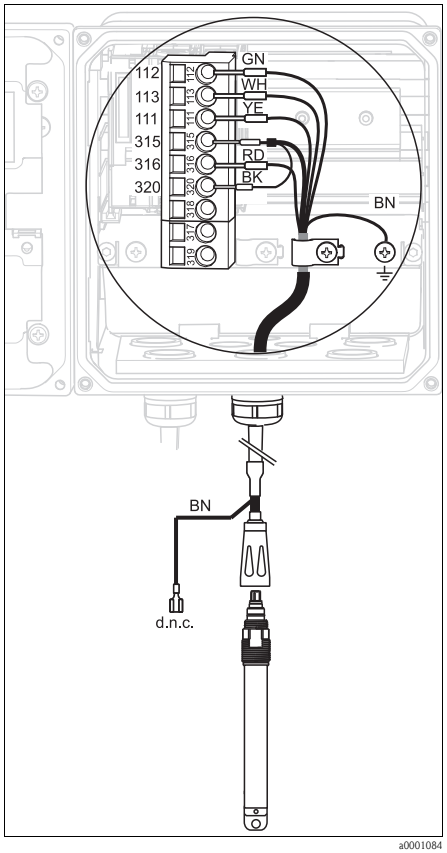


View in device

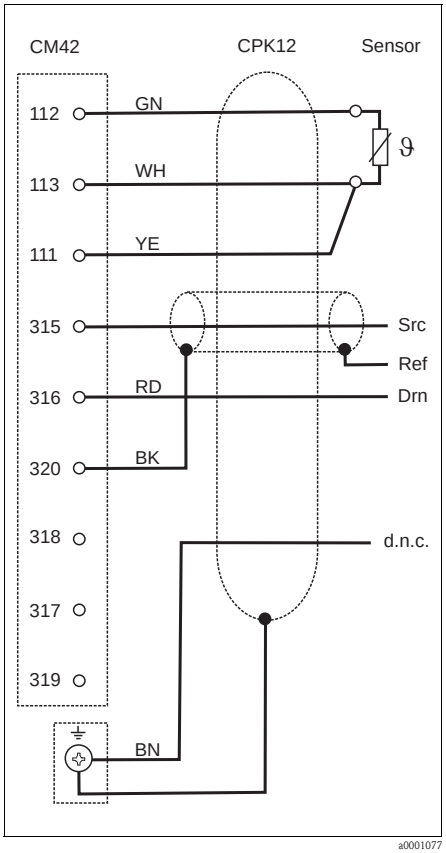


Wiring diagram

ISFET sensors without PML (asymmetrical)



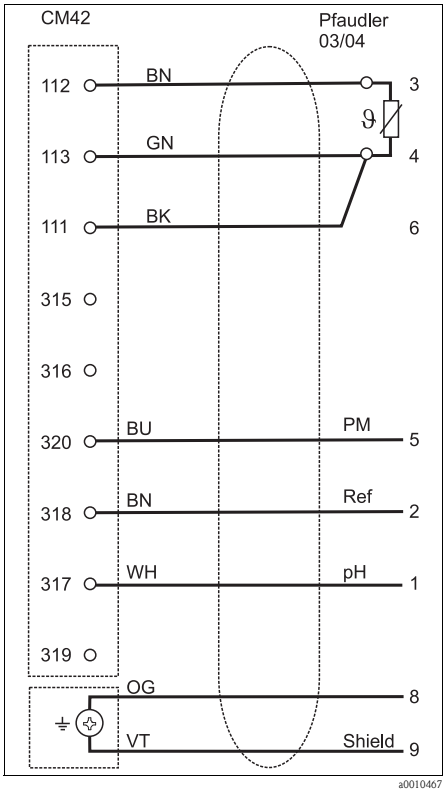
View in device



Wiring diagram

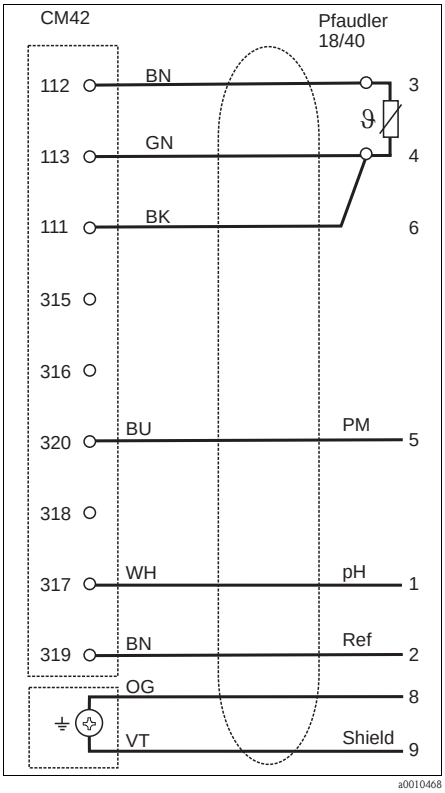
Pfaudler electrodes

With PM (symmetrical)
Pfaudler electrode, absolute
Type 03 / Type 04



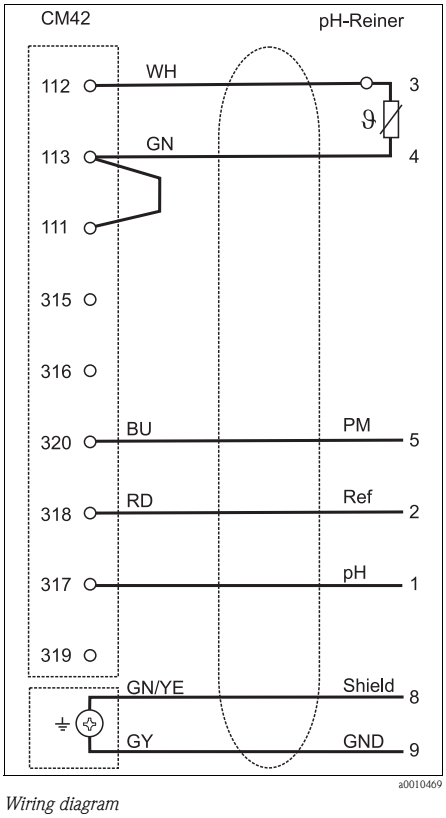
Wiring diagram

With PM (symmetrical)
Pfaudler electrode, relative
Type 18 / Type 40



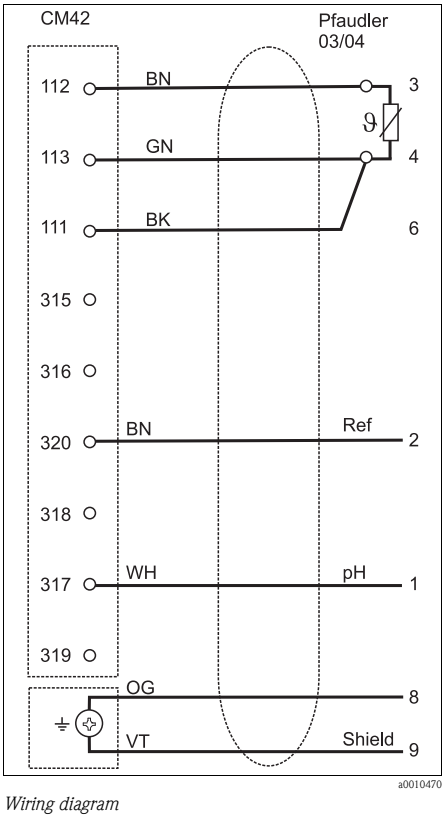
Wiring diagram

With PM (symmetrical)
pH Reiner



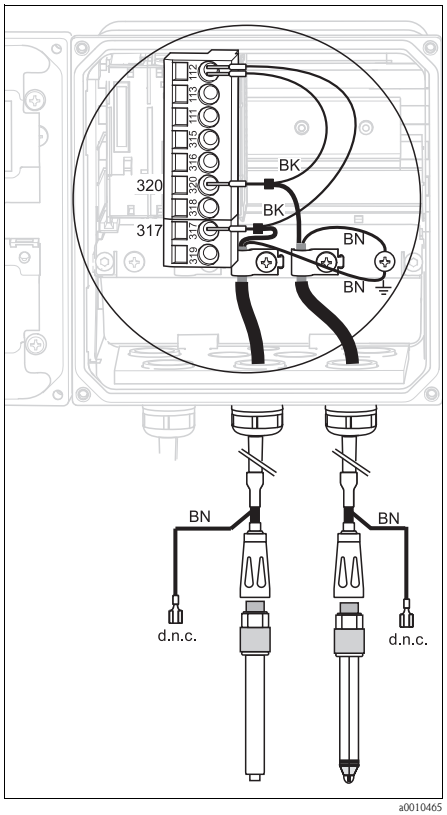
Wiring diagram

Without PM (asymmetrical)
Pfaudler electrode, absolute
Type 03 / Type 04

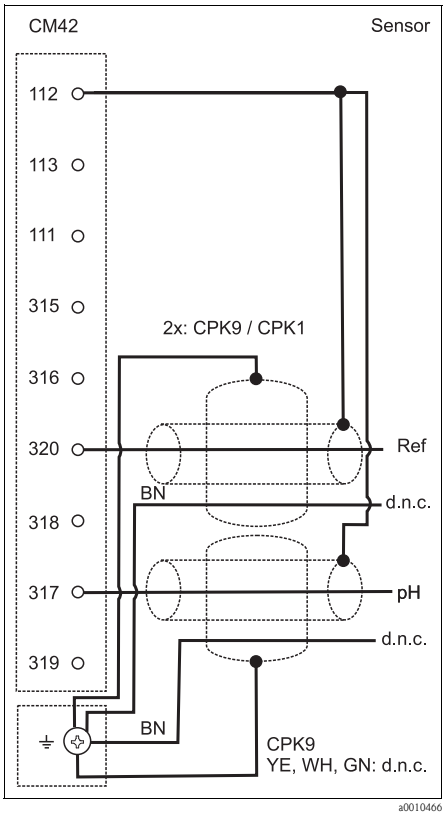


Wiring diagram

Single electrodes (e.g. CPS64 glass or antimony)

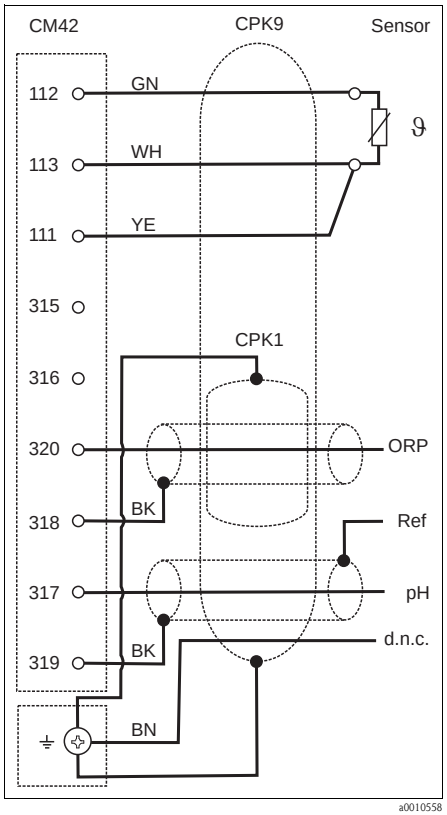


View in device



Wiring diagram

Glass electrode and ORP sensor for the rH measurement

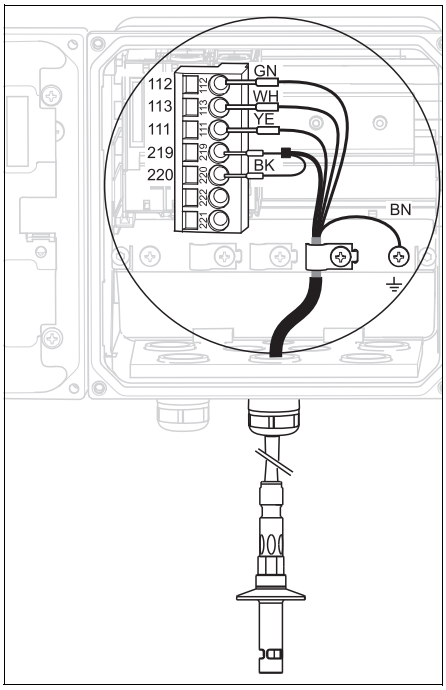


Wiring diagram

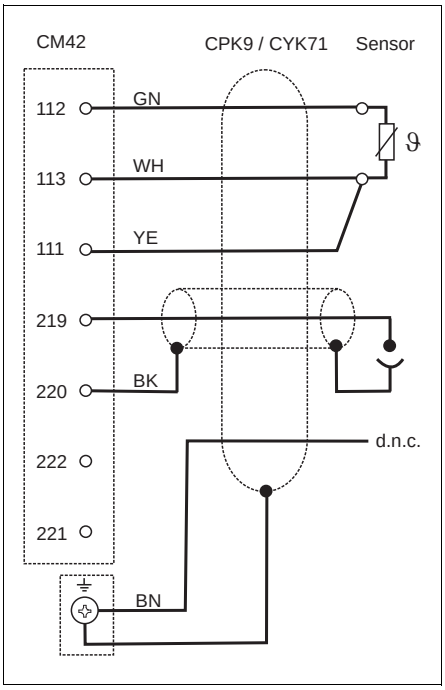
For rH measurement, connect a pH combination electrode (e.g. CPS11 with sensor cable CPK9) **and** an ORP sensor (e.g. CPS12 with sensor cable CPK1).

Sensor connection: analog conductivity sensors

Conductive sensors, two-electrode sensors

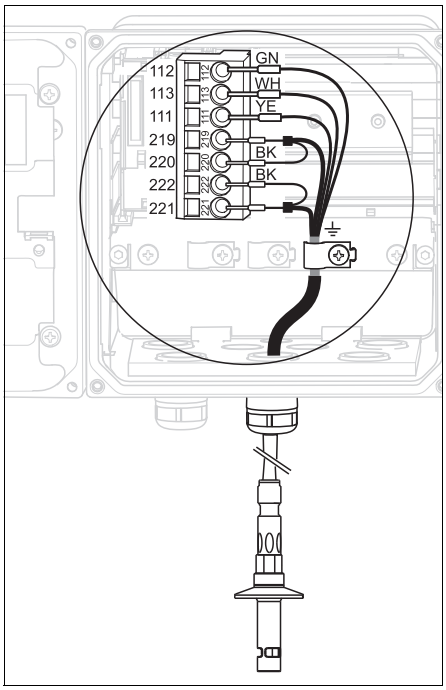


View in device

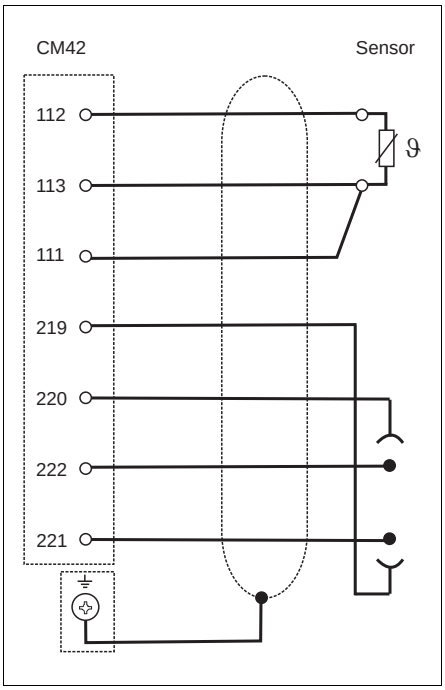


Wiring diagram

Conductive sensors, four-electrode sensors

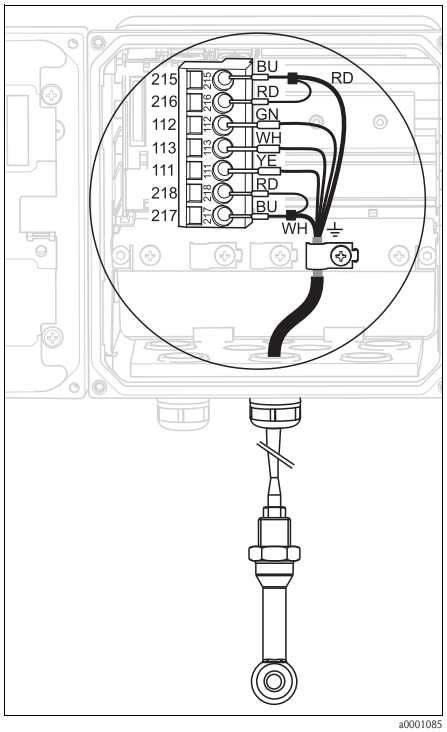


View in device (sensor module)

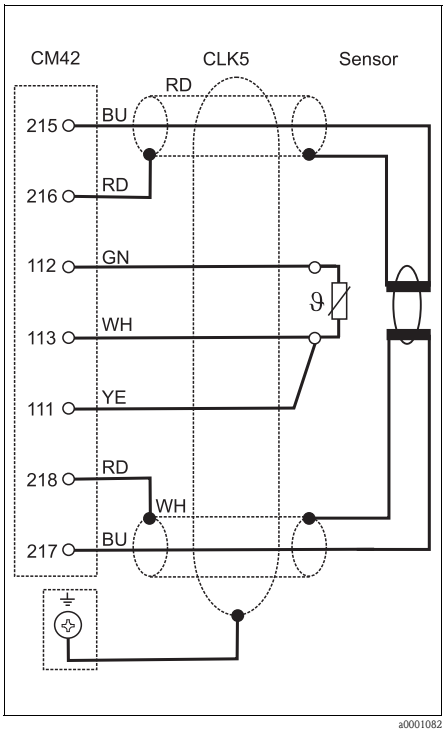


Wiring diagram

Inductive sensors



View in device



Wiring diagram

Performance characteristics

Reference temperature

25 °C (77 °F)
adjustable from –5 to 100 °C (23 to 212 °F)[6)]

Response time of current output

t_{90} = max. 500 ms for an increase from 4 to 20 mA

Measured value resolution

–> Documentation of the connected sensor

Maximum measured error[7)]

–> Documentation of the connected sensor

Current outputs, additionally	25 µA

Repeatability

–> Documentation of the connected sensor

Temperature compensation of the conductivity

Type of compensation	**Range**
none	
linear	α = 0.00 to 20.00 % / K
NaCl acc. to IEC 746-3	0 to 100 °C (32 to 212 °F)
natural waters acc. to IEC 7888	0 to 35 °C (32 to 95 °F)
Ultra-pure water NaCl	0 to 100 °C (32 to 212 °F)
Ultra-pure water HCl (for NH_3 as well)	0 to 100 °C (32 to 212 °F)
4 user tables [1)]	

1) with software package "Advanced"

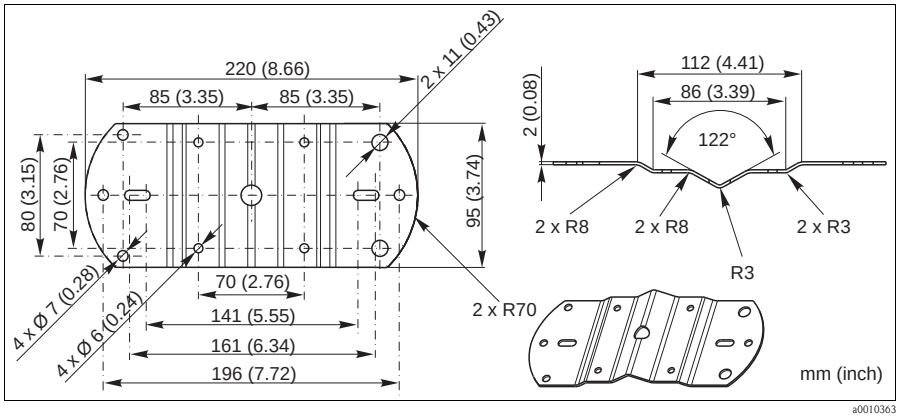
Temperature adjustment

Temperature offset	–5 to +5 °C (23 to 41 °F)
Temperature slope	0.9 to 1.1[1)]

1) with software package "Advanced"

Installation

Mounting plate



Mounting plate

6) with software package "Advanced"
7) acc. to DIN IEC 746 part 1, under nominal operating conditions

Weather protection cover

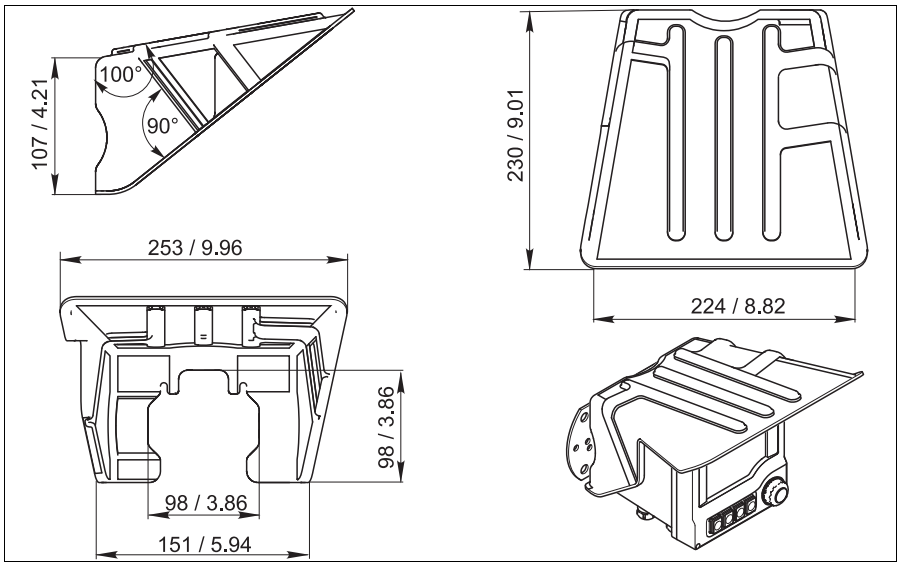
NOTICE

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

Impaired operation to complete transmitter failure

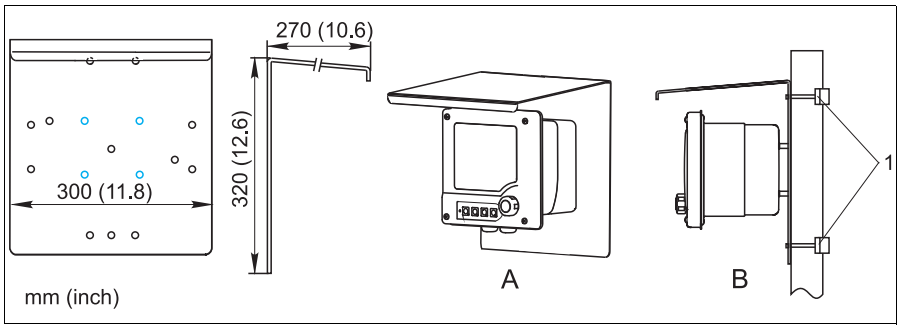
► When installing outside, always use the weather protection cover (accessory).

Plastic housing



Weather protection cover

Stainless steel housing

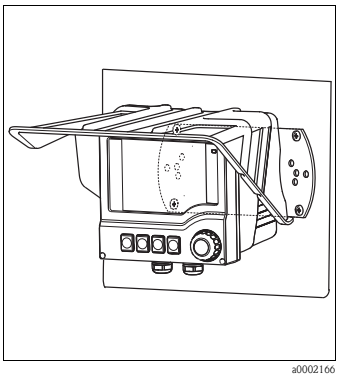


Weather protection cover CYY101

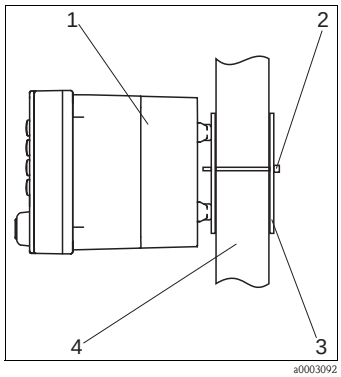
A *Wall mounting*
B *Pipe or round post mounting*
1 *Round post fixture (Accessories)*

To fix the stainless steel weather protection cover CYY101 to vertical or horizontal pipes or round posts, you need the additional round post fixture, –> "Accessories".

Mounting options

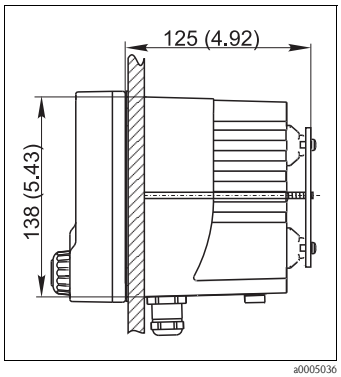


Wall mounting
– Weather protection cover is optional



Pipe or post mounting

1 Liquiline CM42
2, 3 Mounting plate (1x accessories)
4 Pipe or post

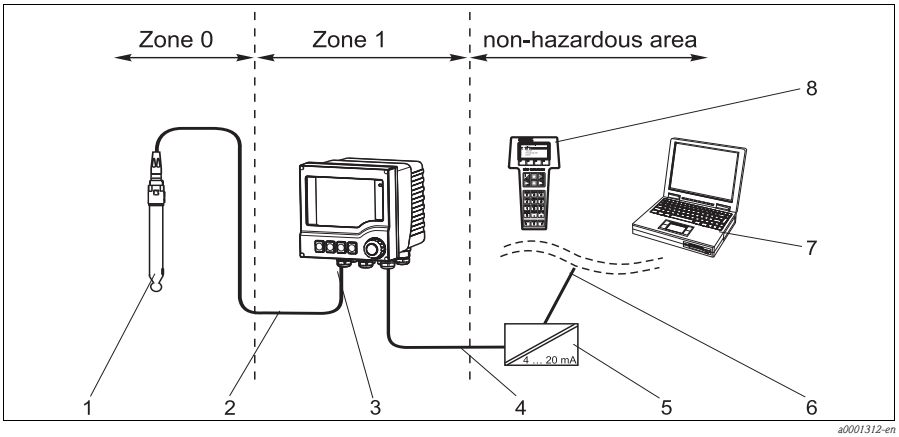


Panel mounting

	Wall mounting	Pipe mounting	Panel installation
Plastic housing			
without protection cover	Mounting plate: in standard	Mounting kit: 51518263	Installation kit: 51518173
with protection cover	Protection cover: 51517382	Mounting kit: 51518263 Protection cover: 51517382	
Stainless steel housing			
without protection cover	Mounting plate: in standard	Mounting kit: 51518286	Installation kit: 51518284
with protection cover	Protection cover: CYY101-A	Protection cover: CYY101-A Round post installation: 50062121	

Installation in Ex area

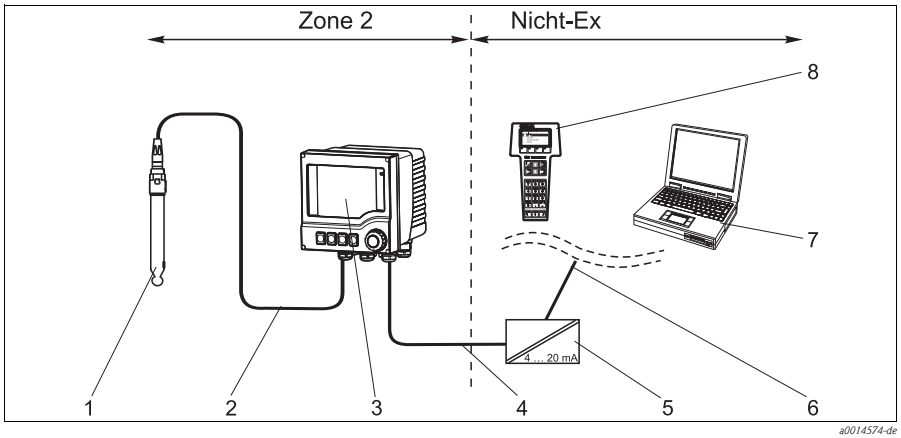
CM42-*G



Installation in Ex area

1 Sensor in Ex version
2 Intrinsically safe sensor circuit Ex ia
3 Transmitter
4 Supply and signal circuit Ex ib (4 to 20 mA)
5 Active barrier, e.g. Preline RN221
6 Signal line Hart/PROFIBUS/FF
7 Fieldcare via PROFIBUS/FF
8 Hart handheld terminal

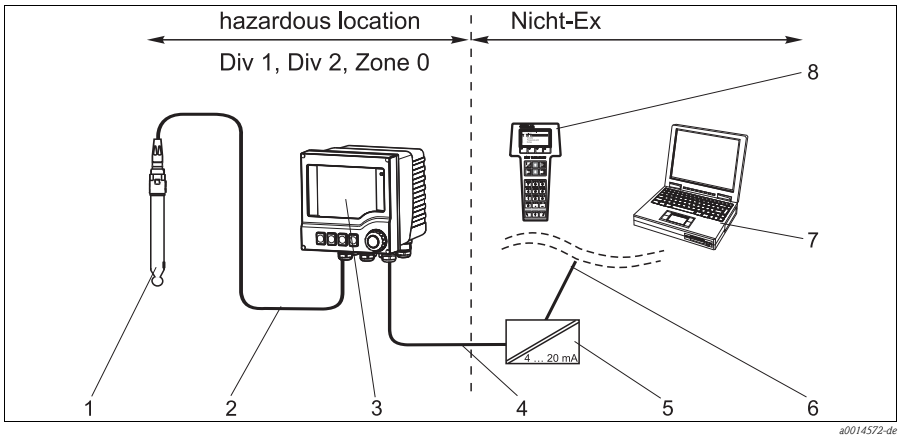
CM42-*V



Installation in Ex area

1	*Sensor in Ex version*	*5*	*Active barrier, e.g. Preline RN221*
2	*Power limited sensor circuit Ex nL*	*6*	*Signal line Hart/PROFIBUS/FF*
3	*Transmitter*	*7*	*Fieldcare via PROFIBUS/FF*
4	*Supply and signal circuit Ex nA (4 to 20 mA)*	*8*	*Hart handheld terminal*

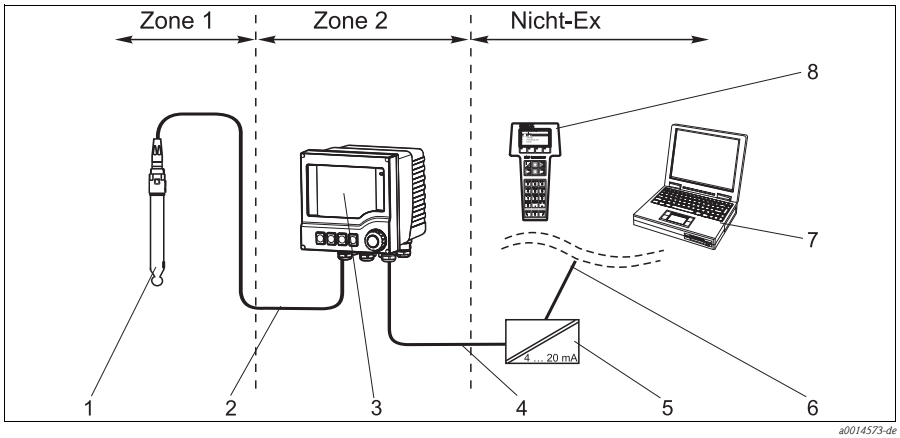
CM42-*P/S



Installation in Ex area

1	*Sensor in Ex version*	*5*	*Active barrier, e.g. Preline RN221*
2	*Intrinsically safe sensor circuit*	*6*	*Signal line Hart/PROFIBUS/FF*
3	*Transmitter*	*7*	*Fieldcare via PROFIBUS/FF*
4	*Supply and signal circuit (4 to 20 mA)*	*8*	*Hart handheld terminal*

CM42-*X/Z



Installation in Ex area

1	*Sensor in Ex version*	*5*	*Active barrier, e.g. Preline RN221*
2	*Power limited sensor circuit Ex nL*	*6*	*Signal line Hart/PROFIBUS/FF*
3	*Transmitter*	*7*	*Fieldcare via PROFIBUS/FF*
4	*Supply and signal circuit Ex nA (4 to 20 mA)*	*8*	*Hart handheld terminal*

Environment

Ambient temperature range

Non-hazardous area version
–30 to 70 °C (–20 to 160 °F)

Hazardous area version: ATEX II (1)2G
–20 to 50 °C (T6)
–20 to 55 °C (T4)

Hazardous area version: ATEX II 3G
–10 to 50 °C (T6)

Hazardous area version: FM
–20 to 50 °C (0 to 130 °F) (T6)

Hazardous area version: CSA
–20 to 50 °C (0 to 130 °F) (T6)
–20 to 55 °C (0 to 120 °F) (T4)

Ambient temperature limits

-30 to +80 °C (–20 to 175 °F)

Storage temperature

–40 to 80 °C (–40 to 175 °F)

Electromagnetic compatibility

Interference emission and interference immunity as per EN 61326-1: 2006, class A for industry

Ingress protection

IP66 / IP 67 / NEMA 4X

Relative humidity

10 to 95%, not condensing

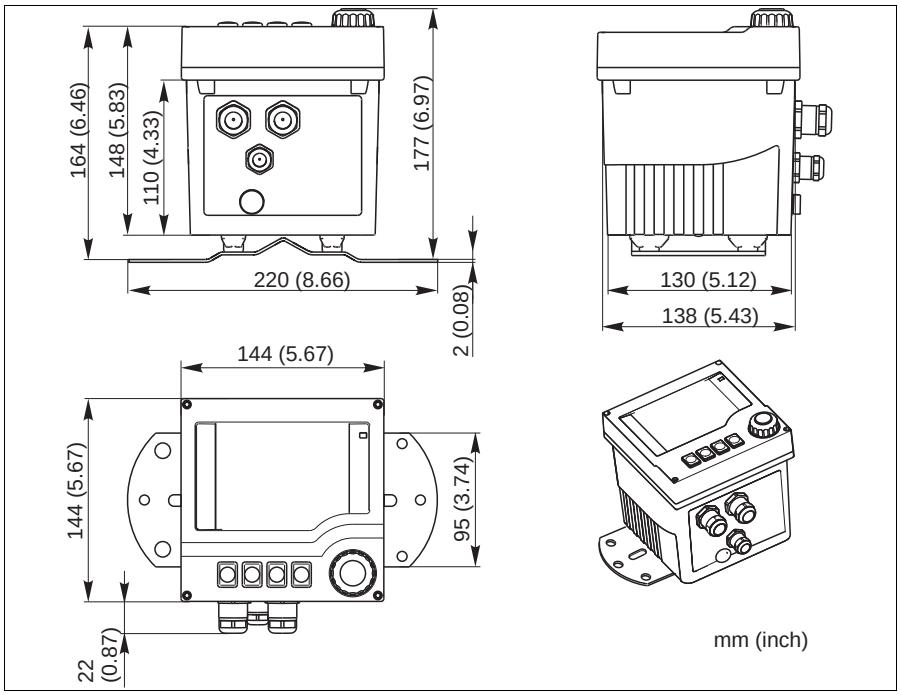
Pollution degree

The product is suitable for pollution degree 3.

Mechanical construction

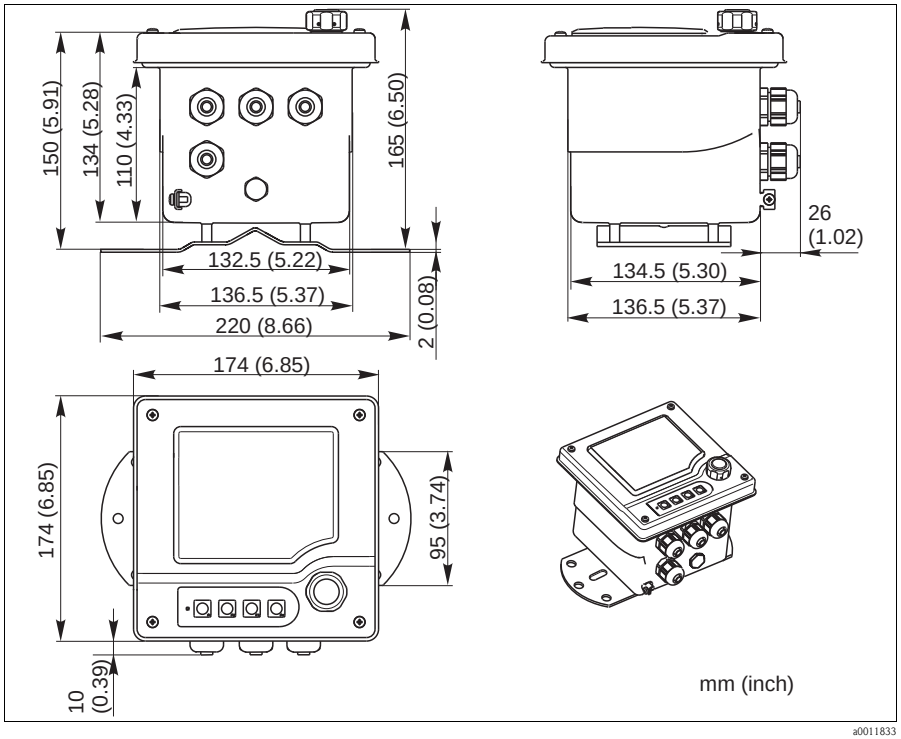
Dimensions

Plastic housing



Plastic housing

Stainless steel housing



Dimensions

Weight

Plastic housing

1.5 kg (3.3 lb)

Stainless steel housing

2.1 kg (4.6 lb)

Material

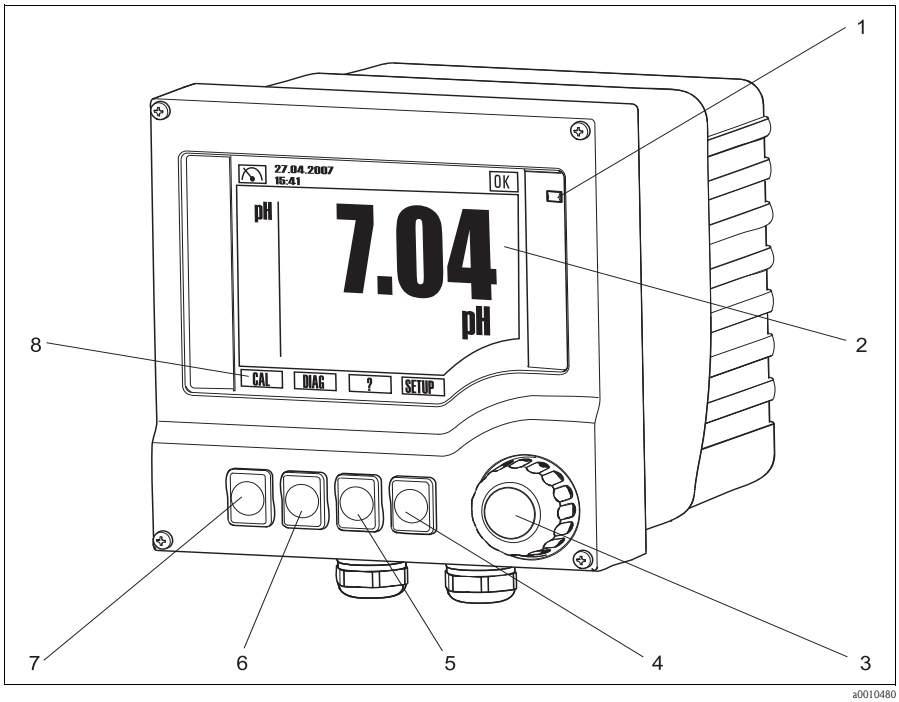
Plastic housing	
Housing	PC-FR (polycarbonate, flame-retardant)
Housing seals	Foamed silicone, EPDM
Stainless steel housing	
Housing	Stainless steel 1.4301 (AISI 304)
Housing seals	EPDM
Plastic and stainless steel housing	
Module housing	PC (polycarbonate)
Soft keys	TPE
Cable mounting rail	Stainless steel 1.4301 (AISI 304)
Display panel	PC-FR (polycarbonate, flame-retardant)

Human interface

Display properties

LCD: FSTN technology (FSTN = Foil Super Twisted Nematic)
Size: 94 x 76 mm (3.7 x 3.0")
Resolution: 240 x 160 dots

Operating elements



Overview of operation

1 Alarm LED
2 Display, current display: pH measuring mode
3 Navigator
4-7 Soft keys
8 Soft key function (depends on menu)

Ordering information

Product structure

	Sensor input
A	No Module
C	Conductivity, conductive measurement
I	Conductivity, inductive measurement
K	Digital sensor: conductivity, conductive measurement
M	Digital sensor: pH/ORP with glass electrodes
N	Digital sensor: pH with ISFET sensors
O	Digital sensor: amperometric oxygen measurement
P	pH (glass/ISFET) or ORP

	Approval
A	Non-hazardous area, CSA GP
G	ATEX II (1)2G, Ex ia/ib IIC T6 / II 3 D tD A22 IP67 T85°C
P	FM IS NI Cl. I, Div. 1&2, Groups A-D
S	CSA IS NI Cl. I, II, III, Div. 1&2, Groups A-G
T	TIIS Ex ib IIC T4
V	ATEX II 3G Ex nA[nL] IIC T6 / II 3 D tD A22 IP67 T85°C
X	ATEX II (2)3G Ex nA[ia] IIC T6 / II 3 D tD A22 IP67 T85°C
Z	NEPSI Ex nA[ia] EC T6

	Certificate
A	not selected
B	Test certificate acc. to EN 10204, 3.1
C	Test certificate acc. to EN 10204, 3.1, factory calibration certificate

	Output
0	1 current output 4 to 20 mA, HART
1	2 current outputs 4 to 20 mA, 1x HART
2	PROFIBUS PA
3	FOUNDATION Fieldbus
4	2 current outputs 4 to 20 mA, SIL

	Housing
0	Plastic
1	Stainless steel 1.4301 (AISI 304)

	Cable entry
0	M20 x 1.5
1	NPT ½"
2	G½

	Software
EA	Standard version
EB	Advanced version

	Device language
C	Cz/En (Czech docs)
D	De/En (German docs)
E	En/De (English docs)
F	Fr/En (French docs)
J	Ja/En (Japanese docs)
K	Kr/En (Korean docs)
L	Pl/En (Polish docs)
N	Nl/En (Dutch docs)
P	Po/En (Portuguese docs)
R	Ru/En (Russian docs)
S	Es/En (Spanish docs)
T	It/En (Italian docs)
W	Sv/En (Swedish docs)
Z	Zh/En (Chinese docs)

	Documentation
0	Installation and configuration

	Additional equipment
0	Basic version
1	SystemDAT CY42-S1

CM42-	complete order code

Optional
Device designation (tag), stainless steel 1.4404
Just add a "1" to the order code.

Scope of delivery

The scope of delivery comprises (depending on the device version):
- A transmitter acc. to the ordered version
- A mounting plate including 4 screws
- A sticker sheet (embedded in the housing, containing nameplates and terminal assignment stickers)
- A test certificate acc. to EN 10204-3.1 (optional)
- A factory calibration certificate
- An Operating Instructions BA381C "Commissioning"
- An Operating Instructions BA382C "Operation"
- A CD ROM with additional documentation
- A Safety Manual acc. to SIL 2 (optional)
- Service broshure "Maintenance documentation SIL 2" (optional)

Certificates and approvals

CE approval

Declaration of conformity
The product meets the requirements of the harmonized European standards. It thus complies with the legal requirements of the EC directives.
The manufacturer confirms successful testing of the product by affixing the CE symbol.

Ex approval

Depending on the version ordered:
- ATEX II (1)2G, Ex ia/ib IIC T6 / II 3 D tD A22 IP67 T85°C
- ATEX II 3G Ex nA[nL] IIC T6 / II 3 D tD A22 IP67 T85°C
- ATEX II (2)3G Ex nA[ia] IIC T6 / II 3 D tD A22 IP67 T85°C
- NEPSI Ex nA[ia] EC T6
- NEPSI Ex nA[nL] EC T6
- CSA IS NI Cl.I, II, III, Div. 1&2, Grps. A-G
- FM IS NI Cl.I, Div. 1&2, Grps. A-D
- TIIS Ex ib IIC T4

Accessories

In the following sections, you find the accessories available at the time of issue of this documentation. For information on accessories that are not listed here, please contact your local service or sales representation.

Mounting kits

Post mounting kit for plastic housing
- 1 Mounting plate
- 2 Threaded rods M5x75 mm A2
- 2 Hexagonal nuts M5 A2, DIN 934
- 2 Spring washers, A2 DIN127, Form B5 (M5)
- 2 Washers A 5.3, DIN125 A2
- order no. 51518263

Post mounting kit for stainless steel housing
- 1 Mounting plate
- 2 Threaded rods M5x75 mm A2
- 2 Hexagonal nuts M5 A2, DIN 934
- 2 Spring washers, DIN127, Form B5 (M5)
- 2 Washers A 5.3, DIN125 A2
- order no. 51518286

Panel installation kit for plastic housing for panel cutout 138x138 mm (5.43x5.43 inch)
- 1 Panel installation seal
- 2 Tensioning screws M6x150 mm
- 4 Hexagonal nuts M6, DIN934 A2
- 4 Spring washers, A2 DIN127, Form B6
- 4 Washers A6.4, DIN125 A2
- order no. 51518173

Panel installation kit for stainless steel housing for panel cutout 138x138 mm (5.43x5.43 inch)
- 1 Panel installation seal
- 2 Tensioning screws M6x150 mm
- 4 Hexagonal nuts M6, DIN934 A2
- 4 Spring washers, A2 DIN127, Form B6
- 4 Washers A6.4, DIN125 A2
- order no. 51518284

Weather protection cover

- Weather protection cover for plastic housing
  order no. 51517382
- Weather protection cover for stainless steel housing
  order no. CYY101-A

Active barrier

Active barrier RN221N
- With power supply for safe separation of 4 to 20 mA current circuits
- Technical Information TI073R/09/en

Fieldbus accessories

HART handheld terminal DXR375
- For communicating with a HART-compatible device via a 4 to 20 mA line
- order no. DXR 375

HART modem Commubox FXA191
- Interface module between HART and serial PC interface
- Technical Information TI237F/00/en
- order no. 016735-0000

Fieldbus connection socket
- FOUNDATION Fieldbus M20 7/8" connection
- order no. 51517974

M12 connector
- Four-pole metal connector for mounting on transmitter
- For connecting to connection box or cable jack. Cable length 150 mm (5.91")
- order no. 51502184

C-module accessories bag
- Capacitor for connecting the cable shielding to ground potential
- Kit documentation SD108C/07/a3
- order no. 71003097

Measuring cables

CYK10 Memosens data cable
- For digital sensors with Memosens technology
- Ordering according to product structure, see Technical Information (TI376C/07/en)

CYK81 measuring cable
- Non-terminated measuring cable for extension of sensor cables of e.g. Memosens sensors, CUS31/CUS41
- 2 wires, twisted pair with shield and PVC-sheath (2 x 2 x 0.5 mm^2 + shield)
- Sold by the meter, order no.: 51502543

CPK9 special measuring cable
- For sensors with TOP68 plug-in head, for high-temperature and high-pressure applications, IP 68
- Ordering acc. to product structure, see Technical Information (TI118C/07/en)

CPK12 special measuring cable
- For pH/ORP glass electrodes and ISFET sensors with TOP68 plug-in head
- Ordering acc. to product structure, see Technical Information (TI118C/07/en)

CYK71 measuring cable
- Non-terminated cable for the connection of sensors (e.g. conductivity sensors) or the extension of sensor cables
- Sold by the meter, order numbers:
  - non-Ex version, black: 50085333
  - Ex version, blue: 51506616

Extension cable CLK5
- For inductive conductivity sensors, for extension via the VBM junction box, sold by the meter
- Order no.: 50085473

Sensors

pH/ORP glass sensors

Orbisint CPS11/CPS11D
- pH sensor for process applications
- Optionally with Memosens technology
- With PTFE diaphragm
- Ordering acc. to product structure, see Technical Information (TI028C/07/en)

Orbisint CPS12/CPS12D
- ORP electrode for process applications
- Optionally with Memosens technology
- With PTFE diaphragm
- Ordering acc. to product structure, see Technical Information (TI367C/07/en)

Ceraliquid CPS41/CPS41D
- pH sensor
- Optionally with Memosens technology
- With ceramics diaphragm and liquid KCl electrolyte
- Ordering acc. to product structure, see Technical Information (TI079C/07/en)

Ceraliquid CPS42/CPS42D
- ORP electrode
- Optionally with Memosens technology
- With ceramics diaphragm and liquid KCl electrolyte
- Ordering acc. to product structure, see Technical Information (TI373C/07/en)

Ceragel CPS71/CPS71D
- pH sensor
- Optionally with Memosens technology
- With double chamber reference system and integrated bridge electrolyte
- Ordering acc. to product structure, see Technical Information (TI245C/07/en)

Ceragel CPS72/CPS72D
- ORP electrode
- Optionally with Memosens technology
- With double chamber reference system and integrated bridge electrolyte
- Ordering acc. to product structure, see Technical Information (TI374C/07/en)

Orbipore CPS91/CPS91D
- pH sensor
- Optionally with Memosens technology
- With open aperture for media with high dirt load
- Ordering acc. to product structure, see Technical Information (TI375C/07/en)

Orbipore CPS92/CPS92D
- ORP sensor
- Optionally with Memosens technology
- With open aperture for media with high dirt load
- Ordering acc. to product structure, see Technical Information (TI435C/07/en)

ISFET sensors

Tophit CPS471/CPS471D
- Sterilizable and autoclavable ISFET sensor for food and pharmaceuticals, process technology,
- water treatment and biotechnology;
- Ordering acc. to product structure, see Technical Information (TI283C/07/en)

Tophit CPS441/CPS441D
- Sterilizable ISFET sensor for media with low conductivity, with liquid KCl electrolyte;
- Ordering acc. to product structure, see Technical Information (TI352C/07/en)

Tophit CPS491/CPS491D
- ISFET sensor with open aperture for media with high dirt load;
- Ordering acc. to product structure, see Technical Information (TI377C/07/en)

Pfaudler electrodes

Ceramax CPS341D
- Electrode with pH sensitive enamel
- Meets highest demands of measuring accuracy, pressure, temperature, sterility and durability
- Ordering acc. to product structure, s. Technical Information (TI468C/07/en)

Inductive sensors

Indumax P CLS50
- Highly resistant conductivity sensor for standard, Ex and high-temperature applications,
- Order according to product structure, see Technical Information TI182C/07/en

Indumax H CLS52
- Inductive conductivity sensor with fast responding temperature sensor for foodstuff applications
- Ordering according to product structure, see Technical Information TI167C/07/en

Indumax H CLS54
- Inductive conductivity sensor in certified, hygienic design for food, beverages, pharma and biotechnology
- Ordering according to product structure, see Technical Information TI400C/07/en

Conductive sensors

Condumax W CLS12
- For process temperatures up to 160 °C (320 °F) and process pressures up to 40 bar (580 psi)
- Ordering according to product structure, see Technical Information TI082C/07/en

Condumax W CLS13
- For process temperatures up to 250 °C (480 °F) and process pressures up to 40 bar (580 psi)
- Ordering according to product structure, see Technical Information TI083C/07/en

Condumax W CLS15/CLS15D
- For measurement in pure and ultrapure water and in Ex applications
- Optionally with Memosens (CLS15D)
- Ordering according to product structure, see Technical Information TI109C/07/en

Condumax H CLS16/CLS16D
- Hygienic sensor for measurement in pure and ultrapure water and in Ex applications
- With EHEDG and 3A certificates
- Optionally with Memosens (CLS16D)
- Ordering according to product structure, see Technical Information TI227C/07/en

Condumax W CLS19
- Competitive sensor for measurement in pure and ultrapure water
- Ordering according to product structure, see Technical Information TI110C/07/en

Condumax W CLS21/CLS21D
- Two-electrode sensor in fixed cable and plug-in head version
- Optionally with Memosens (CLS21D)
- Ordering according to product structure, see Technical Information TI085C/07/en

Amperometric oxygen sensors

Oxymax H COS22D
- Sterilizable sensor for dissolved oxygen, with Memosens technology
- Ordering acc. to product structure, see Technical Information (TI446C/07/en)

Oxymax COS51D
- Amperometric sensor for dissolved oxygen, with Memosens technology
- Ordering acc. to product structure, see Technical Information (TI413C/07/en)

Software update and upgrade

CY42 DAT module
- Function upgrade, update and memory module
- Ordering as per order structure

	Version	
	S1	SystemDAT for software update and language catalog extension
	F1	FunctionDAT for extending the function to 2 current outputs
	F2	FunctionDAT for extending the function to advanced software
	C1	CopyDAT for saving and transferring the configuration

CY42-		Complete order code

Instruments International

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4153 Reinach
Switzerland

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Fax+41 61 715 25 00
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info@ii.endress.com

Endress+Hauser

People for Process Automation

TI381C/07/EN/13.10
71122183
FM9

Level Pressure Flow Temperature Liquid Analysis Registration Systems Components Services Solutions

Technical Information

Liquisys M CUM223/253

Turbidity and suspended solids transmitter

Application

The modular design of the transmitter allows easy adaption to a variety of customer requirements. Starting with the basic version for "measurement and alarm generation", the transmitter can be equipped with additional software and hardware modules for special applications. These modules can also be retrofitted as required.

Areas of application

- Sewage treatment plants, suspended solids measurement
- Wastewater treatment
- Water treatment and drinking water monitoring
- Surface water: rivers, lakes, ocean
- Service water

Your benefits

- Field or panel-mounted housing
- Universal application
  - One instrument for turbidity and suspended solids
  - Units: FNU (formazine standard), ppm, g/l, % or % SS
- Simple handling
  - Logically arranged menu structure
  - Ultrasimple calibration with user samples and alarm signalling for calibration errors
- Safe operation
  - Overvoltage (lightning) protection
  - Direct access for manual contact control
  - User-defined alarm configuration
  - Automatic sensor self-recognition with calibration data transfer

The basic unit can be extended with:

- 2 or 4 additional contacts for use as:
  - Limit contacts (also for temperature)
  - P(ID) controller
  - Timer for simple rinse processes
  - Complete cleaning with Chemoclean
- Plus package:
  - Any current output configuration via table
  - Automatic cleaning start
  - Display in customer units (e.g. density) via table assignment
  - Live check of sensor
- HART® or PROFIBUS® PA / DP
- 2nd current output for temperature, main measured value or actuating variable
- Current input for flow rate monitoring with controller shut off or for feedforward control

TI200C/24/ae/06.08

Endress+Hauser

People for Process Automation

Function and system design

Features of the basic version

Measurement of turbidity and suspended solids

The sensor is selected from the menu. During measurement, the value measured can be displayed in the other measuring mode. The **temperature** is displayed at the same time if desired.

Configuration

Different alarms are required depending on application and operator. Therefore the transmitter permits independent **configuration of the alarm contact and error current** for each individual error. Unnecessary or undesirable alarms can be suppressed in this manner. **Up to four contacts** can be used as limit contacts (also for temperature), to implement a P(ID) controller or for cleaning functions.
Direct **manual operation of the contacts** (bypassing the menu) provides quick access to limit, control or cleaning contacts, permitting speedy correction of deviations.
The **serial numbers** of the instrument and modules and the order code can be called up on the display.

Additional functions of the Plus package TS

Current output configuration

In order to output wide measuring ranges while still achieving a high resolution in specific ranges, the **current output** can be configured as required via a table. This permits **bilinear** or **quasi-logarithmic** curves, etc.

Process Check System (PCS)

It comprises two independent safety functions:
- Errors in applications **without** control are detected by monitoring the limit beween plausible and implausible measured values, i.e. **the alarm theshold**.
- Errors in applications **with** control are detected by the **controller monitor** which monitors freely adjustable, maximum permissible time intervals and reference value overshoot or undershoot.

Live check

The live check issues an alarm when the sensor signal does not change over a defined period of time. This may be caused by blocking, passivation, separation from the process, etc.

Additional functions of version TS

Display of various measurement units

In addition to turbidity (FNU, NTU) and concentration (ppm / % SS), the display can also show other units (e.g. density). A table is used for conversion (calibration in %).

Second current output

The second current output can be configured for temperature, main measured value (turbidity, suspended solids) or actuating variable.

Current input

The current input of the transmitter allows two different applications: controller shut-down in case of lower flow rate violation or total failure in the main flow as well as feedforward control. Both functions are also combinable.

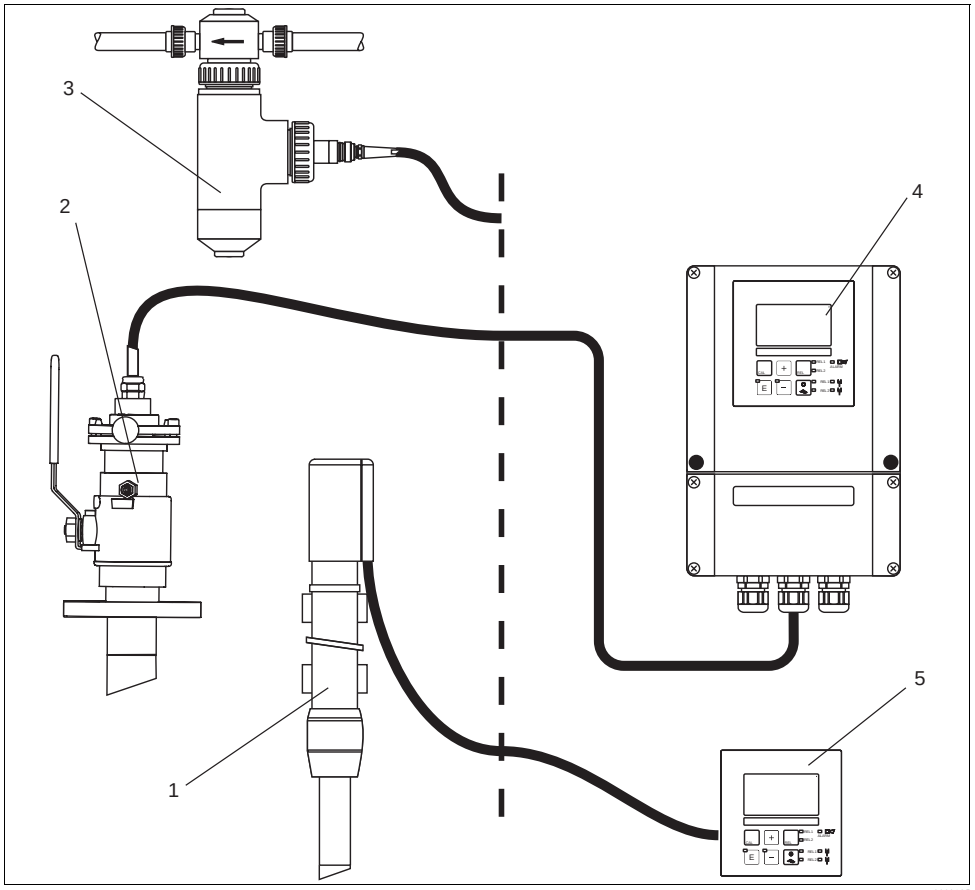
Explosion-proof versions for zone 2

Application of transmitter and sensor in hazardous area zone 2	Field housing CUM253 with power supply 24 V
Application of transmitter as related electrical equipment in non-hazardous area or in simple pressurized apparatus; application of sensor in hazardous area zone 2	Field housing CUM253 with power supply 230 V or Panel-mounted housing CUM223 with power supply 230 V or 24 V

Measuring system

A complete measuring systems comprises:
- The transmitter Liquisys M CUM223 or CUM253
- A sensor with or without an integrated temperature sensor
- An immersion, flow or retractable assembly

Options: extension cable CYK81, junction box VBM or RM



1 Immersion assembly CYA611
2 Retractable assembly CUA451
3 Assembly with gas bubble trap
4 Liquisys CUM253
5 Liquisys CUM223

Input

Measured variables	Turbidity, suspended solids, temperature	
Measuring range	CUS31:	0.000 to 9999 FNU/NTU 0.00 to 3000 ppm 0.0 to 3.0 g/l 0.0 to 200.0 %
	CUS41:	0.00 to 9999 FNU/NTU 0.00 to 9999 ppm 0.0 to 300.0 g/l 0.0 to 200.0 %
	Temperature:	-5.0 to +70.0°C (+23 to +158°F)
Cable specification	Cable length:	max. 200 m (656 ft.)
Signal input	Digital communication	
Temperature measurement	NTC 30 kΩ at 25°C (77°F)	
Binary inputs	Voltage: Power consumption:	10 to 50 V max. 10 mA
Current input	4 to 20 mA, galvanically separated Load: 260 Ω at 20 mA (voltage drop 5.2 V)	

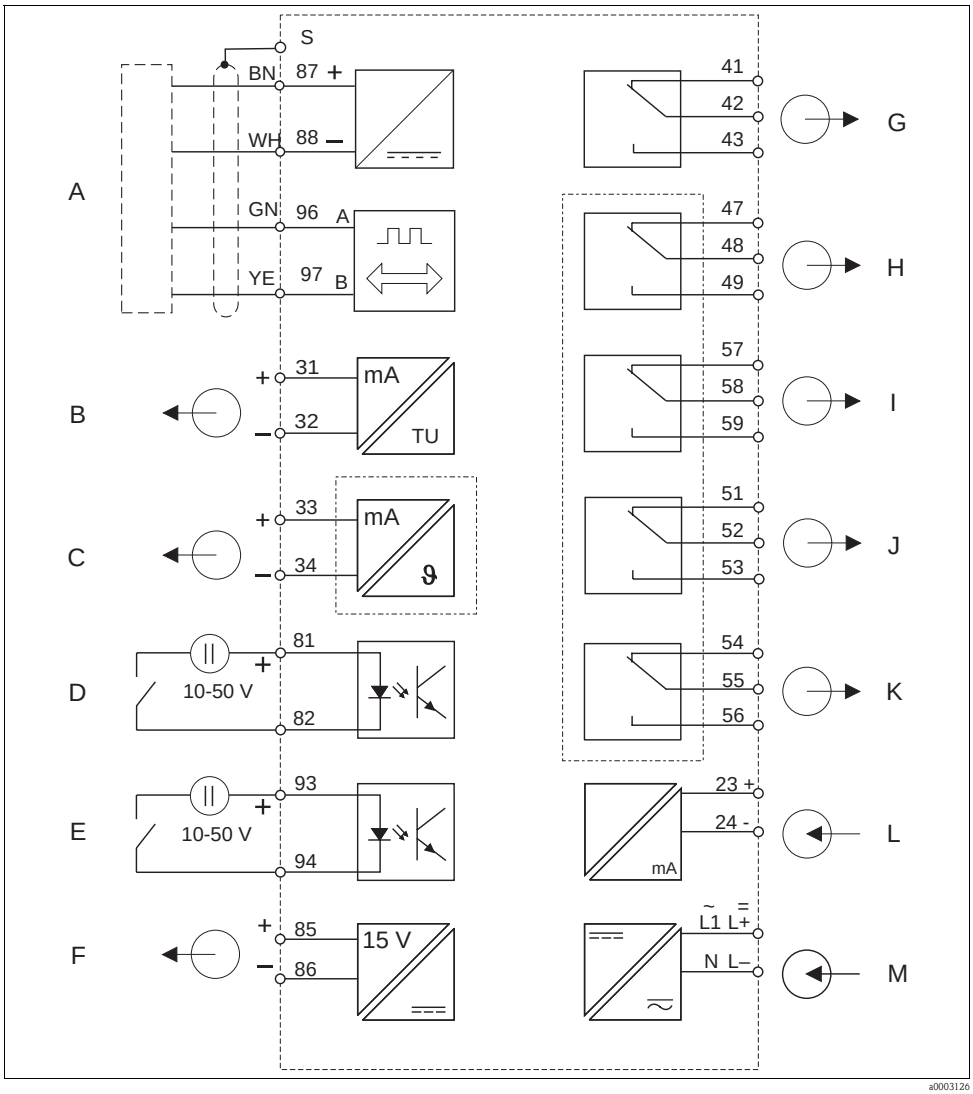
Output

Current range	0/4 to 20 mA, galvanically separated, active	
Error current	2.4 or 22 mA in case of an error	
Load	Maximum 500 Ω	
Transmission range	CUS31/CUS41: Temperature:	adjustable, min. Δ 0.1 FNU, Δ 0.1 ppm, Δ 0.1 g/l, Δ 0.1 % adjustable, Δ 10 to Δ 100 % of measuring range
Resolution	Max. 700 digits/mA	
Isolation voltage	Max. 350 V_{RMS}/500 V DC	
Overvoltage protection	According to EN 61000-4-5	
Auxiliary voltage output	Output voltage: Output current:	15 V ± 0.6 max. 10 mA
Contact outputs	Switching current with ohmic load (cos φ = 1): Switching current with inductive load (cos φ = 0.4): Switching voltage: Switching power with ohmic load (cos φ = 1): Switching power with inductive load (cos φ = 0.4):	max. 2 A max. 2 A max. 250 V AC, 30 V DC max. 500 VA AC, 60 W DC max. 500 VA AC, 60 W DC

Limit contactor	Pickup/dropout delay:	0 to 2000 s
Controller	Function (adjustable):	pulse length/pulse frequency controller
	Controller response:	PID
	Control gain K_p:	0.01 to 20.00
	Integral action time T_n:	0.0 to 999.9 min
	Derivative action time T_v:	0.0 to 999.9 min
	Period for pulse length controller:	0.5 to 999.9 s
	Frequency for pulse frequency controller:	60 to 180 min^{-1}
	Basic load:	0 to 40% of max. set value
Alarm	Function (selectable):	Latching / momentary contact
	Alarm threshold adjustment range:	Turbidity / suspended solids / temperature: complete measuring range
	Alarm delay:	0 to 2000 s 0 to 2000 min

Power supply

Electrical connection



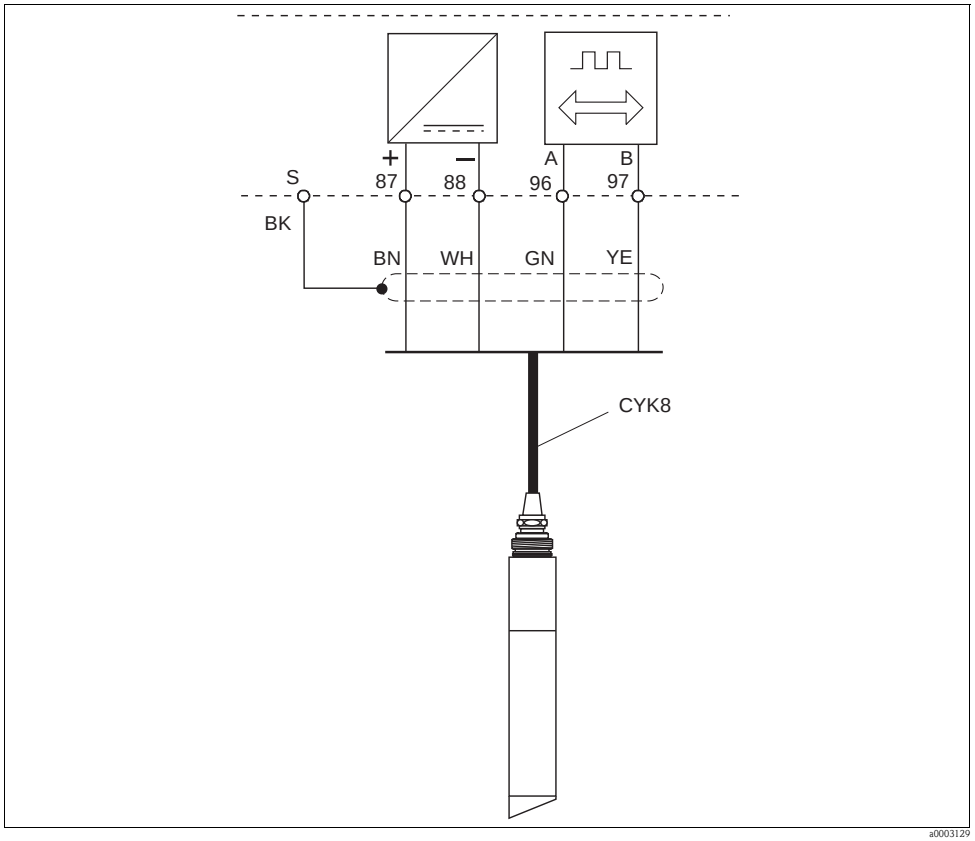
Electrical connection of the transmitter

A	Sensor	H	Relay 1 (current-free contact position)
B	Signal output 1 turbidity/solids content	I	Relay 2 (current-free contact position)
C	Signal output 2 temperature	J	Relay 3 (current-free contact position)
D	Binary input 1 (Hold)	K	Relay 4 (current-free contact position)
E	Binary input 2 (Chemoclean)	L	Current input 4 to 20 mA
F	Aux. voltage output	M	Power supply
G	Alarm (current-free contact position)		

Note!
The device is approved for protection class II and is generally operated without a protective ground connection. The circuits "C" and "F" are not galvanically isolated from each other.

Connection of sensor

The sensors are delivered with measuring cables. Use a junction box and an extension cable to extend the measuring cable (see "Accessories")



Connection of the turbidity sensors CUS31 and CUS41

Power supply

Depending on ordered version:
100/115/230 V AC +10/-15 %, 48 to 62 Hz
24 V AC/DC +20/-15 %

Power consumption

max. 7.5 VA

Mains protection

Fine-wire fuse, medium-slow blow 250 V/3.15 A

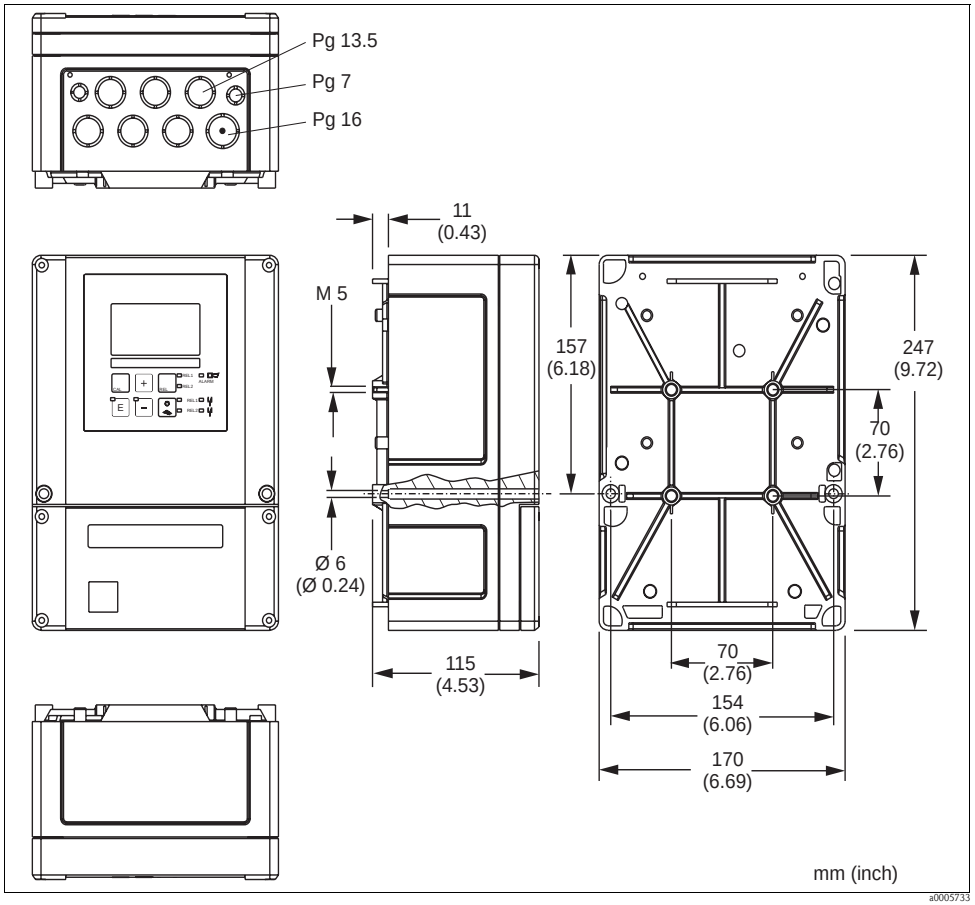
Performance characteristic

Measured value resolution	CUS31:	0.001 FNU/NTU, 0.01 ppm, 0.01 g/l, 0.01 %
	CUS41:	0.01 FNU/NTU, 0.01 ppm, 0.01 g/l, 0.01 %
	Temperature:	0.1 °C
Measurement deviation	Display	
	CUS31/CUS41:	± 2 % of measured value (min. 0.02 FNU)
	Temperature:	max. 1.0 % of measuring range
	Signal output	
	CUS31/CUS41:	1 % of current output range (min. 0.02 FNU)
	Temperature:	max. 1.25 % of current output range
Repeatability[1)]	± 1 % of measured value (min. 0.01 FNU)	

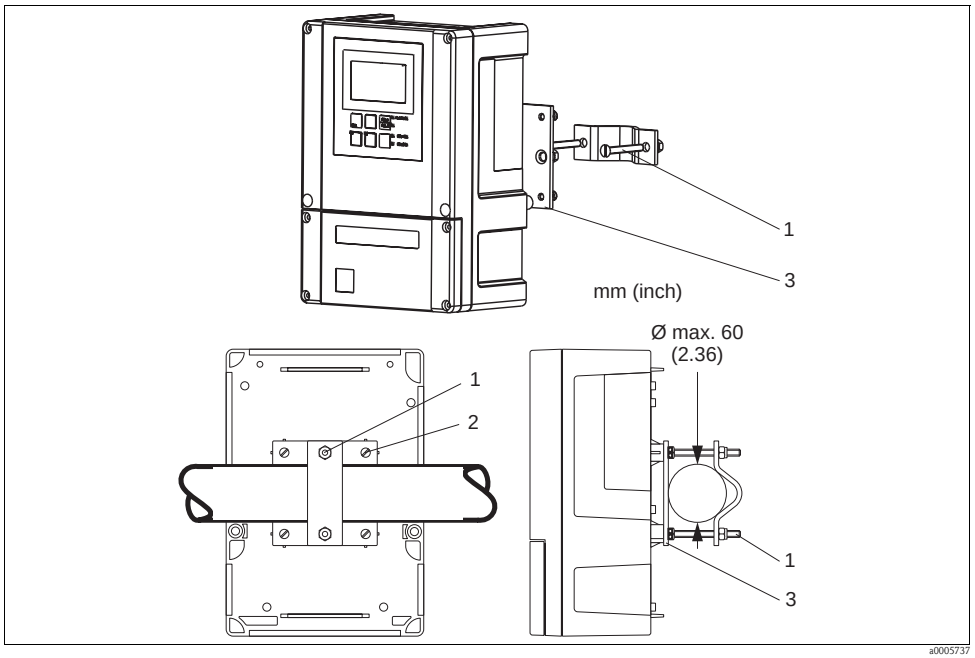
1) acc. to IEC 746-1, for nominal operating conditions

Installation conditions

Installation instructions

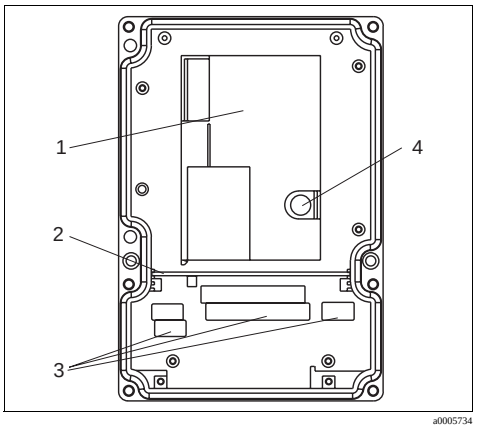


Field instrument



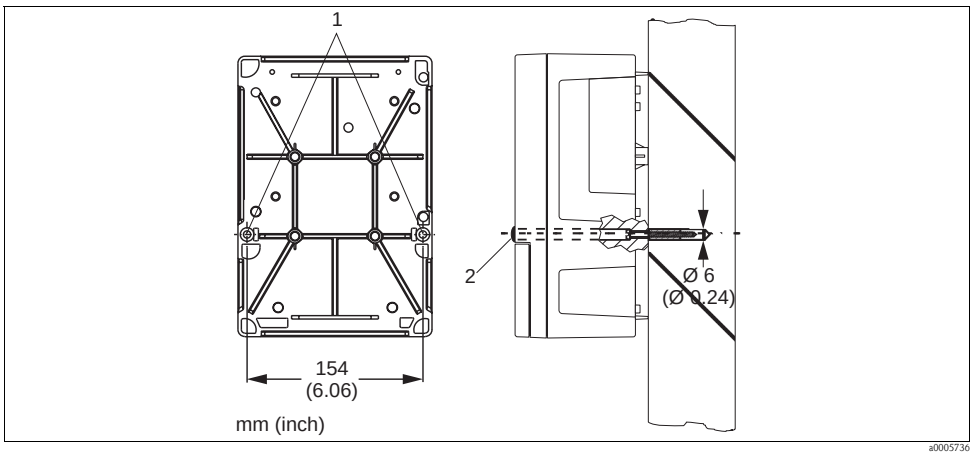
Mounting on pipes

1 - 3 Mounting screws and mounting plate



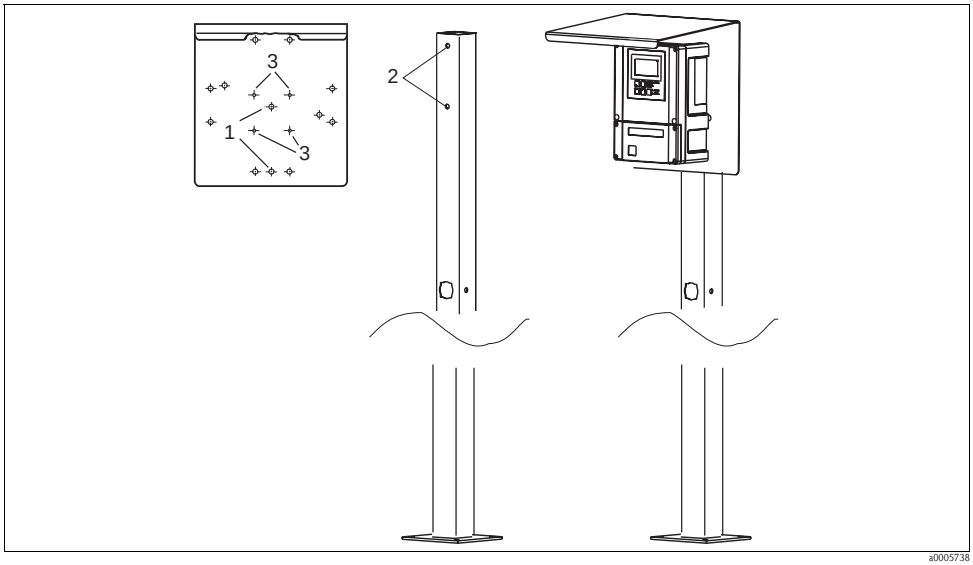
1 Removable electronics box
2 Partition plate
3 Terminal blocks
4 Fuse

View into the field instrument



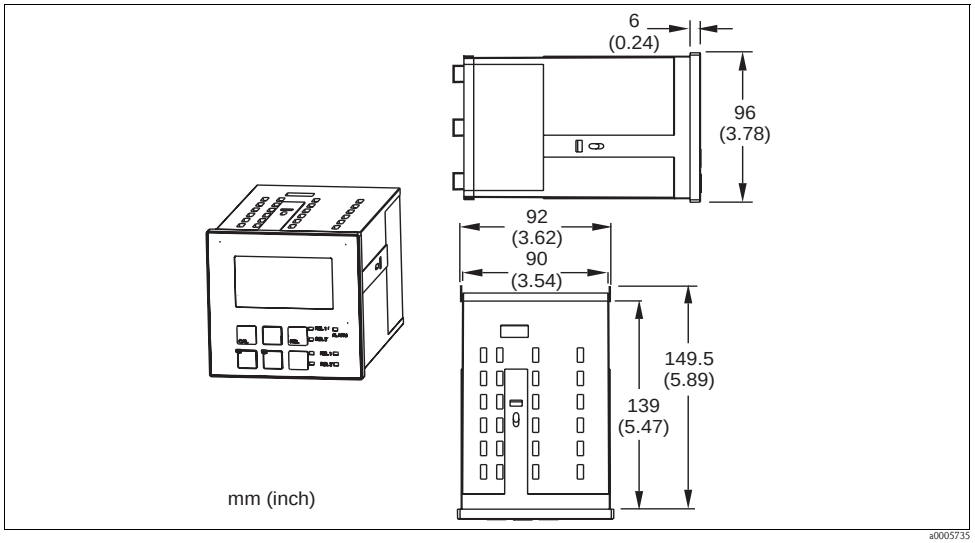
Wall mounting of the field instrument

1 Mounting holes
2 Protecting cap

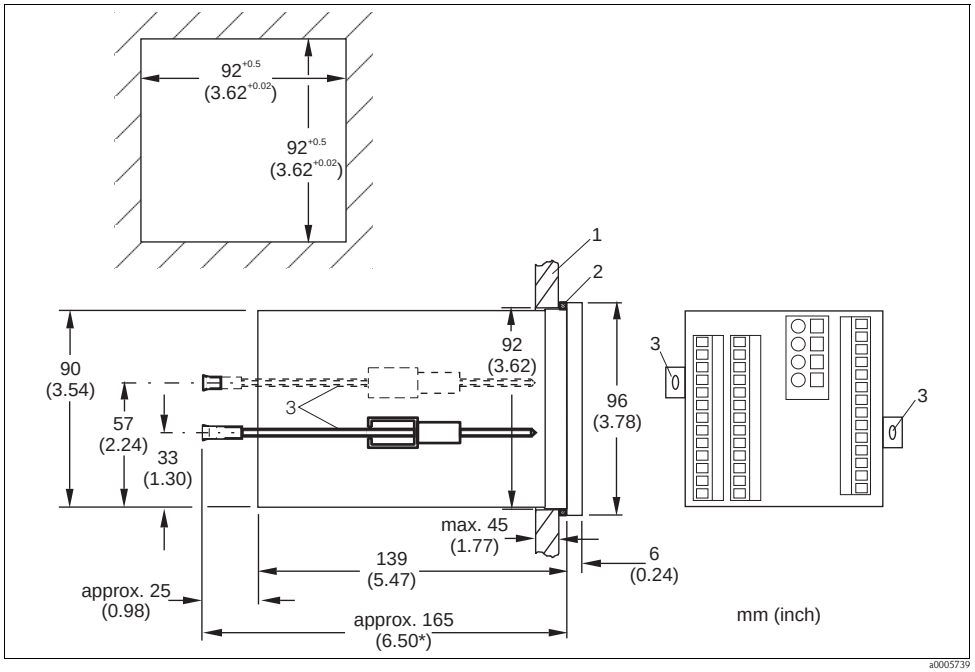


Mounting of the field instrument with mounting post and weather protection cover

1 - 3 Mounting holes



Dimensions of panel-mounted instrument



Installation of the panel-mounted instrument

1 Wall of control cabinet
2 Gasket
3 Tensioning screws
* Required installation depth

Environment

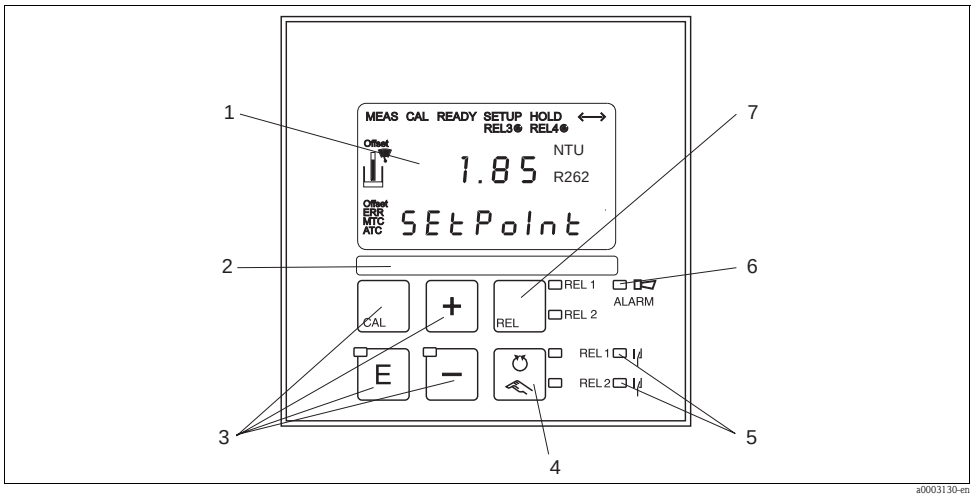
Ambient temperature	-10 to +55°C (+14 to +131°F)	
Ambient temperature limit	–20 to +60°C (-4 to +140°F)	
Storage and transport temperature	–25 to +65°C (-13 to +149°F)	
Electromagnetic compatibility	Interference emission and interference immunity acc. to EN 61326: 1997 / A1: 1998	
Ingress protection	Panel-mounted instrument: Field instrument:	IP 54 / NEMA 3S (front), IP 30 / NEMA 1 (housing) IP 65 (NEMA 4X)
Relative humidity	10 to 95%, non-condensing	

Mechanical construction

Dimensions	Panel-mounted instrument: Field instrument:	96 x 96 x 145 mm (3.78 x 3.78 x 5.71 inches) Installation depth: approx. 165 mm (6.50") 247 x 170 x 115 mm (9.72 x 6.69 x 4.53 inches)
Weight	Panel-mounted instrument: Field instrument:	max. 0.7 kg (1.5 lb) max. 2.3 kg (5.1 lb)
Materials	Housing of panel-mounted instrument: Field housing: Front membrane:	Polycarbonate ABS PC Fr Polyester, UV-resistant
Terminals	Cross section	max. 2.5 mm^2 (14 AWG)

Human interface

Display elements



Operating elements

1 LC display for displaying the measured values and configuration data
2 Field for user labelling
3 4 main operating keys for calibration and device configuration
4 Changeover switch for automatic/manual mode of the relays
5 LEDs for limit contactor relay (switch status)
6 LED for alarm function
7 Display of the active contact and key for relay changeover in manual mode

Instrument control functions

All instrument control functions are arranged in a logical menu structure. Following access code entry, the individual parameters can be easily selected and modified as needed.

Certificates and approvals

CE symbol

Declaration of conformity
The product meets the requirements of the harmonized European standards. It thus complies with the legal requirements of the EC directives.
The manufacturer confirms successful testing of the product by affixing the CE symbol.

Ex approval for zone 2

Version	Approval
CUM253-..6...	ATEX II 3G EEx nA[L] IIC T4
CUM253-..4... CUM223-..4... CUM223-..6...	ATEX II 3G [EEx nAL] IIC

Ordering information

Product structure

	Version
TB	Suspended solids with factory setup > residual concrete water
TU	Turbidity and suspended solids measurement
TS	Turbidity and suspended solids measurement, with additional functions (Plus package)

	Power supply; approval
0	230 V AC
1	115 V AC
2	230 V AC; CSA Gen. Purp.
3	115 V AC; CSA Gen. Purp.
4	230 V AC; ATEX II 3G [EEx nAL] IIC
5	100 V AC
6	24 V AC/DC; ATEX II 3G [EEx nAL] IIC for CUM223, EEx nA[L] IIC T4 for CUM253
7	24 V AC/DC; CSA Gen. Purp.
8	24 V AC/DC

	Output
0	1 x 20 mA, turbidity/SS
1	2 x 20 mA, turbidity/SS and temperature/main measured value/actuating variable
3	PROFIBUS PA
4	PROFIBUS DP
5	1 x 20 mA, turbidity/SS with HART®
6	2 x 20 mA, turbidity/SS with HART® and temp./main measured value/actuating variable

	Additional contacts; analog input
05	Not selected
10	2 x relay (limit/controller/timer)
15	4 x relay (limit/controller/Chemoclean)
16	4 x relay (limit/controller/timer)
20	2 x relay (limit/controller/timer); current input
25	4 x relay with cleaning (limit/controller/Chemoclean); current input
26	4 x relay with timer (limit/controller/timer); current input

CUM253-	complete order code
CUM223-	

Additional functions of the Plus package

- Current output table to cover wide ranges with varying resolution, fields O33x
- Process Check System (PCS): live check of the sensor, function group P
- Concentration measurement, function group K
- Automatic cleaning function start, field F8

Scope of delivery

The delivery of the field instrument includes:
- 1 transmitter CUM253
- 1 plug-in screw terminal
- 1 cable gland Pg 7
- 1 cable gland Pg 16 reduced
- 2 cable glands Pg 13.5
- 1 Operating Instructions BA200C/07/en
- versions with HART communication:
  1 Operating Instructions Field Communication with HART, BA208C/07/en
- versions with PROFIBUS communication:
  1 Operating Instructions Field Communication with PROFIBUS PA/DP, BA209C/07/en
- versions with explosion protection for hazardous area zone II (ATEX II 3G):
  Safety instructions for use in explosion-hazardous areas, XA194C/07/a3

The delivery of the panel-mounted instrument includes:
- 1 transmitter CUM223
- 1 set of plug-in screw terminals
- 2 tensioning screws
- 1 Operating Instructions BA200C/07/en
- versions with HART communication:
  1 Operating Instructions Field Communication with HART, BA208C/07/en
- versions with PROFIBUS communication:
  1 Operating Instructions Field Communication with PROFIBUS PA/DP, BA209C/07/en
- versions with explosion protection for hazardous area zone II (ATEX II 3G):
  Safety instructions for use in explosion-hazardous areas, XA194C/07/a3

Accessories

Sensors

Turbimax W CUS31
- Turbidity sensor for drinking water and wastewater applications, 90 ° scattered light method
- Ordering acc. to product structure, see Technical Information (TI176C/07/en)

Turbimax W CUS41
- Turbidity sensor for wastewater and solid content measurements, 90 ° scattered light method
- Ordering acc. to product structure, see Technical Information (TI177C/07/en)

Assemblies

Retractable assembly Cleanfit CUA451
- retractable assembly with ball valve; for turbidity sensors; material: stainless steel
- ordering acc. to product structure (Technical Information TI369C/07/en)

Flow assembly Flowfit CUA250
- for CUS31/CUS41
- ordering acc. to product structure (Technical Information TI096C/07/en)

- Immersion assembly Dipfit W CYA611
  for sensor immersion in basins, open channels and tanks, PVC;
  Ordering acc. to product structure (Technical Information TI166C/07/en)

Connection accessories

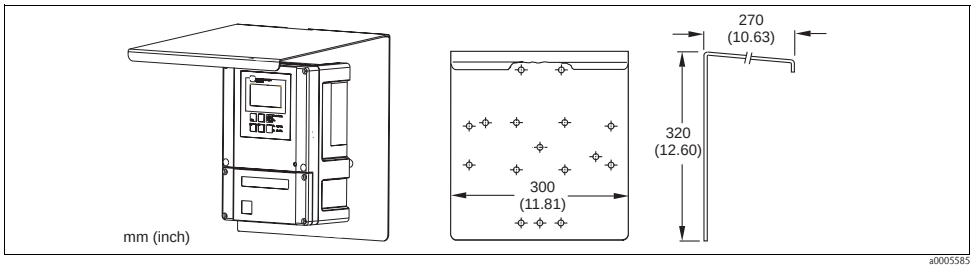
CYK81 measuring cable
- non-terminated measuring cable for extension of sensor cables of e.g. Memosens, CUS31/CUS41
- 2 wires, twisted pair with shield and PVC-sheath (2 x 2 x 0.5 mm^2 + shield)
- Sold by the meter, order no. 51502543

Junction box VBM
- For cable extension, with 10 terminals
- IP 65 (≙ NEMA 4X)
- Material: aluminum
- Order numbers:
  – cable entry Pg 13.5: 50003987
  – cable entry NPT ½": 51500177

Junction box RM
- To lengthen the cable for Memosens or CUS31/CUS41
- With 2 x Pg 13.5
- IP 65 (≙ NEMA 4X)
- Order no. 51500832

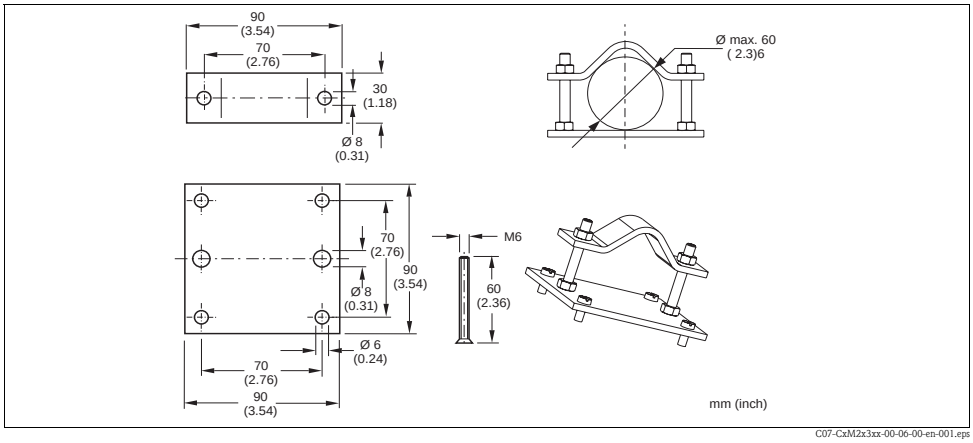
Mounting accessories

- Weather protection cover CYY101 for mounting of field housing, for outdoor installation
  material: stainless steel 1.4031 (AISI 304);
  order no. CYY101-A



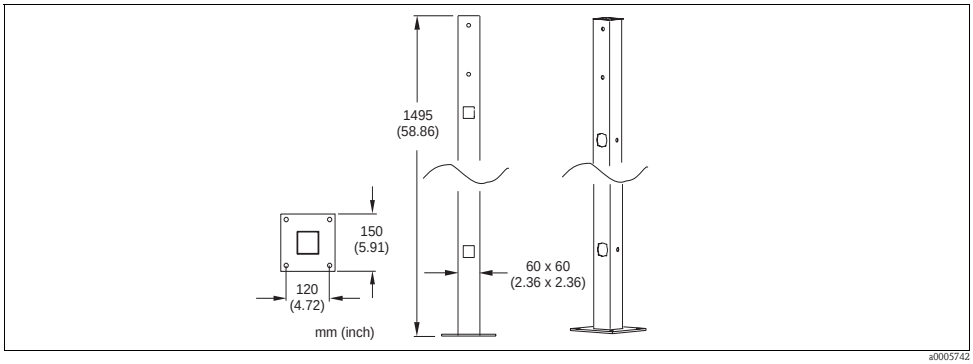
Weather protection cover for field instrument

- Kit for mounting of field housing on horizontal or vertical pipes (Ø max. 60 mm (2.36"))
  order no. 50086842



Pipe mounting kit

- Universal upright post CYY102
  Square post for mounting of field housing, material: stainless steel 1.4301 (AISI 304);
  order no. CYY102-A



Square post

Immersion assembly holder CYH101
- for pH, ORP, oxygen, conductivity assemblies and for oxygen and turbidity sensors;
- Ordering acc. to product structure (Technical Information TI092C/07/en)

Pendulum frame
- for pendulous suspension of CPA111, CLA111, CPA510 and CYA611 assemblies
- Order no. 50080196

Optoscope

- Optoscope
  Interface between transmitter and PC / laptop for service purposes.
  The Windows software "Scopeware" required for the PC or laptop is supplied with the Optoscope. The Optoscope is supplied in a sturdy plastic case with all the accessories required.
  Order no. 51500650

United States	Canada	Mexico
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People for Process Automation

Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

Orbisint CPS11 and CPS11D

pH electrodes, analog or with digital Memosens technology
For standard applications in process and environment technology, with dirt-repellent PTFE diaphragm, optional built-in temperature sensor

Application

- Long-term monitoring and limit monitoring of processes with stable process conditions
  - Pulp and paper industry
  - Plastics chemistry
  - Chemical processes
  - Power plants (e.g. flue gas washers)
  - Incineration plants
  - Food industry
  - Breweries
- Water treatment
  - Drinking water
  - Cooling water
  - Well water

With ATEX, FM and CSA approval for application in hazardous areas

Your benefits

- Robust electrode requiring low maintenance thanks to large PTFE ring diaphragm
- Application under pressures of up to 16 bar (232 psi)
- Process glass for highly alkaline applications available
- Built-in Pt 100 or Pt 1000 temperature sensor for effective temperature compensation (optional)
- Certified biocompatibility
- Sterilizable
- Long service life thanks to double junction system of metal lead and thus long electrode poison diffusion path
- Poison-resistant reference with ion trap (optional, CPS11D only)

Further benefits offered by Memosens technology

- Maximum process safety through contactless inductive signal transmission
- Data safety through digital data transmission
- Easy handling thanks to storage of sensor-specific data in the sensor
- Predictive maintenance possible thanks to registration of sensor load data in the sensor

TI028C/07/en/02.08
71068748

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Function and system design

Measuring principle

pH measurement
The pH value is used as a unit of measurement for the acidity or alkalinity of a liquid medium. The membrane glass of the electrode supplies an electrochemical potential which is dependent upon the pH value of the medium. This potential is generated by the selective penetration of H^+ ions through the outer layer of the membrane. An electrochemical boundary layer with an electric potential forms at this point. An integrated Ag/AgCl reference system serves as reference electrode.
The transmitter converts the measured voltage into the corresponding pH value using the Nernst equation.

General properties

- **Low maintenance**
  The sterilizable dirt-repellent PTFE ring diaphragm of the electrode prevents blocking and assures long-time stability and accuracy.
- **Long service life**
  The double junction system of the metal lead offers better protection from electrode poisons and guarantees a considerably longer service life.
- **Durability**
  Depending on the ordered version, the electrode is pressure proof up to 16 bar (232 psi) and can be applied at temperatures of up to 135 °C (275 °F.)

Important properties of CPS11D

Maximum process safety
The inductive and non-contacting measured value transmission of Memosens guarantees maximum process safety and offers the following benefits:

- All problems caused by moisture are eliminated.
  – The plug-in connection is free from corrosion.
  – Measured value distortion from moisture is not possible.
  – The plug-in system can even be connected under water.
- The transmitter is galvanically decoupled from the medium. The result: No more need to ask about "symmetrically high-impedance" or "unsymmetrical" (for pH/ORP measurement) or an impedance converter.
- EMC safety is guaranteed by screening measures for the digital measured value transmission.
- Application in explosion-hazardous areas is unproblematic; the integrated electronics are intrinsically safe.

Data safety through digital data transfer
The Memosens technology digitalizes the measured values in the sensor and transfers them to the transmitter contactlessly and free from interference potential. The result:

- An automatic error message is generated if the sensor fails or the connection between sensor and transmitter is interrupted.
- The availability of the measuring point is dramatically increased by immediate error detection.

Easy handling
Sensors with Memosens technology have integrated electronics that allow for saving calibration data and further information such as total hours of operation and operating hours under extreme measuring conditions. When the sensor is mounted, the calibration data are automatically transferred to the transmitter and used to calculate the current measured value. Storing the calibration data in the sensor allows for calibration away from the measuring point. The result:

- Sensors can be calibrated unter optimum external conditions in the measuring lab. Wind and weather do neither affect the calibration quality nor the operator.
- The measuring point availability is dramatically increased by the quick and easy replacement of precalibrated sensors.
- The transmitter does not need to be installed close to the measuring point but can be placed in the control room.
- Maintenance intervals can be defined based on all stored sensor load and calibration data and predictive maintenance is possible.
- The sensor history can be documented on external data carriers and evaluation programs at any time. Thus, the current application of the sensors can be made to depend on their previous history.

Communication with the transmitter
Always connect digital sensors to a transmitter with Memosens technology. Data transmission to a transmitter for analog sensors is not possible.

Data storage of CPS11D

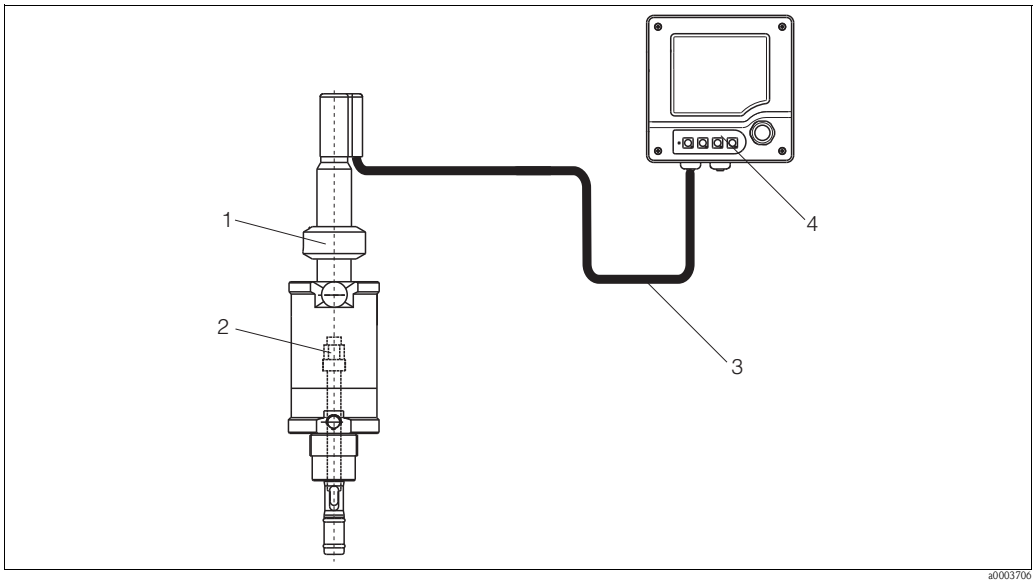
Digital sensors are able to store the following system data in the sensor.

- Manufacturing data
  - Serial number
  - Order code
  - Date of manufacture
- Calibration data
  - Calibration date
  - Calibrated slope at 25 °C (77 °F)
  - Calibrated zero point at 25 °C (77 °F)
  - Temperature offset
  - Number of calibrations
  - Serial number of the transmitter used for the last calibration
- Application data
  - Temperature application range
  - pH application range
  - Date of first commissioning
  - Maximum temperature value
  - Operating hours at temperatures above 80 °C (176 °F) and 100 °C (212 °F)
  - Operating hours at very low and very high pH values (Nernst voltage below -300 mV, above +300 mV)
  - Number of sterilizations
  - Glass membrane impedance

These system data can be displayed with Mycom S and Liquiline M transmitters.

Measuring system

A complete measuring system comprises:
- CPS11 pH electrode or CPS11D digital sensor
- Transmitter, e.g. Liquiline M CM42 (with Memosens technology for CPS11D)
- Special measuring cable, e.g. CPK9 or Memosens data cable CYK10
- Immersion, flow or retractable assembly, e.g. Cleanfit P CPA472



Measuring system for pH measurement

1 Cleanfit P CPA472 retractable assembly
2 CPS11/CPS11D pH electrode
3 Special measuring cable CPK9 for electrodes with TOP68 plug-in head / CYK10 for digital sensors
4 Liquiline M CM42 transmitter

Input

Measured variables

pH value
Temperature

Measuring ranges

Electrode version AA, AS (for water / wastewater):
- pH: 1 to 12 pH
- Temperature: -15 to 80 °C (5 to 176 °F)

Electrode version BA (for process applications, sterilizable)
- pH: 0 to 14 pH
- Temperature: 0 to 135 °C (32 to 275 °F)

Electrode version FA (for hydrofluoric acid):
- pH: 0 to 10 pH
- Temperature: 0 to 70 °C (32 to 158 °F)

Electrode version BT with ion trap (for pulp, paper, chemical applications)
- pH: 0 to 14
- Temperature: 0 to 135 °C (32 to 275 °F)

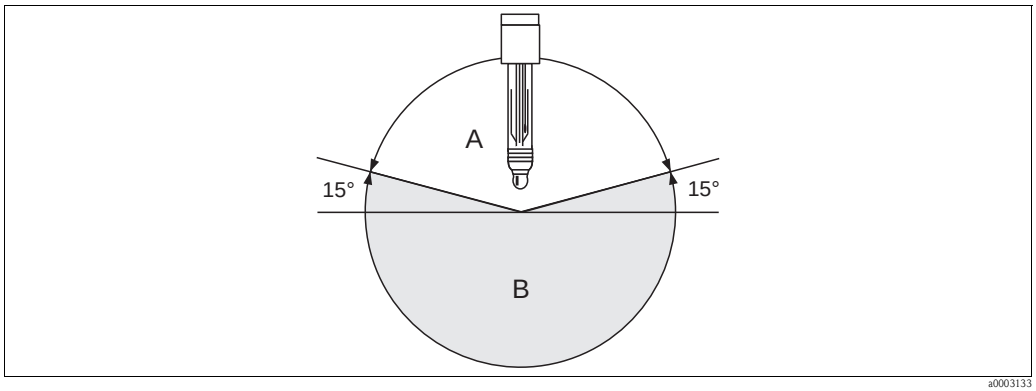
Caution!
Please note the process operating conditions.

Installation

Installation instructions

Do not install the electrode upside down. The inclination angle must be at least 15° from the horizontal. A smaller inclination angle is not permitted as such an inclination results in air cushion forming in the glass sphere. This might impair full wetting of the pH membrane with inner electrolyte.

Caution!
- Make sure that the assembly's threaded connection for the electrode is clean and well running before installing the electrode.
- Hand tighten the electrode (3 Nm)! (Given value only applies to installation in Endress+Hauser assemblies.)
- Make sure to follow the installation instructions in the operating instructions of the used assembly.



Electrode installation; inclination angle min. 15° from the horizontal

A Permitted inclination angle
B Non-permitted inclination angle

Environment

Ambient temperature

Caution!
Danger of frost damage
Do not use the electrode at temperatures below –15 °C (5 °F).

Storage temperature

0 to 50 °C (32 to 122 °F)

Ingress protection

IP 67:	GSA plug-in head (with closed plug-in connection)
IP 68:	TOP68 plug-in head, autoclavable up to 135 °C (275 °F), 1 m (3.28 ft) water column, 50 °C (122 °F), 168 h
IP 68:	Memosens plug-in head, 10 m (32.81 ft) water column, 25 °C (77 °F), 45 days, 1M KCl

Process

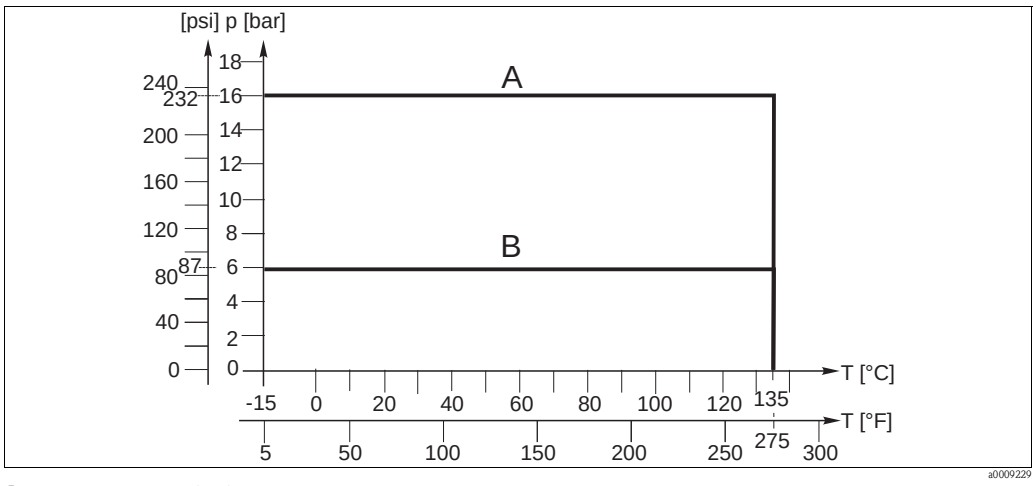
Process temperature

Version AA, AS:	-15 to 80 °C (5 to 176 °F)
Version BA, BT:	0 to 135 °C (32 to 275 °F)
Version FA:	0 to 70 °F (32 to 158 °F)

Process pressure

0 to 6 bar (0 to 87 psi) / 16 bar (232 psi) (versions CPS11-xBAxESA, CPS11D-7BAxx, CPS11D-7BTxx)

Pressure temperature load curve



Pressure temperature load curve

A Versions CPS11-xBAxESA, CPS11D-7BAxx, CPS11D-7BTxx
B CPS11 and CPS11D (except CPS11-xBAxESA, CPS11D-7BAxx, CPS11D-7BTxx)

Conductivity

min. 50 µS/cm

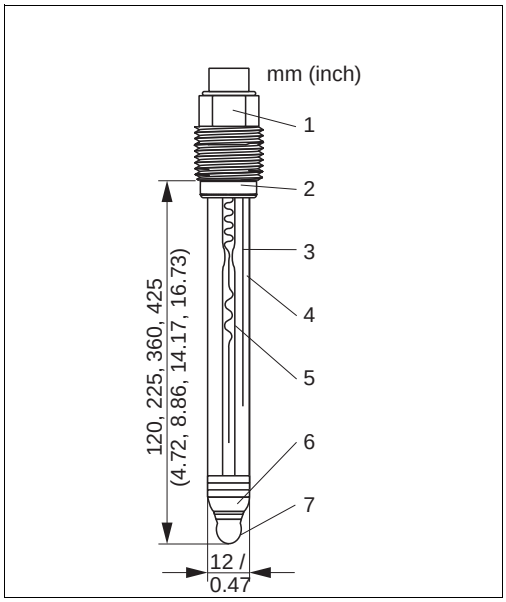
pH range

Version AA, AS:	1 to 12 pH
Version BA, BT:	0 to 14 pH
Version FA:	0 to 10 pH

Caution!
Danger of electrode damage
Do not operate the electrodes in applications outside the given specifications!

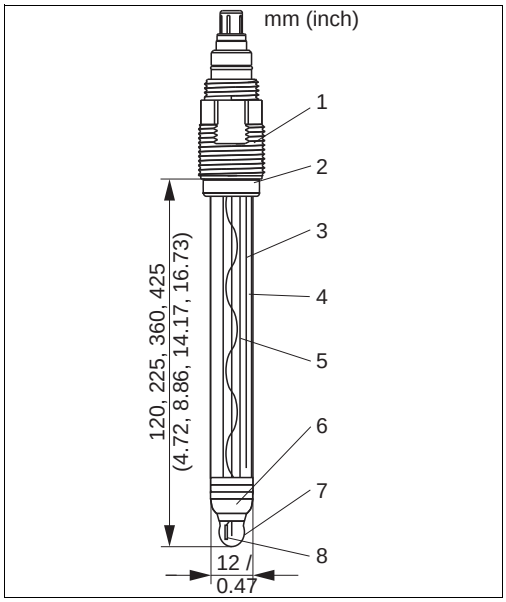
Mechanical construction

Design, dimensions



CPS11 with GSA plug-in head

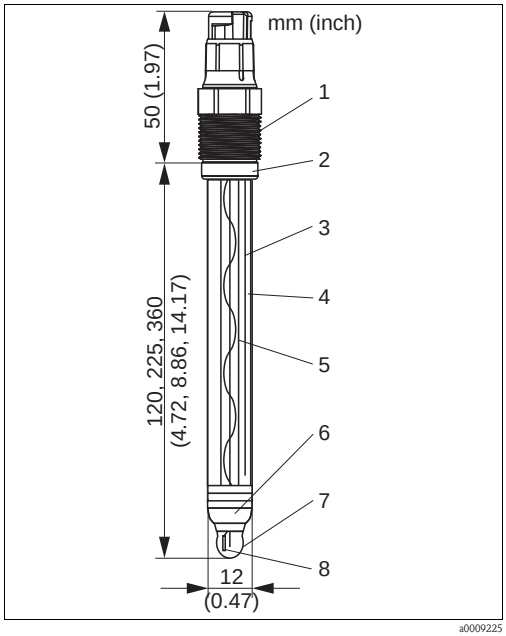
1 GSA plug-in head, Pg 13.5
2 Viton O-ring with thrust collar
3 Ag/AgCl metal lead - reference
4 "Advanced Gel" electrolyte
5 Ag/AgCl metal lead - pH
6 PTFE diaphragm
7 pH glass membrane



CPS11 with TOP68, built-in temperature sensor

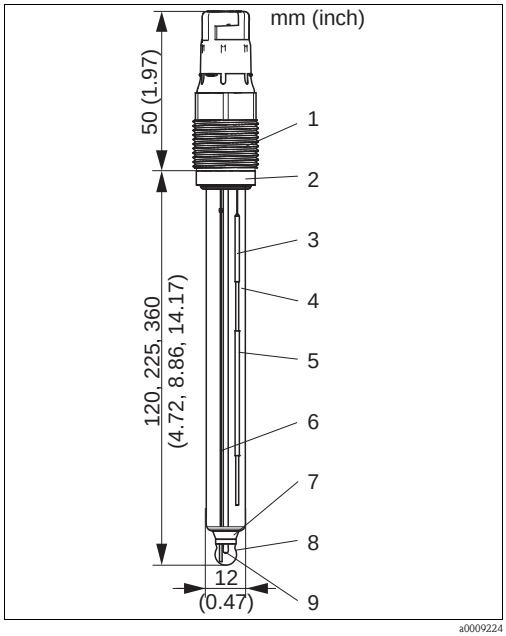
1 TOP68 plug-in head, Pg 13.5
2 Viton O-ring with thrust collar
3 Ag/AgCl metal lead - reference
4 "Advanced Gel" electrolyte
5 Ag/AgCl metal lead - pH
6 PTFE diaphragm
7 pH glass membrane
8 Pt 100 temperature sensor

Design, dimensions CPS11D



CPS11D with Memosens, built-in temperature sensor

1 Memosens plug-in head, Pg 13.5
2 Viton O-ring with thrust collar
3 Ag/AgCl metal lead - reference
4 "Advanced Gel" electrolyte
5 Ag/AgCl metal lead - pH
6 PTFE diaphragm
7 pH glass membrane
8 Temperature sensor



CPS11D-7BTxx

1 Memosens plug-in head, Pg 13.5
2 Viton O-ring with thrust collar
3 Ag/AgCl metal lead - reference
4 "Advanced Gel" electrolyte
5 Ion trap
6 Ag/AgCl metal lead - pH
7 PTFE diaphragm
8 pH glass membrane
9 Temperature sensor

Weight

approx. 0.1 kg (0.22 lbs)

Material

Electrode shaft	process glass
pH membrane glasses	types A, B, F
Metal lead	Ag/AgCl
Diaphragm	ring-shaped Teflon® diaphragm, sterilizable

Process connection

Pg 13.5

Temperature sensor

CPS11:	Pt 100, Pt 1000
CPS11D:	NTC

Plug-in heads

CPS11:
- ESA: plug-in head Pg 13.5, TOP68 for electrodes with or without temperature sensor, 16 bar (232 psi) triple safety overpressure, Ex
- GSA: plug-in head Pg 13.5 for electrodes without temperature sensor

CPS11D: Memosens plug-in head for digital, contactless data transmission

Reference system

CPS11:	Ag/AgCl metal lead with Advanced Gel 3 M KCl, AgCl free
CPS11D:	
Versions AA, AS, BA, FA	Ag/AgCl metal lead with Advanced Gel 3 M KCl, AgCl free
Version BT	Ag/AgCl metal lead with ion trap and Advanced Gel 3 M KCl

Certificates and approvals

Ex approval

CPS11 (TOP68)

- ATEX II 1G EEX ia IIC T3/T4/T6
- FM Class I Div. 2, in combination with the Liquiline M CM42 and Mycom S CPM153 transmitters

CPS11D

- ATEX II 1G EEX ia IIC T3/T4/T6
- FM / CSA Class I Div. 2, in combination with the Liquiline M CM42 and Mycom S CPM153 transmitters

Note!
Ex versions of digital sensors with Memosens technology are indicated by an orange-red ring in the plug-in head.

Biocompatibility

Biocompatibility validated according to:

- ISO 10993-5:1993
- USP, current revision

TÜV certificate

TOP68 plug-in head

Pressure resistance 16 bar (232 psi), min. triple overpressure safety

Memosens plug-in head

Pressure resistance 16 bar (232 psi), min. triple overpressure safety

Electromagnetic compatibility of CPS11D

Interference emission and interference immunity complies with EN 61326: 1997 / A1: 1998

Ordering information

Product structure CPS11

	Electrode type	
	1	without temperature sensor
	2	with built-in Pt 100 (not available with GSA plug-in head)
	3	with built-in Pt 1000 (not available with GSA plug-in head)

	Application range	
	AA	pH = 1 to 12, T = -15 to 80 °C (5 to 176 °F), 6 bar (87 psi)
	AS	pH = 1 to 12, T = -15 to 80°C (5 to 176 °F), 6 bar (87 psi), salt ring
	BA	pH = 0 to 14, T = 0 to 135 °C (32 to 275 °F), sterilizable, 16 bar (232 psi) in combination with ESA plug-in head
	FA	pH = 0 to 10, T = 0 to 70 °C (32 to 158 °F), HF resistant up to 1 g/l, 6 bar (87 psi)

		Shaft length	
		2	120 mm (4.72")
		4	225 mm (8.86")
		5	360 mm (14.17")
		6	425 mm (16.73")

			Plug-in head	
			ESA	Plug-in head Pg 13.5, TOP68, 16 bar (232 psi) in combination with BA application range, Ex
			GSA	Plug-in head Pg 13.5, DIN coax, non-Ex

CPS11-					complete order code

Product structure CPS11D

	Version	
	7	max. 135 °C (275 °F), built-in temperature sensor

		Application range	
		AA	pH = 1 to 12, T = -15 to 80 °C (5 to 176 °F), 6 bar (87 psi)
		AS	pH = 1 to 12, T = -15 to 80 °C (5 to 176 °F), 6 bar (87 psi), salt ring
		BA	pH = 0 to 14, T = 0 to 135 °C (32 to 275 °F), 16 bar (232 psi), sterilizable
		BT	pH = 0 to 14, T = 0 to 135 °C (32 to 275 °F), 16 bar (232 psi), ion trap
		FA	pH = 0 to 10, T = 0 to 70 °C (32 to 158 °F), 6 bar (87 psi), HF resistant up to 1 g/l

			Shaft length	
			2	120 mm (4.72")
			4	225 mm (8.86")
			5	360 mm (14.17")
			6	425 mm (16.73")

				Approval	
				1	Non-hazardous area
				G	ATEX II 1G EEx ia IIC T3/T4/T6

CPS11D-						complete order code

Accessories

Note!
In the following sections, you find the accessories available at the time of issue of this documentation.
For information on accessories that are not listed here, please contact your responsible service.

Transmitters

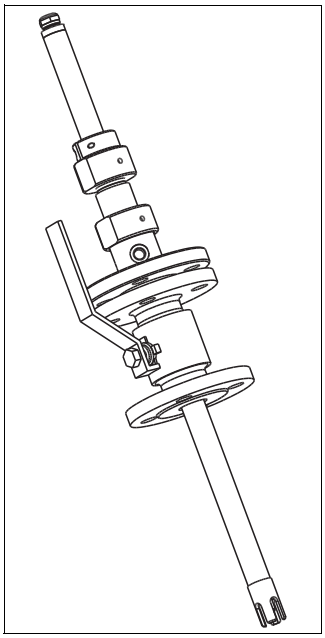
Liquiline M CM42
- Modular two-wire transmitter, stainless steel or plastic, field or panel instrument,
- various Ex approvals (ATEX, FM, CSA, Nepsi, TIIS),
- HART, PROFIBUS or FOUNDATION Fieldbus available
- Ordering acc. to product structure, see Technical Information (TI381C/07/en)

Liquisys M CPM223/253
- Transmitter for pH and ORP, field or panel-mounted housing,
- HART or PROFIBUS available
- Ordering acc. to product structure, see Technical Information (TI194C/07/en)

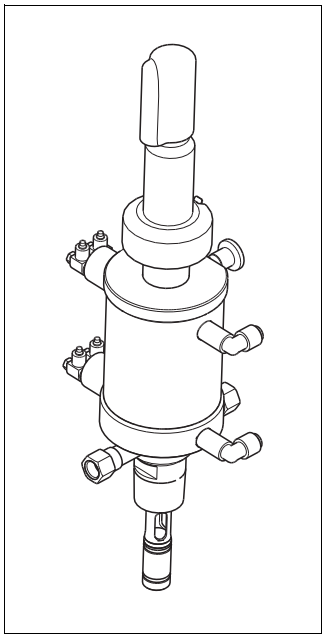
Mycom S CPM153
- Transmitter for pH and ORP, one or two channel version, Ex or non-Ex,
- HART or PROFIBUS available
- Ordering acc. to product structure, see Technical Information (TI233C/07/en)

Assemblies (Selection)

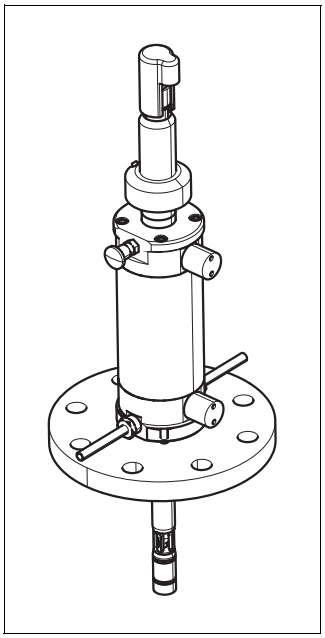
- Cleanfit W CPA450
  Manually operated, retractable assembly for installation of 120 mm (4.72") pH/ORP electrodes in tanks and pipes,
  Ordering acc. to product structure, see Technical Information (TI183C/07/en)
- Cleanfit P CPA471
  Compact retractable stainless steel assembly for installation in tanks and pipes, manual or pneumatic operation
  Ordering acc. to product structure, see Technical Information (TI217C/07/en)
- Cleanfit P CPA472
  Compact retractable plastic assembly for installation in tanks and pipes, manual or pneumatic operation,
  Ordering acc. to product structure, see Technical Information (TI223C/07/en)
- Cleanfit P CPA472D
  Robust retractable assembly for pH, ORP and other industry sensors, manual or pneumatic operation, heavy-duty version;
  Ordering acc. to product structure, see Technical Information (TI403C/07/en)



Cleanfit W CPA450

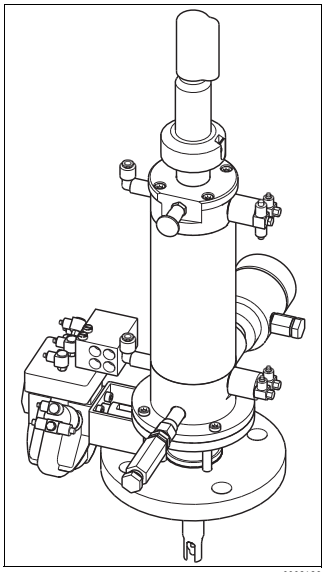


Cleanfit P CPA471 or 472

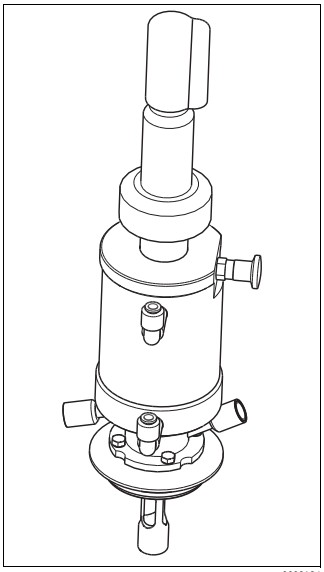


Cleanfit P CPA472D

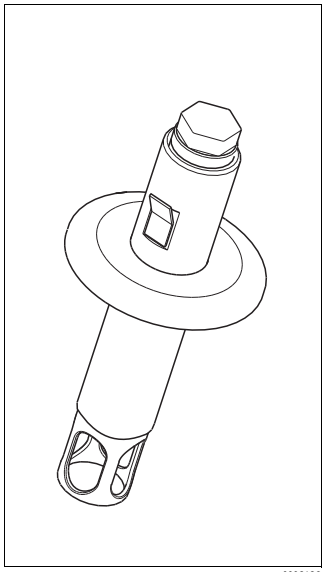
- Cleanfit P CPA473
  Retractable stainless steel process assembly, with ball valve for a particularly safe and reliable separation of the medium from the environment,
  Ordering acc. to product structure, see Technical Information (TI344C/07/en)
- Cleanfit P CPA474
  Retractable plastic process assembly, with ball valve for a particularly safe and reliable separation of the medium from the environment,
  Ordering acc. to product structure, see Technical Information (TI345C/07/en)
- Cleanfit H CPA475
  Retractable assembly for installation in tanks and pipes under sterile conditions,
  Ordering acc. to product structure, see Technical Information (TI240C/07/en)
- Unifit H CPA442
  Process assembly for the food industry, biotechnology and pharmaceutical industry,
  Ordering acc. to product structure, see Technical Information (TI306C/07/en)



Cleanfit P CPA473 or 474

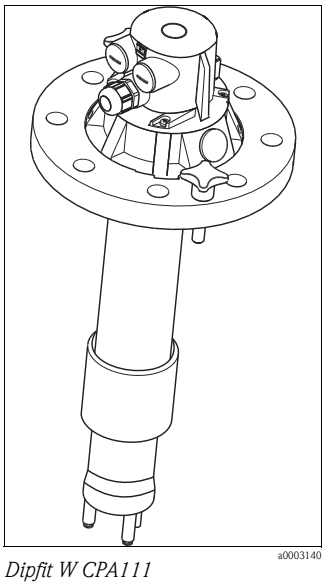


Cleanfit H CPA475

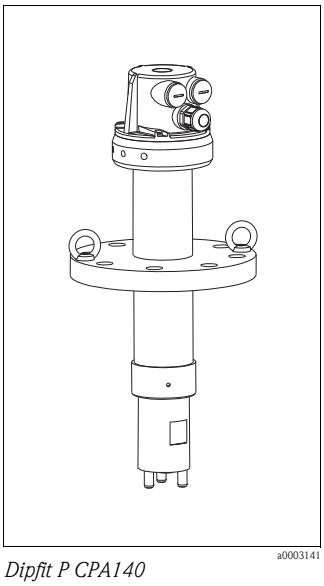


Unifit H CPA442

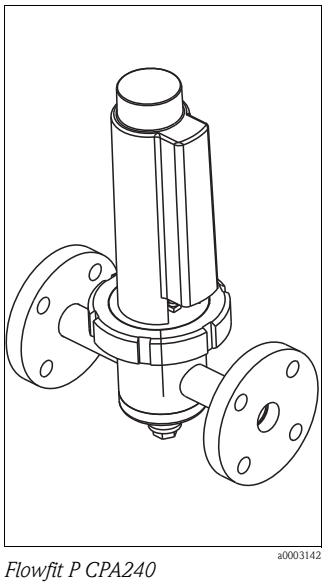
- Dipfit W CPA111
  Plastic immersion and installation assembly for open and closed tanks,
  Ordering acc. to product structure, see Technical Information (TI112C/07/en)
- Dipfit P CPA140
  Immersion assembly for pH/ORP electrodes for demanding processes,
  Ordering acc. to product structure, see Technical Information (TI178C/07/en)
- Flowfit P CPA240
  Flow assembly for pH/ORP electrodes, for demanding processes,
  Ordering acc. to product structure, see Technical Information (TI179C/07/en)



Dipfit W CPA111

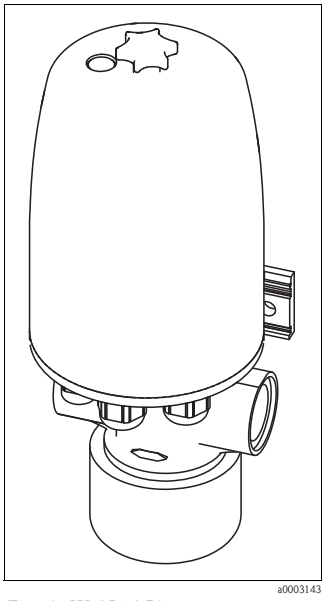


Dipfit P CPA140

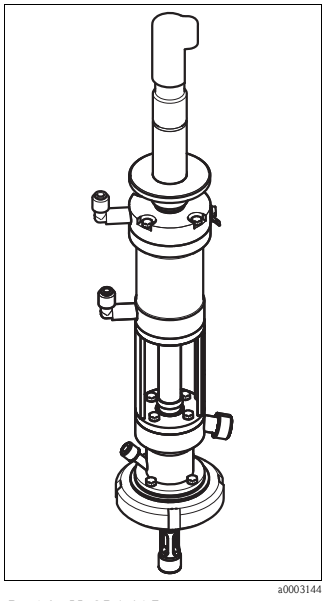


Flowfit P CPA240

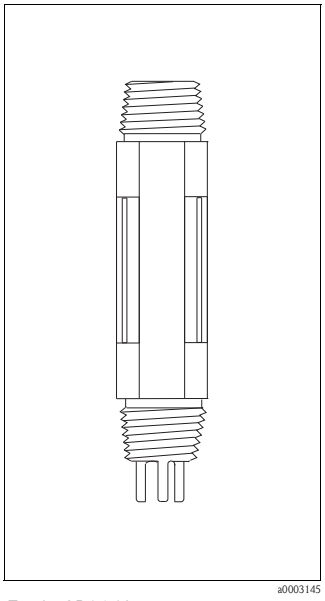
- Flowfit W CPA250
  Flow assembly for pH/ORP electrodes,
  Ordering acc. to product structure, see Technical Information (TI041C/07/en)
- Probfit H CPA465
  Retractable assembly for installation in tanks and pipes under sterile conditions,
  Ordering acc. to product structure, see Technical Information (TI146C/07/en)
- Ecofit CPA640
  Process connection adapter and cable set for 120 mm (4.72") pH/ORP electrodes,
  Ordering acc. to product structure, see Technical Information (TI264C/07/en)



Flowfit W CPA250



Probfit H CPA465



Ecofit CPA640

Buffer solutions

High-quality buffer solutions of Endress+Hauser
The secondary buffer solutions have been referenced to primary reference material of the PTB (German Federal Physico-technical Institute) and to standard reference material of NIST (National Institute of Standards and Technology) according to DIN 19266 by a DKD (German Calibration Service) accredited laboratory.

	pH value					
	A	pH 2.00 (accuracy ± 0.02 pH)				
	C	pH 4.00 (accuracy ± 0.02 pH)				
	E	pH 7.00 (accuracy ± 0.02 pH)				
	G	pH 9.00 (accuracy ± 0.02 pH)				
	I	pH 9.20 (accuracy ± 0.02 pH)				
	K	pH 10.00 (accuracy ± 0.05 pH)				
	M	pH 12.00 (accuracy ± 0.05 pH)				
		Quantity				
		01	20 x 18 ml (0.68 fl.oz) only buffer solutions pH 4.00 and 7.00			
		02	250 ml (8.45 fl.oz)			
		10	1000 ml (0.26 US gal)			
		50	5000 ml (1.32 US gal) canister for Topcal S			
			Certificates			
			A	Buffer analysis certificate		
				Version		
				1	Standard	
CPY20-						complete order code

Measuring cables

CPK9 special measuring cable
- For sensors with TOP68 plug-in head, for high-temperature and high-pressure applications, IP 68
- Ordering acc. to product structure, see Technical Information (TI118C/07/en)

CPK1 special measuring cable
- For pH/ORP electrodes with GSA plug-in head
- Ordering acc. to product structure, see Technical Information (TI118C/07/en)

CPK12 special measuring cable
- For pH/ORP glass electrodes and ISFET sensors with TOP68 plug-in head
- Ordering acc. to product structure, see Technical Information (TI118C/07/en)

CYK10 Memosens data cable
- For digital sensors with Memosens technology
- Ordering according to product structure, see below

	Certificates			
	A	Standard, non Ex		
	G	ATEX II 1G EEx ia IIC T6/T4		
		Cable length		
		03	Cable length: 3 m (9.8 ft)	
		05	Cable length: 5 m (16 ft)	
		10	Cable length: 10 m (33 ft)	
		15	Cable length: 15 m (49 ft)	
		20	Cable length: 20 m (66 ft)	
		25	Cable length: 25 m (82 ft)	
		88	... m length	
		89	... ft length	
			Ready-made	
			1	Wire terminals
CYK10-				complete order code

Note!
Ex versions of CYK10 are indicated by an orange-red coupling end.

Instruments International

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Endress+Hauser
People for Process Automation

TI028C/07/en/02.08
71068748
Printed in Germany / FM+SGML 6.0 / DT

Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

Prosonic M FMU40/41/42/43/44

Ultrasonic Level Measurement
Compact transmitters for non-contact level measurement of fluids, pastes and coarse bulk materials

FMU40 FMU41 FMU42 FMU43 FMU44

Application

- Continuous, non-contact level measurement in fluids, pastes, sullages and coarse bulk materials
- Flow measurement in open channels and measuring weirs
- System integration via:
  - HART® (standard), 4 to 20 mA
  - PROFIBUS® PA
  - FOUNDATION™ Fieldbus
- Maximum measuring range:
  - FMU 40: 16 ft (5 m) in fluids / 6 ft (2 m) in bulk materials
  - FMU 41: 26 ft (8 m) in fluids / 12 ft (3.5 m) in bulk materials
  - FMU 42: 33 ft (10 m) in fluids / 16 ft (5 m) in bulk materials
  - FMU 43: 50 ft (15 m) in fluids / 23 ft (7 m) in bulk materials
  - FMU44: 65 ft (20 m) in fluids / 33 ft (10 m) in bulk materials

Features and benefits

- Quick and simple commissioning via menu-guided on-site operation with four-line plain text display
- Envelope curves on the on-site display for simple diagnosis
- Easy remote operation, diagnosis and measuring point documentation with the supplied FieldCare operating program.
- Suitable for explosion hazardous areas (Gas-Ex, Dust-Ex)
- Linearization function (up to 32 points) for conversion of the measured value into any unit of length, volume or flow rate
- Non-contact measurement method minimizes service requirements
- optional remote display and operation (up to 65 ft / 20 m from transmitter)
- Installation possible from thread 1½ NPT, G 1½“ or 2" NPT or universal slip-on flange
- Integrated temperature sensor for Time of Flight correction provides accurate measurements, even with temperature changes

TI365F/24/ae

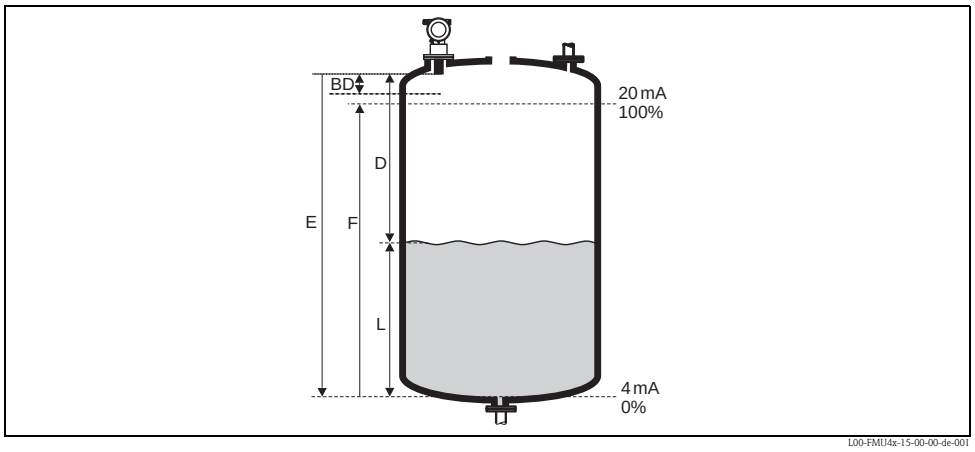
Endress+Hauser

People for Process Automation

Table of Contents

Function and system design

Measuring principle



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

Sensor	BD	Max. range fluids	Max. range bulk materials
FMU40	9.84" (0.25 m)	16 ft (5 m)	6.5 ft (2 m)
FMU41	13.8" (0.35 m)	26 ft (8 m)	11.5 ft (3.5 m)
FMU42	15.7" (0.4 m)	33 ft (10 m)	16 ft (5 m)
FMU43	23.6" (0.6 m)	50 ft (15 m)	23 ft (7 m)
FMU44	19.7" (0.5 m)	65 ft (20 m)	33 ft (10 m)

Time-of-flight method

The sensor of the Prosonic M transmits ultrasonic pulses in the direction of the product surface. There, they are reflected back and received by the sensor. The Prosonic M measures the time t between pulse transmission and reception. The instrument uses the time t (and the velocity of sound c) to calculate the distance D between the sensor membrane and the product surface:

$D = c \cdot t/2$

As the device knows the empty distance E from a user entry, it can calculate the level as follows:

$L = E - D$

An integrated temperature sensor compensates for changes in the velocity of sound caused by temperature changes.

Interference echo suppression

The interference echo suppression feature on the Prosonic M ensures that interference echos (e.g. from edges, welded joints and installations) are not interpreted as a level echo.

Calibration

Enter the empty distance E and the span F to calibrate the device.

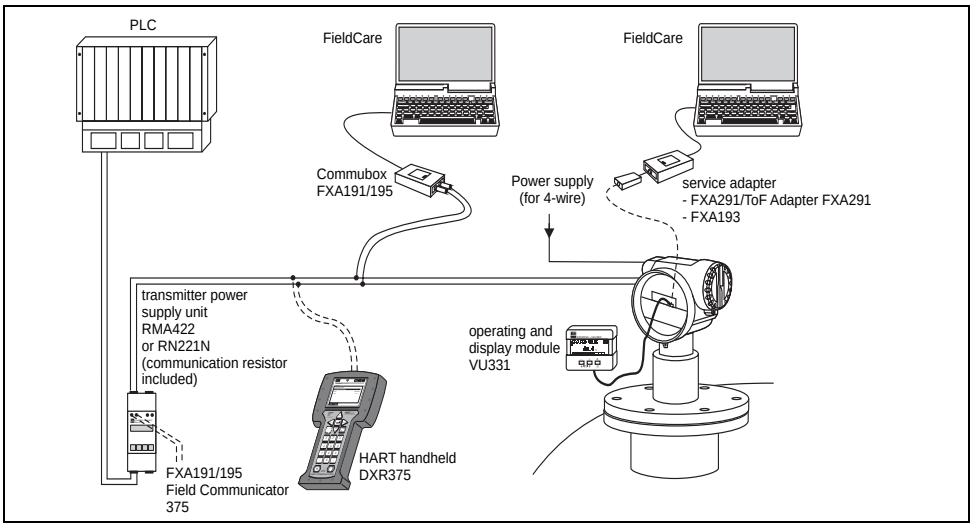
Blocking distance

Span F may not extend into the blocking distance BD. Level echos from the blocking distance cannot be evaluated due to the transient characteristics of the sensor.

Equipment architecture

4 to 20 mA output with HART protocol

The complete measuring system consists of:



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

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

Local operation

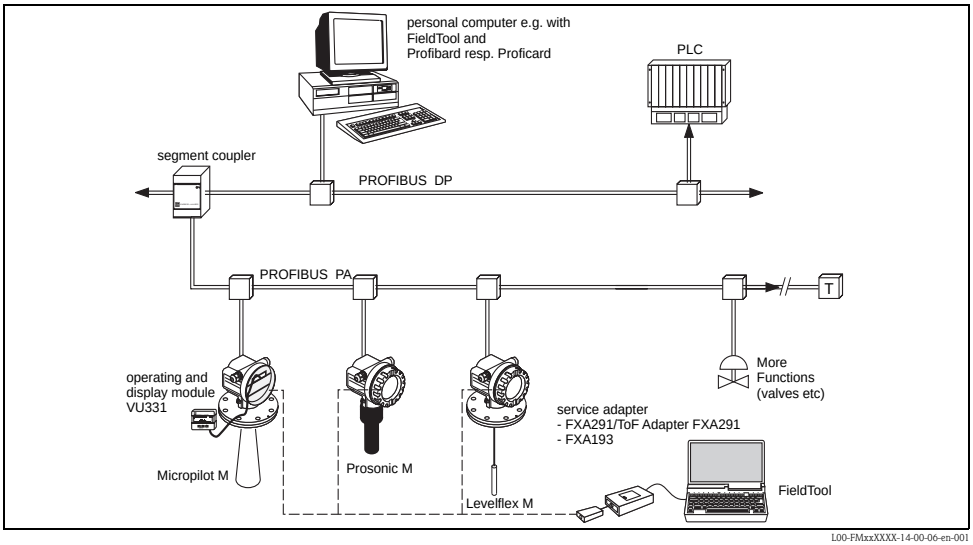
- with display and operating module VU 331
- with a Personal Computer, FXA 193 and the operating software ToF Tool

Remote operation

- with HART handheld terminal DXR 375
- with a Personal Computer, Commubox FXA 191 and the operating software COMMUWIN II respectively ToF Tool.

System integration using PROFIBUS PA

A maximum of 32 transmitters (8 if mounted in an explosion hazardous location EEx ia IIC according to FISCO-model) can be connected to the bus.The segment coupler provides the operating voltage to the bus. Both on-site as well as remote operation are possible.



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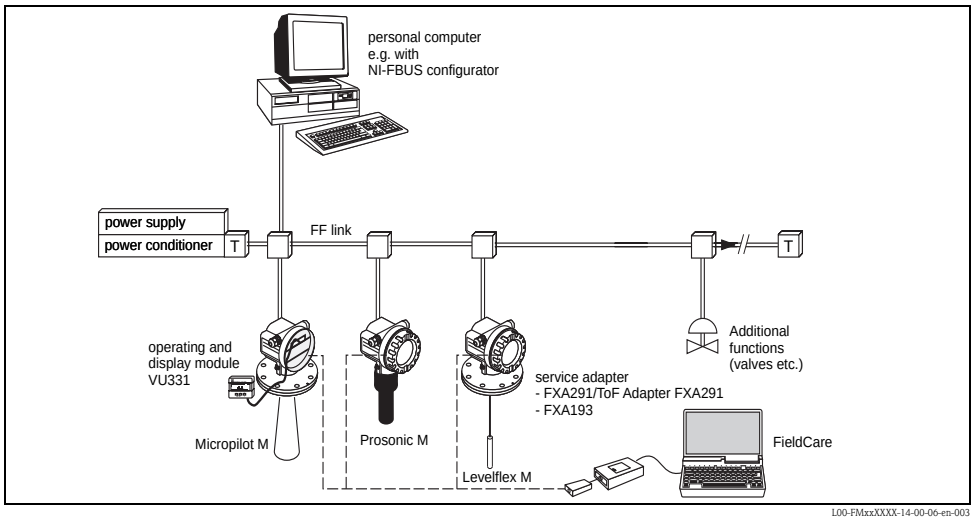
System integration using Foundation Fieldbus (FF)

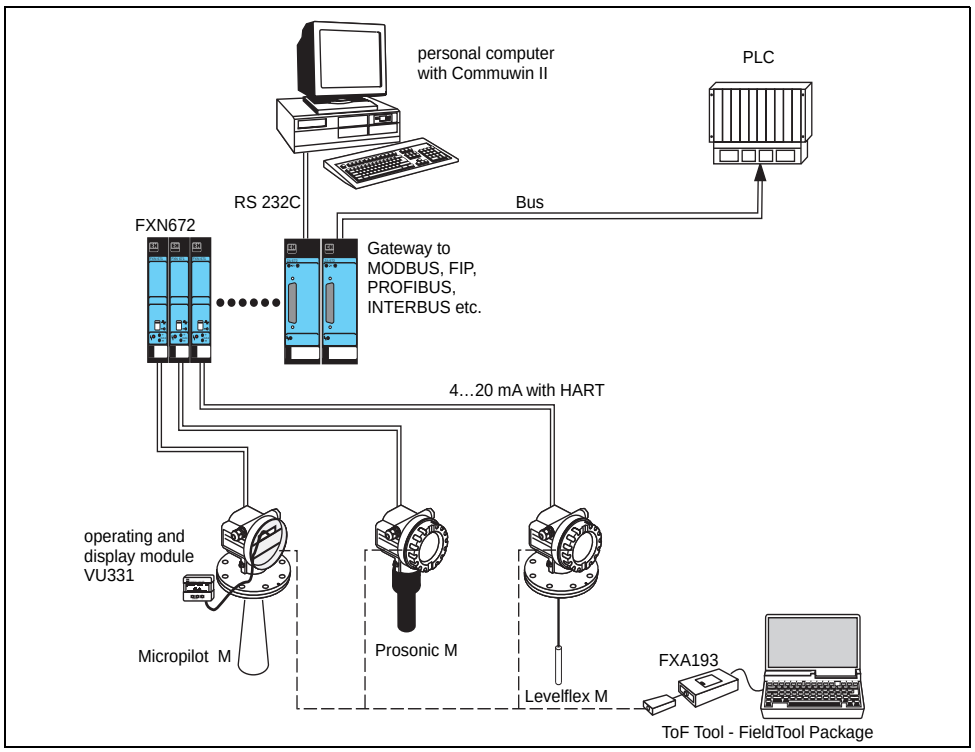
A maximum of 32 transmitters (standard or EEx d) can be connected to the bus. For protection class EEx ia: the maximum number of transmitters depends on the established rules and standards for intrinsically safe circuits (EN 60070-14) and proof of instrinsic safety. Both on-site and remote operation are possible.



L00-FMxxXXXX-14-00-06-en-003

System integration using Endress+Hauser Rackbus

You can interconnect a maximum of 64 2-wire devices with HART protocol to a Rackbus. Use an FXN 672 interface module for each device. You can integrate this bus into a higher-level bus by using a ZA gateway. Gateways are available for MODBUS, FIP, PROFIBUS, INTERBUS etc. Both on-site and remote operation are possible.



L00-FMxxXXXX-14-00-06-en-006

NOTE! The FXN672 can be used with all 2-wire devices of the Prosonic M family.

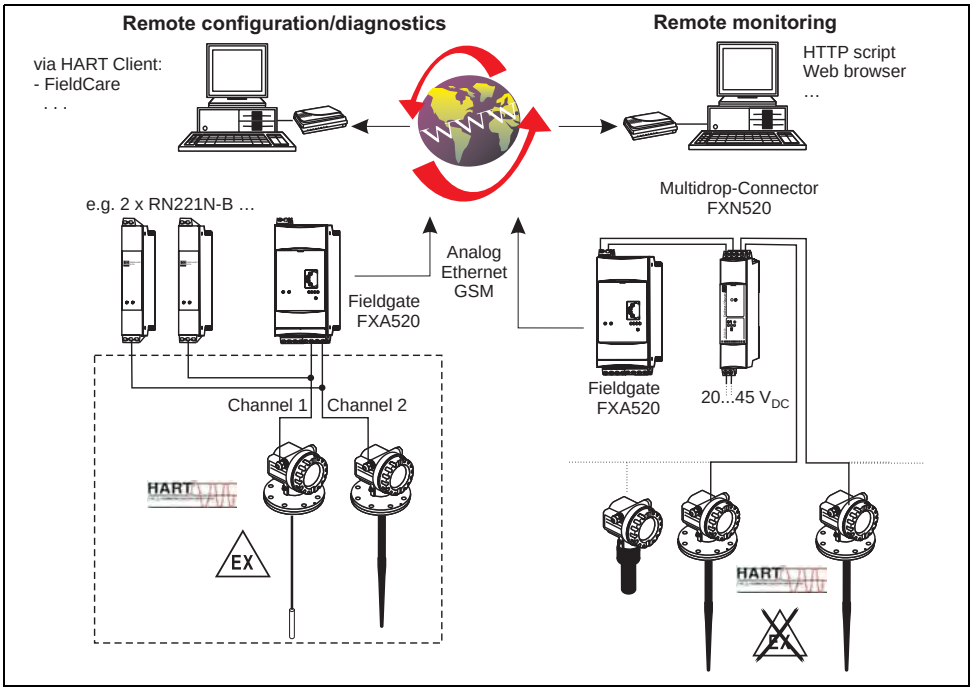
System integration via Fieldgate

Vendor Managed Inventory

By using Fieldgates to interrogate tank or silo levels remotely, suppliers of raw materials can provide their regular customers with information about the current supplies at any time and, for example, account for them in their own production planning. For their part, the Fieldgates monitor the configured level limits and, if required, automatically activate the next supply. The spectrum of options here ranges from a simple purchasing requisition via e-mail through to fully automatic order administration by coupling XML data into the planning systems on both sides.

Remote maintenance of measuring equipment

Fieldgates not only transfer the current measured values, they also alert the responsible standby personnel, if required, via e-mail or SMS. In the event of an alarm or also when performing routine checks, service technicians can diagnose and configure connected HART devices remotely. All that is required for this is the corresponding HART operating software (e.g. ToF Tool - FieldTool Package, FieldCare, ...) for the connected device. Fieldgate passes on the information transparently, so that all options for the respective operating software are available remotely. Some on-site service operations can be avoided by using remote diagnosis and remote configuration and all others can at least be better planned and prepared.



Note!
The number of instruments which can be connected in mutidrop mode can be calculated by the "FieldNetCalc" program. A description of this program can be found in Technical Information TI 400F (Multidrop Conncector FXN520). The program is available form your Endress+Hauser sales organisation or in the internet at: "**www.endress.com Download**" (Text Search = "Fieldnetcalc").

Input

Measured variable

The distance D between the sensor membrane and the product surface is measured.

Using the linearisation function, the device uses D to calculate:
- level L in any units
- volume V in any units
- flow Q across measuring weirs or open channels in any units

Measuring range

The measuring range is limited by the range of a sensor. The sensor range is, in turn, dependent on the operating conditions. To estimate the actual range, proceed as follows (see also the calculation example in the diagram):

1. Determine which of the influences shown in the following table are appropriate for your process.
2. Add the corresponding attenuation values.
3. From the total attenuation, use the diagram to calculate the range.

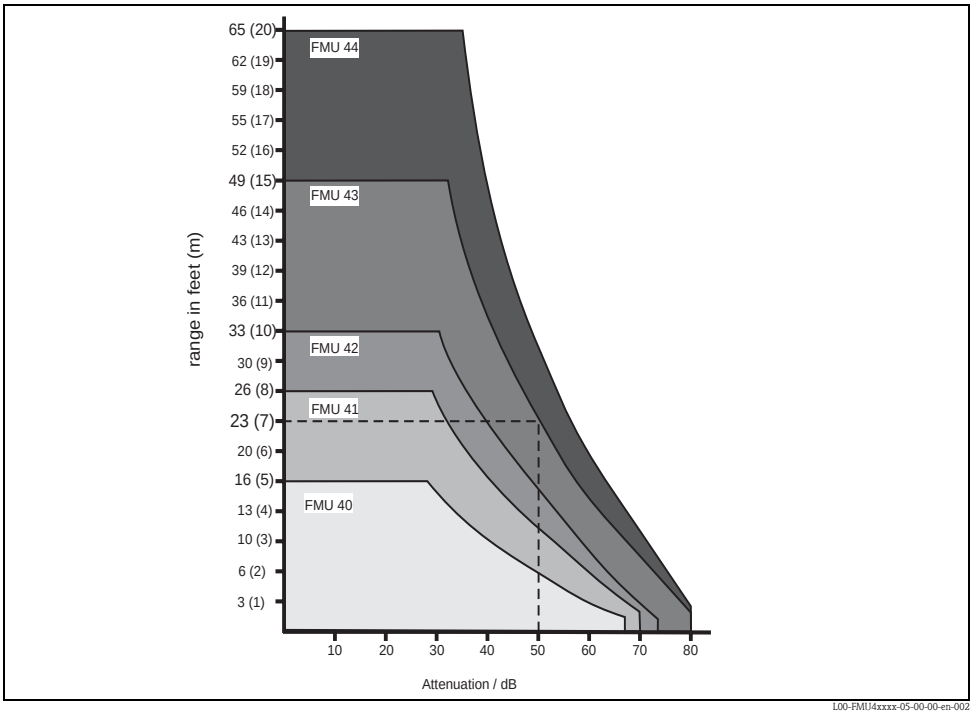
Fluid surface	Attenuation
Calm	0 dB
Waves	5 to 10 dB
Strong turbulence (e.g. stirrers)	10 to 20 dB
Foaming	Ask Endress+Hauser

Bulk material surface	Attenuation
Hard, rough (e.g. rubble)	40 dB
Soft (e.g. peat, dust-covered clinker)	40 to 60 dB

Dust	Attenuation
No dust formation	0 dB
Little dust formation	5 dB
Heavy dust formation	5 to 20 dB

Filling curtain in detection range	Attenuation
None	0 dB
Small quantities	5 to 10 dB
Large quantities	10 to 40 dB

Temperature difference between sensor and product surface	Attenuation
to 68°F (20°C)	0 dB
to 104°F (40°C)	5 to 10 dB
to 176°F (80°C)	10 to 20 dB



Example (for FMU 43)

For typical solid applications, a certain amount of dust coverage is normally present. Therefore, the following range results from the table and the diagram

■ Dust-covered rubble	approx. 50 dB	
■ no dust formation	0 dB	
■ No filling curtain in detection range	0 dB	
■ Temperature diff. < 68°F (20°C)	0 dB	
	approx. 50 dB	=> range approx. 23 ft (7 m)

These measuring conditions have been taken into account during the calculation of the maximum measuring range in solid applications.

Operating frequency

Sensor	Operating frequency
FMU40	approx. 70 kHz
FMU41	approx. 50 kHz
FMU42	approx. 42 kHz
FMU43	approx. 35 kHz
FMU44	approx. 30 kHz

Output

Output signal

according to the instrument version ordered:
- 4 to 20 mA with HART protocol
- PROFIBUS PA
- Foundation Fieldbus (FF)

Signal on alarm

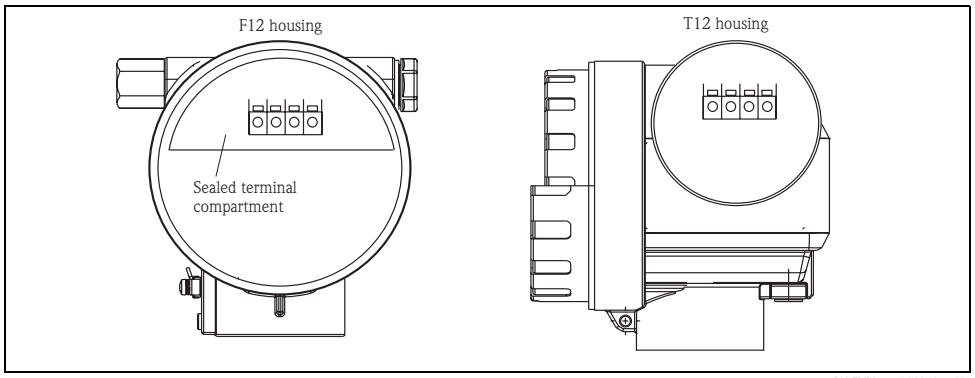
Error information can be accessed via the following interfaces:
- Local display (error symbol, error code and plain text description)
- Current output (error current configurable)
- Digital interface

Load HART	Minimum load for HART communication: 250 Ω
Output damping	Freely selectable, 0 to 255 s
Linearization	The linearization function of the Prosonic M allows conversion of the measured value into any unit of length or volume. In open channels or measuring weirs, also a flow lineariztion is possible (calculation of the flow from the measured level). The linearization table for calculating the volume in an horizontal cylindrical tank is preprogrammed. You can also enter any number of other tables containing up to 32 value pairs either manually or semi-automatically (by filling the vessel under controlled conditions). The supplied ToF Tool operating program can automatically calculate the table for any tank, weir or flume and upload it into the device. Flow curves for open channels can be calculated and entered into the instrument by the ToF Tool as well.

Auxiliary energy

Terminal compartment

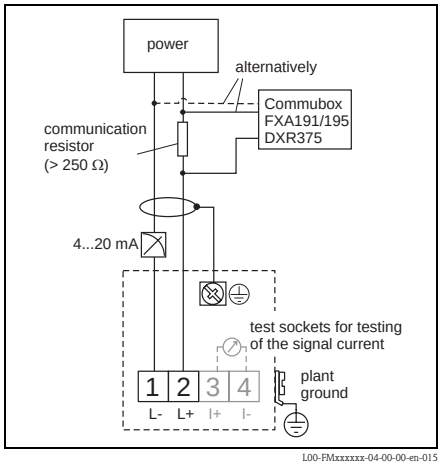
In the F12 housing, the terminals are located underneath the housing cover. In the T12 housing, they are under the cover of the separate terminal compartment.



L00-FMR2xxxx-04-00-00-en-001

Terminal assignment

4 to 20 mA with HART, 2-wire



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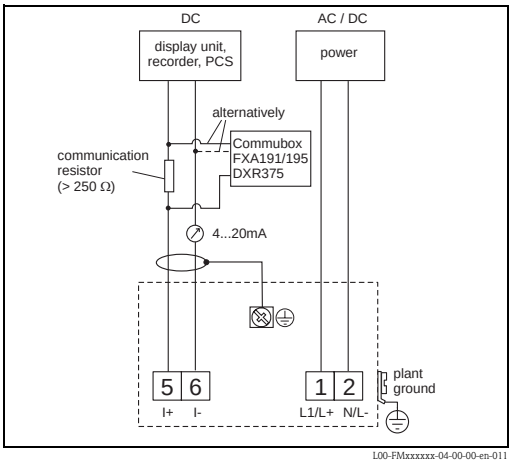
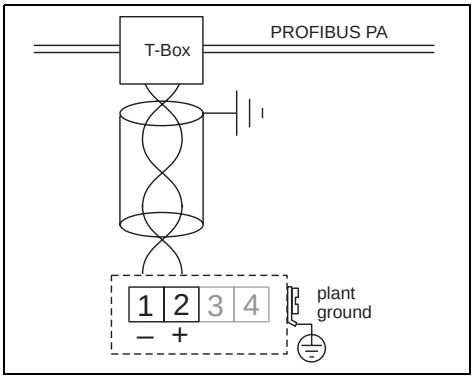
4 to 20 mA active with HART, 4-wire



L00-FMxxxxxx-04-00-00-en-011

- Connect the connecting line to the screw terminals (line cross-sections of 20 to 14 AWG / 0.5 to 2.5mm) in the terminal compartment.
- Use 2-wire twisted pair cable with shield for the connection.
- Protective circuitry against reverse polarity, RFI and over-voltage peaks is built into the device (see also Technical Information TI 241F/00/en "EMC Test Procedures")

PROFIBUS PA



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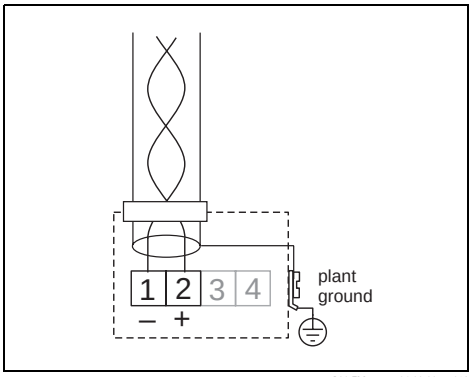
Foundation Fieldbus



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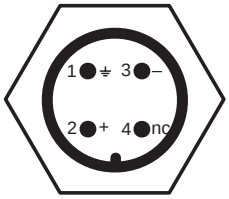
The digital communication signal is transmitted to the bus via a 2-wire connection. The bus also provides the auxiliary energy. Use 2-wire twisted pair cable with shield.

Refer to the following operating manuals for information on cable types, and how to set up and ground the network:
- BA 198F/00/de „PROFIBIS -DP/-PA, Guidelines for planning and commissioning“
- BA 013S/04/en „Foundation Fieldbus, Installation and Commissioning Guidelines“

Fieldbus plug connectors

For the versions with fieldbus plug connector (M12 or 7/8"), the signal line can be connected without opening the housing.

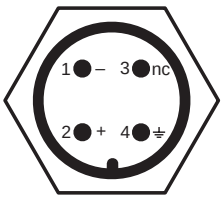
Pin assignment of the M12 plug connector (PROFIBUS PA plug)



L00-FMxxxxxx-04-00-00-yy-016

Pin	Meaning
1	Ground
2	Signal +
3	Signal -
4	not connected

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



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

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

Supply voltage

HART, 2-wire

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

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

1) Start-up current 11 mA

HART, 4-wire, active

Version	Voltage	max. load
DC	10.5 to 32 V	600 Ω
AC 50/60 Hz	90 to 253 V	600 Ω

Terminals

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

Cable entry

- Cable gland: M20x1.5 (recommended cable diameter 0.24" to 0.39" / 6 to 10 mm)
- Cable entry G ½ or ½ NPT
- PROFIBUS-PA M12 plug
- Fieldbus Foundation 7/8" plug

Power consumption

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

Current consumption (2-wire-instruments)

Communication	Current consumption
HART	3.6 to 22 mA
PROFIBUS PA	max. 13 mA
Foundation Fieldbus	max. 15 mA

HART ripple

47 to 125 Hz: Vpp = 200 mV (measured at 500 Ω)

Max. noise HART

500 Hz to 10 kHz: Vrms = 2.2 mV (measured at 500 Ω)

Galvanic isolation

With 4-wire devices, the evaluation electronics and main power supply are galvanically isolated from each other.

Performance characteristics

Reaction time

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

- 2-wire devices (FMU40/41/42): min. 2 s
- 2-wire diveces (FMU43 – PROFIBUS PA or FOUNDATION Fieldbus): min. 2 s
- 2-wire devices (FMU44): min. 3 s
- 4-wire devices (FMU40/41/42/43/44): 0.5 s

Reference operating conditions

- Temperature = +68°F (+20°C)
- Pressure = 14.7 psia (1013 mbar abs.)
- Humidity = 50 %
- Ideal reflective surface (e.g. calm, smooth fluid surface)
- No interference reflections within signal beam
- Set application parameters:
  - Tank shape = flat ceiling
  - Medium property = liquid
  - process conditions = calm surface

Measured value resolution

Sensor	Measured value resolution
FMU40	0.04" (1 mm)
FMU41	0.04" (1 mm)
FMU42	0.08" (2 mm)
FMU43	0.08" (2 mm)
FMU44	0.08" (2 mm)

Pulse frequency

- 2-wire devices (FMU40/41/42): max. 0.5Hz
- 2-wire devices (FMU43 – PROFIBUS PA or FOUNDATION Fieldbus): max. 0.5 Hz
- 2-wire devices (FMU44): max. 0.3 Hz
- 4-wire devices (FMU40/41/42/43/44): max. 2Hz

The exact values are dependent on the type of device and the parameter settings.

Measuring error

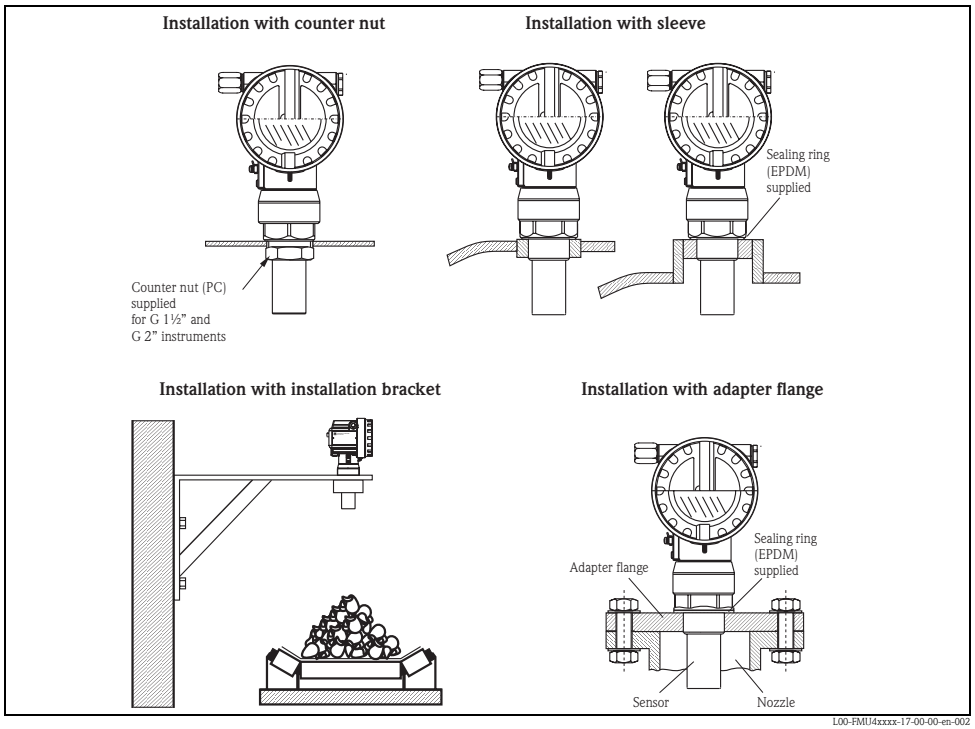
Typical specifications for reference operating conditions (include linearity, repeatability, and hysteresis):

Sensor	Measuring error
FMU40	±0.08" (2 mm) or 0.2% of set measuring distance (empty calibration)[1]
FMU41	± 0.08" (2 mm) or 0.2% of set measuring distance (empty calibration)[1]
FMU42	± 0.16" (4 mm) or 0.2% of set measuring distance (empty calibration)[1]
FMU43	± 0.16" (4 mm) or 0.2% of set measuring distance (empty calibration)[1]
FMU44	± 0.16" (4 mm) or 0.2% of set measuring distance (empty calibration)[1]

[1] whichever is greater

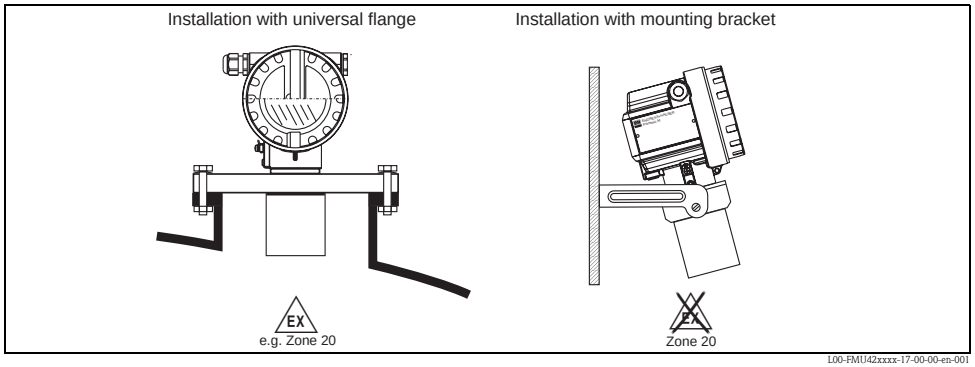
Installation conditions

Installation variants FMU 40, FMU 41

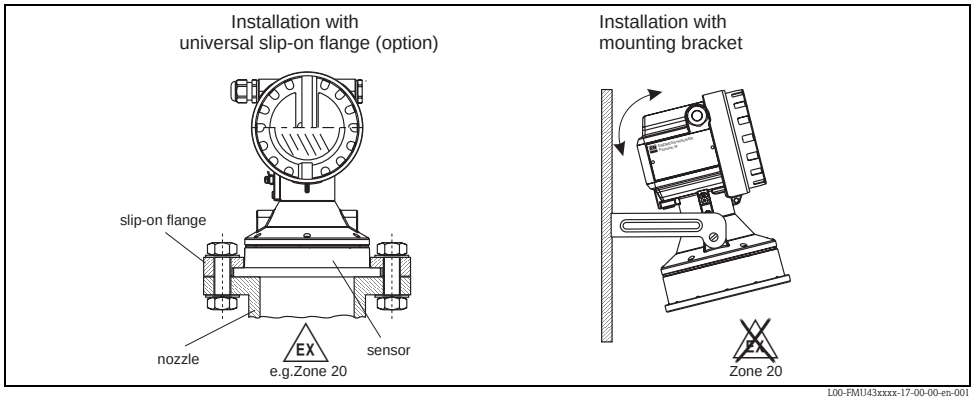


For installation bracket or adapter flange s. chapter "Accessories".

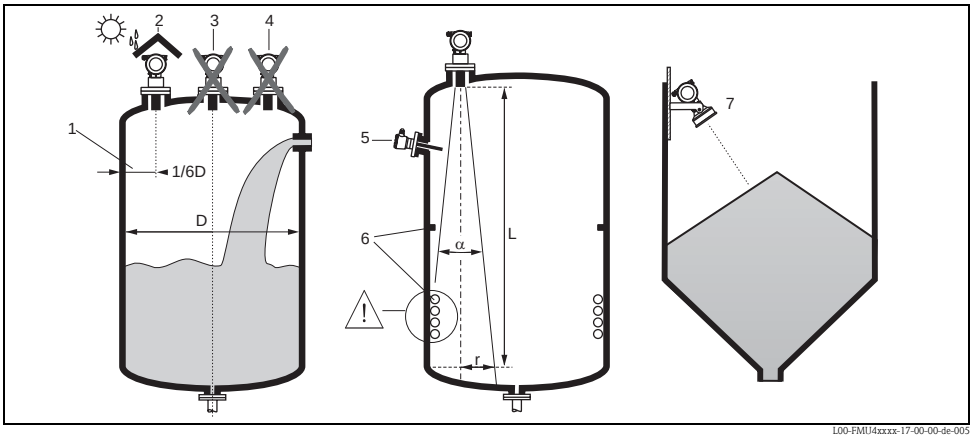
Installation variants FMU42, FMU44



Installation variants FMU 43



Installation conditions for level measurements



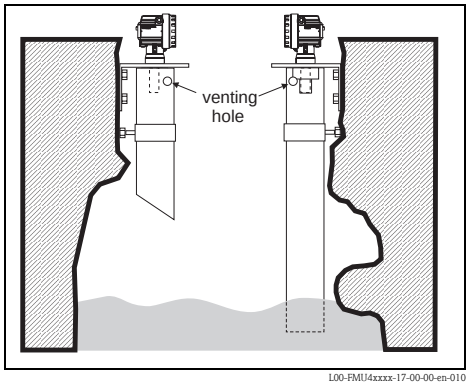
L00-FMU4xxxx-17-00-00-de-005

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

Sensor	α	L_{max}	r_{max}
FMU40	11°	16 ft (5 m)	18.9" (0.48 m)
FMU41	11°	26 ft (8 m)	30.3" (0.77 m)
FMU42	9°	33 ft (10 m)	31.1" (0.79 m)
FMU43	6°	50 ft (15 m)	31.1" (0.79 m)
FMU44	11°	65 ft (20 m)	76" (1.93 m)

Installation in narrow shafts

In narrow shafts with strong interference echoes, we recommend using an ultrasound guide pipe (e.g. PE or PVC wastewater pipe) with a minimum diameter of 4" (100 mm).
Make sure that the pipe is not soiled by accumulated dirt. If necessary, clean the pipe at regular intervals.



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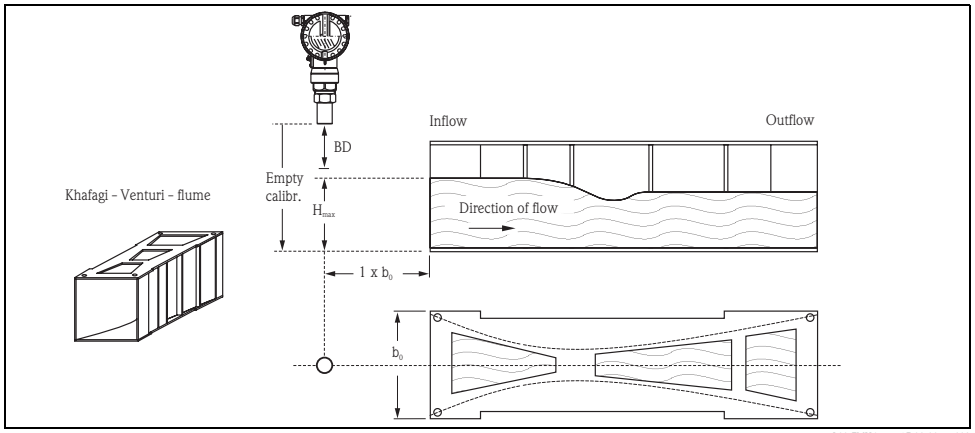
Installation conditions for flow measurements

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

Example: Khafagi-Venturi flume



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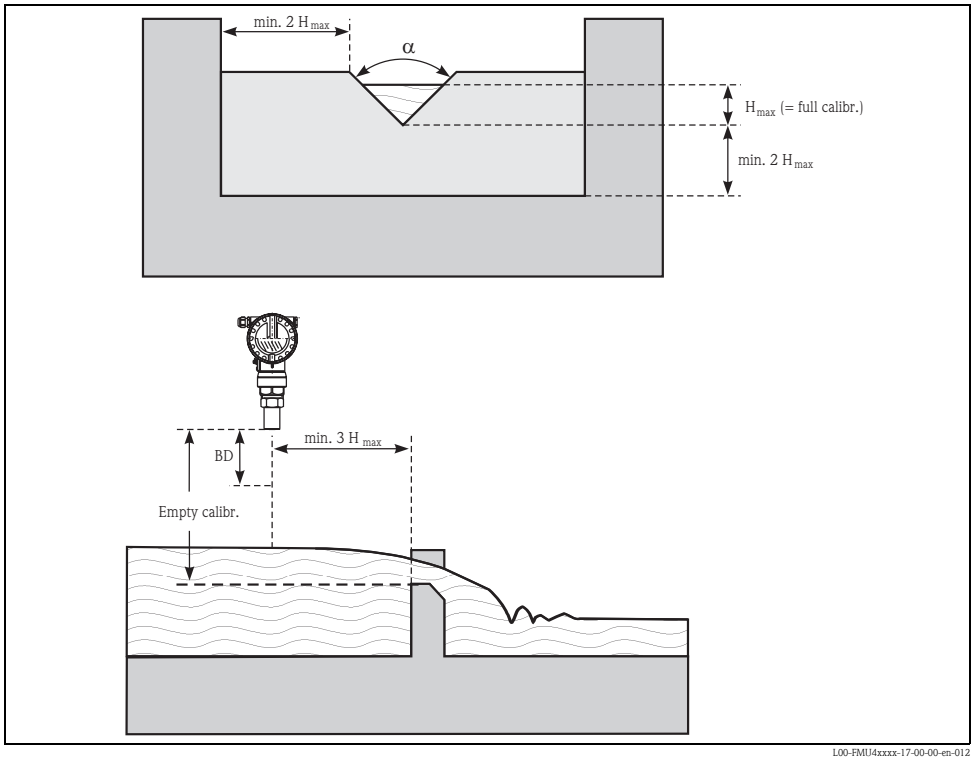
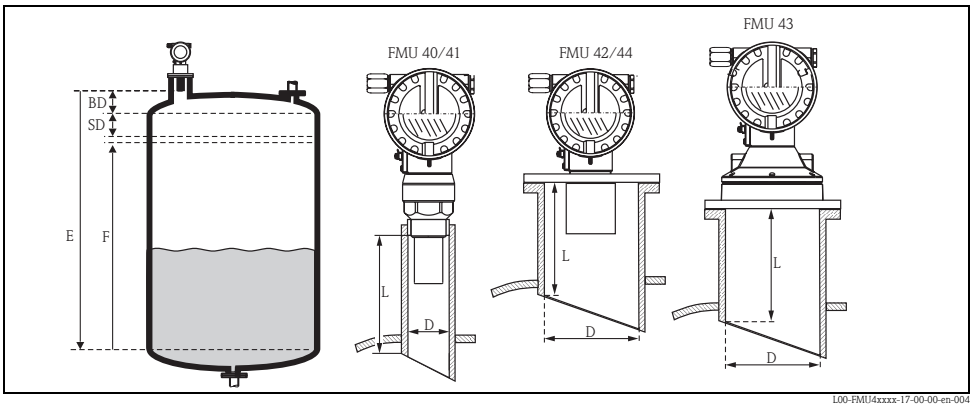
Example: Triangular weir



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

Blocking distance, nozzle installation

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



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

Sensor	BD	Max. range liquids	Max. range bulk materials	nozzle diameter inches (mm)	max. nozzle length inches (mm)
FMU40	9.8" (0.25 m)	16 ft (5 m)	6.5 ft (2 m)	2 (50)	approx. 3.15 (80)
				3 (80)	approx. 9.45 (240)
				4 (100)	approx. 11.8 (300)
FMU41	13.8" (0.35 m)	26 ft (8 m)	11.5 ft (3.5 m)	3 (80)	approx. 9.45 (240)
				4 (100)	approx. 11.8 (300)
FMU42	15.7" (0.4 m)	33 ft (10 m)	16 ft (5 m)	3 (80)	approx. 9.8 (250)
				4 (100)	approx. 11.8 (300)
FMU43	23.6" (0.6 m)	50 ft (15 m)	23 ft (7 m)	min. 4 (100)	approx. 11.8 (300)
FMU44	19.7" (0.5 m)	65 ft (20 m)	33 ft (10 m)	min. 6 (150)	approx. 15.7 (400)

Caution!
If the blocking distance is not above the maximum level, it may cause device malfunction.

Note!
In order to notice if the level approaches the blocking distance, you can specify a safety distance (SD). If the level is within this safety distance, the Prosonic M outputs a warning or alarm message.

Ambient conditions

Ambient temperature

-40 to +176°F (-40 to +80°C)
The functionality of the LC display becomes restricted at Tu< -4°F (-20°C) and Tu> +140°F (+60°C).
If the device is operated outdoors in strong sunlight, you should use a protective cover.

Storage temperature

-40 to +176°F (-40 to +80°C)

Resistance to alternating temperature cycles

to DIN EN 60068-2-14; Nb test : +176°F/-40°F (+80°C/-40°C), 1 K/min, 100 cycles

Climate class

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

Ingress protection

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

Caution!
Degree of protection IP 68 NEMA 6P applies for M12 PROFIBUS-PA plugs only when the PROFIBUS cable is plugged in.

Vibration resistance

DIN EN 60068-2-64 / IEC 68-2-64: 20 to 2000 Hz, 1 $(m/s^2)^2/Hz$; 3 x 100 min

Electromagnetic compatibility (EMC)

- Interference emission to EN 61326, Equipment Class B
- Interference immunity to EN 61326, Appendix A (Industrial) and NAMUR Recommendation NE 21 (EMC).
- A standard installation cable is sufficient if only the analogue signal is used. Use a screened cable when working with a superimposed communication signal (HART).

Process conditions

Process temperature

-40 to +176°F (-40 to +80°C)
A temperature sensor is integrated in the sensor for correction of the temperature-dependent time-of-flight.

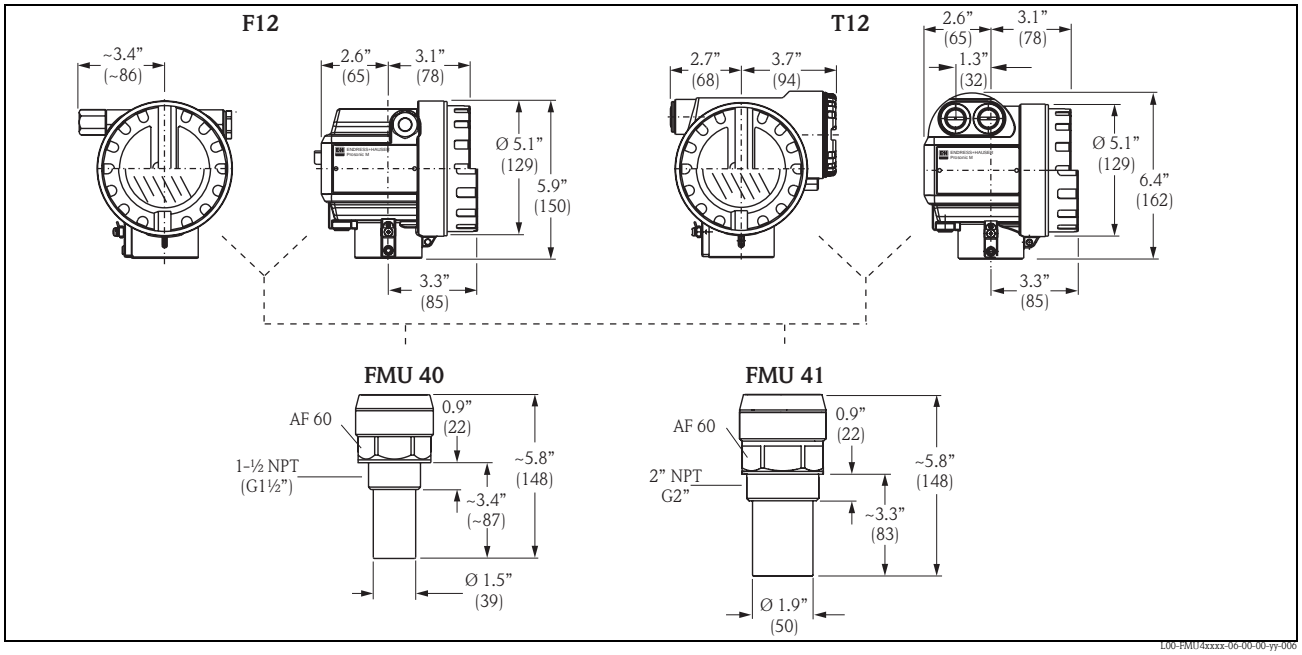
Process pressure

- FMU 40/41: 10 to 44 psia (0.7 bar to 3bar abs.)
- FMU 42/43/44: 10 to 36 psia (0.7 bar to 2.5bar abs.)

Mechanical construction

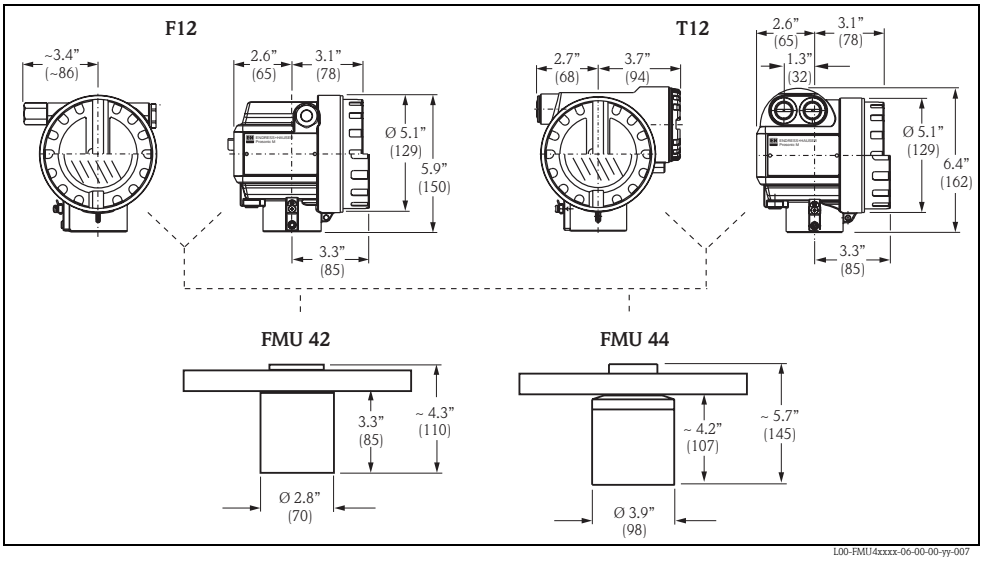
Design; dimensions

FMU40, FMU41



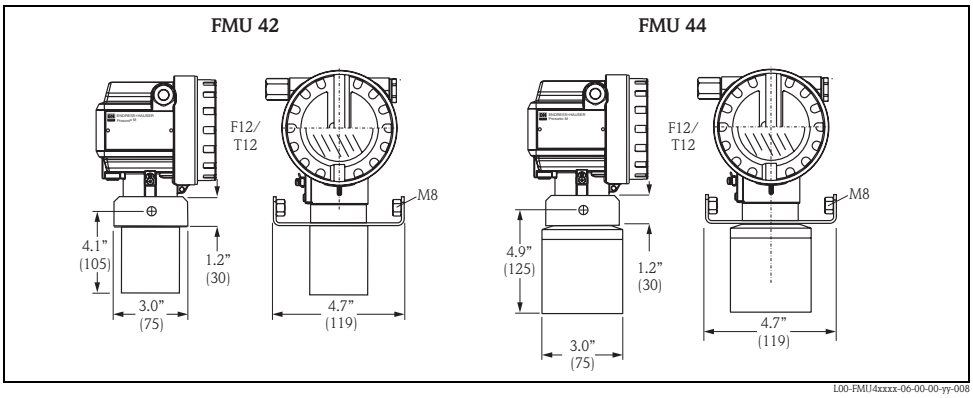
Dimensions in inches (mm)

FMU42, FMU44 with slip-on flange



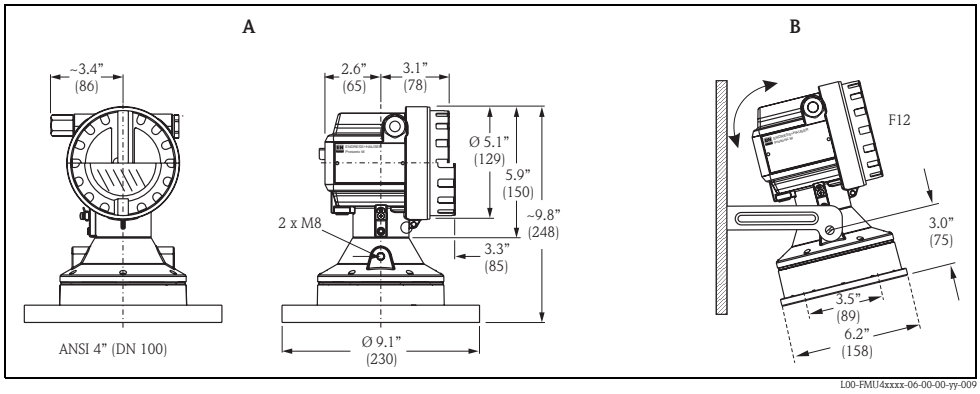
Dimensions in inches (mm)

FMU42, FMU44 with mounting bracket



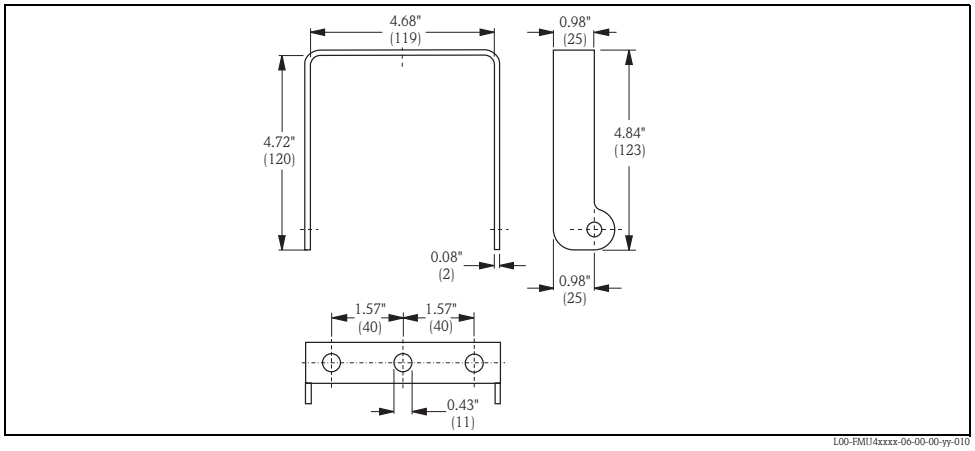
Dimensions in inches (mm)

FMU43



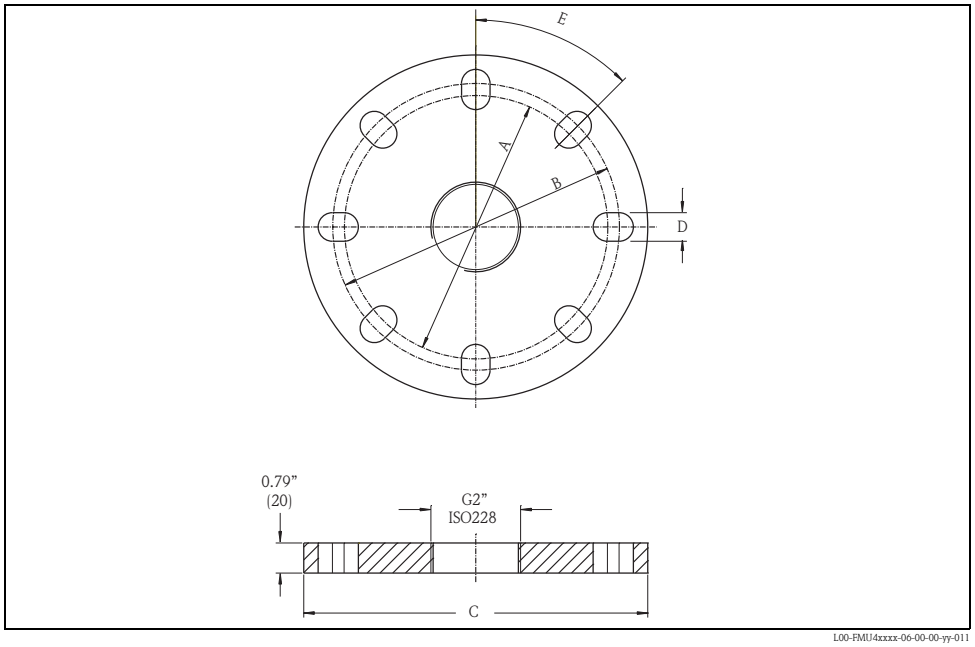
Dimensions in inches (mm);
A: with slip-on flange; B: with mounting bracket

Mounting bracket for FMU42, FMU43 and FMU44



Dimensions in inches (mm)

Flanges for FMU42 and FMU44



suitable for	A	B	C	D	E	number of bolt holes
3" 150lbs / DN80 PN16 / 10K 80	150 mm (5.91")	160 mm (6.30")	200 mm (7.87")	19 mm (0.75")	45°	8
4" 150 lbs / DN100 PN16 / 10K 100	175 mm (6.90")	190,5 mm (7.50")	228,6 mm (9.00")	19 mm (0.75")	45°	8
6" 150 lbs / DN150 PN16 / 10 K 150	240 mm (9.45")	241,3 mm (9.50")	285 mm (11.22")	23 mm (0.91")	45°	8
8" 150 lbs	298,5 mm (11.75")	298,5 mm (11.75")	342,9 mm (13.50")	22, 5 mm (0.89")	45°	8
DN200 PN16 / 10 K 200	290 mm (11.42")	295 mm (11.61")	340 mm (13.39")	23 mm (0.91")	30°	12

Weight

Sensor	Weight
FMU40	approx. 5.5 lb (2.5 kg)
FMU41	approx. 6 lb (2.6 kg)
FMU42	approx. 6.6 lb (3 kg)
FMU43	approx. 8 lb (3.5 kg)
FMU44	approx. 9 lb (4 kg)

Housing design

Types of housings

- F12 housing with sealed terminal compartment for standard or intrinsically safe (EEx ia) applications
- T12 housing with separate terminal compartment and explosionproof encapsulation

Material

Aluminum, seawater resistant, powder-coated

Cover

- Aluminum, for version without local display
- Inspection glass for version with local display. This version cannot be supplied together with the ATEX II 1/2 D certificate.

Process connection, sealing material, sensor material

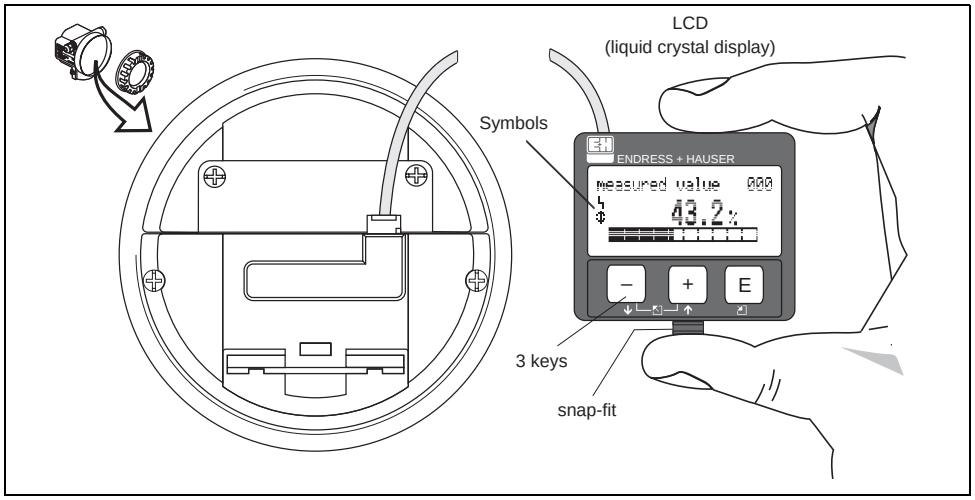
Sensor	Process connection	Material in contact with process
FMU40	■ Thread G 1½“ ■ Thread NPT 1½“ – 11.5	Sensor: PVDF Seal: EPDM
FMU41	■ Thread 2" ■ Thread NPT 2" – 11,5	Sensor: PVDF Seal: EPDM
FMU42	■ Universal flange DN 80 PN16 / ANSI 3" 150 lbs / JIS 10K 80 ■ Universal flange DN 100 PN16 / ANSI 4" 150 lbs / JIS 10K 100 ■ Mounting bracket	Sensor: PVDF Seal: VITON or EPDM Flange: PP, PVDF or SS 316L (1.4435 or 1.4404) [1]
FMU43	■ Universal flange DN 100 / ANSI 4" / JIS16K100 ■ Mounting bracket	Sensor: UP and SS 316Ti Seal: EPDM Flange: PP or SS 316Ti
FMU44	■ Universal flange DN 100 PN16 / ANSI 4" 150 lbs / JIS 10K 100 ■ Universal flange DN 150 PN16 / ANSI 6" 150 lbs / JIS 10K 150 ■ Universal flange DN200 PN16 / JIS 10K 200 ■ Flange ANSI 8" 150 lbs ■ Mounting bracket	Sensor PVDF Seal: VITON or EPDM Flange: PP, PVDF or SS 316L (1.4435 or 1.4404) [1]

1 Endress+Hauser supplies DIN/EN flanges made of stainless steel AISI 316L with material number 1.4435 or 1.4404. With regard to their temperature stability properties, the materials 1.4435 and 1.404 are grouped under 13E0 in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.

Human interface

Display and operating elements

The LCD module VU 331 for display and operation is located beneath the housing cover. The measured value is legible through the glass in the cover. Open the cover to operate the device.



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Symbol in display	continuous	flashing		
Meaning	Alarm	Warning	Communication	Security Locking

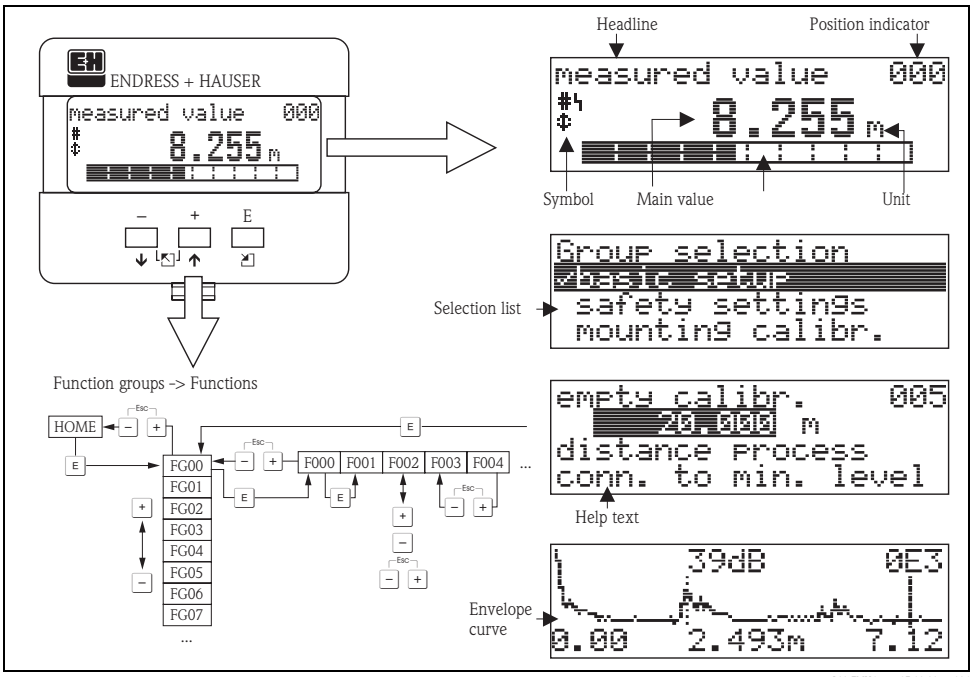
Function of the keys

Key(s)	**Meaning**
+ or ↑	Navigate upwards in the selection list Edit numeric value within a function
– or ↓	Navigate downwards in the selection list Edit numeric value within a function
Esc – + or ←	Navigate to the left within a function group
E	Navigate to the right within a function group, confirmation.
+ and E or – and E	Contrast settings of the LCD
+ and – and E	Hardware lock / unlock After a hardware lock, an operation of the instrument via display or communication is not possible! The hardware can only be unlocked via the display. An unlock parameter must be entered to do so.

Local operation

Operation with VU 331

The LC-Display VU 331 allows configuration via 3 keys directly at the instrument. All device functions can be set through a menu system. The menu consists of function groups and functions. Within a function, application parameters can be read or adjusted. The user is guided through a complete configuration procedure.



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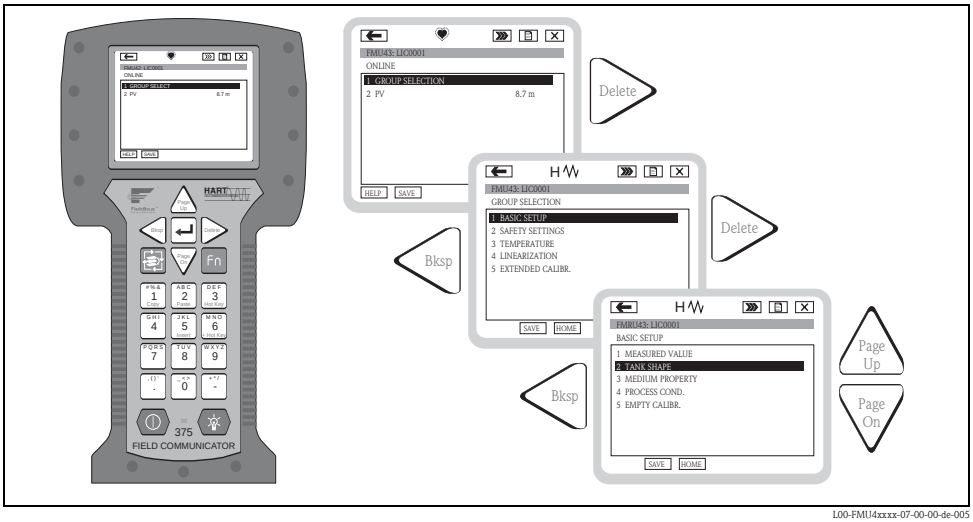
Operation with the handheld terminal DXR 375

On devices with HART communication, you can also access the menu using the handheld terminal DXR 375.



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

Remote operation

Operation with ToF Tool

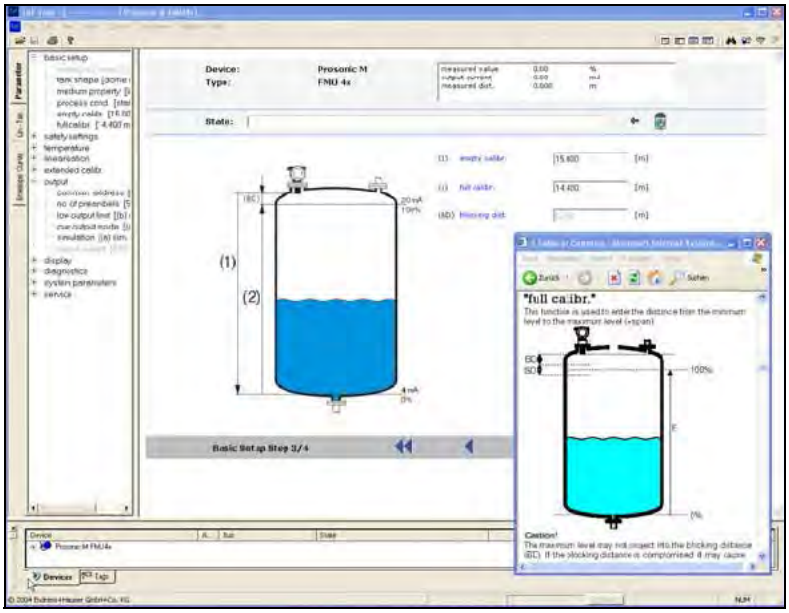
The ToF Tool is a graphical operation software for instruments from Endress+Hauser. It is used to support commissioning, securing of data, signal analysis and documentation of the instruments. It is compatible with the following operating systems: WinNT4.0, Win2000 and WinXP.

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

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

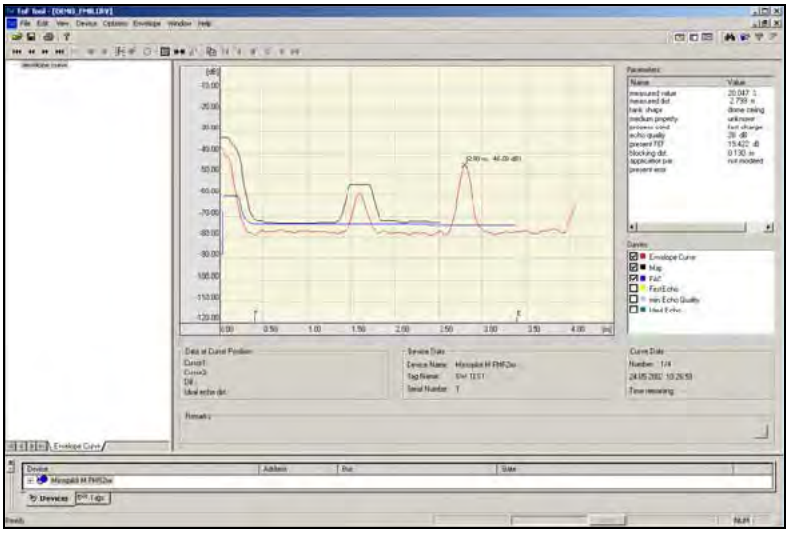
Connection options
- HART with Commubox FXA 191 (available as accessory)
- PROFIBUS PA
- Service-interface with adapter FXA 193 (available as accessory)

Menu-guided commissioning:



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

Signal analysis via envelope curve:



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

Operation with FieldCare

FieldCare is Endress+Hauser's FDT based Plant Asset Management Tool. It can configure all intelligent field devices in your plant and supports you in managing them. By using status information, it also provides a simple but effective means of checking their health.

- Supports Ethernet, HART, PROFIBUS, FOUNDATION Fieldbus etc.
- Operates all Endress+Hauser devices
- Operates all third-party actuators, I/O systems and sensors supporting the FDT standard
- Ensures full functionality for all devices with DTMs
- Offers generic profile operation for any third-party fieldbus device that does not have a vendor DTM

Operation with Commuwin II (for communication variants HART or PROFIBUS-PA)

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

Commuwin II supports the following functions:
- Online configuration of transmitters
- Loading and saving of instrument data (Upload/Download)
- Orderly visualisation of measured values and limit values
- Display and recording of measured values with a line recorder

It is not possible to display envelope curves with Commuwin II. To display them, please use the ToF Tool program supplied.

Connections:
- HART with Commubox FXA 191 (available as accessory)
- PROFIBUS PA

Operation with NI-FBUS Configurator (only Foundation Fieldbus)

The NI-FBUS Configurator is an easy-to-use graphical environment for creating linkages, loops, and a schedule based on the fieldbus concepts.

You can use the NI-FBUS Configurator to configure a fieldbus network as follows:
- Set block and device tags
- Set device addresses
- Create and edit function block control strategies (function block applications)
- Configure vendor-defined function and transducer blocks
- Create and edit schedules
- Read and write to function block control strategies (function block applications)
- Invoke Device Description (DD) methods
- Display DD menus
- Download a configuration
- Verify a configuration and compare it to a saved configuration
- Monitor a downloaded configuration
- Replace devices
- Save and print a configuration

Certificates and Approvals

CE mark

The measuring system meets the legal requirements of the EC-guidelines. Endress+Hauser confirms the instrument passing the required tests by attaching the CE-mark.

Hazardous approvals

The available certificates are listed in the ordering information. Note the associated safety instructions (XA) and control or installation drawing documents (ZD). Documentation can be requested from Endress+Hauser.

External standards and guidelines

EN 60529

Protection class of housing (IP-code)

EN 61326

Electromagnetic compatibility (EMC requirements)

NAMUR

Standards committee for measurement and control in the chemical industry

Ordering information

Product structure FMU 40

Certificates								
A	Variant for non-hazardous area							
E	NEPSI Ex nA II T6							
G	ATEX II 3G EEx nA II T6							
I	NEPSI Ex ia IIC T6							
J	NEPSI Ex d(ia) IIC T6							
K	TIIS Ex ia II C T6							
N	CSA General Purpose							
Q	NEPSI DIP							
S	FM IS Cl. I,II,III Div. 1 Gr. A-G / NI Cl. I Div. 2							
T	FM XP Cl. I,II,III Div. 1 Gr. A-G							
U	CSA IS Cl. I,II,III Div. 1 Gr. A-G / NI Cl. I Div. 2							
V	CSA XP Cl. I,II,III Div. 1 Gr. A-G							
1	ATEX II 1/2 G or II 2 G; EEX ia IIC T6							
2	ATEX II 1/2D, Alu blind cover							
4	ATEX II 1/2 G or II 2 G; EEX d [ia] IIC T6							
5	ATEX II 1/3D							
Y	Special certificate							
		Process connection						
		R	G 1½“ threadISO 228					
		N	NPT 1½“ - 11.5 thread					
		Y	Special version					
				Power supply/communication				
				B	2 wire, 4...20mA-loop/HART			
				H	4 wire, 10.5...32VDC / 4-20mA HART			
				G	4 wire, 90...253VAC / 4-20mA HART			
				D	2 wire, PROFIBUS PA			
				F	2 wire, Foundation Fieldbus			
				Y	Special version			
					Display / on-site operation			
					1	Without LC display		
					2	With LC display VU 331 incl. on-site operation		
					3	Prepared for remote display FHX 40		
					9	Special version		
						Housing		
						A	Aluminum F12 housing coated to IP 68	
						C	Aluminum T12 housing coated to IP 68; with separate terminal compartment	
						D	Aluminum T12 housing coated to IP 68; with separate terminal compartment; with overvoltage protection	
						9	Special version	
							Screw union/entry	
							2	M20x1.5 screw union
							3	G 1/2“ entry
							4	NPT 1/2“ entry
							5	M12 PROFIBUS-PA plug-in connector
							6	7/8" FF plug
							9	Special version
FMU 40 -								Product designation

Product structure FMU 41

Certificates								
A	Variant for non-hazardous area							
E	NEPSI Ex nA II T6							
G	ATEX II 3G EEx nA II T6							
I	NEPSI Ex ia IIC T6							
J	NEPSI Ex d(Ia) IIC T6							
K	TIIS Ex ia II C T6							
N	CSA General Purpose							
Q	NEPSI DIP							
S	FM IS Cl. I,II,III Div. 1 Gr. A-G / NI Cl. I Div. 2							
T	FM XP Cl. I,II,III Div. 1 Gr. A-G							
U	CSA IS Cl. I,II,III Div. 1 Gr. A-G / NI Cl. I Div. 2							
V	CSA XP Cl. I,II,III Div. 1 Gr. A-G							
1	ATEX II 1/2 G or II 2 G; EEX ia IIC T6							
2	ATEX II 1/2D, Alu blind cover							
4	ATEX II 1/2 G or II 2 G; EEX d [ia] IIC T6							
5	ATEX II 1/3D							
Y	Special certificate							
		Process connection						
		R	G 2“ threadISO 228					
		N	NPT 2“ - 11.5 thread					
		Y	Special version					
			Power supply/communication					
			B	2 wire, 4...20mA-loop/HART				
			H	4 wire, 10.5...32VDC / 4-20mA HART				
			G	4 wire, 90...253VAC / 4-20mA HART				
			D	2 wire, PROFIBUS PA				
			F	2 wire, Foundation Fieldbus				
			Y	Special version				
				Display / on-site operation				
				1	Without LC display			
				2	With LC display VU 331 incl. on-site operation			
				3	Prepared for remote display FHX 40			
				9	Special version			
					Housing			
					A	Aluminum F12 housing coated to IP 68		
					C	Aluminum T12 housing coated to IP 68 with separate terminal compartment		
					D	Aluminum T12 housing coated to IP 68; with separate terminal compartment; with overvoltage protection		
					9	Special version		
						Screw union/entry		
						2	M20x1.5 screw union	
						3	G 1/2“ entry	
						4	NPT 1/2“ entry	
						5	M12 PROFIBUS-PA plug-in connector	
						6	7/8" FF plug	
						9	Special version	
FMU 41 -								Product designation

Product structure FMU 42

	Certificates									
	A	Variant for non-hazardous area								
	E	NEPSI Ex nA II T6								
	G	ATEX II 3G EEx nA II T6								
	I	NEPSI Ex ia IIC T6								
	J	NEPSI Ex d (Ia) IIC T6								
	K	TIIS Ex ia II C T6 (in preparation)								
	N	CSA General Purpose								
	Q	NEPSI DIP								
	S	FM IS Cl. I,II,III Div. 1 Gr. A-G / NI Cl. I Div. 2								
	T	FM XP Cl. I,II,III Div. 1 Gr. A-G								
	U	CSA IS Cl. I,II,III Div. 1 Gr. A-G / NI Cl. I Div. 2								
	V	CSA XP Cl. I,II,III Div. 1 Gr. A-G								
	1	ATEX II 1/2 G EEX ia IIC T6								
	2	ATEX II 1/2 D, Alu bond cover								
	4	ATEX II 1/2 G EEX d [ia] IIC T6								
	5	ATEX II 1/3D								
	Y	Special certificate								
		Process connection								
		M	mounting bracket FAU20							
		P	DN80/ANSI 3"/JIS10K80, PP, Universal flange							
		Q	DN80/ANSI 3"/JIS10K80, PVDF, Universal flange							
		S	DN80/ANSI 3"/JIS10K80, 316L, Universal flange							
		T	DN100/ANSI 4"/JIS16K100, PP, Universal flange							
		U	DN100/ANSI 4"/JIS16K100, PVDF, Universal flange							
		V	DN100/ANSI 4"/JIS16K100, 316L, Universal flange							
		Y	Special version							
			Power supply/communication							
			B	2 wire, 4...20mA-loop/HART						
			H	4 wire, 10.5...32VDC / 4-20mA HART						
			G	4 wire, 90...253VAC / 4-20mA HART						
			D	2 wire, PROFIBUS PA						
			F	2 wire, Foundation Fieldbus						
			Y	Special version						
				Display / on-site operation						
				1	Without LC display					
				2	With LC display VU 331 incl. on-site operation					
				3	Prepared for remote display FHX 40					
				9	Special version					
					Housing					
					A	Aluminum F12 housing coated to IP 68				
					C	Aluminum T12 housing coated to IP 68, with separate terminal compartment				
					D	Aluminum T 12 housing coated to IP 68, with separate terminal compartment; with overvoltage protection				
					Y	Special version				
						Gland/Entry				
						2	M20x1.5 gland			
						3	G 1/2“ entry			
						4	NPT 1/2“ entry			
						5	M12 PROFIBUS-PA plug			
						6	7/8" FF plug			
						9	Special version			
							Sealing Sensor/Flange			
							2	VITON flat sealing		
							3	EPDM flat sealing		
							9	special version		
								Additional options		
								A	Additional options not selected	
FMU 42 -										Product designation

Product structure FMU 43

	Certificates							
	A	Variant for non-hazardous area						
	M	FM DIP Class II, III, Div. 1, Gr. E,F,G NI						
	N	CSA General Purpose						
	P	CSA DIP, Class II, III, Div. 1, Gr. E,F,G NI						
	Q	NEPSI DIP						
	2	ATEX II 1/2 D or II 2 D, Aluminium Deckel						
	5	ATEX II 1/3 D or II 3 D, Sichtdeckel						
	Y	Special version						
		Process connection/material						
		P	Flange DN 100/ANSI 4"/JIS 16K100, PP (universal slip-on flange included)					
		S	Flange DN 100/ANSI 4"/JIS 16K100, SS 316TI (universal slip-on flange included)					
		K	Without slip-on flange/without mounting bracket (customer mounting equipment)					
		M	With mounting bracket					
		Y	Special version					
			Power supply/communication					
			H	4 wire, 10.5...32VDC / 4-20mA HART				
			G	4 wire, 90...253VAC / 4-20mA HART				
			D	2 wire, PROFIBUS PA				
			F	2 wire, Foundation Fieldbus				
			Y	Special version				
				Display / on-site operation				
				1	Without LC display			
				2	With LC display VU 331 incl. on-site operation			
				3	Prepared for remote display FHX 40			
				9	Special version			
					Housing			
					A	Aluminum F12 housing coated to IP 68		
					9	Special version		
						Screw union/entry		
						2	M20x1.5 screw union	
						3	G 1/2“ entry	
						4	NPT 1/2“ entry	
						5	M12 PROFIBUS-PA plug-in connector	
						6	7/8" FF plug	
						9	Special version	
FMU 43 -								Product designation

Product structure FMU 44

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

					Housing					
					A	F12 Alu, coated IP68 NEMA6P				
					C	T12 Alu, coated IP68 NEMA6P, Separate conn. compartment				
					D	T12 Alu, coated IP68 NEMA6P + OVP, Sep. conn. compartment, OVP = overvoltage protection				
					9	Special version, to be specified				
						CAble entry				
						2	Gland M20 (EEx d > thread M20)			
						3	Thread G1/2			
						4	Thread NPT 1/2			
						5	Plug M12			
						6	Plug 7/8“			
						9	Special version, to be specified			
							Process Sealing Sensor/ Flange			
							2	Viton		
							3	EPDM		
							9	Special version, to be specified		
								Additional option		
								A	Basic version	
								Y	Special version, to be specified	
FMU 44 -										complete product designation

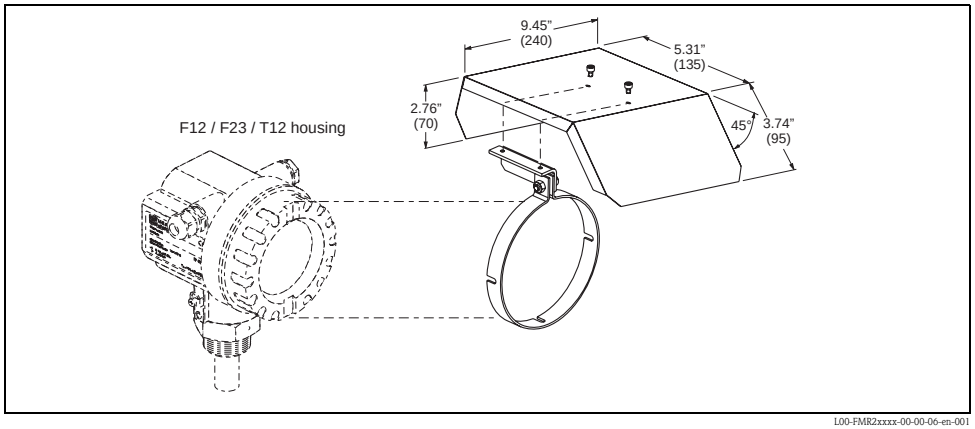
Scope of delivery

- Instrument according to the version ordered
- "ToF Tool FieldTool Package (2 CD-ROMs: Program CD-ROM, Utility CD-ROM)
- Operating manual according to the communication version
- for certified instrument versions: Safety Instructions, Control- or Installation drawings
- for FMU 40 *R**** and FMU 41 *R****: counter nut (PC)
- for FMU 40/41: sealing ring (EPDM)
- for gland M20x1.5:
  – 1 cable gland for 2-wire instruments
  – 2 cable glands for 4-wire instruments
  The cable glands are mounted on delivery.

Accessories

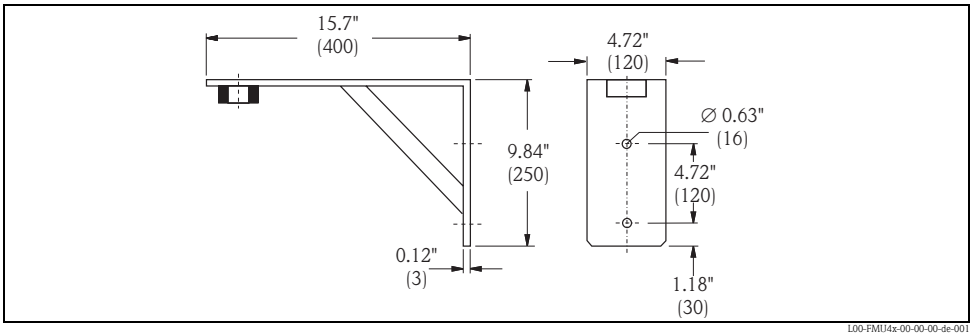
Weather protection cover

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



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

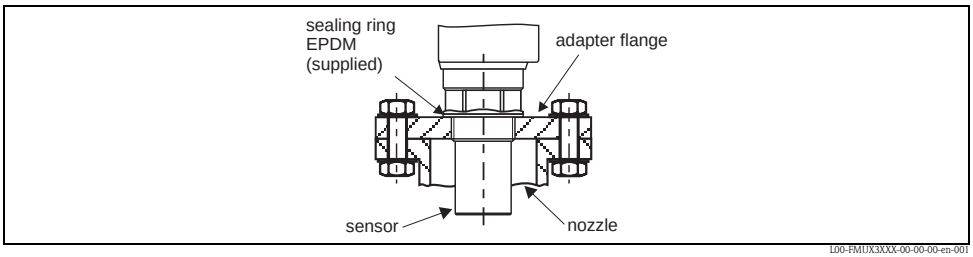
Installation bracket for FMU 40/41



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

suited for NPT 1½" and 2" as well

Adapter flange



Version with metrical thread (FAU 70 E)

	Process Connection
12	DN 50 PN 16 A, flange EN1092-1 (DIN2527 B)
14	DN 80 PN 16 A, flange EN1092-1 (DIN2527 B)
15	DN 100 PN 16, A, flange EN1092-1 (DIN2527 B)

	Sensor Connection
3	Thread ISO228 G1-1/2
4	Thread ISO228 G2

	Flange Material
2	316L
7	Polypropylene

FAU 70 E	Product designation

Version with conical thread(FAU 70 A)

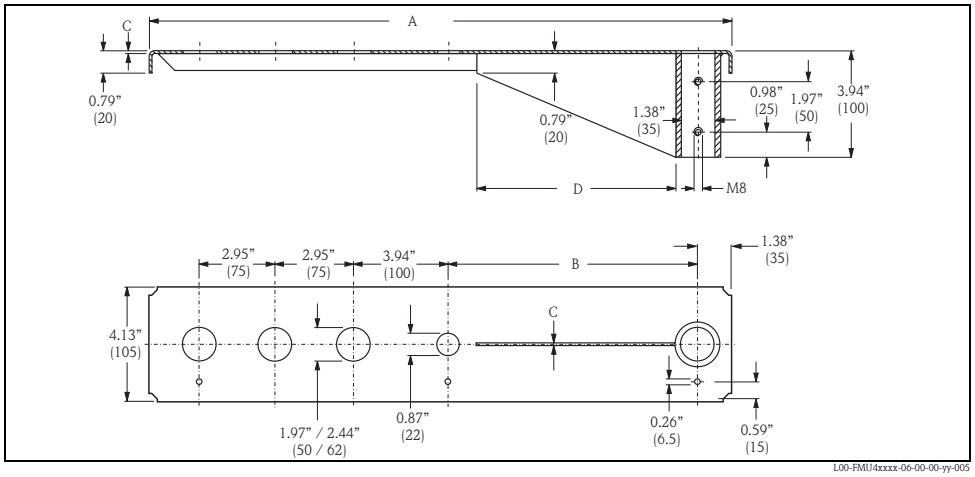
	Process Connection
22	2" 150lbs FF, flange ANSI B16.5
24	3" 150lbs FF, flange ANSI B16.5
25	4" 150lbs FF, flange ANSI B16.5

	Sensor Connection
5	Thread NPT1-1/2
6	Thread NPT2

	Flange Material
2	316L
7	Polypropylene

FAU 70 A	Product designation

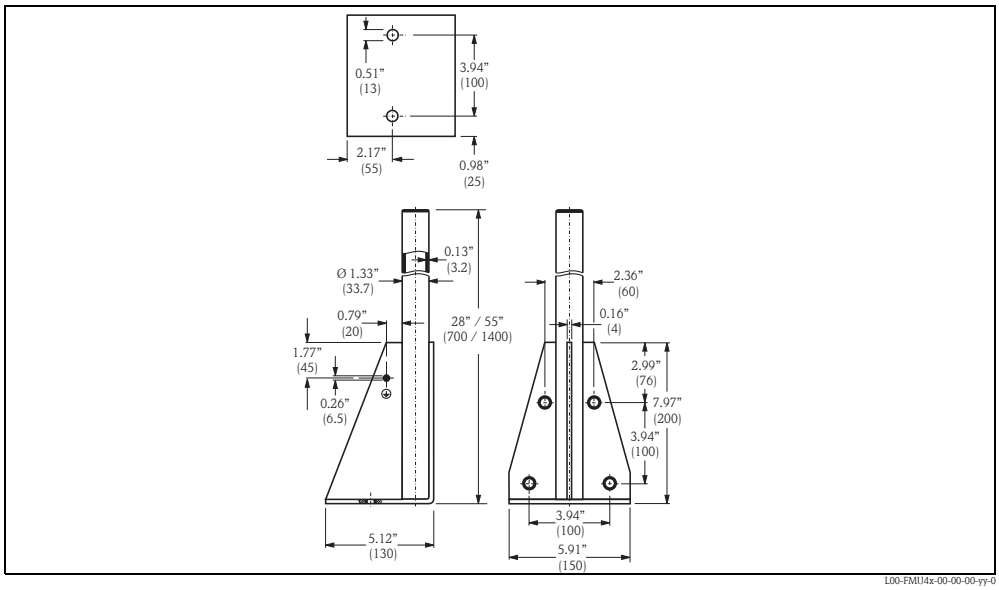
Cantilever



A	B	C	D	for Sensor	Material	Order Code
23" (585 mm)	9.83" (250 mm)	0.08" (2 mm)	7.87" (200 mm)	FMU 40	1.4301 (AISI 304)	52014132
					galv. steel	52014131
				FMU 41	1.4301 (AISI 304)	52014136
					galv. steel	52014135
42.7" (1085 mm)	29.5" (750 mm)	0.12" (3 mm)	11.8" (300 mm)	FMU 40	1.4301 (AISI 304)	52014134
					galv. steel	52014133
				FMU 41	1.4301 (AISI 304)	52014138
					galv. steel	52014137

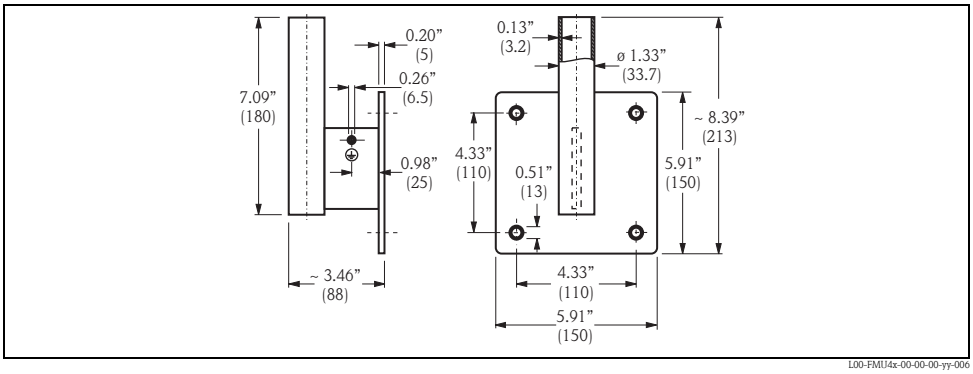
- The 1.97" (50 mm) or 2.44" (62 mm) orifices serve for the mounting of the FMU 40 or FMU 41 sensor, respecitvely.
- The 0.87" (22 mm) orifice may be used for an additional sensor.

Mounting Frame



Height	Material	Order Code
28" (700 mm)	galv. steel	919791-0000
28" (700 mm)	1.4301 (AISI 304)	919791-0001
55" (1400 mm)	galv. steel	919791-0002
55" (1400 mm)	1.4301 (AISI 304)	919791-0003

Wall Bracket



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

Commubox FXA191 HART

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

Commubox FXA195 HART

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

Service Interface FXA193

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

Product structure

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

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

FXA193-				Complete product designation

Associated documentation

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

Commubox FXA291

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

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

- Cerabar S PMC71, PMP7x
- Deltabar S PMD7x, FMD7x
- Deltapilot S FMB70
- Gammapilot M FMG60
- Levelflex M FMP4x
- Micropilot FMR130/FMR131
- Micropilot M FMR2xx
- Micropilot S FMR53x, FMR540
- Prosonic FMU860/861/862
- Prosonic M FMU4x
- Tank Side Monitor NRF590 (with additional adapter cable)
- Prosonic S FMU9x

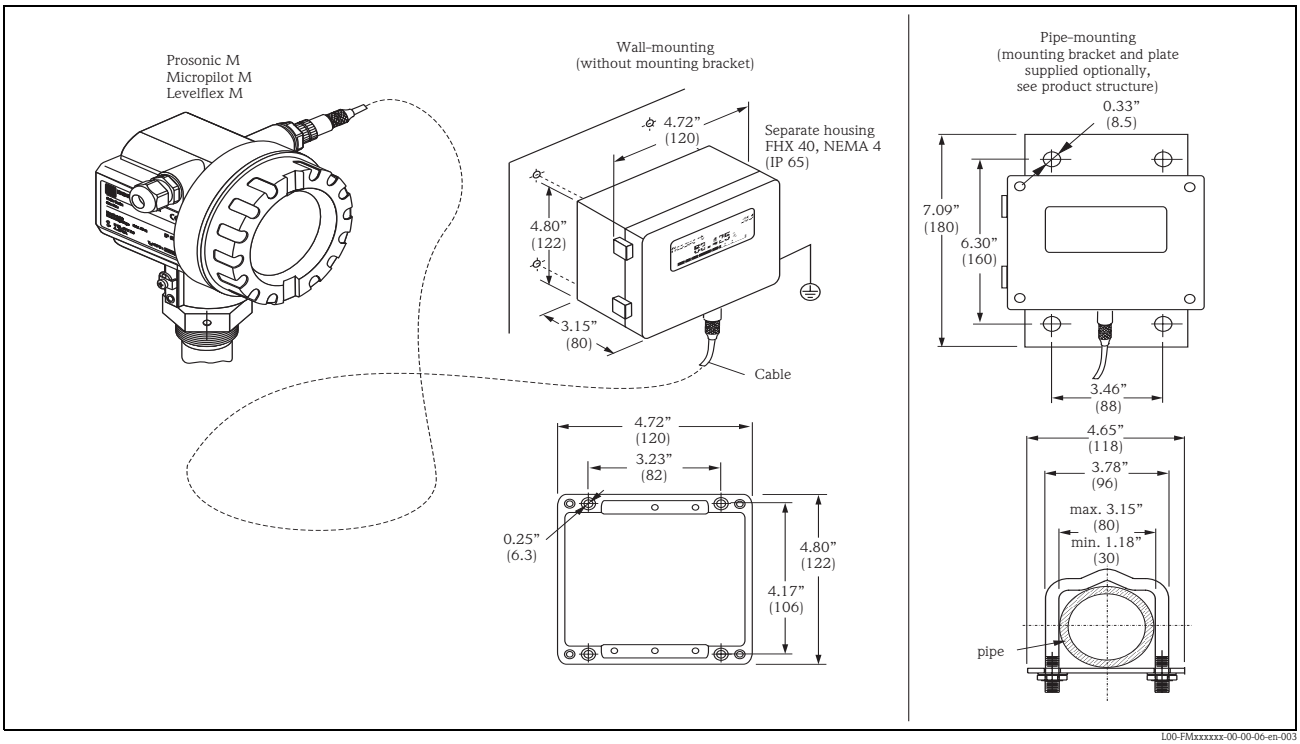
ToF Adapter FXA291

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

- Cerabar S PMC71, PMP7x
- Deltabar S PMD7x, FMD7x
- Deltapilot S FMB70
- Gammapilot M FMG60
- Levelflex M FMP4x
- Micropilot FMR130/FMR131
- Micropilot M FMR2xx
- Micropilot S FMR53x, FMR540
- Prosonic FMU860/861/862
- Prosonic M FMU4x
- Tank Side Monitor NRF590 (with additional adapter cable)
- Prosonic S FMU9x

For details refer to KA271F/00/a2.

Remote display FHX40



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

Technical data (cable and housing) and product structure:

Max. cable length	65 ft (20 m)
Temperature range	-22°F to 158°F (-30°C to +70°C)
Degree of protection	Housing, IP65/67 (NEMA 4); cable, IP68 (NEMA 6), acc. to EN 60529
Materials	Housing: AlSi12; cable glands: nickle plated brass
Dimensions [mm] / [inch]	122x150x80 (HxWxD) / 4.8 x 5.9 x 3.2

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

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

Supplementary documentation

System Information

SI 005F

Ultrasonic level measurement

Operating manual

Depending on the communication variant ordered, the following operating manuals are supplied with the device:

Communication	Operating manual
4 to 20mA, HART	BA 237F
Profibus PA	BA 238F
Foundation Fieldbus	BA 239F

These instructions describe the installation and first commissioning of the Prosonic M. From the operating menu, all functions are included, which are required for standard measurement tasks. Additional functions are **not** contained in the manual.

Description of device functions

BA 240F

This contains a detailed description of **all** the functions of the Prosonic M and is valid for all communication variants.
A pdf file of this document can be found
- in the supplied "ToF Tool - FieldTool Package" at "Help/ToF Tool Help/ Online Manual/ Operating Manual/Ultrasonic/Prosonic M FMU4x Functions"[1].
- in the internet at "www.endress.com". Click "Download" and enter the product code "FMU4*" into the search form.

Short instructions

KA 183F

Can be found under the device housing cover.
The most important menu functions are summarised on this sheet. It is intended primarily as a memory jogger for users who are familiar with the operating concept of Endress+Hauser time-of-flight instruments.

Safety Instructions ATEX

The following safety instructions are supplied with ATEX-certified device versions. If the devices are used in explosive areas, comply with all the specifications in these safety instructions.

Instrument version	Certificate	Communication	Housing	Safety Instructions
■ FMU40 - 1*B*A* ■ FMU41 - 1*B*A* ■ FMU42 - 1*B*A***	ATEX II 1/2 G or II 2 G EEx ia II C T6	HART (2-wire)	F12	XA 174F
■ FMU40 - 1*B*D* ■ FMU41 - 1*B*D* ■ FMU42 - 1*B*D***	ATEX II 1/2 G or II 2 G EEx ia II C T6	HART (2-wire)	T12 with overvoltage protection	XA 224F
■ FMU40 - 1*D*A* - 1*F*A* ■ FMU41 - 1*D*A* - 1*F*A* ■ FMU42 - 1*D*A*** - 1*F*A***	ATEX II 1/2 G or II 2 G EEx ia II C T6	■ Profibus-PA ■ Foundation Fieldbus	F12	XA 175F
■ FMU40 - 1*D*D* - 1*F*D* ■ FMU41 - 1*D*D* - 1*F*D* ■ FMU42 - 1*D*D*** - 1*F*D***	ATEX II 1/2 G or II 2 G EEx ia II C T6	■ Profibus-PA ■ Foundation Fieldbus	T12 with overvoltage protection	XA 225F

1) If the Operating Instructions have not been installed together with the "ToF Tool - FieldTool Package", they can be added to the installation subsequently.

Instrument version	Certificate	Communication	Housing	Safety Instructions
■ FMU40 - 4*B*C* - 4*D*C* - 4*F*C* ■ FMU41 - 4*B*C* - 4*D*C* - 4*F*C* ■ FMU42 - 4*B*C*** - 4*D*C*** - 4*F*C***	ATEX II 1/2 G or II 2 G EEx d [ia] II C T6	■ HART (2-wire) ■ Profibus-PA ■ Foundation Fieldbus	T12	XA 176F
■ FMU40 - G***** ■ FMU41 - G***** ■ FMU42 - G*******	ATEX II 3G EEx nA II T6	■ HART (2-wire) ■ HART (4-wire, DC) ■ HART (4-wire, AC) ■ Profibus-PA ■ Foundation Fieldbus	■ F12 ■ T12 ■ T12 with overvoltage protection	XA 179F
■ FMU40 - 2*B*A* - 2*D*A* - 2*F*A* - 5*B*A* - 5*D*A* - 5*F*A* ■ FMU41 - 2*B*A* - 2*D*A* - 2*F*A* - 5*B*A* - 5*D*A* - 5*F*A* ■ FMU42 - 2*B*A*** - 2*D*A*** - 2*F*A*** - 5*B*A*** - 5*D*A*** - 5*F*A***	■ ATEX II 1/2D ■ ATEX II 1/3D	■ HART (2-wire) ■ Profibus-PA ■ Foundation Fieldbus	F12	XA 180F
■ FMU40 - 2*G*A* - 2*H*A* - 5*G*A* - 5*H*A* ■ FMU41 - 2*G*A* - 2*H*A* - 5*G*A* - 5*H*A* ■ FMU42 - 2*G*A*** - 2*H*A*** - 5*G*A*** - 5*H*A***	■ ATEX II 1/2D ■ ATEX II 1/3 D	■ HART (4-wire, DC) ■ HART (4-wire, AC)	F12	XA 259
■ FMU43 - 2*G*A* - 2*H*A* - 5*G*A* - 5*H*A*	■ ATEX II 1/2 D or II 2 D ■ ATEX II 1/3 D or II 3 D	■ HART (4-wire, DC) ■ HART (4-wire, AC)	F12	XA 177F
■ FMU43 - 2*D*A* - 2*F*A* - 5*D*A* - 5*F*A*	■ ATEX II 1/2 D or II 2 D ■ ATEX II 1/3 D or II 3 D	■ Profibus-PA ■ Foundation Fieldbus	F12	XA 178F

Control drawings Installation drawings

The following control or installation drawings are supplied with the FM, CSA and TIIS-certified device versions:

Instrument version	Certificate	Communication	Housing	Control or Installation Drawing
■ FMU40 – S*B*A* ■ FMU41 – S*B*A* ■ FMU42 – S*B*A***	FM IS	HART (2-wire)	F12	ZD 096F
■ FMU40 – S*D*A* – S*F*A* ■ FMU41 – S*D*A* – S*F*A* ■ FMU42 – S*D*A*** – S*F*A***	FM IS	■ Profibus-PA ■ Foundation Fieldbus	F12	ZD 097F
■ FMU40 – S*B*D* ■ FMU41 – S*B*D* ■ FMU42 – S*B*D***	FM IS	HART (2-wire)	T12 with overvoltage protection	ZD 139F
■ FMU40 – S*D* D* – S*F*D* ■ FMU41 – S*D* D* – S*F*D* ■ FMU42 – S*D* D*** – S*F*D***	FM IS	■ Profibus-PA ■ Foundation Fieldbus	T12 with overvoltage protection	ZD 140F
■ FMU40 – T*B*C* – T*D*C* – T*F*C* ■ FMU41 – T*B*C* – T*D*C* – T*F*C* ■ FMU42 – T*B*C*** – T*D*C*** – T*F*C***	FM XP	■ HART (2-wire) ■ Profibus PA ■ Foundation Fieldbus	T12	ZD 098F
■ FMU40 – U*B*A* ■ FMU41 – U*B*A* ■ FMU42 – U*B*A*** ■ FMU44 – U*B*A***	CSA IS	HART (2-wire)	F12	ZD 088F
■ FMU40 – U*D*A* – U*F*A* ■ FMU41 – U*D*A* – U*F*A* ■ FMU42 – U*D*A*** – U*F*A*** ■ FMU44 – U*D*A*** – U*F*A***	CSA IS	■ Profibus-PA ■ Foundation Fieldbus	F12	ZD 099F
■ FMU40 – U*B* D* ■ FMU41 – U*B* D* ■ FMU42 – U*B* D*** ■ FMU44 – U*B* D***	CSA IS	HART (2-wire)	T12 with overvoltage protection	ZD 101F
■ FMU40 – U*D*D* – U*F*D* ■ FMU41 – U*D*D* – U*F*D* ■ FMU42 – U*D*D*** – U*F*D*** ■ FMU44 – U*D*D*** – U*F*D***	CSA IS	■ Profibus-PA ■ Foundation Fieldbus	T12 with overvoltage protection	ZD 102F

Instrument version	Certificate	Communication	Housing	Control or Installation Drawing
■ FMU40 – V*B*C* – V*D*C* – V*F*C* ■ FMU41 – V*B*C* – V*D*C* – V*F*C* ■ FMU42 – V*B*C*** – V*D*C*** – V*F*C*** ■ FMU44 – V*B*C*** – V*D*C*** – V*F*C***	CSA XP	■ HART (2-wire) ■ Profibus PA ■ Foundation Fieldbus	T12	ZD 100F
■ FMU 40 – K***** ■ FMU 41 – K*****	TIIS Ex ia IIC T6	HART	F12	ZD 138F

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TI365F/24/ae/07.08

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People for Process Automation

Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

Turbimax CUS31

Turbidity sensor
Installation and immersion sensor for drinking water and industrial water according to the 90° scattered light method

Application

- All phases of drinking water processing
- Coagulation and flocculation
- Filter rupture monitoring
- Filter backwash
- Control of clear rinsing cycles
- Monitoring of phase separation processes
- Boiler feedwater
- Monitoring of cooling water
- Monitoring of surface waters
- Outlet monitoring of sewage treatment plants
- Monitoring of industrial water discharge
- Recycling of industrial water

Your benefits

- All-purpose:
  - Direct installation in water pipes
  - Suitable as a drinking water sensor for every installation with a wall distance greater than 8 cm (3")
  - Measurement under pressure to avoid degassing
  - Integrated temperature measurement
  - Permissible distance between sensor and transmitter: 200 m (660 ft)
- Standardized and simple:
  - Measurement according to EN 27027 / ISO 7027
  - Commissioning without formazine
  - Factory calibration (“plug and play”)
- Cost saving and safe:
  - Inclined plain sensor surface uses medium flow to increase the self-cleaning effect and repels air bubbles
  - Wiper unit can be retrofitted
  - Self-monitoring and plausibility check
  - Scratch-resistant sapphire glass measuring window

TI176C/24/ae/02.08

Endress+Hauser

People for Process Automation

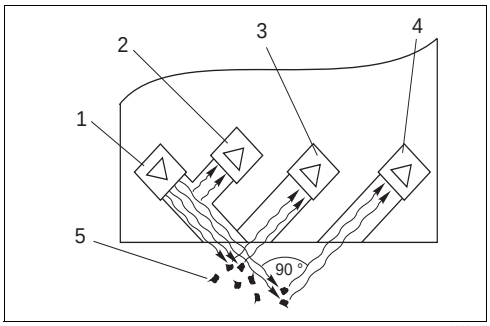
Function and system design

Measuring principle

Turbidity measurement
For turbidity measurement a light beam is sent through the medium and is diverted from its original direction by optically denser particels, e.g. solid matter particles.

Function

Nephelometric measuring principle 90° NIR scattered light according to EN 27027
The 90° scattered light method with a wavelength in the near-infrared range (880 nm) according to ISO 7027 / EN 27027 records turbidity values under standardized, comparable conditions. A temperature signal is also recorded and transmitted in addition to the turbidity signal. The excitation radiation of an infrared transmitter (see below, item 1) strikes the medium at a defined angle of beam. The different refractions of light between the entrance window and the medium (water) are taken into account. Particles in the medium (item 5) create a scattered radiation which strikes the scattered light receivers (items 3, 4) at a defined angle of beam. The measurement in the medium is constantly compared with the values of a reference receiver (item 2). Digital filter functions with excellent interference signal suppression and sensor self-monitoring ensure additional measurement reliability.

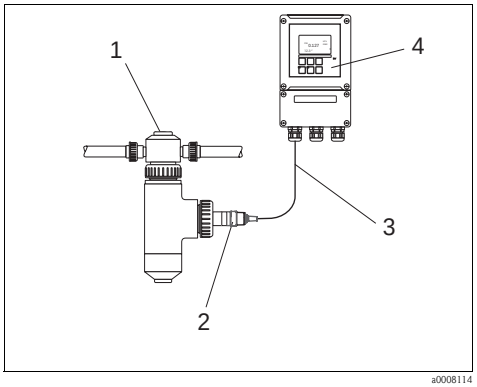


1 Infrared sender
2 Reference diode
3 Scattered light receiver 1
4 Scattered light receiver 2
5 Particle

Turbidity measurement acc. to ISO 7027 / EN 27027

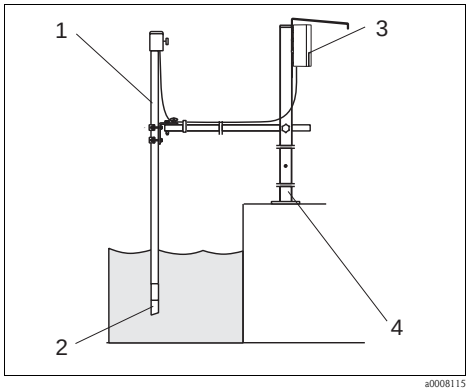
Measuring system

A complete measuring system comprises:
- Turbidity sensor CUS31
- Transmitter, e.g. Liquisys M CUM253
- Assembly:
  - Flow assembly E or S (each with installed, factory calibrated sensor) or
  - Immersion assembly, e.g. Dipfit W CYA611 or
  - Retractable assembly, e.g. Cleanfit W CUA451



Measuring system with flow assembly

1 Flow assembly S
2 CUS31-**S
3 Sensor cable
4 Transmitter Liquisys M CUM253



Measuring system with immersion assembly

1 Immersion assembly Dipfit W CYA611
2 CUS31-**A
3 Transmitter Liquisys M CUM253 (with weather protection cover CYY101)
4 Universal assembly holder CYH101

Input

Measured variable

Turbidity

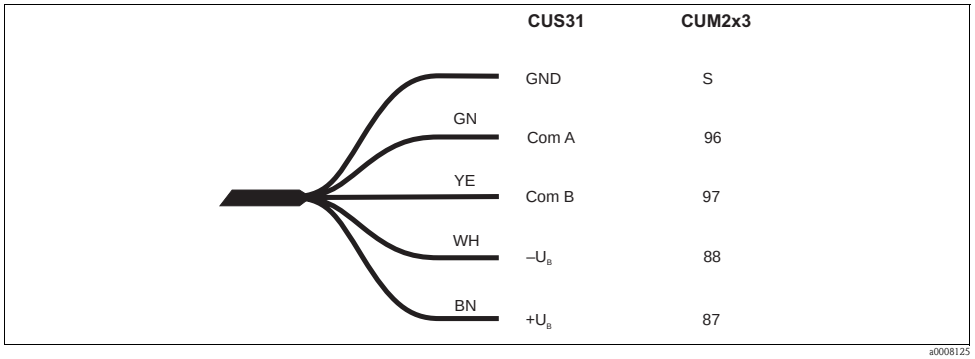
Measuring range

0.000 to 9999 FNU
0.00 to 3000 ppm
0.0 to 3.0 g/l
0.0 to 200 %

Power supply

Electrical connection

The sensor is connected to the transmitter by means of a multi-core, shielded measuring cable (fixed cable at the sensor.
To extend the measuring cable, a VBM or RM junction box and a CYK81 extension cable must be used.



Measuring cable (fixed cable) resp. extension cable (CYK81)

Note!
Please pay special attention to the instructions on sensor connection in the Operating Instructions of the transmitter.

Performance characteristics

Maximum measured error

< 5 % (min. 0.02 FNU) of measured value (system measured error related to the primary formazine standard / tracing according to ISO 5725 and ISO 7027 / EN 27027)

Repeatability

< 1 % (min. 0.01 FNU) of measured value

Wavelength

880 nm

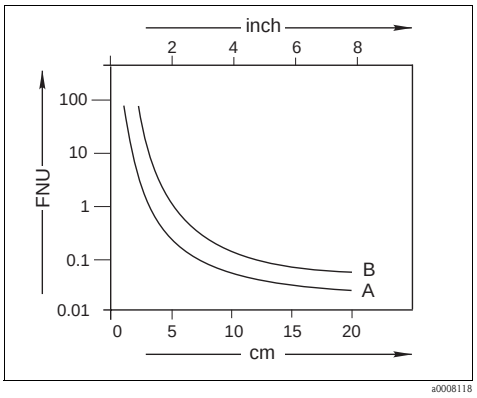
Factory calibration

traceable to formazine standard and SiO_2

Installation

Wall distance

Installing the sensor in pipework or very close to the wall can cause backscatter which results in a higher sensor signal. The effective wall or bottom distance can be optimized by aligning the flat sensor side.



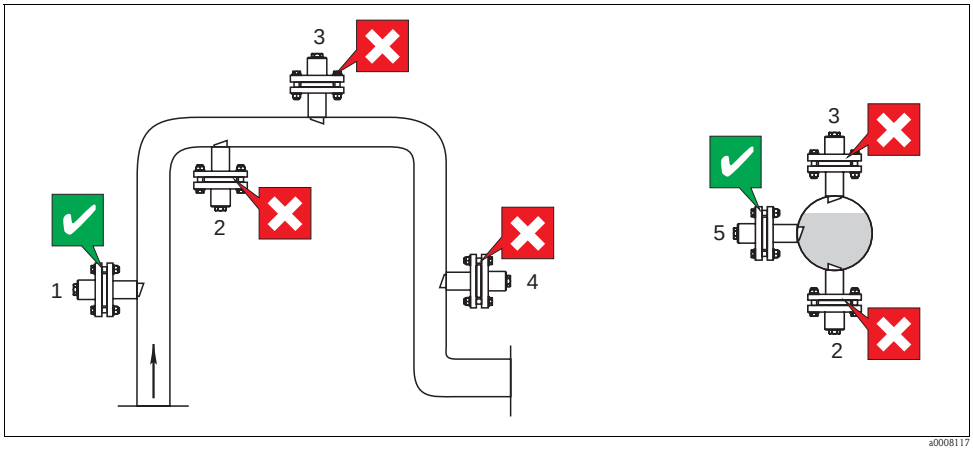
Effect of the distance from the wall or bottom

A Dark wall or bottom (non-reflective)
B Bright wall or bottom (reflective)

Note!
The following generally applies: The lower the turbidity to be measured, the darker the vessel walls should be and the greater the wall distance should also be.
When measuring in drinking water, the wall distance to a dark wall must be **at least 8 cm** (3"). Bright pipes are not suitable for the drinking water sector.

Pipe installation

The following figure illustrates various installation positions in pipes and indicates whether they are permitted or not.



Orientation and installation positions (with adapter CUA120-A/B resp. retractable assembly CUA451)

- The pipeline diameter must be at least 100 mm (4") if reflective materials (e.g. stainless steel) are used.
- Install the sensor in places with uniform flow conditions.
- Orientate the sensor surface against the medium flow (self-cleaning effect).
- The best installation location is in the ascending pipe (see above, item 1). Installation is also possible in the horizontal pipe (item 5).
- Do not install the sensor in places where air may collect or foam bubbles form (item 3) or where suspended particles may settle (item 2).
- Avoid installation in the down pipe (item 4).