

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 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

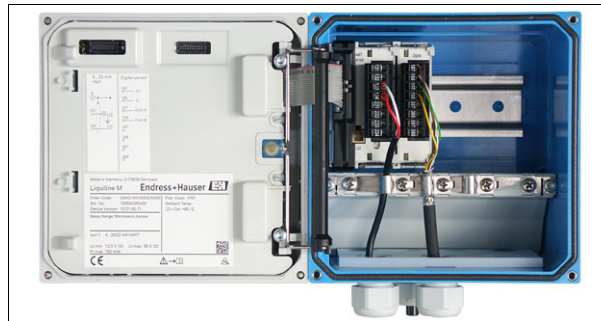
- Cost-saving:
 - Simple commissioning with Quick Setup and Navigator (multifunction button)
 - Thanks to Memosens technology, a calibration in the plant is not required
 - Predictive maintenance system detects when a sensor has to be cleaned, calibrated or replaced
 - Less storage thanks to modular design
- Safe:
 - Active display of cable interruption with Memosens version
 - User-guided commissioning, graphic display and plain text guidance
 - Approvals: ATEX, FM, CSA, NEPSI
 - Code-protected commissioning and calibration
- Industry solutions:
 - Modular concept: sensor module replaceable
 - Asset management (Fieldcare, W@M)

Table of contents

General features	3	Electromagnetic compatibility	27
Modular design	3	Ingress protection	27
Quick setup	3	Relative humidity	27
Navigator and plain text	3		
Sensor monitor	3	Mechanical construction	28
Process check system (PCS)	3	Dimensions	28
Memosens	4	Weight	28
Software packages	4	Material	29
Safety	5		
		Human interface	29
Special features	5	Operating elements	29
pH / ORP	5		
Conductivity	6	Ordering information	30
Oxygen	6	Product structure	30
		Scope of delivery	31
Measuring system	7		
		Certificates and approvals	31
Input	8	CE approval	31
Binary input (Memosens): pH/ORP, Oxygen, Conductivity	8	Ex approval	31
Analog input: pH / ORP	9		
Analog input: Conductivity	10	Accessories	31
		Mounting kits	31
Output	11	Weather protection cover	32
Output signal	11	Active barrier	32
Signal on alarm	11	Fieldbus accessories	32
Load	11	Measuring cables	33
Output signal range	11	Sensors	33
Ex specification current output 4/20 mA	11	Software update and upgrade	34
Ex specification PROFIBUS PA and FOUNDATION Fieldbus	12		
Wiring	12		
Housing grounding	12		
Supply and signal circuit	13		
Supply voltage	15		
Sensor connection	16		
Sensor connection: digital sensors (Memosens)			
pH/ORP/ISFET/Oxygen/ Conductivity	16		
Sensor connection: analog pH / ORP sensors	17		
Sensor connection: analog conductivity sensors	21		
Performance characteristics	23		
pH / ORP (analog and digital sensors)	23		
Conductivity (analog and digital sensors)	23		
Oxygen (digital sensors)	24		
Maximum measured error of current outputs	24		
Installation	25		
Mounting plate	25		
Weather protection cover	25		
Mounting options	26		
Installation in Ex area	27		
Environment	27		
Ambient temperature range	27		
Ambient temperature limits	27		
Storage temperature	27		

General features

Modular design



Inside Liquiline (version with sensor module, without wiring)



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.

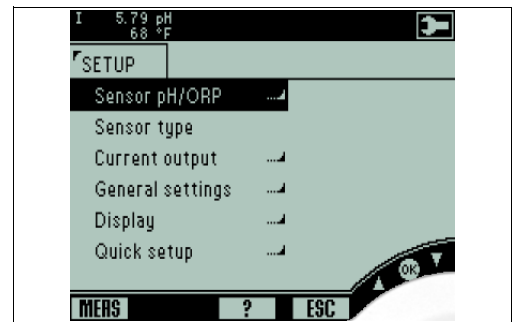
Navigator and plain text

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



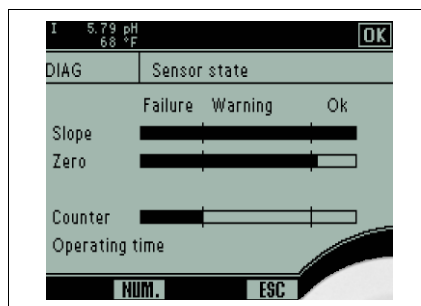
Navigator



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.



Sensor monitor (example)

Process check system (PCS)

This function checks the measuring signal for stagnation. If the measuring signal does not change for some time (several measured values), an alarm is triggered. Soiling, blockage or similar could be the cause of such behavior.

Memosens

The measuring point is safer with Memosens:

- No-contact, inductive signal transmission, thus optimum galvanic separation
- No galvanic corrosion
- Completely water-tight
- Automatic error message if data flow interrupted
- Sensor calibration possible in laboratory
- Predictive maintenance thanks to recording of sensor data, e.g.:
 - Total hours of operation
 - Hours of operation for very high or very low measuring values
 - Hours of operation for high temperatures
 - Number of steam sterilizations
 - Consumption counter

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	<p>Analog sensors</p> <ul style="list-style-type: none"> – 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 <p>Digital sensors features like analog sensors plus:</p> <ul style="list-style-type: none"> – Sensor information 	<p>Analog sensors</p> <ul style="list-style-type: none"> – Sample calibration – Temperature calibration: one-point – Temperature compensation: linear, NaCl, Ultrapure water (NaCl, HCl) – Simulation of current output – Self-diagnosis – Concentration measurement – Clock <p>Digital sensors features like analog sensors plus:</p> <ul style="list-style-type: none"> – Sensor information 	<p>Digital sensors</p> <ul style="list-style-type: none"> – 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
Advanced	<p>Analog sensors</p> <ul style="list-style-type: none"> – Medium compensation – Calibration timer – Sensor statistics – Logbooks – Data logbook <p>Digital sensors features like analog sensors plus:</p> <ul style="list-style-type: none"> – Operating hours counter – Sterilizations counter 	<p>Software package "Basic" and also:</p> <p>Analog sensors</p> <ul style="list-style-type: none"> – 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 <p>Digital sensors features like analog sensors plus:</p> <ul style="list-style-type: none"> – Operating hours counter – Sterilizations counter – USP alarm and pre-alarm 	<p>Digital sensors</p> <ul style="list-style-type: none"> – Polarization voltage setting – Medium compensation – Calibration stability settings – Calibration timer – Sensor statistics – Logbooks – Data logbook – Operating hours counter – Sterilizations counter

Safety

Code protection

The device offers two different user administration modes:

- Standard
 - There are 3 fixed user roles (Operator, Maintenance, Expert).
 - The expert can only change the maintenance password (factory setting: 0000). To do so, the expert must log onto the device with a fixed password (4685) that cannot be changed.
 - No other users 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 four user roles (View, Operator, Maintenance, Expert).
 - Several "Experts" are possible.
 - One user ("Administrator") is already created at the factory (password: 4685).

PCS: 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.

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

Connection of all types of pH and ORP sensors:

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

Sensor Condition Check (SCC)

This function monitors the state of the electrodes or the degree of electrode ageing. The "Electrode OK", "Low wear" or "Replace electrode" messages inform you on the state of the electrode. The electrode state is updated after each calibration. When the "Replace electrode" message appears, an additional error message is triggered.

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 digital conductive sensors:
 - Two-electrode sensors
 - Four-electrode sensors
- Analog and digital 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 $\mu\text{S}/\text{cm}$
- 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

Application-optimized calibration models

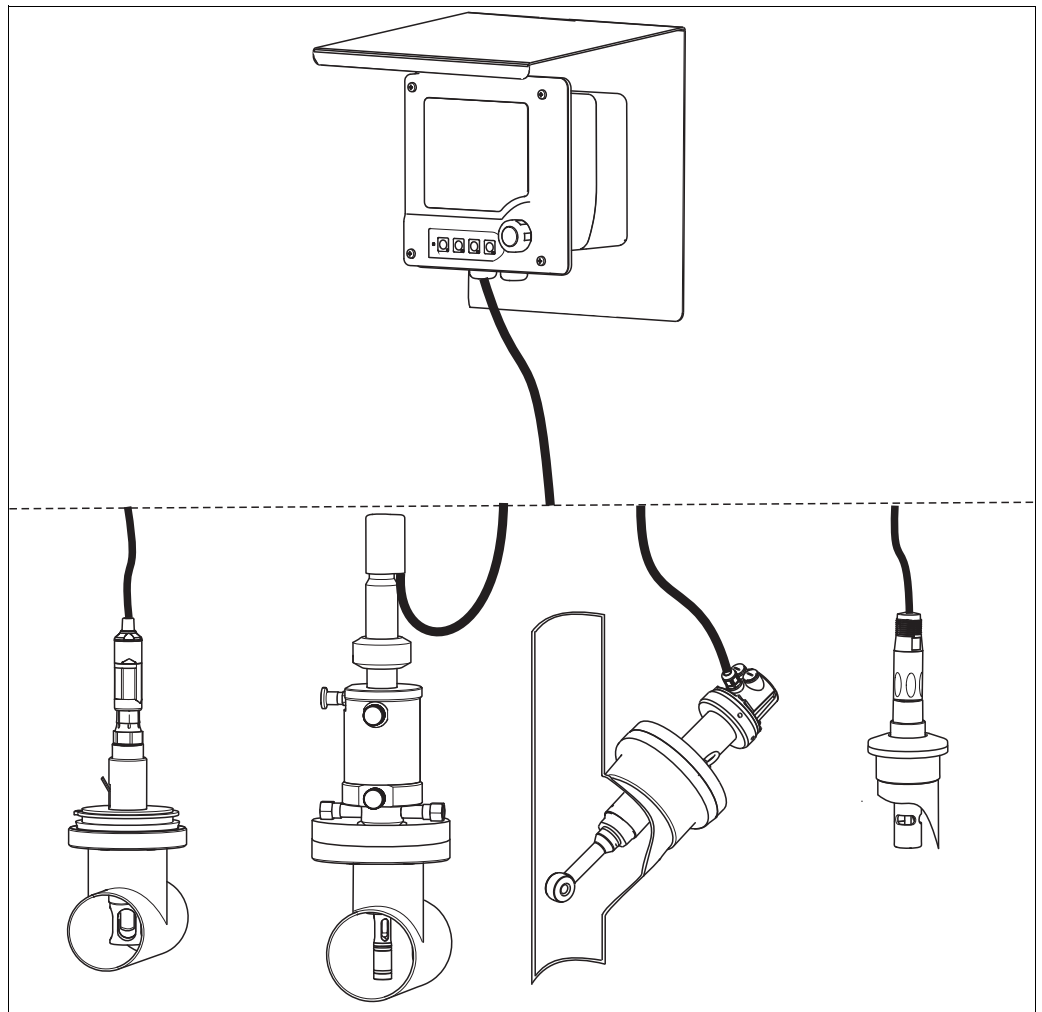
The transmitter offers separate functions for zero-point calibration and slope calibration. This allows for optimum adaption to the process.

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



Measuring system: Examples

a0002012

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)/ COS21D/51D (oxygen) / CLS15D/16D/21D (conductivity, cond. meas.)

Note!

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.

Input

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

Measured variable

- pH value
- Oxidation-reduction potential
- Oxygen
- Conductivity (conductive sensors)
- Resistivity
- Temperature

Measuring range


pH value	-2 to 16 (glass electrodes) 0 to 14 (ISFET sensors)
ORP	-1500 to +1500 mV
Dissolved oxygen	0.0 to 100.0 mg/l 0 to 1000 %SAT 0 to 2000 hPa
Conductivity, conductively measured	0.1 $\mu\text{S}\cdot\text{k}^{1)}$ to 20 mS/k
Resistivity, conductively measured	10 $\text{M}\Omega/\text{k}$ to 50 Ω/k
Concentration	NaOH: 0 to 15% (0 to 100 °C / 32 to 212 °F) HNO ₃ : 0 to 25% (0 to 80 °C / 32 to 180 °F) H ₂ SO ₄ : 0 to 30% (0 to 100 °C / 32 to 212 °F) H ₃ PO ₄ : 0 to 15% (0 to 80 °C / 32 to 180 °F) HCl: 0 to 20% (0 to 65 °C / 32 to 150 °F) 4 user tables
Temperature	-25 to + 150 °C (-10 to 300 °F)

- 1) k = cell constant in cm^{-1}
Example: 2-electrode sensor, $k=0.01 \text{ cm}^{-1}$, resulting measuring range: 0.001 to 200 $\mu\text{S}/\text{cm}$

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	5.04 V
Max. output current I_o	80 mA
Max. output P_o	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**

- pH value
- Oxidation-reduction potential (ORP)
- Temperature

Measuring range

pH value	-2 to 16
ORP	-1500 to +1500 mV
Temperature	-25 to + 150 °C (-10 to 300 °F)


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	10.08 V	10.08 V
Max. output current I_o	4.1 mA	50.7 mA
Max. output P_o	10.2 mW	128 mW
Max. external inductance L_o	1 mH	1 mH
Max. external capacity C_o	250 nF	250 nF
Connection class acc. to NE116 ³⁾	SensISCO1X	-

- 1) CM42-*G***** , CM42-*X***** , CM42-*Z*****
- 2) CM42-*V*****
- 3) CM42-*G*****

Note!

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

> $1 \cdot 10^{12} \Omega$ (at nominal operating conditions)

Input leakage current

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

Analog input: Conductivity**Measured variable**

- Conductivity
- Resistivity (conductive measurement only)
- Concentration

Measuring range

Conductivity, conductively measured Two-electrode sensor Four-electrode sensor	0.1 $\mu\text{S}\cdot\text{k}^{1)}$ to 20 $\text{mS}\cdot\text{k}$ 0.1 $\mu\text{S}\cdot\text{k}$ to 1.5 $\text{S}\cdot\text{k}$
Conductivity, inductively measured	1.7 $\mu\text{S}\cdot\text{k}^{2)}$ to 1 $\text{S}\cdot\text{k}$
Resistivity, conductively measured	10 $\text{M}\Omega/\text{k}$ to 50 Ω/k
Concentration	NaOH: 0 to 15% (0 to 100 °C / 32 to 212 °F) HNO ₃ : 0 to 25% (0 to 80 °C / 32 to 180 °F) H ₂ SO ₄ : 0 to 30% (0 to 100 °C / 32 to 212 °F) H ₃ PO ₄ : 0 to 15% (0 to 80 °C / 32 to 180 °F) HCl: 0 to 20% (0 to 65 °C / 32 to 150 °F) 4 user tables

- 1) k = cell constant in cm^{-1}
Example: 2-electrode sensor, $k=0.01 \text{ cm}^{-1}$, resulting measuring range: 0.001 to 200 $\mu\text{S}/\text{cm}$
- 2) k =cell constant in cm^{-1} Example: sensor, $k=2 \text{ cm}^{-1}$, resulting measuring range: 3.4 $\mu\text{S}/\text{cm}$ to 2 S/cm

Cable specification


Conductivity/resistivity, conductively measured ¹⁾ Two-electrode sensor 10 $\mu\text{S}\cdot\text{k}$ to 20 $\text{mS}\cdot\text{k}$ / 0.1 $\text{M}\Omega/\text{k}$ to 50 Ω/k 5 $\mu\text{S}\cdot\text{k}$ to 20 $\text{mS}\cdot\text{k}$ / 0.2 $\text{M}\Omega/\text{k}$ to 50 Ω/k 0.1 $\mu\text{S}\cdot\text{k}$ to 20 $\text{mS}\cdot\text{k}$ / 20 $\text{M}\Omega/\text{k}$ 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 $\mu\text{S}\cdot\text{k}$ to 1.5 $\text{S}\cdot\text{k}$ 0.1 $\mu\text{S}\cdot\text{k}$ to 20 $\text{mS}\cdot\text{k}$	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

 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	10.08 V
Max. output current I_o	23 mA
Max. output P_o	57 mW
Max. external inductance L_o	300 μH
Max. external capacity C_o	50 nF

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

Ex specification, inductive sensors

 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	10.08 V
Max. output current I_o	64 mA
Max. external P_o	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 circuit¹⁾
 2x 4 to 20 mA, potentially isolated against sensor circuit²⁾
 PROFIBUS PA³⁾
 FOUNDATION Fieldbus⁴⁾


Signal on alarm 3.6 to 22.0 mA
 digital via field bus⁵⁾

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


pH	adjustable, $\Delta\text{pH} > 0.5$
ORP	adjustable, $\Delta U > 5 \text{ mV}$
Dissolved oxygen	adjustable
Conductivity, conductive measured	adjustable
Conductivity, inductive measured	adjustable
Temperature	adjustable, $\Delta\vartheta > 2 \text{ }^\circ\text{C}$ (2 $^\circ\text{F}$)

Ex specification current output 4/20 mA

 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)

- 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

Ex specification PROFIBUS PA and FOUNDATION Fieldbus

 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 μ H
Max. internal capacity C_i	< 5 nF

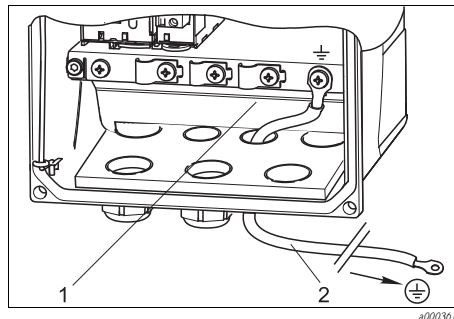
Wiring

Housing grounding

Plastic housing

Caution!

You must connect the "Fixing plate" to the foundation ground with a separate functional ground line ($\geq 2.5 \text{ mm}^2 \cong 14 \text{ AWG}$).



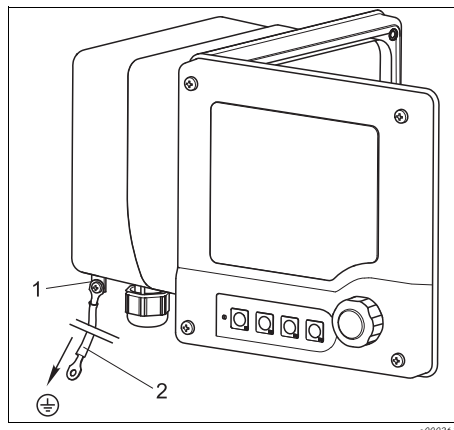
Housing grounding

- 1 Fixing plate
- 2 $\geq 2.5 \text{ mm}^2 (\cong 14 \text{ AWG})$ functional ground

Stainless steel housing

Caution!

You must connect the outer ground connection of the housing to the foundation ground with a separate line (GN/YE) ($\geq 2.5 \text{ mm}^2 \cong 14 \text{ AWG}$).



Housing grounding

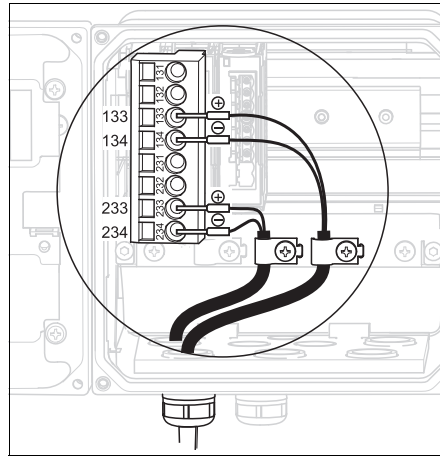
- 1 Outer ground connection
- 2 $\geq 2.5 \text{ mm}^2 (\cong 14 \text{ AWG})$ line (GN/YE)

Supply and signal circuit

4 ... 20 mA

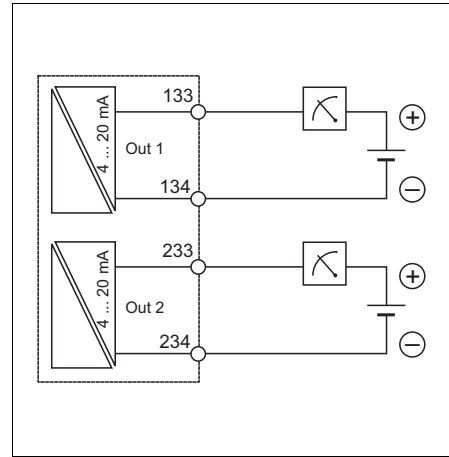
Note!

Connect the transmitter via a two-wire cable.
The second current output is an option (see "Ordering information").



View in device (CPU module)

a0005037



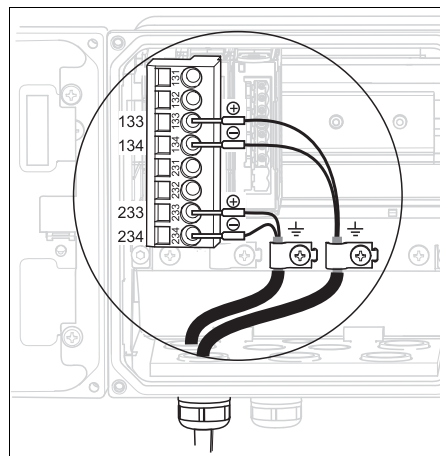
Wiring diagram

a0005038

4 ... 20 mA / Hart®

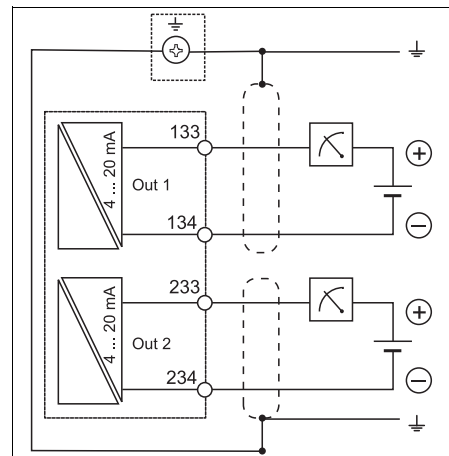
Note!

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)

a0002365



Wiring diagram

a0003100

PROFIBUS PA and FOUNDATION Fieldbus

Note!

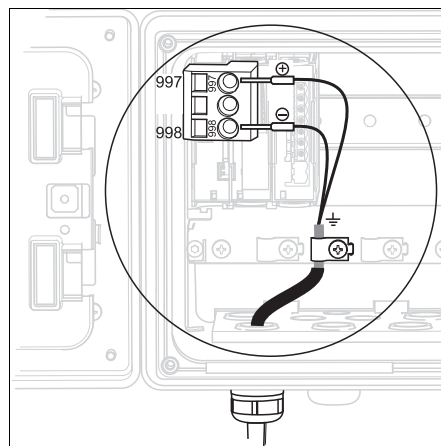
Always use a fieldbus cable that is grounded on both sides (device **and** PCS).

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)

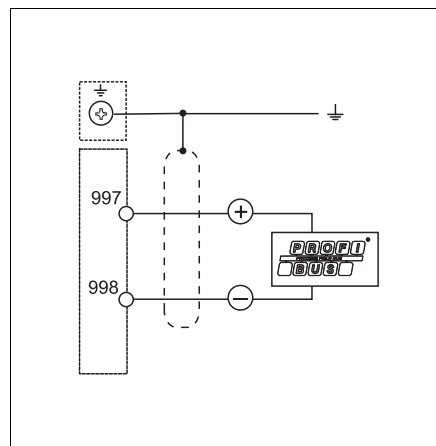
"Hard grounding"

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



View in device (CPU module)

a0004060

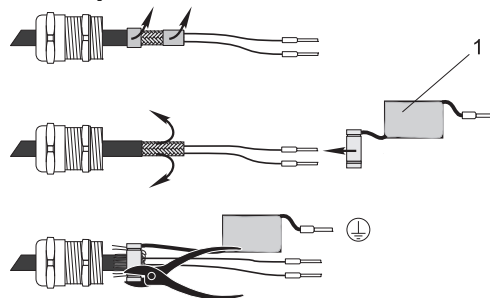


Wiring diagram

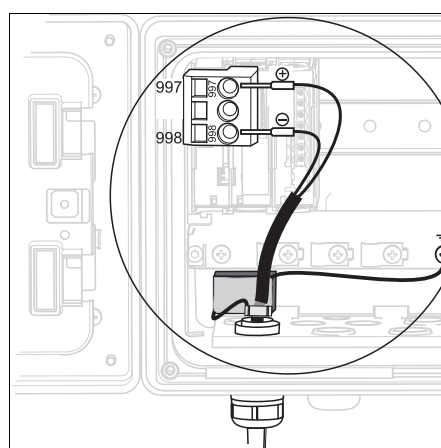
a0001640

"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:

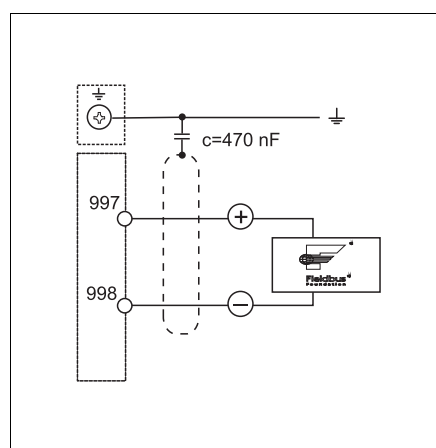


- Place the extension wire on the "Fixing plate".
- Connect the cable wires as per the assignment.



View in device (CPU module)

a0004071

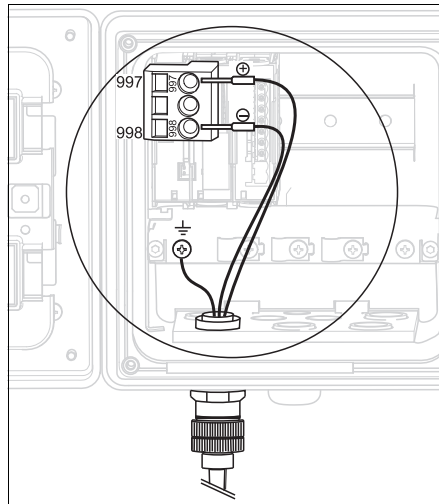


Wiring diagram

a0004073

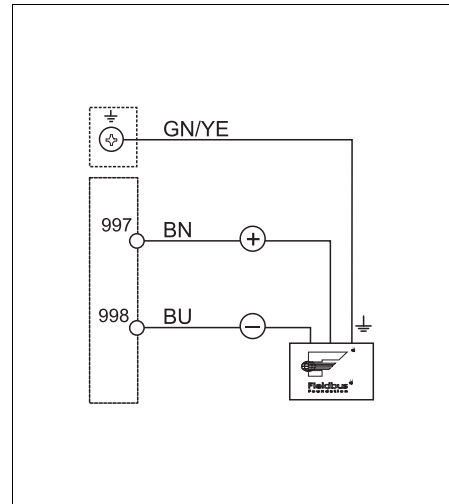
"Fieldbus connection socket"

- 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)

a0002378



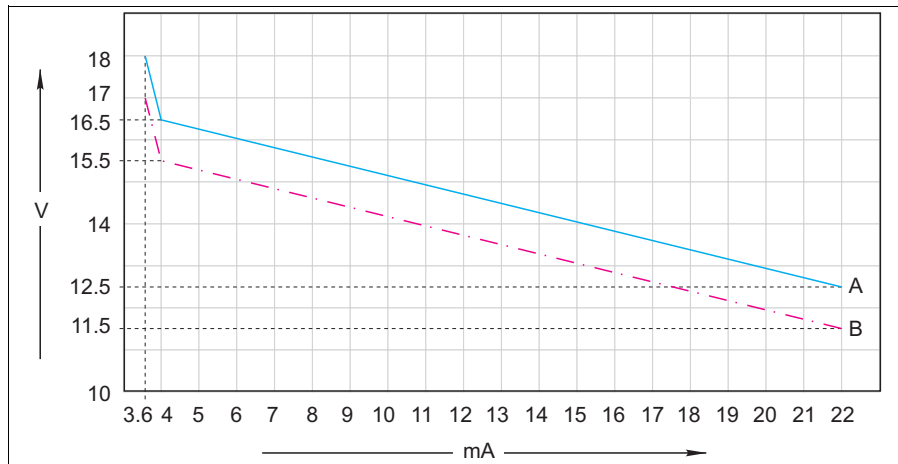
Wiring diagram

a0004062

Cable specification

Max. cable cross-section: 2.5 mm² (≈14 AWG), GND 4 mm² (≈12 AWG)

Supply voltage



Minimum supply voltage at transmitter to output current

- A with HART communication
- B without HART communication

a0008804

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

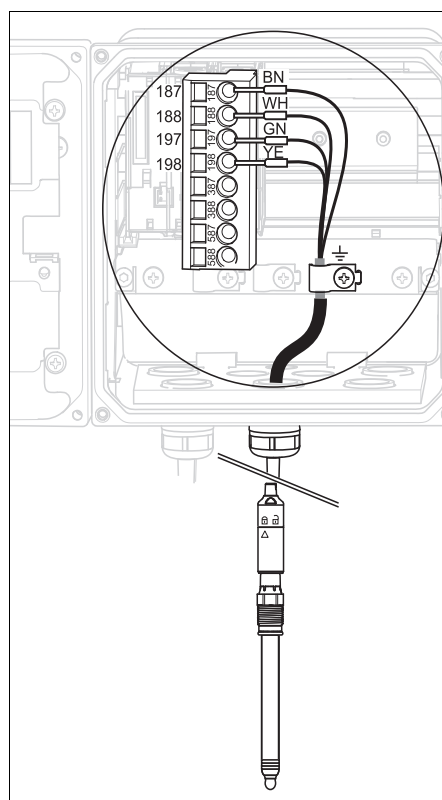
Explanation of abbreviations in the following diagrams:

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	
∅	Temperature signal
d.n.c.	Do not connect!

Note!

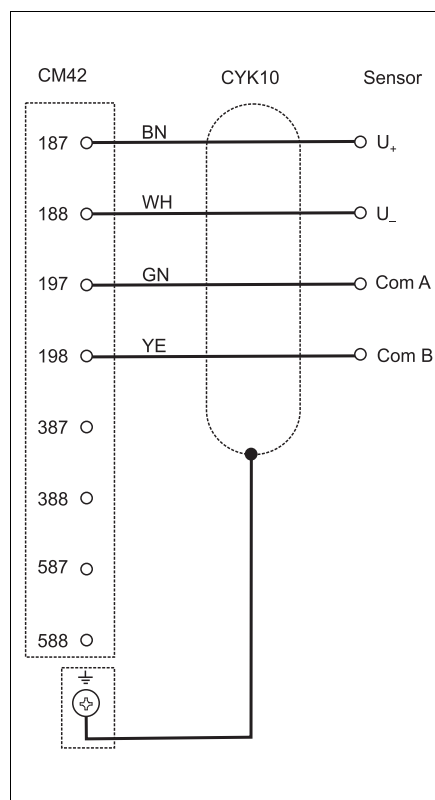
- Cable colors indicated as per IEC 757 (see CD-ROM).
- You must connect shielded connections and terminals with functional earth (\perp) (there is no protective earth (\oplus) for plastic housings).
- Since inductive conductivity sensors work with magnetic fields, avoid any magnetic interferences.

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



View in device

a0001087

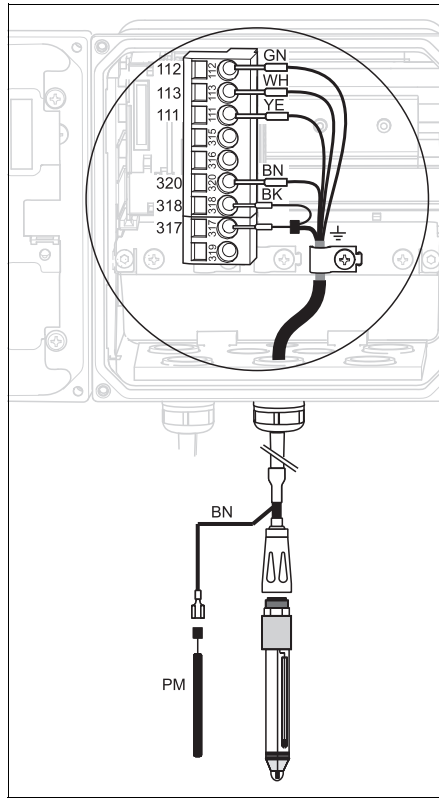


Wiring diagram

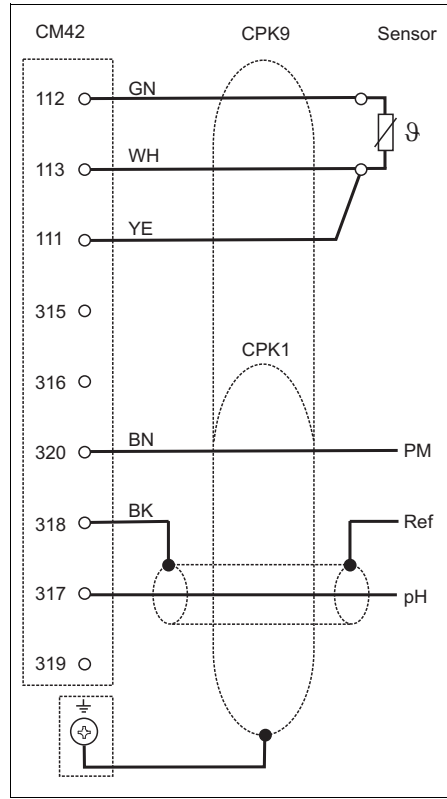
a0001078

Sensor connection:
analog pH / ORP sensors

Glass electrodes with PML (symmetrical)

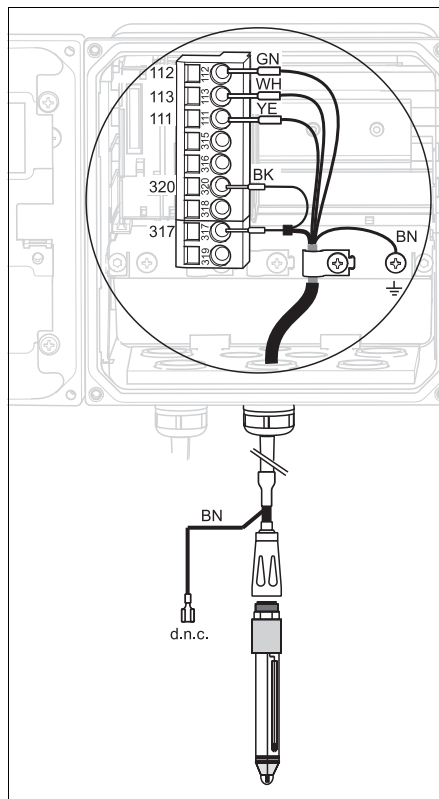


View in device

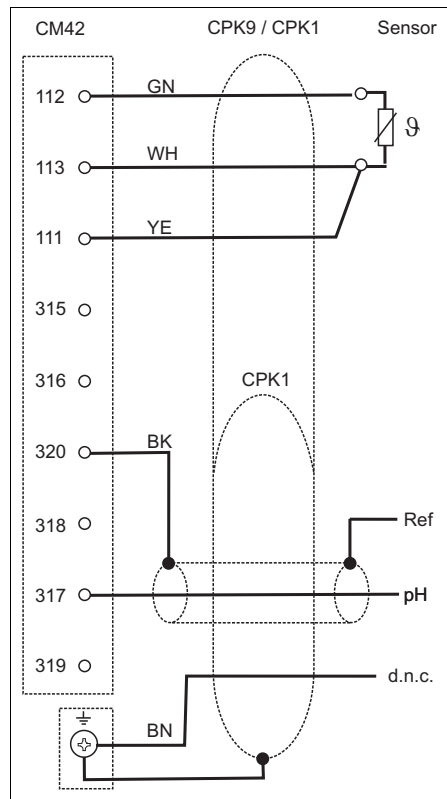


Wiring diagram

Glass electrodes without PML (asymmetrical)

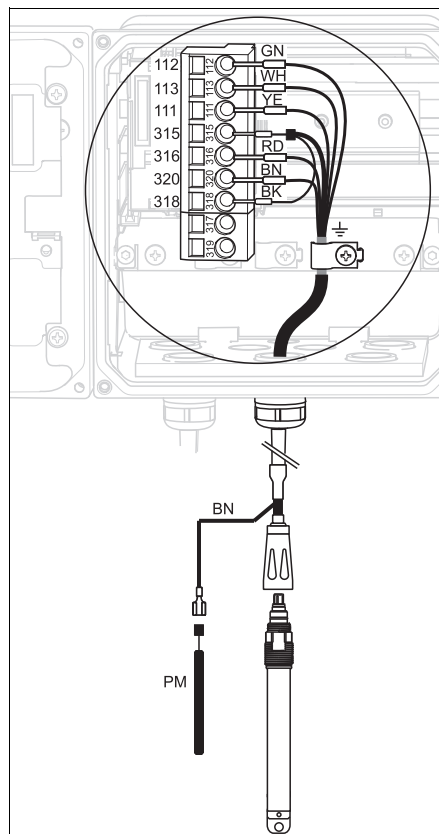


View in device



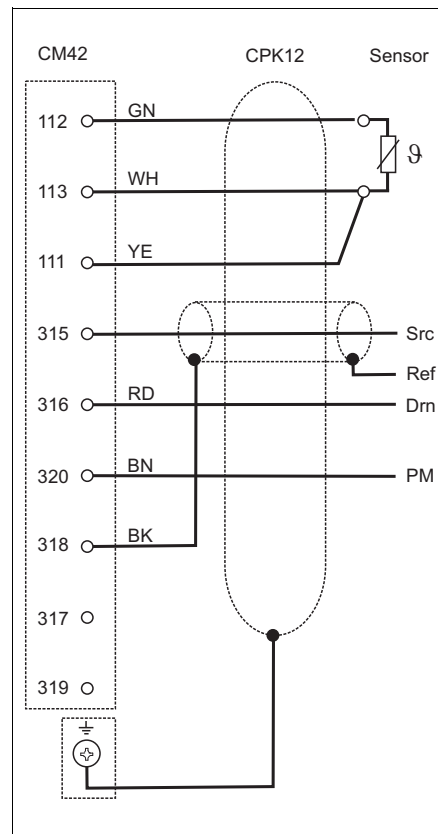
Wiring diagram

ISFET sensors with PML (symmetrical)



View in device

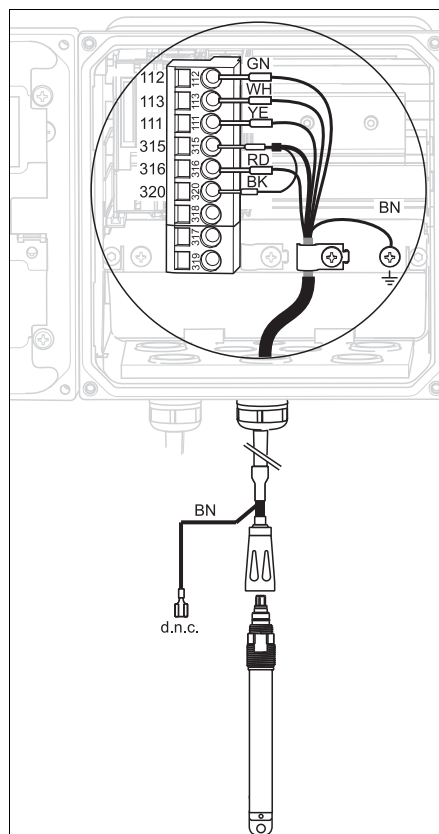
a0001090



Wiring diagram

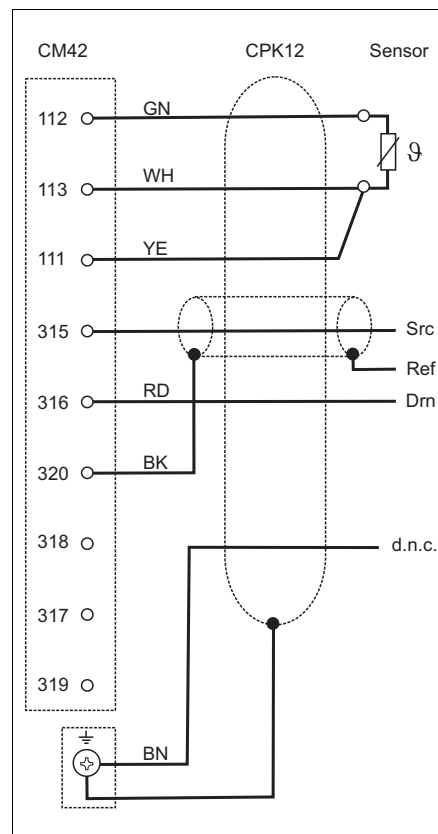
a0001076

ISFET sensors without PML (asymmetrical)



View in device

a0001084



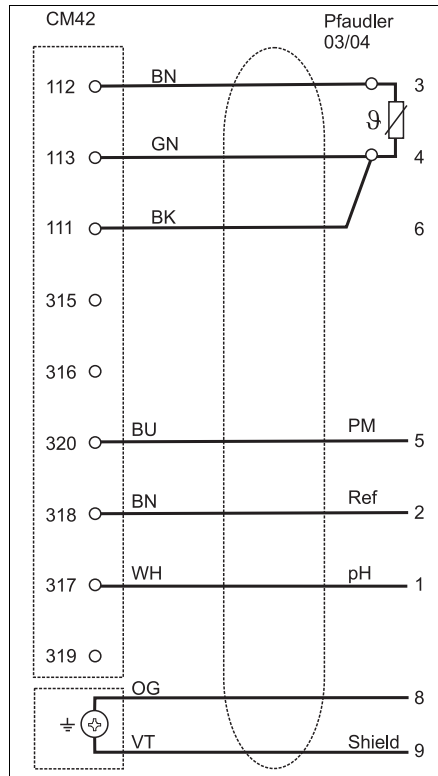
Wiring diagram

a0001077

Pfaudler electrodes

With PM (symmetrical)

Pfaudler electrode, absolute
Type 03 / Type 04

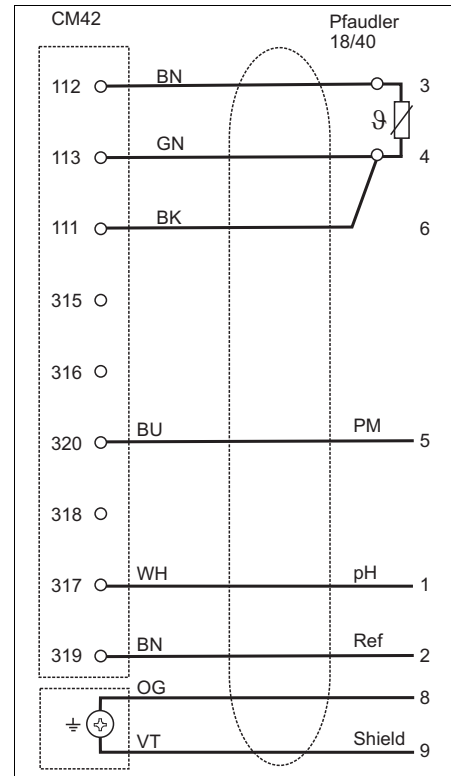


Wiring diagram

a0010467

With PM (symmetrical)

Pfaudler electrode, relative
Type 18 / Type 40

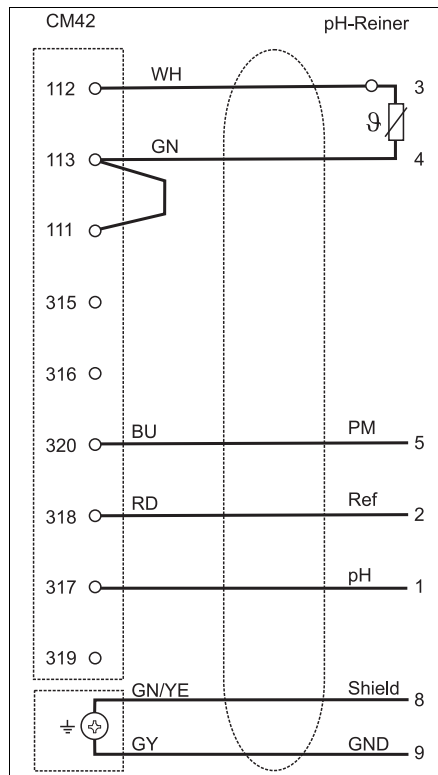


Wiring diagram

a0010468

With PM (symmetrical)

pH Reiner

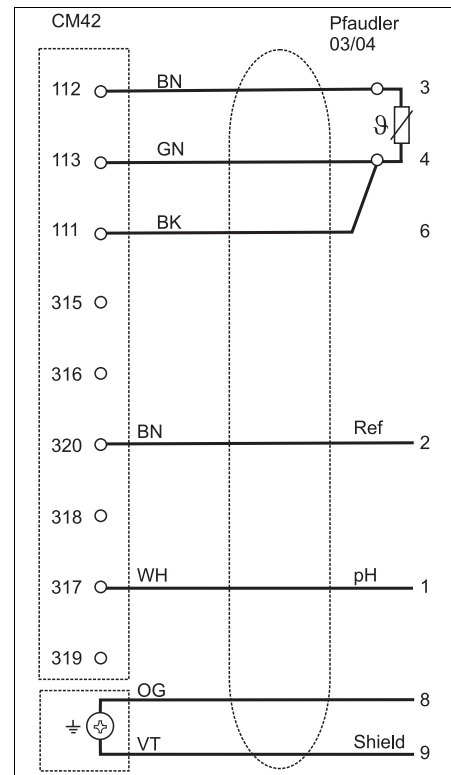


Wiring diagram

a0010469

Without PM (asymmetrical)

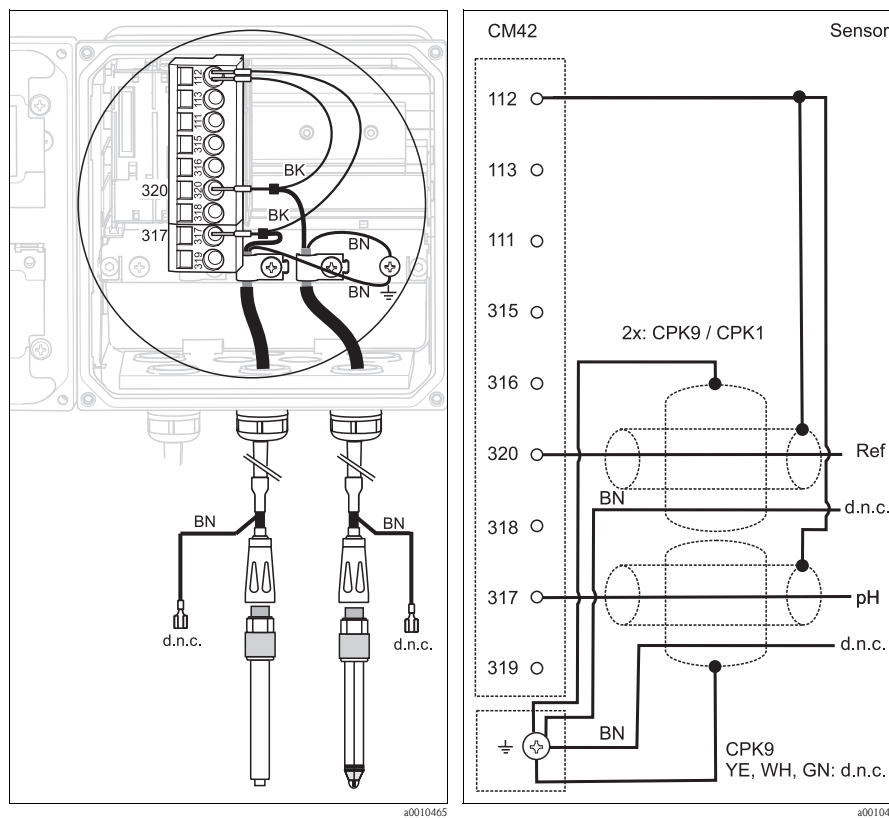
Pfaudler electrode, absolute
Type 03 / Type 04



Wiring diagram

a0010470

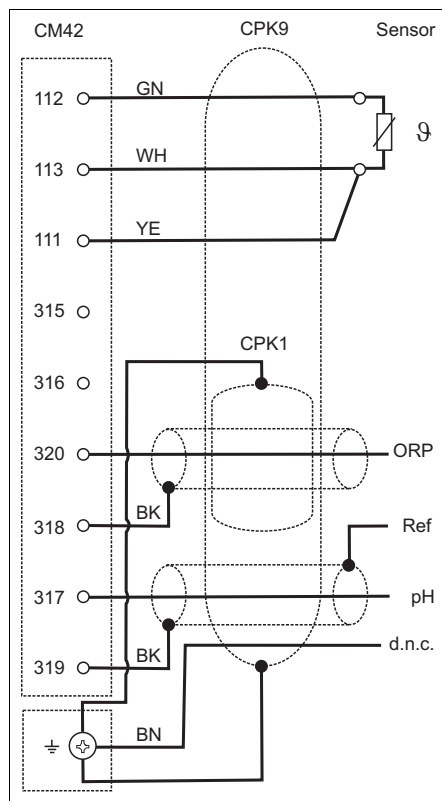
Single electrodes (e.g. CPS64 glass or antimony)



View in device

Wiring diagram

Glass electrode and ORP sensor for the rH measurement

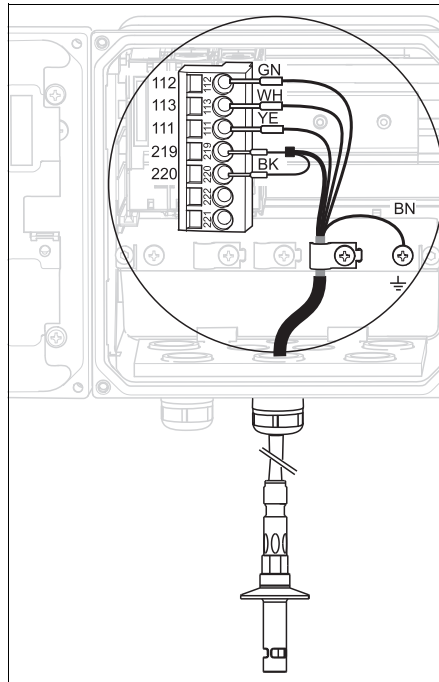


Wiring diagram

Note! 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).

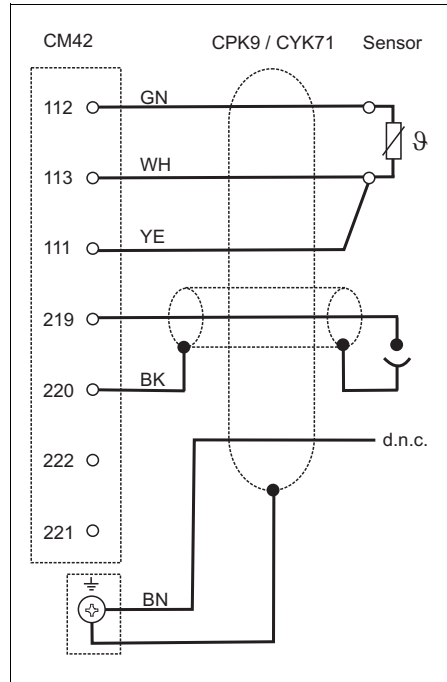
**Sensor connection:
analog conductivity sensors**

Conductive sensors, two-electrode sensors



View in device

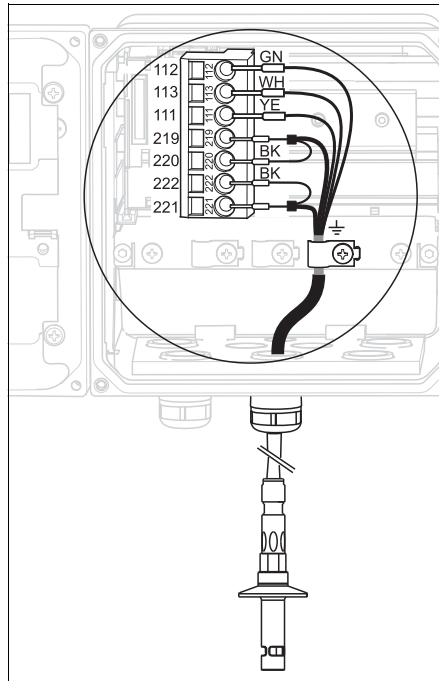
a0001086



Wiring diagram

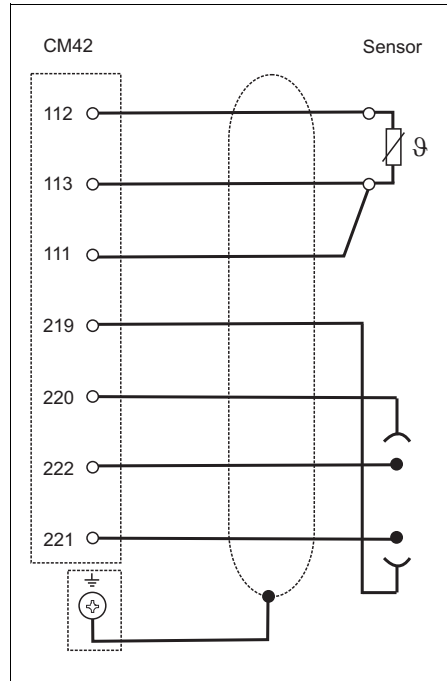
a0001083

Conductive sensors, four-electrode sensors



View in device (sensor module)

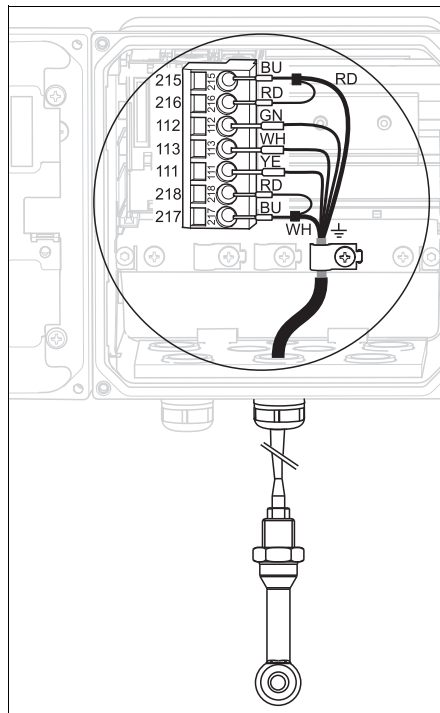
a0002363



Wiring diagram

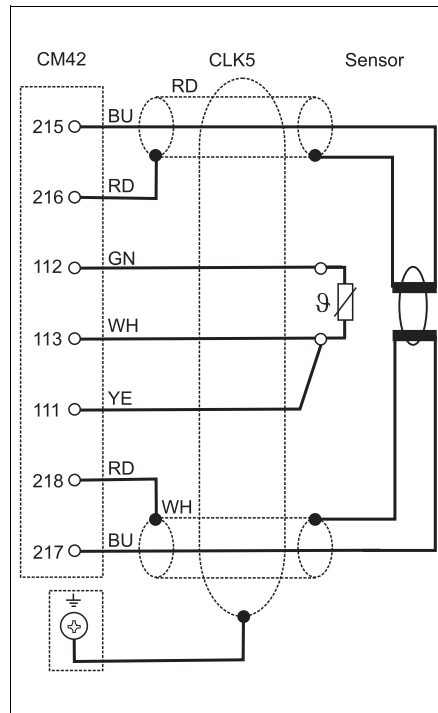
a0002371

Inductive sensors



View in device

a0001085



Wiring diagram

a0001082

Performance characteristics

pH / ORP (analog and digital sensors)

Reference temperature

25 °C (77 °F)

Measured value resolution

pH (glass electrodes and ISFET sensors)	0.01 pH
ORP:	1 mV
Temperature:	0.1 °C (0.1 °F)
SCS glass electrodes:	
Glass:	100 k Ω
Reference (analog sensors only):	100 Ω
Leak current, ISFET sensors:	100 nA

Maximum measured error⁶⁾

pH (glass electrodes and ISFET sensors)	0.02 pH
ORP:	1 mV
Temperature:	
NTC30k:	0.5 K
Pt100 / Pt1000:	0.25 K
Memosens sensors:	1 K
SCS glass electrodes:	
Glass:	200 M Ω
Reference:	200 Ω
Leak current, ISFET sensors:	100 nA

Repeatability

pH	< 0.01
----	--------

Conductivity (analog and digital sensors)

Reference temperature

25 °C (77 °F)
adjustable from -5 to 100 °C (23 to 212 °F)⁷⁾

Measured value resolution

Conductivity	< 0.1% from the measured value (4 digits)
minimum, at:	
cell constant $k \leq 0.15 \text{ cm}^{-1}$	0.001 $\mu\text{S/cm}$
cell constant $k \leq 1.5 \text{ cm}^{-1}$	0.01 $\mu\text{S/cm}$
cell constant $k > 1.5 \text{ cm}^{-1}$	0.1 $\mu\text{S/cm}$
Temperature (Pt100 / Pt1000)	0.01 °C (0.01 °F)
Resistivity	< 0.1% from the measured value (4 digits)
minimum	1 k $\Omega\cdot\text{cm}$

6) acc. to DIN IEC 746 part 1, under nominal operating conditions

7) with software package "Advanced"

Maximum measured error⁸⁾

Conductivity, conductive measured	
Two-electrode sensors	0.5 % from measured value $\pm 0.01 \mu\text{S}\cdot\text{k}$
Four-electrode sensors	0.5 % from measured value $\pm 0.01 \mu\text{S}\cdot\text{k}$ ¹⁾ 1.0 % from measured value $\pm 0.01 \mu\text{S}\cdot\text{k}$ ²⁾ 2.0 % from measured value $\pm 0.01 \mu\text{S}\cdot\text{k}$ ³⁾
Conductivity, inductive measured	0.5 % from measured value $\pm 1.7 \mu\text{S}\cdot\text{k}$
Resistivity, conductive measured (two-electrode sensors)	0.5 % from measured value $\pm 0.01 \mu\text{S}\cdot\text{k}$ ⁴⁾

- 1) from 0.1 $\mu\text{S}\cdot\text{k}$ to 20 $\text{mS}\cdot\text{k}$ (max. cable length 15 m (50 ft))
- 2) from 10 $\mu\text{S}\cdot\text{k}$ to 1000 $\text{mS}\cdot\text{k}$ (max. cable length 100 m (330 ft))
- 3) from 10 $\mu\text{S}\cdot\text{k}$ to 1500 $\text{mS}\cdot\text{k}$ (max. cable length 100 m (330 ft))
- 4) from 10 $\text{M}\Omega/\text{k}$ to 50 Ω/k (max. cable length 15 m (50 ft))
from 200 $\text{k}\Omega/\text{k}$ to 50 Ω/k (max. cable length 50 m (160 ft))

Temperature compensation

Type of compensation	Range
none	
linear	$\alpha = 0.00$ 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"

Oxygen (digital sensors)**Measured value resolution**

Dissolved oxygen	0.01 resp. 0.001 mg/l (append. on sensor)
Temperature	0.1 °C (0.1 °F)

Maximum measured error⁹⁾

Dissolved oxygen	1% of measured value
Temperature	1 K

Maximum measured error of current outputs

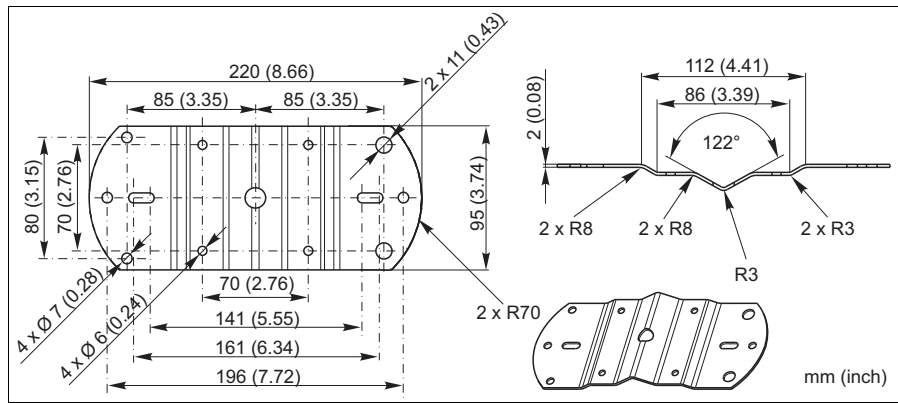
Current outputs, additionally	25 μA
-------------------------------	------------------

8) acc. to DIN IEC 746 part 1, under nominal operating conditions

9) acc. to DIN IEC 746 part 1, under nominal operating conditions

Installation

Mounting plate

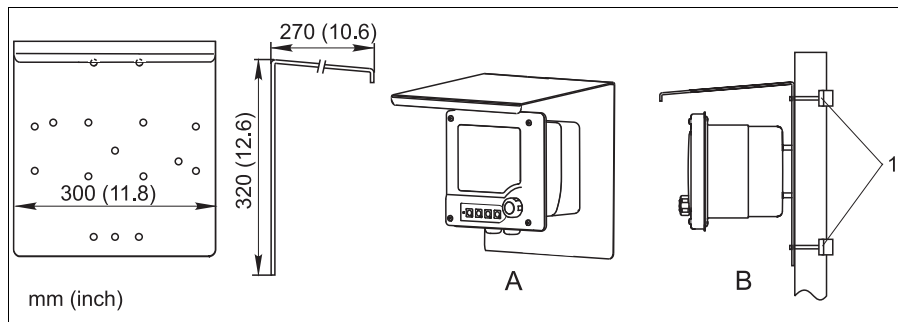


Mounting plate

a0010363

Weather protection cover

Stainless steel housing



Weather protection cover CYY101

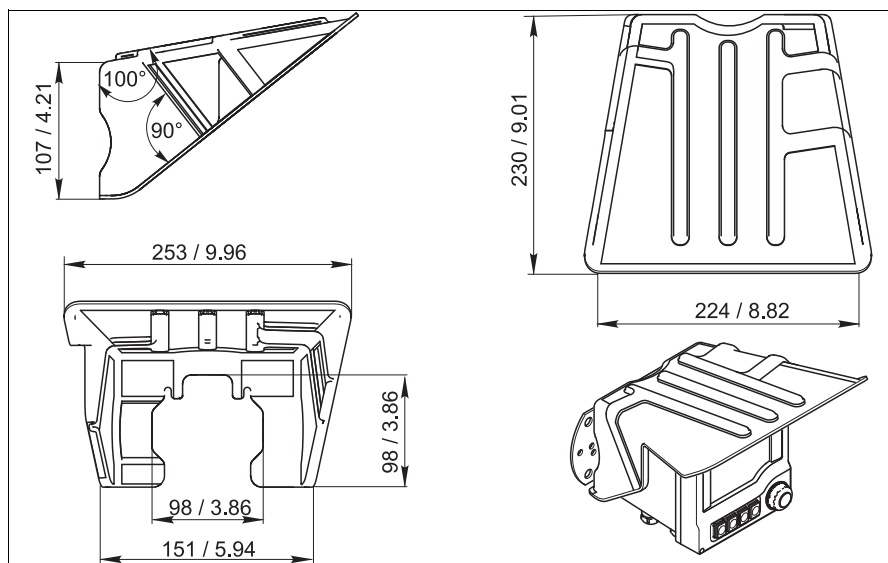
- A Wall mounting
- B Pipe or round post mounting
- 1 Round post fixture (Accessories)

a0001676

Note!

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".

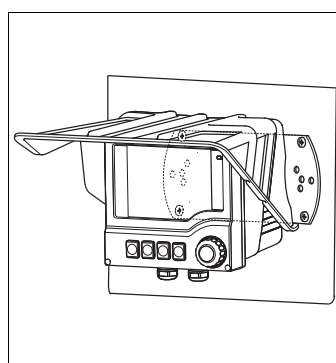
Plastic housing



a0001671-en

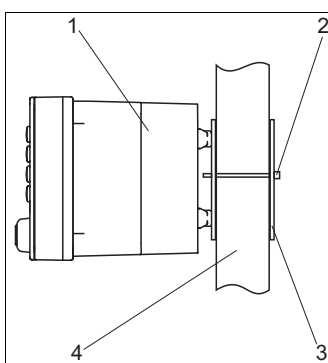
Weather protection cover

Mounting options



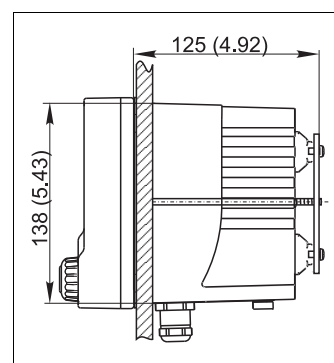
a0002166

Wall mounting
– Weather protection cover is optional



a0003092

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



a0005036

Panel mounting

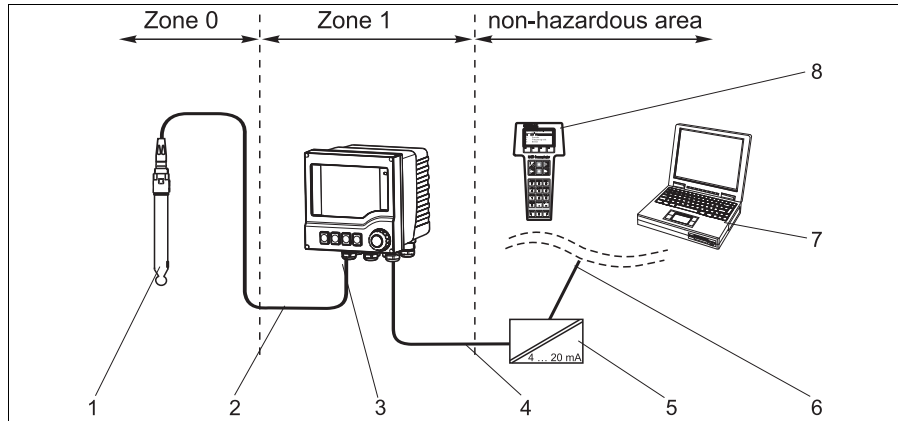


	Wall mounting	Pipe mounting	Panel installation
--	---------------	---------------	--------------------

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	

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



Installation in Ex area

- | | | | |
|---|--|---|------------------------------------|
| 1 | Sensor in Ex version | 5 | Active barrier, e.g. Preline RN221 |
| 2 | Intrinsically safe sensor circuit EEx ia | 6 | Signal line Hart/PROFIBUS/FF |
| 3 | Transmitter | 7 | Fieldcare via PROFIBUS/FF |
| 4 | Supply and signal circuit EEx ib (4...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: 2004

Ingress protection

IP 67 (similar to NEMA 4X)

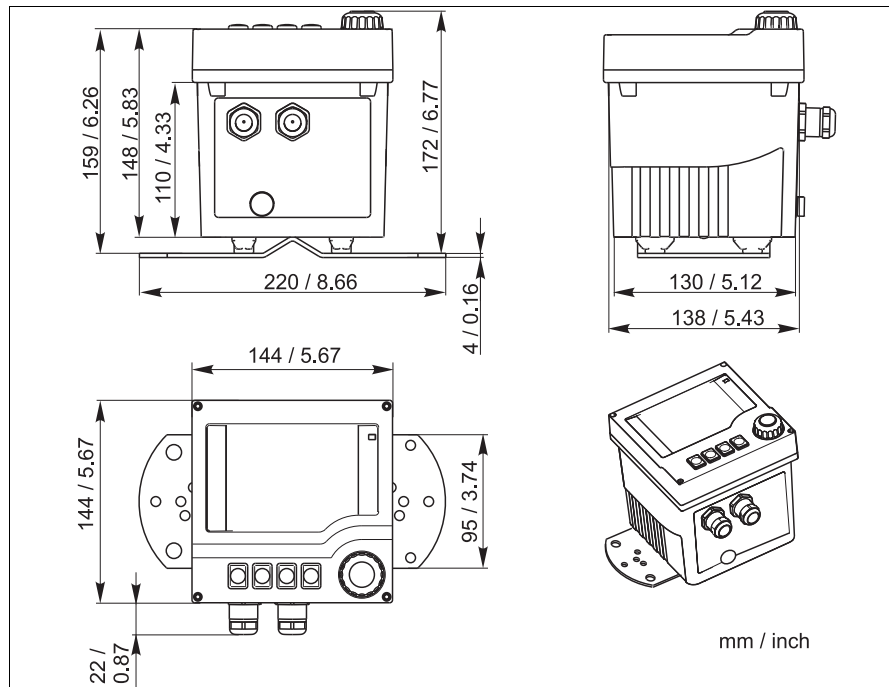
Relative humidity

10 to 95%, not condensing

Mechanical construction

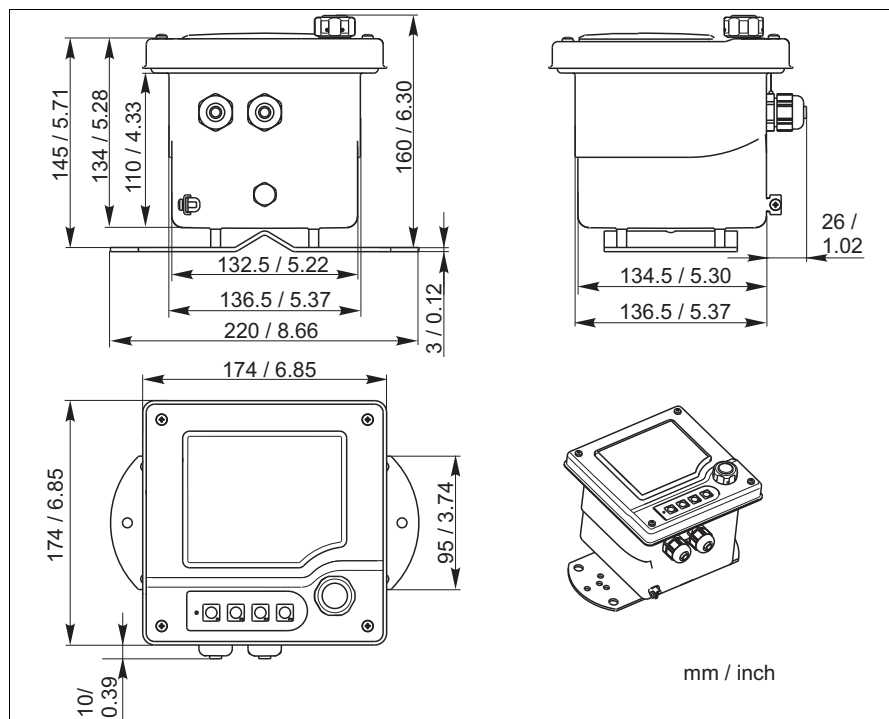
Dimensions

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

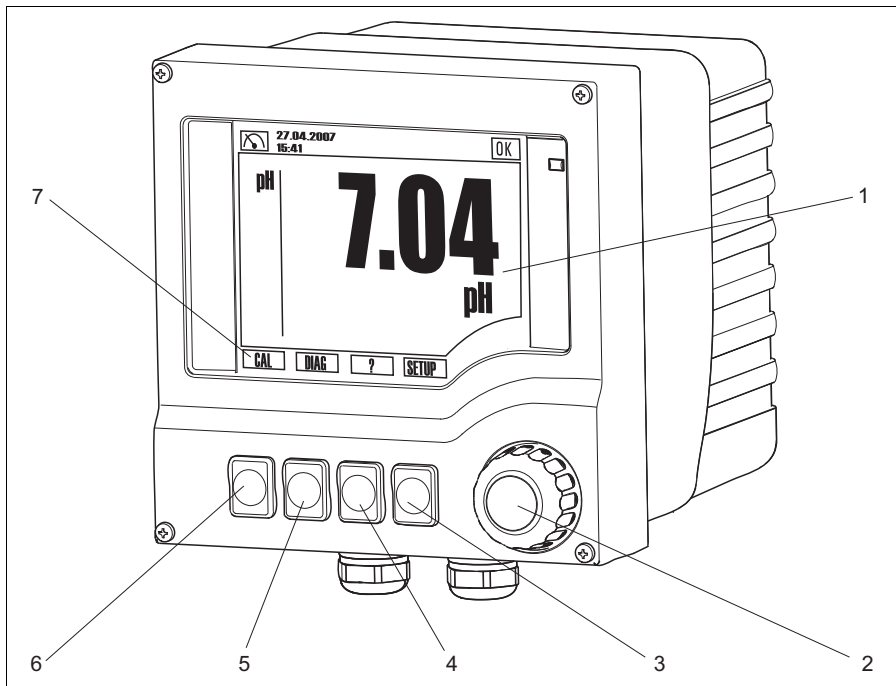
Housing:	Polycarbonate
Housing seals:	Foamed silicone, EPDM

Stainless steel housing

Housing:	Stainless steel 1.4301 (AISI 304)
Housing seals:	EPDM

Human interface

Operating elements



Overview of operation

- 1 Display, current display: pH measuring mode
- 2 Navigator
- 3-6 Soft keys
- 7 Soft key function (depends on menu)

a0010480

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
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
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)
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

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 Safety Manual acc. to SIL 2 (optional)
- A CD ROM with additional documentation

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
- CSA IS NI Cl.I, II, III, Div. 1&2, Grps. A-G
- FM IS NI Cl.I, Div. 1&2, Grps. A-D

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 local service.

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

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

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 mm² + shield)
- Sold by the meter, order no. 51502543

Sensors**Glass electrodes**

Orbisint CPS11/CPS11D

- pH electrode for process applications, with PTFE diaphragm;
- Ordering acc. to product structure, see Technical Information (TI028C/07/en)

Orbisint CPS12/CPS12D

- ORP electrode for process applications, with PTFE diaphragm;
- Ordering acc. to product structure, see Technical Information (TI367C/07/en)

Ceraliquid CPS41/CPS41D

- pH electrode with ceramics diaphragm and liquid KCl electrolyte;
- Ordering acc. to product structure, see Technical Information (TI079C/07/en)

Ceraliquid CPS42/CPS42D

- ORP electrode with ceramics diaphragm and liquid KCl electrolyte;
- Ordering acc. to product structure, see Technical Information (TI373C/07/en)

Ceragel CPS71/CPS71D

- pH electrode 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 with double chamber reference system and integrated bridge electrolyte;
- Ordering acc. to product structure, see Technical Information (TI374C/07/en)

Orbipore CPS91/CPS91D

- pH electrode with open aperture for media with high dirt load;
- Ordering acc. to product structure, see Technical Information (TI375C/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)

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

Oxygen sensors

Oxymax H COS21D

- Sterilizable sensor for dissolved oxygen, with Memosens technology
- Ordering acc. to product structure, see Technical Information (TI402C/07/en)

Oxymax W 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 the configuration
CY42-		Complete order code

Instruments International

Endress+Hauser
Instruments International AG
Kaegenstrasse 2
4153 Reinach
Switzerland

Tel.+41 61 715 81 00
Fax+41 61 715 25 00
www.endress.com
info@ii.endress.com

Endress+Hauser 
People for Process Automation