Operating Instructions
Liquiline Compact CM82

Compact multi-parameter transmitter for Memosens sloreensors

Endress+Hauser [EH]

People for Process Automation

Table of contents

1   About this document

1.1   Warnings

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

1.2   Symbols

Symbol	Meaning
ℹ	Additional information, tips
✅	Permitted or recommended
❌	Not permitted or not recommended
📖	Reference to device documentation
📄	Reference to page
🖾	Reference to graphic
↳	Result of a step

1.3   Symbols at the device
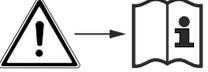
Symbol	Meaning
⚠ → 📖	Reference to device documentation

1.4   Documentation

The following instructions complement these Operating Instructions and are available on the product pages on the Internet:
Operating Instructions Memosens, BA01245C
- Software description for Memosens inputs
- Calibration of Memosens sensors
- Sensor-specific diagnostics and troubleshooting

2   Basic safety instructions

2.1   Requirements for personnel

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

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

2.2   Designated use

The Liquiline CM72 Liquiline CM82 is a transmitter for connecting digital sensors with Memosens technology, configurable, with 4..20 mA/HART communication and optional operation via smartphone or other mobile devices via Bluetooth.

The device is designed for use in the following industries:
- Life science
- Chemical industry
- Water and wastewater
- Food and beverages
- Power stations
- Other industrial applications

2.3   Occupational safety

As the user, you are responsible for complying with the following safety conditions:
- Installation guidelines
- Local standards and regulations
- Regulations for explosion protection

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

2.4   Operational safety

Before commissioning the entire measuring point:

1. Verify that all connections are correct.

2. Ensure that electrical cables and hose connections are undamaged.

3. Do not operate damaged products, and protect them against unintentional operation.

4. Label damaged products as defective.

During operation:

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

⚠ CAUTION

Cleaning not switched off during calibration or maintenance activities
Risk of injury due to medium or cleaning agent!

▸ If a cleaning system is connected, switch it off before removing a sensor from the medium.
▸ If you wish to check the cleaning function and have therefore not switched off the cleaning system, wear protective clothing, goggles and gloves or take other appropriate measures.

3   Product description

3.1   Product design
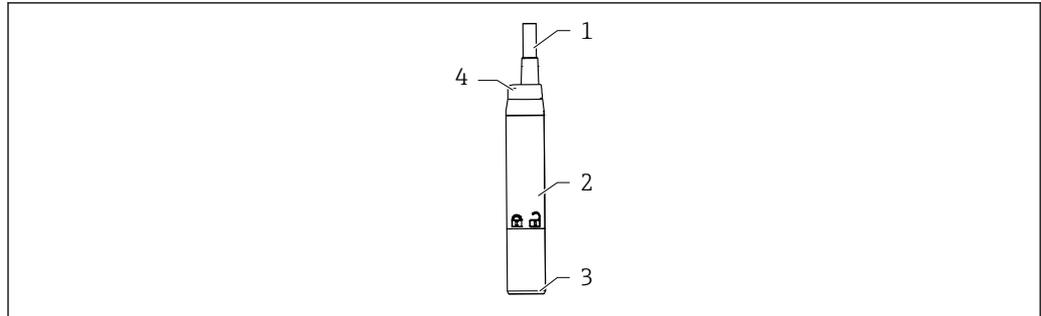
⊡ 1   Transmitter design

1   Cable
2   Housing
3   Memosens connection
4   LED, for optical signaling of operating statuses of measuring point

3.1.1   Measuring parameters

The transmitter is designed for digital Memosens sensors with inductive plug-in head:
- pH, ORP, pH/ORP combined sensors
- Conductive conductivity
- Dissolved oxygen

4   Incoming acceptance and product identification

4.1   Incoming acceptance

1. Verify that the packaging is undamaged.
   ↳ Notify the supplier of any damage to the packaging.
     Keep the damaged packaging until the issue has been resolved.

2. Verify that the contents are undamaged.
   ↳ Notify the supplier of any damage to the delivery contents.
     Keep the damaged goods until the issue has been resolved.

3. Check that the delivery is complete and nothing is missing.
   ↳ Compare the shipping documents with your order.

4. Pack the product for storage and transportation in such a way that it is protected against impact and moisture.
   ↳ The original packaging offers the best protection.
     Make sure to comply with the permitted ambient conditions.

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

4.2   Product identification

4.2.1   Nameplate

The nameplate provides you with the following information on your device:
- Manufacturer identification
- Order code
- Extended order code
- Serial number
- Firmware version
- Ambient and process conditions
- Input and output values
- Safety information and warnings
- Approvals as per version ordered

▶ Compare the data on the nameplate with your order.

4.2.2   Product identification

Product page

www.endress.com/CM82

Interpreting the order code

The order code and serial number of your product can be found in the following locations:
- On the nameplate
- In the delivery papers

Obtaining information on the product

1. Go to www.endress.com.

2. Call up the site search (magnifying glass).

3. Enter a valid serial number.

4. Search.
    ↳ The product structure is displayed in a popup window.
5. Click on the product image in the popup window.
    ↳ A new window (**Device Viewer**) opens. All of the information relating to your device is displayed in this window as well as the product documentation.

4.3 Scope of delivery

The scope of delivery includes:
• CM82
• Brief Operating Instructions

▶ If you have any queries:
  Please contact your supplier or local sales center.

4.4 Certificates and approvals

4.4.1 CE mark

Endress+Hauser Conducta GmbH+CO. KG hereby declares that the radio system type CM82 complies with directives 2014/53/EU and 2011/65/EU.

The complete text of the EU declaration of conformity can be found at the following web address:

www.endress.com/CM82

Frequency band: 2400-2483.5 MHz, power output: < 10dBm EIRP

4.4.2 Radio approval

USA/Canada radio approval (FCC/IC)

FCC ID: **2AKGY-BT41INTA01**

IC: **22173-BT41INTA01**

This device complies with Part 15 of the FCC Rules [and with Industry Canada license-exempt RSS standard(s)]. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Any changes or modifications made to this equipment not expressly approved by Endress+Hauser may void the FCC authorization to operate this equipment. This device complies with Part 15 of the FCC Rules and with Industry Canada license- exempt RSS standard(s).

Operation is subject to the following two conditions:
• this device may not cause harmful interference, and
• this device must accept any interference received, including interference that may cause undesired operation.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:
• l'appareil ne doit pas produire de brouillage, et
• l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and

used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
- Increase the separation between the equipment and receiver.
- Consult the dealer or an experienced radio technician for help.

Radio approval for Japan
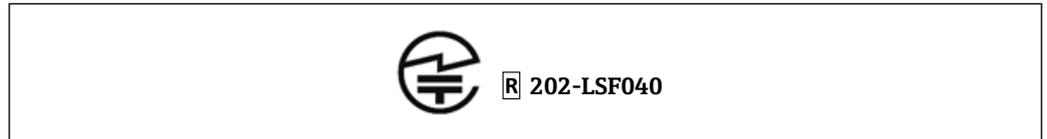
A0036603

Japanese Radio Law and Japanese Telecommunications Business Law Compliance. This device is granted pursuant to the Japanese Radio Law (電波法). This device should not be modified (otherwise the granted designation number will become invalid).

Radio approval for China

Certification number: **CMIIT ID: 2017DJ6495**

Radio approval for South Korea
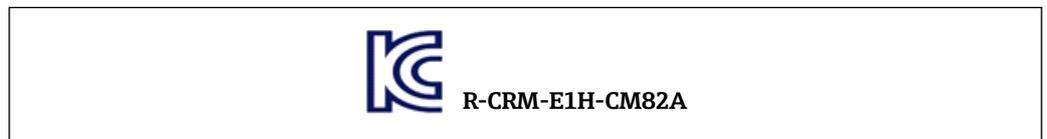
A0036602

Brazil radio approval

A0039074

00182-18-11036

Este equipamento não tem direito à proteção contra interferência prejudicial e não pode causar interferência em sistemas devidamente autorizados.

Mexico radio approval
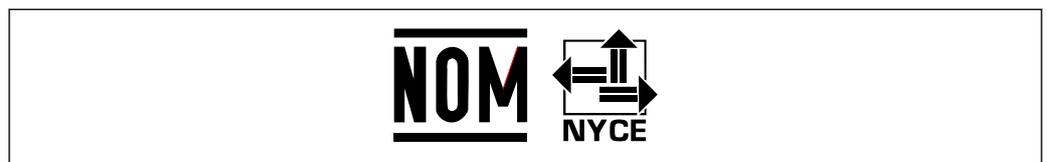
A0034100

Número **IFETEL: RCPENCM18-0926-A1**

La operación de este equipo está sujeta a las siguientes dos condiciones: (1) es posible que este equipo o dispositivo no cause interferencia perjudicial y (2) este equipo o dispositivo debe aceptar cualquier interferencia, incluyendo la que pueda causar su operación no deseada.

Thailand radio approval

CM82 complies with the Thai radio requirements (SDoC procedure).

Singapore radio approval

**Complies with
IMDA Standards
DA 108204**
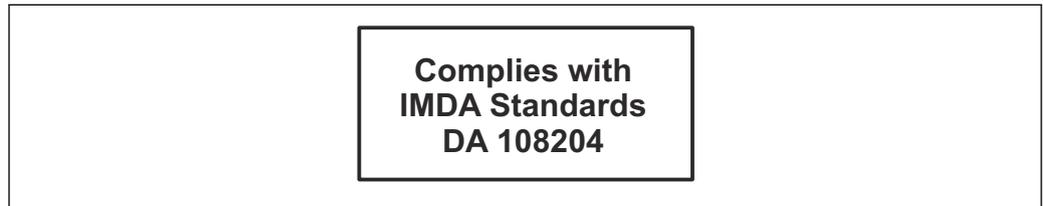
A0044087

Argentina radio approval

CNC ID: **C-23309**

4.4.3 Marine approvals

A selection of the devices and sensors have type approval for marine applications, issued by the following classification societies: ABS (American Bureau of Shipping), BV (Bureau Veritas), DNV-GL (Det Norske Veritas-Germanischer Lloyd) and LR (Lloyd's Register). Details of the order codes of the approved devices and sensors, and the installation and ambient conditions, are provided in the relevant certificates for marine applications on the product page on the Internet.

5 Installation

5.1 Dimensions
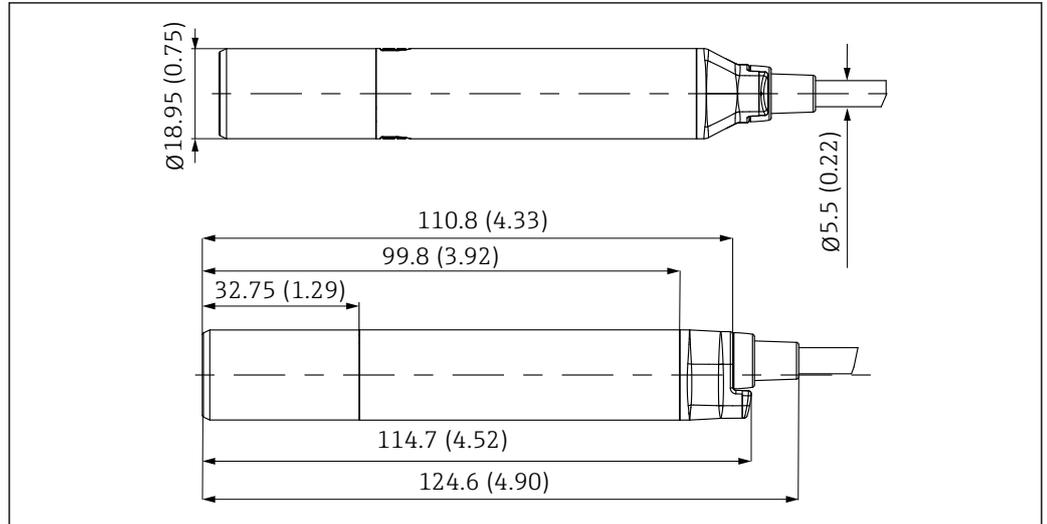
2   *Dimensions in mm (inch)*

6 Electrical connection

⚠ WARNING

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

6.1 Connection

Supply voltage:	12.6 to 30 VDC (when error current > 20 mA)
	14 to 30 VDC (if the error current is set to 3.6 mA.)
Cable length:	3 m (10 ft)
	7 m (23 ft)
	15 m (46 ft)
Signal output:	4 to 20 mA
Signal on alarm:	Configurable
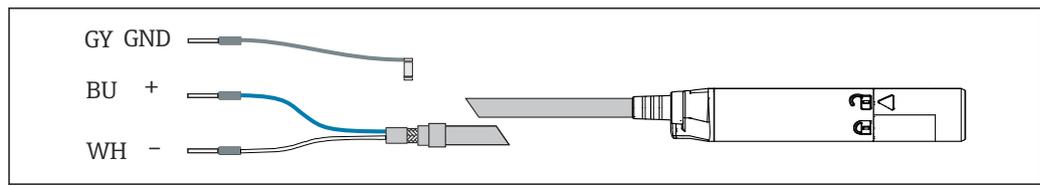
🖾 3   Electrical connection

▶ Connect ferrules as specified in the table:

Cable	Function
Gray (GY)	Grounding, GND
BU (blue)	4 to 20 mA +
White (WH)	4 to 20 mA -

The ground cable must be provided by the customer.

6.1.1 With RIA15

ℹ The RIA15 process display unit is loop-powered and does not require any external power supply.

📖 Further information is available in the RIA15 Operating Instructions BA01170K.

6.1.2 With junction box

| Max. operating voltage: | 30 V |
| Max. operating current | 30 mA |

Wiring

1. Unscrew cover and remove.
   ↳ The terminal assignment is indicated in the box.

2. Guide the cable cores through the M16 cable gland.

3. Connect cores in accordance with the assignment provided.
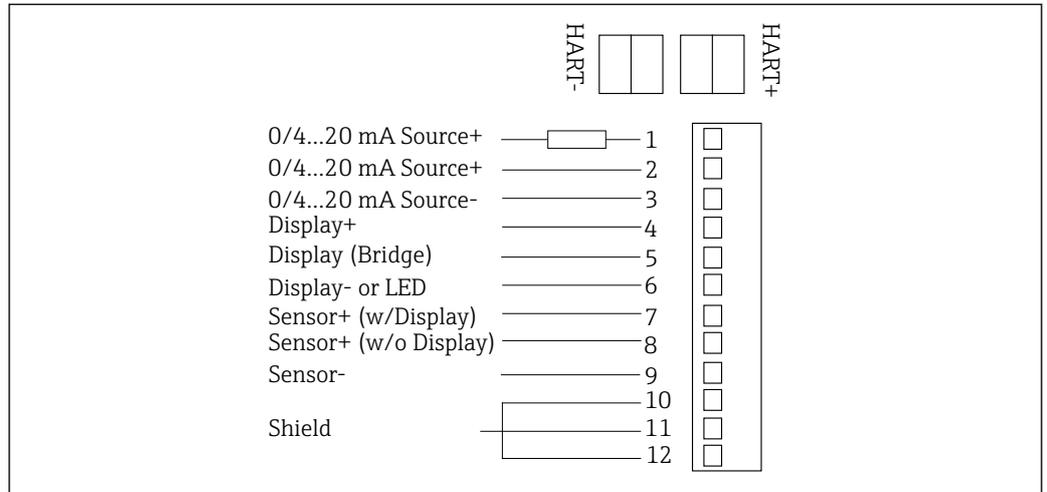
4   *Terminal diagram*

A0034718

📖 Further information is available in the Operating Instructions BA01802C.

6.2   Post-connection check

⚠ WARNING

Connection errors
The safety of people and of the measuring point is under threat. The manufacturer does not accept any responsibility for errors that result from failure to comply with the instructions in this manual.
▶ Put the device into operation only if you can answer **yes** to **all** the following questions.

Electrical connection
▶ Is the device or cable undamaged (visual inspection)?
▶ Do the mounted cables have adequate strain relief?
▶ Are the cables routed without loops and cross-overs?
▶ Does the supply voltage match the specifications on the nameplate?
▶ No reverse polarity, is terminal assignment correct?

7 Operation options

7.1 Overview of operating options

Operation and settings via:
- SmartBlue (app)
- RIA15 (with reduced operating function compared to app and HART)
- PLC control station (via HART)

7.2 Access to operating menu via SmartBlue (app)

SmartBlue is available as a download for Android terminals from the Google Playstore and for iOS devices from the App Store.

If you scan the QR code, you will be brought directly to the app:

5   Download links

6   SmartBlue App

7   Livelist

The Livelist displays all of the devices that are within range.

System requirements
- iOS devices: iPhone 4S or higher from iOS9.0; iPad2 or higher from iOS9.0; iPod Touch 5. Generation or higher from iOS9.0
- Devices with Android: from Android 4.4 KitKat and Bluetooth® 4.0

7.2.1 Structure and function of the operating menu

In the Home view, the current measured values are displayed along with the device information (tag labeling, device type, serial number, firmware version, order code).
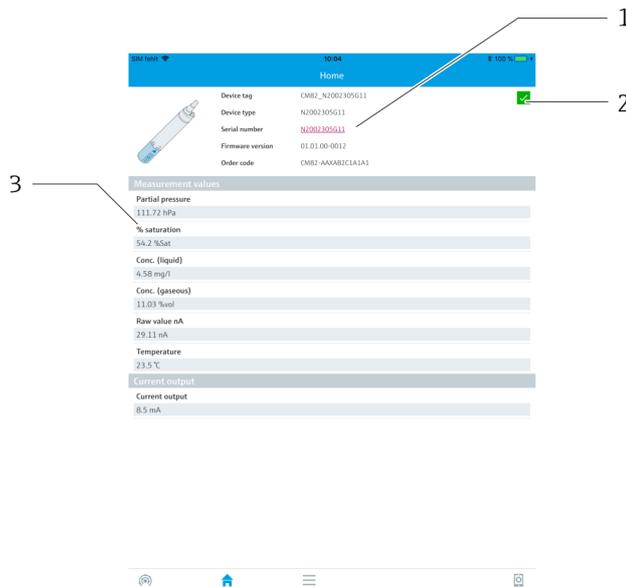
 8   Overview of current measured values

1   System and device information CM82
2   Shortcut to diagnostic list
3   Overview of measured values of connected sensor

The device is operated via four main menus:
- Guidance
- Diagnostics
- Application
- System
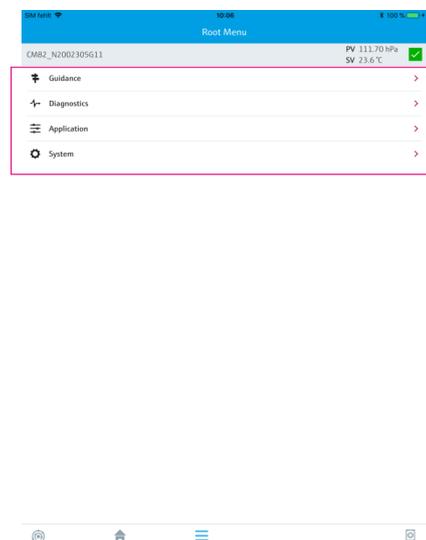
 9   Main menu

Menu	Function
Guidance	Contains functions involving a self-contained sequence of activities, e.g. for calibration (="Wizard", guided operation).
Diagnostics	Contains information regarding operation, diagnostics and troubleshooting, as well as configuration of the diagnostic behavior.
Application	Sensor data for specific optimization and for detailed process adjustment. Adjustment of measuring point to the application.
System	These menus contain parameters for configuring the overall system.

7.3 Access to operating menu via RIA15

The RIA15 process indicator is incorporated into the 4 to 20 mA/HART® loop and displays the measuring signal in digital form. The process indicator does not require an external power supply. It is powered directly from the current loop.

By means of HART® communication, the RIA15 enables configuration and commissioning of selected field devices and readouts of device/sensor status messages.
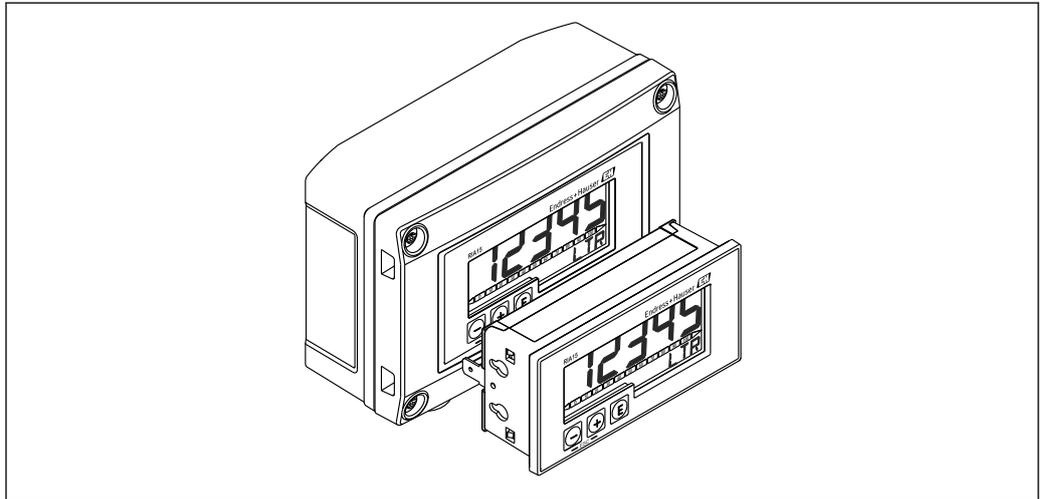
A0017816

⬚ *10 Process display unit RIA15*

8 System integration

8.1 Integrating the measuring device into the system

Interfaces for measured value transmission:
- 4 to 20 mA
- Bluetooth® LE wireless technology
- HART

8.1.1 Bluetooth® LE wireless technology

With the Bluetooth® LE wireless technology (energy-efficient wireless transmission) option that can be ordered, the device can be controlled via mobile terminals.
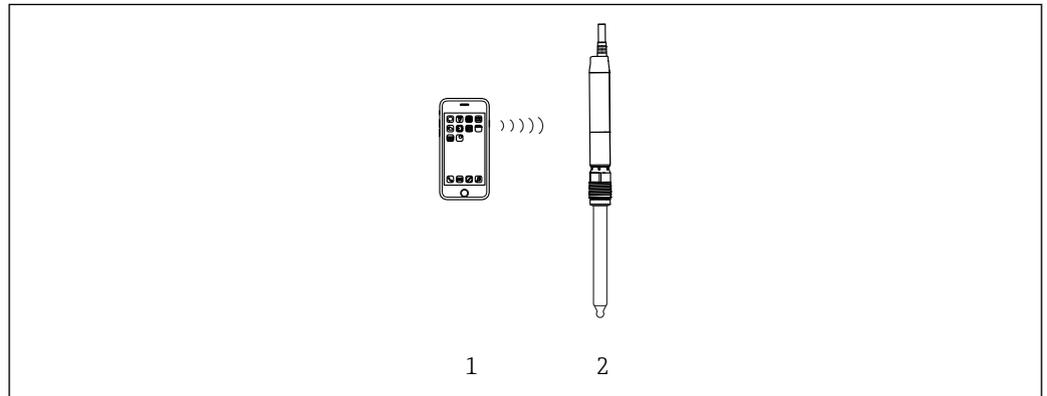
⊞ 11   *Options for remote operation via Bluetooth® LE wireless technology*

1   Smartphone / tablet with SmartBlue (app)
2   Transmitter with Bluetooth® LE wireless technology

8.1.2 HART

In addition to the analog 4 to 20 mA signal, other measured values as well as the device status can be transmitted digitally via the HART protocol.

Configuration is also possible using an additional operating device and an appropriate driver.

HART operation is possible via the following hosts (at least):
- Fieldcare and compatible DTM hosts
- Emerson TREX
- Emerson AMS
- Siemens PDM
- ABB FIM
- Honeywell FDM
- Yokogawa PRM
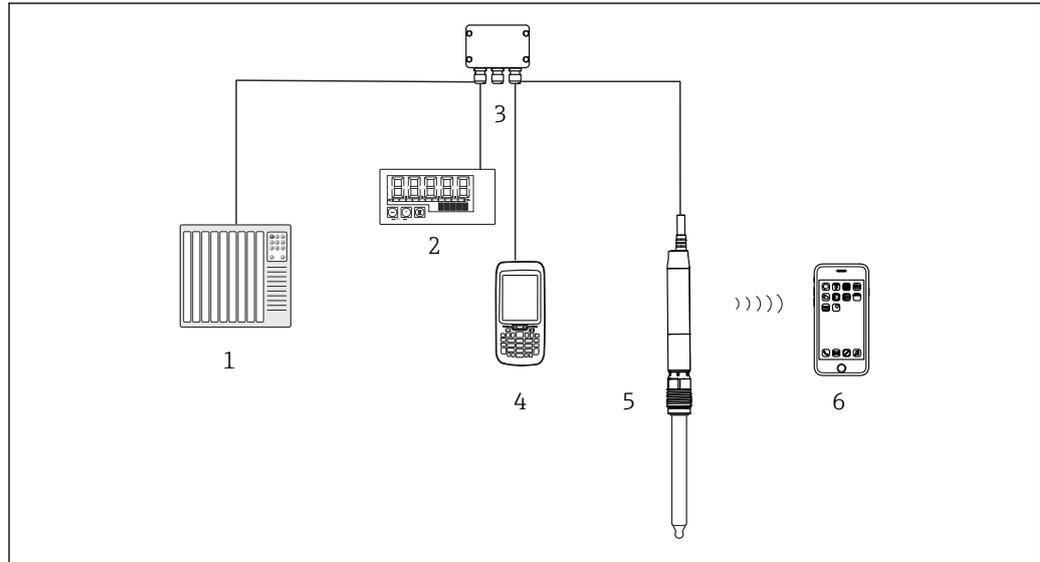
⊠ 12   Wiring options for remote operation via HART protocol

1   PLC (programmable logic controller)
2   RIA15 loop-powered process indicator, optional
3   Junction box
4   HART operating device (e.g. SFX350), optional
5   Transmitter with Bluetooth® LE wireless technology
6   Optional: Smartphone / tablet with SmartBlue (app)

9   Commissioning

9.1   Preparatory steps

▶ Connect the device.
    ↳ The device starts up and transmits the measured value as a current value.

To operate via the SmartBlue, the Bluetooth® LE signal on the smartphone or tablet must be switched on.

9.2   Function check

⚠ WARNING

Incorrect connection, incorrect supply voltage
Safety risks for staff and device malfunctions!
▶ Check that all connections have been established correctly in accordance with the wiring diagram.
▶ Ensure that the supply voltage matches the voltage indicated on the nameplate.

Familiarize yourself with the operation of the device before it is first switched on. In particular, please read the "Basic safety instructions" sections. After power-up, the device performs a self-test and then goes to the measuring mode.

9.2.1   LED display

LED messages signal the status of the device and sensor.

LED behavior	Status
Green Flashes quickly	Everything OK Device starting up
Green Flashes twice	Everything OK Read out Memosens sensor information from sensor to transmitter (sensor type, calibration data, etc.)
Green Flashes slowly	Everything OK Sensor and device OK and functioning correctly.
Green Flashes quickly three times	Everything OK Measured value at PLC in automatic HOLD. If the "Sensor replacement alarm delay" is exceeded, the device transmits a signal on alarm. The automatic hold is set to 30 seconds but can be configured to suit the customer's needs.
Red Flashes quickly	Failure of device or sensor Fault state as per NAMUR NE107
Red, green Three red flashes alternating with three green flashes	Squawk Squawk is signaled briefly while the connection is established. Squawk can also be activated via the app. This makes it possible to locate the device more quickly, e. g. when several devices are installed, you can see which one the connection is established with.

9.3   Connection via process indicator RIA15

9.3.1   Establishing a connection via RIA15

The loop-powered process indicator RIA15 can be used to display the measured values as well as for basic configuration of the Liquiline CM82 via HART®.

Here, the RIA15 communicates with the CM82 via HART as a secondary master in addition to the PLC or process control system. The RIA15 is not invisible to the PLC in this case. The RIA15 does not alter the current value of the current output of the CM82.

A0036208
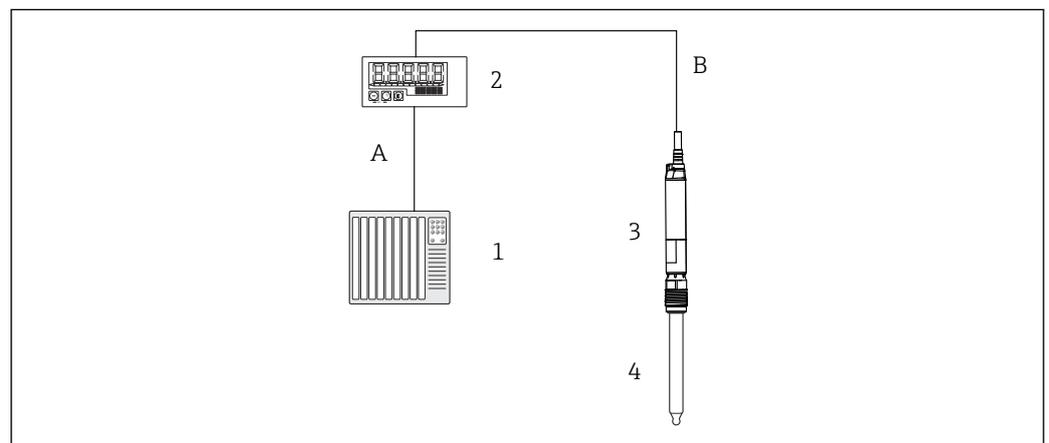
🖾 13   *Remote operation of CM82 via RIA15*

1   PLC
2   RIA15 loop-powered process display unit
3   CM82 transmitter
4   Memosens sensor (e.g. pH sensor)
A   4 to 20 mA (HART optional)
B   4 to 20 mA with HART
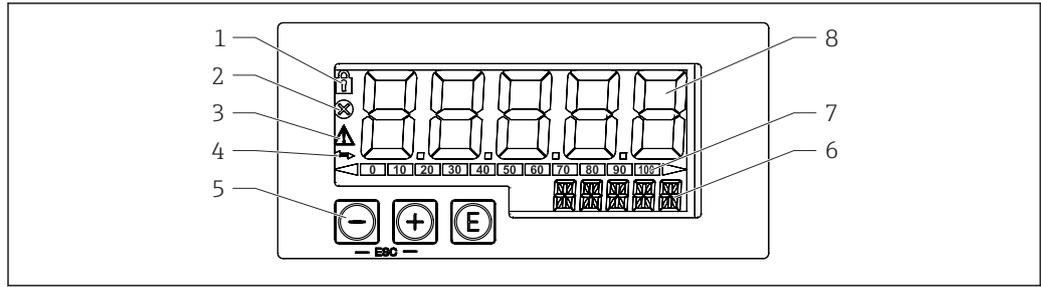
14   Display and operating elements of the process display unit

1   Operating menu locked
2   Error
3   Warning
4   HART communication enabled
5   Operating keys "-", "+", "E"
6   14-segment display for unit/TAG
7   Bar graph with indicators for under range and over range
8   5-digit 7-segment display for measured value, digit height 17 mm (0.67 in)

The device is operated using three operating keys on the front of the housing.

The device setup can be disabled with a 4-digit user code. If the setup is disabled, a padlock symbol appears on the display when an operating parameter is selected.

	Enter key; calling up the operating menu, confirming the option/setting parameters in the operating menu
	Selecting and setting/changing values in the operating menu; pressing the '-' and '+' keys simultaneously takes the user back up a menu level. The configured value is not saved.

RIA15 operating matrix

In HART mode, the RIA15 with "Analysis" option can be used for basic configuration of the Liquiline CM82.

The measuring ranges are dependent on the connected sensor and can be found in the relevant sensor documentation.

Local measured value display and basic configuration of the CM82

The RIA15 can be used as a local indicator of the measured values as well as for the basic commissioning of the Liquiline CM82 via HART®.

The following values are output with the factory settings:
• Digital output (HART®): measured value and unit depending on the connected sensor
• PV: Configured primary value (CMAIN operating parameter)
• SV: Temperature (sensor)
• TV: Dependent on the connected transmitter parameter + sensor type
• QV: Dependent on the connected transmitter parameter + sensor type

PV, SV, TV and QV can be adjusted via the SmartBlue app, for example.

Transmitter parameter	Sensor type	"TV" value	"QV" value
pH	Glass	Raw value in mV	Glass impedance in MOhm
pH	ISFET	Raw value in mV	Leak current in nA
pH	ORP	Relative ORP value as %	Raw value in mV

Transmitter parameter	Sensor type	"TV" value	"QV" value
pH	pH/ORP combined sensor	pH	ORP in mV
Conductivity		Resistance	Conductivity, raw value
Dissolved oxygen		Liquid concentration	Saturation as %

ℹ️ If "UC170" is displayed instead of the unit:
Configure the unit manually → 🖺 26

The following settings for the CM82 can be made using the three operating keys on the front of the RIA15:
• Units of connected sensor
• Current output range
• Retrieval of diagnostic information

Basic configuration of the CM82

The RIA15 must be in the HART mode (MODE = HART) to make the basic settings. The ANALYSIS menu is not visible in analog mode (MODE = 4-20).

1. Press the 🔘Ⓔ key.
   ↳ The **Setup** menu opens.

2. Press the 🔘Ⓔ key.
   ↳ The **CT** submenu opens.

3. Set the desired parameters. For parameter descriptions, see the following table.

Setup -> ANALYSIS menu			
The CT menu and all of the associated submenus are visible only if the RIA15 was ordered with the "Analysis" option, the HART option has been configured and a CM82 has been detected by the RIA15. Using this menu, the basic settings for the CM82 can be made via the RIA15.			
Parameter		**Values**	**Description**
CT			This menu contains the parameters for configuring the CM82 compact transmitter.
CSET			Access the "CM82 setup" submenu
	TUNIT	℃ ℉ °K	Select the unit for temperature on the CM82.
	OUTS		Access the "CM82 - Output Setting" submenu to change the setting on the CM82. The primary value (CMAIN) of the CM82 is assigned here and the measuring range (4-20mA) configured. ℹ️ Depending on the sensor type connected, only certain measured values can be configured/displayed.
	pH glass sensors		
	CMAIN	pH mV_PH IMPGL TEMP	PH: pH measured value in pH mV_PH: pH raw value in mV IMPGL: Glass impedance in MOhm [1] TEMP: Temperature in ℃/℉/K (unit as per setting in TUNIT)
	pH/ISFET sensors		
	CMAIN	pH mV_PH LEAKC TEMP	PH: pH measured value in pH mV_PH: pH raw value in mV LEAKC: ISFET leak current in "nA" [1] TEMP: Temperature in ℃/℉/K (unit as per setting in TUNIT)
	pH/ORP sensors		

Setup -> ANALYSIS menu			
The CT menu and all of the associated submenus are visible only if the RIA15 was ordered with the "Analysis" option, the HART option has been configured and a CM82 has been detected by the RIA15. Using this menu, the basic settings for the CM82 can be made via the RIA15.			
Parameter		**Values**	**Description**
	CMAIN	mVORP %_ORP TEMP	mVORP: ORP measured value in mV %_ORP: Percentage ORP value as % TEMP: Temperature in ℃/℉/K (unit as per setting in TUNIT)
	pH/ORP combined sensors		
	CMAIN	pH mV_PH IMPGL IMPRE mVORP %_ORP RH TEMP	PH: pH measured value in pH mV_PH: pH raw value in mV IMPGL: Glass impedance in MOhm [1] IMPRE: Reference impedance in Ohm mVORP: ORP measured value in mV %_ORP: Percentage ORP value as % RH: rH value in rH TEMP: Temperature in ℃/℉/K (unit as per setting in TUNIT)
	Oxygen sensors		
	CMAIN	PAR_P %SAT C_LIQ C_GAS CURR RTIME TEMP	PAR_P: Partial pressure of oxygen in hPa %SAT: Percentage saturation as % C_LIQ: Liquid concentration (unit as per setting in UCLIQ) C_GAS: Gas concentration (unit as per setting in UCGAS) CURR: Raw value, measuring current of sensor in nA [1] (visible only in the case of amperometric oxygen sensors) RTIME: Decay time, raw value in μs (visible only in the case of optical oxygen sensors) TEMP: Temperature in ℃/℉/K (unit as per setting in TUNIT)
	UCLIQ	mG_L uG_L PPM PPB	Unit of upper and lower turndown setting if the primary value (CMAIN) is set to C_LIQ mG_L: milligram/liter [1] uG_L: microgram/liter PPM: parts per million PPB: parts per billion
	UCGAS	%_VOL PPM_V	Unit of upper and lower turndown setting if the primary value (CMAIN) is set to C_GAS %_VOL: percent by volume PPM_V: parts per million
	Conductivity sensors		
	CMAIN	COND RESIS RAWC TEMP	COND: specific conductivity (unit as per setting in UCOND) RESIS: specific resistance (unit as per setting in URES) RAWC: uncompensated conductivity (unit as per setting in UCOND) TEMP: temperature (unit as per setting in TUNIT)
	URES	KO*CM MO*CM KO*M	Unit of upper and lower turndown setting if the primary value (CMAIN) is set to RESIS KO*CM: kOhm*cm MO*CM: MOhm*cm KO*M: kOhm*m
	UCOND	uS/cm mS/cm S/cm uS/m mS/m S/m	Unit of upper and lower turndown setting if the primary value (CMAIN) is set to COND or RESIS uS/cm: microsiemens/cm mS/cm: millisiemens/cm S/cm: siemens/cm uS/m: microsiemens/m mS/m: millisiemens/m S/m: siemens/m
	for all sensors		

Setup -> ANALYSIS menu			
The CT menu and all of the associated submenus are visible only if the RIA15 was ordered with the "Analysis" option, the HART option has been configured and a CM82 has been detected by the RIA15. Using this menu, the basic settings for the CM82 can be made via the RIA15.			
Parameter		Values	Description
	LOW	-19,999 to 99,999	Configure turndown of current output. The measured value that corresponds to 4 mA is set here. The limits of adjustment vary depending on the sensor type and measured value. The position of the decimal point is permanently preset depending on the primary value (CMAIN) configured. **Valid ranges of adjustment:** **pH sensor:** PH: -2.00 to 16.00 pH mV_PH: -2000 to 2000 mV LEAKC: -4000.0 to 4000.0 nA IMPGL: 0 to 99999 MOhm IMPRE: 0 to 99999 Ohm mVORP: -2000 to 2000 mV %_ORP: -3000.0 to 3000.0 % RH: 0.0 to 70.0 rH TEMP: -50.0 to 150.0 ℃ (depending on the unit configured under TEMP) -58.0 to 302.0℉ 223.1 to 423.1 K **dissolved oxygen sensor:** PAR_P: 0.0 to 2500.0 hPa %SAT: 0.02 to 200.00 % saturation C_LIQ: -0.02 to 120.00 mg/l -20.00 to 999.99 ug/l -0.02 to 120.00 ppm -20.00 to 999.99 ppb (depending on the unit configured in UCLIQ) C_GAS: -0.02 to 200 .00 % Vol -0.02 to 200 .00 % Vol -200.00 to 999.99 ppm Vol (depending on the unit configured under UCGAS) CURR: 0.0 to 9999.9 nA RTIME: 0.0 to 100.0 μs TEMP: -10.0 to 140.0 ℃ 14.0 to 284 ℉ 263.1 to 413.1 K (depending on the unit configured under TEMP) **Conductivity sensor:** COND: 0.000 to 99.999 uS/cm 0.000 to 99.999 mS/cm 0.000 to 2.000 S/cm 0.000 to 99.999 uS/m 0.000 to 99.999 mS/m 0.000 to 99.999 S/m (depending on the unit configured in UCOND) RESIS: 0.00 to 999.99 kOhm*cm 0.00 to 200.00 MOhm*cm 0.00 to 999.99 kOhm*m (depending on the unit configured in URES) RAWC: 0.000 to 99.999 uS/cm 0.000 to 99.999 mS/cm 0.000 to 2.000 S/cm 0.000 to 99.999 uS/m 0.000 to 99.999 mS/m 0.000 to 99.999 S/m (depending on the unit configured in UCOND)

Setup -> ANALYSIS menu			
The CT menu and all of the associated submenus are visible only if the RIA15 was ordered with the "Analysis" option, the HART option has been configured and a CM82 has been detected by the RIA15. Using this menu, the basic settings for the CM82 can be made via the RIA15.			
Parameter		**Values**	**Description**
			TEMP: -50.0 to 250.0 ℃ -58.0 to 482.0 ℉ 223.1 to 523.1 K (depending on the unit configured under TEMP)
	HIGH	-19,999 to 99,999	Configure turndown of current output. The measured value that corresponds to 20 mA is set here. The limits of adjustment vary depending on the sensor type and measured value. The position of the decimal point is permanently preset depending on the primary value (CMAIN) and units (UCLIQ, UCGAS, URES, UCOND) configured. For valid ranges of adjustment, see LOW (setting for 4 mA)
	ERRC	3.6 to 23.0	Configure the error current on the CM82 in mA
CDIAC			Access the "CM82 - Device diagnostics" submenu
	FCSM	Error category as per NAMUR and error number	Display the error message with the highest priority on the CM82
	DTAG	Device tag	Display the device tag of the CM82 (use +/- keys to scroll through text)
	DSER	Device serial number	Display the serial number of the CM82 (use +/- keys to scroll through text)
	SENOC	Sensor order code	Display the oder code of the sensor (use +/- keys to scroll through text)
	SENSN	Sensor serial number	Display the serial number of the sensor (use +/- keys to scroll through text)
CTRES			Access the "CM82 -Reset" submenu
	RBOOT	No YES	Trigger a restart of the CM82
	FDEF	No YES	Reset the CM82 to factory settings
CTSIM			Access the "CM82 -Simulation" submenu
	SIMUL	OFF ON	Switch on simulation for current output value on CM82
	VALUE	3.6 to 23.0	Configure current output value on CM82 for simulation in mA

1)   If "UC170" is displayed instead of the unit: Configure the unit manually → 🖹 26

📖 Further information is available in the RIA15 Operating Instructions BA01170K.

"UC170" displayed instead of HART® unit

By default, the unit of the transmitted measured value is automatically read out and displayed using a HART® command. If the transmitted "unit code" cannot be uniquely assigned by the RIA15, the unit code (UC170) is displayed instead of the unit. To remedy this, the unit must be set manually. (SETUP => HART => HART1-4 => UNIT1-4 => TEXT1-4).

The unit codes 170 to 219 are assigned multiple times as per the HART® specification. As the UC170 is also used with the CM82, the unit must be assigned manually. This applies to the following measured values/units:

PV (TEXT1):

Transmitter parameter	Primary value (CMAIN)	Unit
pH	Leak current (LEAKC)	nA
pH	Glass impedance (IMPGL)	MOhm
Dissolved oxygen	Liquid concentration (C_LIQ)	mg/l
Dissolved oxygen	Raw value of sensor (CURR)	nA

QV (TEXT4):

Transmitter parameter	Sensor type	Unit
pH	Glass	MOhm
pH	ISFET	nA

9.4   Establishing connection via SmartBlue (app)

1. Download and install the SmartBlue.

2. Start the SmartBlue.

3. Select device from livelist displayed. All available devices are displayed.

4. Perform login

5. Enter user name -> admin

6. Enter initial password -> device serial number

7. It is advisable to change the user name and password after logging in for the first time.

You can drag additional information (e. g. main menu) onto the screen by swiping across the screen.

9.4.1   System settings

Path: Settings		
Function	**Options**	**Info**
Information		
Version		Displays the app version
About Endress+Hauser		Manufacturer's information
User interface		
Language	Picklist of different languages	Change language
Save device login passwords	**Selection** • Off • 5 minutes • 15 minutes • 60 minutes	Options for saving password The password is stored temporarily for the selected time period. It does not need to be entered when re-establishing a connection, e.g. to replace a sensor.
Device List		

Path: Settings		
Function	Options	Info
Sorting	**Selection** • Signal strength • Name	Sorting options
Show demo devices	**Selection** • Never • Only, if no device is present • Always	Determines when demo devices are displayed in the list.

9.5 Setting the operating language

You can change the operating language in the app settings:

Settings/User interface/Language

9.6 Date and time

Set the date and time under **System/Date/Time**.

Alternatively, the date and time can be applied automatically to the mobile device.

The date and time function runs only while the device is supplied with power. They must be reset if the power supply is interrupted.

(Start time: 01.01.1970 0:00 hours...)

9.7 Configuring the measuring device

Path: Application		
Function	Options	Info
Units		
Temperature unit	**Selection** • ℃ • ℉ • K **Factory setting** ℃	
Cond. unit	**Selection** • µS/cm • mS/cm • S/cm • µS/m • mS/m • S/m **Factory setting** mS/cm	To be selected for conductivity
Conc. (liquid) unit	**Selection** • mg/l • µg/l • ppm • ppb	To be selected for oxygen.
Conc. (gaseous) unit	**Selection** • %vol • ppm	

9.7.1 Changing the device tag

You can change the device tag here:

System/**Device management**/**TAG**

The device tag is changed in:
- Sensor information
- Device information

9.7.2 Configuring the sensor

Path: Application		
Function	**Options**	**Info**
Sensor		Sensor-dependent settings
Sensor type		Display the sensor type
Order code		Order code of sensor
Damping		The damping causes a floating average curve of the measured values over the time specified.
Damping ORP Damping pH Damping DO Damping conductivity	0 to 60 s **Factory setting** 0 s	Determine damping of primary value of connected sensor.
Damping temperature	0 to 60 s **Factory setting** 0 s	Determine damping of integrated temperature sensor.
Tag control		Check the manually assigned sensor name or sensor group. Sensor will not function if name is different.
Sensor check	**Selection** - Off - Tag - Group **Factory setting** Off	Check sensor name or determine sensor group.
Group	Range: 0 to 65535	Determine accepted sensor group.
Show ORP % value		Display ORP as percentage value (ORP and combined sensor)
Extended setup		Depends on the connected sensor
Conductivity:		
Current cell constant	Read only	Value currently saved in the sensor
Compensation	Linear	Compensation of temperature dependency is linear.
Meas. ref. temp.	-5.0 to 100.0 ℃ (23.0 to 212.0 ℉) **Factory setting** 25.0 ℃ (77.0 ℉)	Reference temperature for calculating the temperature-compensated conductivity
Factor alpha	0.000 to 20.000 %/K **Factory setting** 2.100 %/K	Enter the conductivity coefficient of your process medium
pH, ORP:		

Path: Application		
Function	Options	Info
Temp. compensation	**Selection** • Off • Automatic • Manual **Factory setting** Automatic	Determine compensation of fluid temperature: • Automatically using the temperature sensor of your sensor (ATC) • Manually by entering the medium temperature • Not at all
Medium comp.	**Selection** • Off • 2-point calibration **Factory setting** Off	Take a sample from the medium and determine its pH value at different temperatures in the lab. Decide whether you want to compensate using two points or several points in a table.
Offset	-18.00 to 18.00 pH -100 to 100 mg/l **Factory setting** 0.00 pH 0.00 mg/l	The offset compensates for a difference between a laboratory measurement and an online measurement which is caused by interference ions. Enter this value manually. If you are using a compensation electrode, keep the offset at zero.
Internal buffer	pH 0 to 14 **Factory setting** pH 7.00	Only change the value if you are using a sensor with an internal buffer other than pH 7.
Customer ID	User-defined **Factory setting** ---	Determine customer identification using up to 16 characters.
Sterilization settings		
Temperature threshold	**Selection** 120 to 150 °C (248 to 302 °F) **Factory setting** 121 °C (249.8 °F)	Define temperature threshold.
Duration	**Selection** 1 to 250 min **Factory setting** 20 min	Define duration of sterilization.
CIP settings		
Function	**Selection** • Off • On **Factory setting** Off	Switches the function on or off
Type	**Selection** • Acidic • Alkaline	Enter type of cleaning agent.
pH Threshold	**Selection** 2 to 20 pH **Factory setting** 11 pH	Determine a pH threshold. The counter runs if the T threshold is exceeded and the pH threshold is overshot (CIP is alkaline) or undershot (CIP is acidic) at the same time.
Upper temp. threshold	**Selection** **Lower temp. threshold** ... 90 °C (194 °F) **Factory setting** 85 °C (185 °F)	The lower temperature threshold of the CIP criteria. One CIP cycle is taken into account within the temperature thresholds.

Path: Application		
Function	Options	Info
Lower temp. threshold	**Selection** 5 °C (41 °F)… **Upper temp. threshold** **Factory setting** 75 °C (167 °F)	The lower temperature threshold of the CIP criteria. One CIP cycle is taken into account within the temperature thresholds.
Duration	**Selection** 1 to 250 min **Factory setting** 30 min	The length of time in minutes that must elapse in order to increment the counter by one CIP cycle.
Load recommended values		Load factory settings from the connected sensor and use in the device.
Oxygen:		
Medium pressure	**Selection** • Process pressure • Air pressure • Altitude • Measured value **Factory setting** Air pressure	For each type of compensation, specify a compensation value for the measurement. • Altitude (-300 to 4000 m) • Process pressure (500 to 9999 hPa) • Air pressure (500 to 1200 hP) Specify medium pressure during calibration: **Calib. settings/Medium pressure** ▸ Accept with **OK** or discard with **Cancel**.
Air pressure	Choose from Medium pressure	Specify air pressure (500 to 9999 hPa) of measuring point
Salinity	**Selection** • Fixed value • Measured value **Factory setting** Fixed value	Specify salinity.
Diagnostic settings		For diagnostic settings of sensor, see section→ 🖹 46
Format settings		Set the number of decimal places.

Calibration settings

Path: Application/Sensor/Extended setup/Calibration settings		
Function	Options	Info
pH:		
Stability criteria		Once the stability criterion is met, the measured value is displayed in mV.
Delta mV	1 mV to 10 mV **Factory setting** 1 mV	Measured value depending on connected sensor
Duration	0 to 60 s **Factory setting** 0 s	
Temp. compensation	**Selection** • Off • Automatic • Manual **Factory setting** Automatic	Configure compensation of buffer temperature: • Automatically using the temperature sensor of your sensor (ATC) • Manually by entering the medium temperature • Not at all

Path: Application/Sensor/Extended setup/Calibration settings		
Function	**Options**	**Info**
Buffer recognition	**Selection** ▪ Fixed ▪ Automatic [1] ▪ Manual **Factory setting** Fixed	**Fixed** Choose values from a list. The list depends on the setting for **Buffer manufacturer**. **Automatic** The device recognizes the buffer automatically. The recognition depends on the setting for "**Buffer manufacturer**". ℹ️ As their zero point is offset, enamel pH sensors cannot be calibrated and adjusted with automatic buffer recognition. **Manual** Enter any two buffer values. These must differ in terms of their pH value.
Buffer manufacturer	**Selection** ▪ Endress+Hauser ▪ Ingold/Mettler ▪ DIN 19266 ▪ DIN 19267 ▪ Merck/Riedel ▪ Hamilton **Factory setting** Endress+Hauser	Temperature tables are stored internally in the unit for the following pH values: ▪ **Endress+Hauser** 2.00 / 4.00 / 7.00 / (9.00) / 9.22 / 10.00 / 12.00 ▪ **Ingold/Mettler** 2.00 / 4.01 / 7.00 / 9.21 ▪ **DIN 19266** 1.68 / 4.01 / 6.86 / 9.18 ▪ **DIN 19267** 1.09 / 4.65 / 6.79 / 9.23 / 12.75 ▪ **Merck/Riedel** 2.00 / 4.01 / 6.98 / 8.95 / 12.00 ▪ **Hamilton** 1.09 / 1.68 / 2.00 / 3.06 / 4.01 / 5.00 / 6.00 7.00 / 8.00 / 9.21 / 10.01 / 11.00 / 12.00
Calibration buffer 1 ... 2		The possible options and the factory setting depend on the **Buffer recognition**
Oxygen:		
Stability criteria		
Delta signal	0.1 to 2.0 % **Factory setting** 0.2 %	Permitted measured value fluctuation during calibration. Referenced to the raw value in nA in the case of amperometric sensors, and referenced to the raw value in µS in the case of optical sensors.
Delta temperature	0.10 to 2.00 K **Factory setting** 0.50 K	Permitted temperature fluctuation during calibration
Duration	5 to 60 s **Factory setting** 20 s	Timeframe within which the permitted measured value variation may not be exceeded
Ambient conditions		
Medium pressure	**Selection** ▪ Process pressure ▪ Air pressure ▪ Altitude ▪ As in measurement **Factory setting** Air pressure	

Path: Application/Sensor/Extended setup/Calibration settings		
Function	Options	Info
Process pressure **Medium pressure = Process pressure**	500 to 9999 hPa **Factory setting** 1013 hPa	Enter the altitude or the average air pressure **of the place of calibration** (mutually dependent values). If the altitude is specified, the average air pressure is calculated from the barometric altitude formula and vice versa. If the process pressure is used for compensation, enter the pressure in the calibration fluid. The pressure is then independent of the altitude.
Air pressure **Medium pressure = Air pressure**	500 to 1200 hPa **Factory setting** 1013 hPa	
Altitude	-300 to 4000 m **Factory setting** 0 m	
Rel. hum. (air variable)	0 to 100 % **Factory setting** 100 %	
Calibration timer		
Function	**Selection** ▪ Off ▪ On **Factory setting** Off	
Calibration check		The function checks whether the calibration of a sensor is still valid. Example: A precalibrated sensor is installed. The function checks how long ago the sensor was last calibrated. A diagnostics message is displayed if the time since the last calibration is longer than specified by the predefined warning and alarm limit.
Function	**Selection** ▪ During operation ▪ When connecting **Factory setting** Off	
Warning limit	1 to 20000 h **Factory setting** 0 h	Warning and alarm limits mutually influence each other's possible adjustment range.
Alarm limit	1 to 20000 h **Factory setting** 0 h	Warning and alarm limits mutually influence each other's possible adjustment range.
Reference value	Conc. (liquid) Conc. (gaseous) % saturation Partial pressure	Specify a measured value and a reference value.

1)   Only pH sensor or pH/ORP combined sensor

9.7.3   Current output

Path: Application		
Function	Options	Info
Current output		
Output value	**pH, ISFET, ORP and combined options** • pH • Raw value pH • Glass impedance • Impedance reference • rH • ISFET Leakage current • ORP mV • ORP % • Temperature **Oxygen options** • Partial pressure • % saturation • Conc. (liquid) unit • Conc. (gaseous) unit • Raw value µs • Raw value nA • Temperature **Conductivity options** • Conductivity • Resistivity • Raw value (cond. uncomp.) • Temperature	Depends on connected sensor
Range lower value (4mA)	The unit depends on the sensor configured.	Enter the measuring range. The lower and upper range values are assigned to the 3.6 mA value and the 20 mA value respectively. The system uses the engineering unit which you entered beforehand.
Range upper value (20mA)		

9.7.4   HART

Path Application/HART		
Function	Options	Info
Bus address	0 to 63 **Factory setting** 0	Enter the bus address Address 1 to 63 Multidrop - mode
PV value	Choose from **Current output/Output value**	Primary process value

Path Application/HART		
Function	**Options**	**Info**
SV value	**pH, ISFET, ORP and combined**	Protocol-specific data, dynamic variables of HART communication.
TV value	• pH	SV = Secondary (temperature preselection)
QV value	• Raw value pH	TV = Tertiary
	• Glass impedance	QV = Quaternary
	• Impedance reference	
	• rH	
	• ISFET Leakage current	
	• ORP mV	
	• ORP %	
	• Temperature	
	Oxygen	
	• Partial pressure	
	• % saturation	
	• Conc. (liquid)	
	• Conc. (gaseous)	
	• Raw value µs	
	• Raw value nA	
	• Temperature	
	Conductivity	
	• Conductivity	
	• Resistivity	
	• Raw value (cond. uncomp.)	
	• Temperature	

9.7.5 Hold

The hold state is a safe condition during configuration and calibration.

Path:System/Hold		
Function	**Options**	**Info**
Hold release time	0 to 600 s **Factory setting** 0 s	The hold status is maintained for the duration of the delay time when you switch to the measuring mode.
Hold behavior	**Selection** • Ignore • Freeze • Fixed value **Factory setting** Freeze	
Manual hold	**Selection** • Off • On **Factory setting** Off	Set manual "hold".
Calibration hold	**Selection** • Yes • No **Factory setting** No	During calibration, the output signal is set to "HOLD"

9.8 Configuration management

Display the following configurations:

System/System information
- TAG
- Order code
- Order code extended
- Serial number
- Software version
- Hardware version
- Modbus
- HART
- Sensor communication statistics
  (only in **Expert** mode)

System/Sensor information
- General information
- Extreme values
- Sensor operation
- Sensor specification
- Cap operation
  (COS81D only)
- Calibration information
  - Temperature adjustment
  - Main value
  - Main measurement value - zero point
  - Main measurement value - slope
  - Main measurement value - point at oxygen
    (COS81D only)
  - Fermenter scaling
    (COS81D only)
  - Calibration history list (sensor-dependent)

9.9 Unauthorized access via Bluetooth® LE

The compact transmitter is password-protected against unauthorized access via Bluetooth. The password can be changed.
- Immediately after entering the password
- In the menu under:
  System/Security/Bluetooth password

9.9.1 Resetting the password

The reset code is used to resolve password problems during commissioning of the device. Data security is not guaranteed until the default reset code has been changed by the user.

If the user-defined password is lost, access can be restored via a reset code.

The reset code is the *serial number* of the device in reverse.

> **NOTICE**
>
> **Forgotten reset code**
> If lost, passwords can be reset via Bluetooth only if HART is used. The device cannot be used if it does not have HART communication.
> ▶ Ensure that the login and reset code are stored in a safe place.

9.9.2   Safe signal transmission via Bluetooth® LE

Signal transmission via Bluetooth® wireless technology uses a cryptographic technique tested by the Fraunhofer Institute.
- Without the SmartBlue app, the device is not visible via Bluetooth® wireless technology.
- Only one point-to-point connection is established between a sensor and a smartphone or tablet.
- The Bluetooth® wireless technology interface can be disabled via the SmartBlue.
- Bluetooth® is optional. It can be ordered with this functionality enabled.
  If ordered with Bluetooth® disabled, Bluetooth® can be enabled at a later stage by means of an activation code (accessory kit) linked to the serial number.
- If the Bluetooth® interface has been disabled, it can be reactivated only via HART.

9.9.3   RIA15 locking

The device setup can be disabled with a 4-digit user code.

🔲 Further information is available in the RIA15 Operating Instructions BA01170K.

10 Operation

10.1 Reading measured values

The display of the primary values in the app is dependent on the connected sensor.

HOME view
Function
Measurement values
For pH glass, ISFET, ORP or combined sensors:
pH
Raw value pH
Glass impedance
Impedance reference
ORP mV
ORP %
rH
Temperature
For oxygen sensors:
Partial pressure
% saturation
Conc. (liquid)
Conc. (gaseous)
Raw value nA or Raw value µs
Temperature
For conductivity sensors:
Conductivity
Resistivity
Raw value (cond. uncomp.)
Temperature
Current output

Data relating to the transmitter:

TAG
Device type
Serial number
Firmware version
Order code

10.1.1 Changing the parameters

In the order configuration, the device detects Memosens sensors automatically using plug and play.

ℹ️ When replacing the sensor at a later stage, the appropriate sensor type must be selected to ensure that no settings are lost.

Path: Guidance/Measurement parameter		
Function	**Options**	**Info**
Measurement parameter	**Selection** • pH, Redox, pH/Redox • Dissolved oxygen • Conductivity	Select the parameters supported by the device.
With "Finish" the device will be restarted and the measurement parameter change will be executed. This may take a few minutes.		

10.2 Adapting the measuring device to the process conditions

10.2.1 Medium compensation (in the process) for oxygen

Path: Application/Sensor/Extended setup		
Function	**Options**	**Info**
Medium pressure	**Selection** • Process pressure • Air pressure • Altitude	Satisfy one of the following measuring point specifications: • Process pressure (500 to 9999 hPa) • Air pressure (500 to 1200 hPa) • Altitude (-300 to 4000 m),
Salinity	0 to 40 g/kg **Factory setting** 0 g/kg	The influence of salt content on oxygen measurement is compensated with this function. Example: sea water measurement as per Copenhagen Standard (30 g/kg).

10.2.2   LED settings (optical oxygen sensors only)

Path: Application/Sensor/Extended setup		
Function	Options	Info
LED temp. mode	**Selection** • Off • On **Factory setting** Off	Switches off the LED when the set temperature threshold is exceeded. This prevents the premature aging of the sensor cap, e.g. during a CIP or SIP cycle.
LED temp. threshold	30 to 130 ℃ (86 to 266 ℉) **Factory setting** 80 ℃ (176 ℉)	
LED measuring interval	**Selection** • 1 second • 3 seconds • 10 seconds • 30 seconds **Factory setting** 1 second	The LED measuring interval influences the response time on the one hand and the operating life of the sensor cap on the other. Shorter intervals improve the response time but reduce the operating life of the sensor cap. Make your setting depending on the requirements of your process.
Measurement filter	**Selection** • **Off** • **Weak** • **Normal** • **Strong** • **Very strong**	Use this function to select how strong or weak the signal filtering in sensor COS81D should be. **Off** No signal filtering takes place ⑤ the recorded signals are passed through virtually unfiltered. **Weak** Signal filtering is weak. **Normal** Signal filtering is normal. **Strong** Signal filtering is strong. **Very strong** Signal filtering is very strong. Widely fluctuating raw signals are greatly attenuated by the sensor.

10.2.3   ORP percentage assignment (ORP and combined sensors)

Path: Guidance/Calibration		
Function	Options	Info
ORP % assignment	can be selected	The measured value in mV is converted to a % concentration using a conversion table.

11   Calibration

ℹ️ If calibration is not enabled on the device, the following message is displayed:
Calibration functions are not unlocked on this device.

ℹ️ If there is a problem with the sensor, calibration is not possible. The following
message is displayed:

Currently no calibration possible
due to sensor failure.

To calibrate the sensor, remove it from the medium and calibrate it in the laboratory. Since
Memosens sensors save their data, it is possible to work with "precalibrated" sensors at any
time and there is no need to interrupt process monitoring for the calibration.

1. Menu: Select **Guidance/Calibration**.

2. Select calibration type.

3. Follow the instructions of the software.

The calibration can be canceled at any time with **X**. No data are then used to adjust the
sensor.

11.1   Types of calibration

Path: Guidance/Calibration	
Type of calibration	**Info**
Oxygen (not COS81D):	
Slope	In the case of slope calibration, the dependency on partial pressure is used to compare the signal current to a known and readily available reference (air). In many cases, this function is a simple linear slope.
Air 100% rh	The slope of the sensor is determined by calibrating the sensor in air that is saturated with water vapor. For this model to work correctly, the sensor to be calibrated must be close to a water surface or be located in the headspace of a vessel partially filled with water, for example.
H2O air-saturated	The slope of the sensor is determined by calibrating the sensor in air-saturated water.
Air variable	This calibration model is for all applications in which the air pressure and air humidity in the vicinity of the sensor do not correspond to the standard atmospheric values previously mentioned, but are still known. Both variables can be specified here.
Numeric input	The slope can be calibrated by entering data. This data can be calculated or obtained via a reference measurement, for example.
Zero point	Oxygen must be eliminated for zero-point calibration of the sensor, and the sensor signal in the absence of oxygen is determined.
1-point cal.	The zero point of the sensor is determined by calibrating the sensor in the absence of oxygen. Zero-point gel COY8 or nitrogen gas (N5), for example, are suitable for this purpose.
Numeric input	The zero point can be calibrated by entering a new zero-point value. This can be calculated or obtained via a reference measurement, for example.

Path: Guidance/Calibration	
Type of calibration	**Info**
Change electrolyte	Following sensor maintenance, including electrolyte replacement, this command can be used to reset the electrolyte counter. This counter can be assigned a message and can assist with maintenance planning.
Change sensor cap	Following sensor maintenance, including physical replacement of the diaphragm, this command can be used to reset all cap-dependent counters, e.g. SIP and CIP counters of the cap. This counter can be assigned a message and can assist with maintenance planning.
Oxygen (COS81D):	
Point at oxygen	In the case of slope calibration, the dependency on partial pressure is used to compare the sensor signal to a known and readily available reference (air). In the case of optical oxygen sensors, the measuring principle is based on the Stern-Vollmer equation instead of a linear function and cannot be compared with a simple slope.
Air 100% rh	The sensor signal in the presence of oxygen is determined by calibrating the sensor in air that is saturated with water vapor. For this model to work correctly, the sensor to be calibrated must be close to a water surface or be located in the headspace of a vessel partially filled with water, for example.
H2O air-saturated	The sensor signal in the presence of oxygen is determined by calibrating the sensor in air-saturated water.
Air variable	This calibration model is for all applications in which the air pressure and air humidity in the vicinity of the sensor do not correspond to the standard atmospheric values previously mentioned, but are still known. Both variables can be specified here.
Slope test gas	Using a defined oxygen gas mixture, the sensor measured value is determined at a defined oxygen partial pressure. Traceable calibration can be performed in conjunction with an absolute pressure measurement (to determine the gas pressure at the sensor membrane) and a certified calibration gas. The reference variable in oxygen volume concentration and the gas pressure are entered here as input variables in the transmitter. The model assumes a dry gas mixture with 0% humidity.
Numeric input	The point in oxygen can be calibrated by entering a new Ksv value. This can be calculated or obtained via a reference measurement, for example.
Zero point	
1-point cal.	The zero point of the sensor is determined by calibrating the sensor in the absence of oxygen. Zero-point gel COY8 or nitrogen gas (N5), for example, are suitable for this purpose.
Numeric input	The zero point can be calibrated by entering a new zero-point value. This can be calculated or obtained via a reference measurement, for example.

Path: Guidance/Calibration	
Type of calibration	**Info**
Fermenter scaling	Overpressure is present in a fermenter before fermentation begins. The sensor is subjected to stress in the form of sterilization in place (SIP). Using fermenter scaling, the measured value of the sensor is adjusted to the desired start value in %SAT. A factor for the calibration function (scaling factor) is derived from the specification as to which saturation set point (desired saturation) the measured saturation should correspond to (usually 100 %SAT). This requires that the saturation index be selected as the primary value in the menu. The scaled saturation index is then visible in the measured value display.
Reset to factory calibration	The calibration is reset to factory settings.
Change sensor cap	Following sensor maintenance, including physical replacement of the optical cap, this command can be used to reset all cap-dependent counters, e.g. SIP and CIP counters of the cap. This counter can be assigned a message and can assist with maintenance planning.
pH:	
1-point cal.	The measured value is adjusted using a known reference value (buffer solution or known medium). The zero point shift is stored in the sensor.
2 point cal.	Adjustment of zero point and slope of sensor with 2 buffers.
Sample	The measured value is adjusted using a known reference value (buffer solution or known medium). The zero point shift is stored in the sensor.
Reset to factory calibration	The calibration is reset to factory settings.
Reset to reference calibration	The calibration is reset to a manually stored reference calibration.
Set current adj. as reference	The current values are stored as a reference for later calibrations.
ORP:	
1 point calibration (mV)	The measured value is adjusted using a known reference value (buffer solution or known medium). The zero point shift is stored in the sensor.
Reset to factory calibration	The calibration is reset to factory settings.
Reset to reference calibration	The calibration is reset to a manually stored reference calibration.
Set current adj. as reference	The current values are stored as a reference for later calibrations.
ORP % assignment	The measured value in mV is converted to a % concentration using a conversion table.
Combined sensor (pH):	
1-point cal.	The measured value is adjusted using a known reference value (buffer solution or known medium). The zero point shift is stored in the sensor.
2 point cal.	Adjustment of zero point and slope of sensor with 2 buffers.
Sample	The measured value is adjusted using a known reference value (buffer solution or known medium). The zero point shift is stored in the sensor.
Combined sensor (ORP):	

Path: Guidance/Calibration	
Type of calibration	**Info**
1 point calibration (mV)	Single-point calibration is used when only the deviation from a reference value and not an absolute value is required.
ORP % assignment	The measured value in mV is converted to a % concentration using a conversion table.
Conductivity:	
Cell constant	The electrical resistance, or its reciprocal value - conductance G - is calculated based on Ohm's law. The specific conductance κ is determined from the conductance value using the cell constant **k**, which depends on the sensor geometry.
Installation factor	In confined installation conditions, the conductivity measurement in the medium is affected by the vessel wall located in the area of influence of the electromagnetic field of the sensor electrodes . This effect is compensated for by the installation factor: the transmitter corrects the cell constant by multiplying it by the installation factor.

12 Diagnostics and troubleshooting

12.1 Diagnostic information via LED

See LED display in Commissioning section. (→ 🕮 21)

12.2 Adapting the diagnostic information

Path: Diagnostics/Diagnostic settings		
Function	Options	Info
Sensor change alarm delay	0 ... 180 s **Factory setting** 30 s	Period of time before the transmitter switches to alarm mode when sensor is removed. Used when sensor is replaced, for example.
Error current	3.6 to 23.0 mA **Factory setting** 3.6 mA	Possible range of error current.
LED shows NAMUR status signal	**Selection** • Off • On **Factory setting** Off	* Additional LED signals for diagnostic messages as per NAMUR NE107 categories.
Diagnostics behavior		The list of diagnostic messages displayed. There are device-specific messages, and messages that depend on what sensor is connected. Select the message to be adapted. Only then can you make the settings for this message.
Status signal	**Selection** • Off • On **Factory setting** Off	The messages are divided into different error categories in accordance with NAMUR NE 107.
Diagnostics behavior	**Selection** • Warning • Alarm	

* LED as per NAMUR NE107 categories:

Three rapid green flashes at the start of the message means: Everything OK - but pay attention!

The more red flashes there are at the end of a message, the more critical the diagnosis as per NE107. Continuous red only flashes mean: Error in device or sensor, take action immediately.

LED behavior	Status
Three rapid green flashes and a single rapid red flash	Device or sensor requires maintenance. M status signal as per NAMUR NE107
Three rapid green flashes and two rapid red flashes	Device and sensor are being operated out of specification. S status as per NAMUR NE107

LED behavior	Status
Three rapid green flashes and three rapid red flashes	Device or sensor undergoing function check. C status signal as per NAMUR NE107
Red Flashes quickly	Failure of device or sensor F status signal as per NAMUR NE107

12.3   Adapting sensor diagnostic information

This menu branch is used for specifying warning limits, and for defining whether and how diagnostics tools should be used.

12.3.1   Impedance monitoring

Path: Application/Sensor/Extended setup/Diagnostic settings		
Function	Options	Info
Glass impedance		
Upper limit	**Selection** • Off • On **Factory setting** Off	On The Sensor Check System (SCS) operates with the following settings for the upper warning and alarm limits. Off Monitoring of the upper warning and alarm limits is switched off.
Upper limit	**Selection** • Off • On **Factory setting** On	**On** The Sensor Check System (SCS) operates with the following settings for the upper warning and alarm limits. **Off** Monitoring of the upper warning and alarm limits is switched off.
Upper alarm limit	0 to 10000 MΩ **Factory setting** 3000 MΩ	Diagnostics code and associated message text: 124 **Sensor glass**
Upper warning limit	0 to 10000 MΩ **Factory setting** 2500 MΩ	Diagnostics code and associated message text: 125 **Sensor glass**
Lower limit	**Selection** • Off • On **Factory setting** Off	On The Sensor Check System (SCS) operates with the following settings for the lower warning and alarm limits. Off Monitoring of the lower warning and alarm limits is switched off.
Lower limit	**Selection** • Off • On **Factory setting** On	**On** The Sensor Check System (SCS) operates with the following settings for the lower warning and alarm limits. **Off** Monitoring of the lower warning and alarm limits is switched off.

Path: Application/Sensor/Extended setup/Diagnostic settings		
Function	Options	Info
Lower warning limit	0 to 10000 MΩ **Factory setting** 0.1 MΩ	Diagnostics code and associated message text: 123 **Sensor glass**
Lower alarm limit	0 to 10000 MΩ **Factory setting** 0 MΩ	Diagnostics code and associated message text: 122 **Sensor glass**

12.3.2 Slope

pH, oxygen

The slope characterizes the sensor condition. The greater the deviation from the ideal value (pH), the worse the condition of the sensor.

Path: Application/Sensor/Extended setup/Diagnostic settings		
Function	Options	Info
pH		
Slope		
Warning limit	25.00 to 65.00 mV/pH **Factory setting** 55.00 mV/pH	Specify the limit values for slope monitoring. If the limit value is undershot, diagnostic code 509 **Sensor calibration** is triggered.
Oxygen		
Upper warning limit	0.0 to 200.0 % **Factory setting** 140.0 %	Associated diagnostic code and message: 511**Sensor calibration**
Lower warning limit	0.0 to 200.0 % **Factory setting** 60.0 %	Associated diagnostic code and message: 509**Sensor calibration**

12.3.3 Delta slope

pH, pH/ORP combined sensor, oxygen

The device determines the difference in slope between the last calibration and the penultimate calibration, and issues a warning or an alarm depending on the setting configured. The difference is an indicator for the condition of the sensor. The greater the change, the greater the wear experienced by the pH-sensitive glass membrane as a result of chemical corrosion or abrasion.

Path: Application/Sensor/Extended setup/Diagnostic settings		
Function	Options	Info
pH and pH/ORP combined sensors		
Delta slope		
Function	**Selection** • Off • On	Switch function on or off.

Path: Application/Sensor/Extended setup/Diagnostic settings		
Function	Options	Info
Warning limit	0.10 to 10.00 mV/pH **Factory setting** 6.00 mV/pH	Specify the limit values for monitoring the slope differential. Associated diagnostic code and message: 518**Sensor calibration**
Oxygen		
Delta slope		The device determines the difference in slope between the last calibration and the penultimate calibration, and issues a warning or an alarm depending on the setting configured. The difference is an indicator for the condition of the sensor. An increasing change indicates the formation of buildup on the sensor diaphragm or electrolyte contamination. Replace the diaphragm and electrolyte as specified in the instructions in the sensor operating manual.
Function	**Selection** • Off • On **Factory setting** Off	Switch function on or off.
Warning limit	0.0 to 50.0 % **Factory setting** 5.0 %	Specify the limit values for monitoring the slope differential. Associated diagnostic code and message: 518**Sensor calibration**

12.3.4   Zero point and operating point

pH, ISFET, oxygen

The zero point or operating point characterizes the condition of the sensor reference. The bigger the deviation from the ideal value (pH 7.00) the poorer the condition. This can be caused by KCl dissolving away or reference contamination, for example.

Path: Application/Sensor/Extended setup/Diagnostic settings		
Function	Options	Info
pH, ISFET		
Zero point (pH glass) Operating point (ISFET)		
Upper warning limit	pH 6.00 to pH 12.00 **Upper warning limit** 900 mV to **Upper warning limit** [2] **Factory setting** pH 8.00 / -300 mV	Associated diagnostics code and message text: 505 **Sensor calibration** 515 **Sensor calibration** [2]

Path: Application/Sensor/Extended setup/Diagnostic settings		
Function	Options	Info
Lower warning limit	**Lower warning limit** H 2.00 to pH 8.00 [1] **Lower warning limit** to -900 mV [2] **Factory setting** pH 6.00 / 300 mV	Associated diagnostics code and message text: 507 **Sensor calibration** 517 **Sensor calibration** [2]
Oxygen		
Zero point		The zero point corresponds to the sensor signal that is measured in a medium in the absence of oxygen. The zero point can be calibrated in oxygen-free water or ultrapure nitrogen. This improves accuracy in the trace range.
Warning limit	0.0 to 10.0 nA **Factory setting** 3.0 nA	Specify the limit values for zero point monitoring of your sensor. Associated diagnostic code and message: 513**Zero Warning**

1)   **pH Glass**
2)   **pH ISFET**

12.3.5   Delta zero point/operating point

pH, ISFET, oxygen

The device determines the difference (delta) between the last calibration and the penultimate calibration, and issues a warning or an alarm depending on the setting configured. The difference is an indicator for the condition of the sensor.

Path: Application/Sensor/Extended setup/Diagnostic settings		
Function	Options	Info
pH, ISFET		
Delta zero point		
Function	**Selection** • Off • On	Switches the function on or off
Warning limit	pH 0.00 to 2.00 (pH glass) **Factory setting** pH 0.50 / 25 mV	Specify your limit values for monitoring the slope differential. Associated diagnostics code and message text: • 520 **Sensor calibration** (pH glass) • 522 **Sensor calibration** (ISFET)
Oxygen		

Path: Application/Sensor/Extended setup/Diagnostic settings		
Function	Options	Info
Function	**Selection** • Off • On **Factory setting** Off	Switches the function on or off
Warning limit	0.0 to 10 nA **Factory setting** 1.0 nA	Specify your limit values for monitoring the slope differential. Associated diagnostic code and message: 520**Sensor calibration**

12.3.6   Operating hours limits

Path: Application/Sensor/Extended setup/Diagnostic settings		
Function	Options	Info
Limits operating hours		The total operating time of the sensor and its use under extreme conditions is monitored. If the operating time exceeds the defined threshold values, the device issues a corresponding diagnostics message.
Function	**Selection** • Off • On	**On** The operation of the sensor under extreme conditions is monitored, recorded in the sensor and diagnostics messages are displayed on the controller. **Off** No diagnostics messages. However, the time the sensor operates under extreme conditions is recorded in the sensor and can be read in the sensor information in the diagnostics menu.
Operating time	**Factory setting** Depends on the sensor	
Operating time > 80 ℃	**Factory setting** Depends on the sensor	Diagnostic code and message: 193**Operating time**
Operating time > 80 ℃ < 100 nS/cm	**Factory setting** Depends on the sensor	Only conductive conductivity sensors
Operating time > 100 ℃	**Factory setting** Depends on the sensor	Diagnostic code and message: 194**Operating time**
Operating time > 120 ℃ Not for pH	**Factory setting** Depends on the sensor	Diagnostic code and associated message: 195**Operating time**
Operating time > 150 ℃ Not for pH	**Factory setting** Depends on the sensor	Diagnostic code and associated message: 198**Operating time**
Operating time < -300 mV	**Factory setting** 1000 h	*Only pH sensor or pH/ORP combined sensor*
Operating time > 300 mV	**Factory setting** 1000 h	*Only pH sensor or pH/ORP combined sensor*

12.3.7 Sterilizations

Path: Application/Sensor/Extended setup/Diagnostic settings		
Function	**Options**	**Info**
Sterilizations		The system counts the number of operating hours in which the sensor is exposed to a temperature that is typical for a sterilization. This temperature depends on the sensor.
Function	**Selection** • Off • On	Switches the function on or off
Warning limit	0 to 1000 **Factory setting** 800	Specify the limit value for the number of sensor sterilizations. Diagnostics code and associated message text: 108 **SIP, CIP, autoclaving**

Cap sterilizations (for oxygen sensors only)

Path: Application/Sensor/Extended setup/Diagnostic settings		
Function	**Options**	**Info**
No. sterilizations cap		Not displayed for optical oxygen sensors. The sterilization counters in the sensor make a distinction between the sensor and the membrane/fluorescence cap currently used. If this is replaced, only the (cap) counter is reset.
Function	**Selection** • Off • On **Factory setting** Off	Switches the function on or off
Warning limit	0 to 100 **Factory setting** 30	Define the number of sterilizations before the diaphragm cap needs to be replaced. The number depends heavily on the process and must be determined individually. Associated diagnostic code and message: 109**SIP, CIP, autoclav cap**

12.3.8 Sensor Condition Check (SCC)

Path: Application/Sensor/Extended setup/Diagnostic settings		
Function	Options	Info
Sensor condition check		Sensor condition check (SCC) monitors the electrode status and the degree of electrode aging. The condition of the electrode is updated after every calibration. The main reasons for a deteriorating electrode status are: • Glass membrane blocked or dry • Diaphragm (reference) blocked
Function	**Selection** • Off • On	Switches the function on or off Diagnostics code and associated message text: 127 SCC adequate 126 SCC poor

12.3.9 Process monitoring

Path: Application/Sensor/Extended setup/Diagnostic settings		
Function	Options	Info
Process check system		The process check system (PCS) checks the measuring signal for stagnation. If the measuring signal does not change over a certain period of time (several measured values), this indicates that a fault is present. An alarm is triggered.
Function	**Selection** • Off • On **Factory setting** Off	Switches the function on or off
Duration	**Selection** 0 to 240 min **Factory setting** 60 min	If the measured value stagnates over this time period, the calibration timer diagnostic message is output with the code 904.
Tolerance width	The range depends on the sensor	Interval for detecting stagnation in the measuring signal (raw value). Measured values within the set interval are regarded as stagnating.
pH glass	0.02 pH	
ORP	5 mV	
pH ISFET	0.02 pH	
pH/ ORP	0.1 rH	

Path: Application/Sensor/Extended setup/Diagnostic settings		
Function	Options	Info
Oxygen	can be selected **Unit** hPa	
Conductivity	can be selected **Unit** % of the measured value	

12.3.10 Measured value

Path: Application/Sensor/Extended setup/Diagnostic settings		
Function	Options	Info
ORP-Meas value		
Function	**Selection** • Off • On **Factory setting** Off	Switches the function on or off
Upper alarm value	can be selected from the following range: 0 to 10000 mV	Diagnostic code and associated message: 124 **Sensor glass**
Upper warning limit	can be selected from the following range: 0 to 10000 mV	Diagnostic code and associated message: 125 **Sensor glass**
Lower warning limit	can be selected from the following range: 0 to 10000 mV	Diagnostic code and associated message: 123 **Sensor glass**
Lower alarm value	can be selected from the following range: 0 to 10000 mV	Diagnostic code and associated message: 122 **Sensor glass**

12.3.11 Pharmaceutical water

Settings can be made here for monitoring pharmaceutical water in accordance with the United States Pharmacopoeia (USP) or European Pharmacopoeia (EP).

The uncompensated conductivity value and the temperature are measured for the limit functions. The measured values are compared against the tables defined in the standards. An alarm is triggered if the limit value is exceeded. Furthermore, you can also set a

preliminary alarm (warning limit) which signals undesired operating states before they occur.

Path: Application/Sensor/Extended setup/Diagnostic settings		
Pharma water		
Function	**Selection** • Off • EP • USP **Factory setting** Off	The alarm values are stored in the device in accordance with USP 645 or EP 169 specifications for pharmaceutical water. The warning limit can be defined for a value as a % of the alarm value.
Off	10.0 to 99.9 % **Factory setting** 80.0 %	Diagnostic code and associated message: 915 **USP / EP warning** If the value exceeds the USP or EP alarm values saved in the software, diagnostic message 914 "**USP/ EP alarm**" is displayed.

12.3.12 Cap calibrations (oxygen sensors only)

Path: Application/Sensor/Extended setup/Diagnostic settings		
Function	**Options**	**Info**
No. calibrations cap		Not displayed for optical oxygen sensors The calibration counters in the sensor make a distinction between sensor calibrations and calibrations with the membrane cap currently used. If this cap is replaced, only the (cap) counter is reset.
Function	**Selection** • Off • On **Factory setting** Off	Specify how many calibrations may be performed with a membrane cap before the cap has to be replaced. The number depends heavily on the process and must be determined individually.
Warning limit	0 to 1000 **Factory setting** 6	Associated diagnostics code and message text: 535 **Sensor check**

12.3.13 Calibration quality index (optical oxygen sensor only)

Path: Application/Sensor/Extended setup/Diagnostic settings		
Function	Options	Info
Cal. quality index		Monitoring of calibration quality index for COS81D. Significant changes in the value may be a sign of spot aging or poor calibration.
Function	**Selection** • Off • On **Factory setting** Off	Switches the function on or off
Warning limit	0 ... 100 % **Factory setting** 80 %	Associated diagnostics code and message text: 734 **Calibration quality**

12.3.14 CIP counter monitoring

Path: Application/Sensor/Extended setup/Diagnostic settings		
Function	Options	Info
CIP cycles		Monitoring of CIP cycles performed.
Function	**Selection** • Off • On **Factory setting** Off	Switches the function on or off
Warning limit	**Selection** 0 ... 500 **Factory setting** 80	Define the number of CIP cycles performed before a warning is issued. Associated diagnostic code and message: 108 **SIP, CIP, autoclaving**

12.4 Simulation

Certain parameters can be simulated for test purposes:
• Current value
• Measured value
• Temperature

Main menu/Diagnostics/Simulation		
Function	Options	Info
Current output		Simulation of an output current
Simulation	**Selection** • Off • On **Factory setting** Off	Switch on or off simulation
Simulation value	3.6 to 23 mA	Set current value
Measured value		Simulation of a measured value

Main menu/Diagnostics/Simulation		
Function	**Options**	**Info**
Simulation	**Selection** • Off • On **Factory setting** Off	Switch on or off simulation
Measured value	Depends on the sensor	Select measured variable to be simulated, depending on connected sensor.
Simulation value		Display the simulated measured value in the selected unit.
Temperature		Simulation of temperature
Simulation	**Selection** • Off • On **Factory setting** Off	Switch on or off simulation
Simulation value	Unit: depends on sensor Range: depends on sensor	Display the simulated temperature value in the selected unit

12.5 Diagnostic list

12.5.1 Diagnostic messages

In accordance with Namur specification NE 107, the diagnostic messages are characterized by:
• Message number
• Message text
• Error category (letter in front of the message number):
  • **F** = (Failure) a malfunction has been detected
  • **C** = (Function check), (no error)
    Maintenance work is being performed on the device. Wait until the work has been completed.
  • **S** = (Out of specification), the measuring point is being operated outside its specification
    Operation is still possible. Risk of increased wear, shorter operating life or reduced accuracy. The cause of the problem is to be found outside the measuring point.
  • **M** = (Maintenance required), action should be taken as soon as possible
  • **OK** = OK, without status
• Factory settings for:
  • S = status signal
  • D = diagnostic behavior [1]
• Sensor type:
  • P = pH
  • C = conductivity
  • O = oxygen
• Information about the configurability of the diagnostic behavior
• Detailed message

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[1]   An error current flows in case of an alarm but not in case of a warning.

No.	Message	Factory settings		Sensor type	Configurable	Tests or remedial action
		S	D			
002	Sensor unknown	F	Alarm	All	No	▸ Sensor unknown 1. Replace sensor
004	Sensor defective	F	Alarm	All	No	▸ Sensor defective 1. Replace sensor
005	Sensor data invalid	F	Alarm	All	No	▸ Invalid sensor data 1. Check the software compatibility of sensor and transmitter. Update the transmitter and sensor, if applicable 2. Perform Factory default sensor and power cycle sensor afterwards 3. Update the date of the transmitter 4. Replace the sensor
010	Sensor scanning	F	Warning	All	No	▸ Sensor scan active, please wait
012	Writing data failed	F	Alarm	All	No	▸ Writing data to sensor failed 1. Repeat writing 2. Replace sensor
013	Sensor type wrong	F	Alarm	All	No	▸ Sensor type wrong - The sensor does not fit to the device configuration - The device configuration may be changed to a new sensor type 1. Change to a sensor of configured type 2. Change device configuration to connected sensor
018	Sensor not ready	F	Alarm	All	No	▸ Sensor communication blocked Possible reasons: - connected sensor failed sensor check. - internal software error 1. Replace sensor
022	Temperature sensor	F	Alarm	All	Yes	▸ Temperature sensor defective 1. Replace sensor
061	Sensor electronic	F	Alarm	All	No	▸ Sensor electronic defective 1. Check sensor connections 2. Replace sensor electronics
062	Sensor connection	F	Alarm	All	No	▸ Sensor connection defective 1. Check sensor connection
100	Sensor communication	F	Alarm	All	No	▸ Sensor no communication possible reasons: - sensor disconnected - faulty sensor connection - short-circuit in sensor cable - short-circuit in next channel - faulty sensor FW update 1. Check sensor cable connection 2. Check for short-circuit of the cables 3. Replace sensor 4. Update the sensor FW again

No.	Message	Factory settings		Sensor type	Configurable	Tests or remedial action
		S	D			
104	Calibration validity	M	Alarm	All	Yes	▶ Validity of last calibration expired. Date of last calibration of the sensor is too long ago. Measurement is still possible. Possible reasons: - long storage of sensor 1. Calibrate sensor 2. Check the configuration of the calibration validity
105	Calibration validity	M	Warning	All	Yes	▶ Validity of last calibration expires soon. Date of last calibration of the sensor is long ago. Measurement is still possible. Possible reasons: - long storage of sensor 1. Calibrate sensor 2. Check the configuration of the calibration validity
106	Sensor TAG	F	Alarm	All	No	▶ Sensor TAG control The connected sensor has an invalid TAG or TAG-group 1. Change sensor 2. Use new sensor of same type 3. Deactivate the TAG control
107	Calibration active	C	Warning	All	No	▶ Sensor calibration is active, please wait.
108	SIP, CIP, autoclaving	M	Warning	All	Yes	▶ The configured max. number of sterilizations / cleanings / autoclavings is reached. Measurement is still possible. 1. Replace sensor
109	SIP, CIP, autoclav cap	M	Warning	O	No	▶ The configured max. number of sensor cap sterilizations / cleanings / autoclavings is reached. Measurement is still possible. 1. Replace sensor
111	Operating time cap	M	Warning	O	No	▶ Sensor cap operating time warning Measurement is still possible The configured limit of the sensor cap operating time is reached. Current values are displayed under DIAG / Sensor information. 1. Replace sensor cap 2. Adjust limit
118	Sensor glass break.	F	Alarm	P (glass)	Yes	▶ Sensor glass breakage alarm Glass membrane impedance too low 1. Check glass electrode for cracks 2. Check the temperature of the medium 3. Replace sensor
120	Sensor reference	F	Alarm	P (glass)	Yes	▶ Sensor reference alarm Reference impedance too low 1. Check glass electrode for cracks 2. Check the temperature of the medium 3. Replace sensor

No.	Message	Factory settings		Sensor type	Configurable	Tests or remedial action
		S	D			
122	Sensor glass	F	Alarm	P (glass)	Yes	▶ Sensor glass limit lower value exceeded Glass membrane impedance too low 1. Check the pH sensor, clean as needed 2. Check the configured glass limit value, correct as needed 3. Replace sensor
123	Sensor glass	M	Warning	P (glass)	Yes	▶ Sensor glass limit lower value reached Glass membrane impedance low Measurement is still possible until alarm message 1. Check the pH sensor, clean as needed 2. Check the configured glass limit value, correct as needed 3. Replace sensor
124	Sensor glass	F	Alarm	P (glass)	Yes	▶ Sensor glass limit upper value exceeded Glass membrane impedance too high 1. Check the pH sensor, replace as needed 2. Check the glass limit value, correct as needed 3. Replace sensor
125	Sensor glass	M	Warning	P (glass)	Yes	▶ Sensor glass limit upper value reached Glass membrane impedance high 1. Check the pH sensor, clean as needed 2. Check the configured glass limit value, correct as needed 3. Replace sensor
126	Sensor check	M	Warning	P (glass)	No	▶ Sensor check Electrode condition bad. Possible reasons: - glass membrane blocked or dry - diaphragm blocked 1. Clean or regenerate sensor 2. Replace sensor
127	Sensor check	M	Warning	P (glass)	No	▶ Sensor check Electrode condition still sufficient but close to the limit. Possible reasons: - glass membrane blocked or dry - diaphragm blocked 1. Clean or regenerate sensor soon 2. Replace sensor soon
128	Sensor leakage	F	Alarm	P (ISFET), O	Yes	▶ Sensor leakage current alarm Sensor defective due to abraision or damage 1. Replace sensor
129	Sensor leakage	M	Warning	P (ISFET), O	Yes	▶ Sensor leakage current warning Sensor defective due to abraision or damage Measurement is still possible until alarm message 1. Replace sensor

No.	Message	Factory settings		Sensor type	Configurable	Tests or remedial action
		S	D			
130	Sensor supply	F	Alarm	All	Yes	▶ Sensor check Sensor power supply bad 1. Check cable connections 2. Replace sensor
131	Sensor calibration	M	Warning	O	No	▶ Sensor relaxation time underrange Measurement is still possible possible reasons: - high oxygen content - wrong calibration data 1. Repeat calibration 2. Replace sensor cap
132	Sensor calibration	M	Warning	O	No	▶ Sensor relaxation time overrange Measurement is still possible possible reasons: - low oxygen content - wrong calibration data 1. Repeat calibration 2. Replace sensor cap
133	Sensor signal	F	Alarm	O	No	▶ Sensor low signal decay 1. Replace sensor cap
134	Sensor signal	M	Warning	O	No	▶ Sensor low signal amplitude Measurement is still possible 1. Replace sensor cap
141	Polarization	S	Warning	C	No	▶ Polarisation warning High conductivity falsifys the measurement by non-linearity because of polarisation. The measurement error increases. possible reasons: - upper measurement range of sensor reached 1. Use sensor with greater cell constant
142	Sensor signal	S	Warning	C	No	▶ Sensor check No conductivity indication possible reasons: - sensor in air - sensor defective 1. Check sensor installation 2. Replace sensor
146	Sensor temperature	S	Warning	C, O	Yes	▶ Sensor temperature out of spec. Range 1. Check temperature 2. Check measurement 3. Change sensor type
154	Sensor data invalid	M	Warning	C	No	▶ Sensor data No calibration data of sensor, factory settings are used. 1. Check calibration information of sensor 2. Calibrate cell constant
164	Sensor data invalid	O K	Warning	C	Yes	▶ Sensor data No calibration data of temperature sensor, factory settings are used. 1. Check calibration information of sensor 2. Calibrate temperature sensor

No.	Message	Factory settings		Sensor type	Configurable	Tests or remedial action
		S	D			
168	Polarization	S	Warning	C	No	▸ Polarization Warning A too high conductivity solution during the polarization can distort the measured value 1. Review process 2. Check sensor, if necessary replace it with sensor with the proper cell constant
179	Operating time	M	Warning	P	No	▸ Operating time warning Measurement is still possible The configured limit of operating time >300 mV is reached 1. Replace sensor 2. Adjust limit 3. Deactivate monitoring
180	Operating time	M	Warning	P	No	▸ Operating time warning Measurement is still possible The configured limit of operating time < -300 mV is reached 1. Replace sensor 2. Adjust limit 3. Deactivate monitoring
183	Operating time	M	Warning	O (amp.)	No	▸ Operating time warning Measurement is still possible The configured limit of operating time > 15 nA is reached 1. Replace sensor 2. Adjust limit 3. Deactivate monitoring
184	Operating time	M	Warning	O (amp.)	No	▸ Operating time warning Measurement is still possible The configured limit of operating time > 30 nA is reached 1. Replace sensor 2. Adjust limit 3. Deactivate monitoring
185	Operating time	M	Warning	O (amp.)	No	▸ Operating time warning Measurement is still possible The configured limit of operating time > 50 nA is reached 1. Replace sensor 2. Adjust limit 3. Deactivate monitoring
186	Operating time	M	Warning	O (amp.)	No	▸ Operating time warning Measurement is still possible The configured limit of operating time > 160 nA is reached 1. Replace sensor 2. Adjust limit 3. Deactivate monitoring
187	Operating time	M	Warning	C	No	▸ Operating time warning Measurement is still possible The configured limit of operating time > 80 ℃ and < 100 nS/cm is reached 1. Replace sensor 2. Adjust limit 3. Deactivate monitoring

No.	Message	Factory settings		Sensor type	Configurable	Tests or remedial action
		S	D			
189	Operating time	M	Warning	O	No	▶ Operating time warning Measurement is still possible The configured limit of operating time > 5 ℃ is reached 1. Replace sensor 2. Adjust limit 3. Deactivate monitoring
191	Operating time	M	Warning	O	No	▶ Operating time warning Measurement is still possible The configured limit of operating time > 30 ℃ is reached 1. Replace sensor 2. Adjust limit
192	Operating time	M	Warning	O	No	▶ Operating time warning Measurement is still possible The configured limit of operating time > 40 ℃ is reached 1. Replace sensor 2. Adjust limit 3. Deactivate monitoring
193	Operating time	M	Warning	All	No	▶ Operating time warning Measurement is still possible The configured limit of operating time > 80 ℃ is reached 1. Replace sensor 2. Adjust limit 3. Deactivate monitoring
194	Operating time	M	Warning	P, C	No	▶ Operating time warning Measurement is still possible The configured limit of operating time > 100 ℃ is reached 1. Replace sensor 2. Adjust limit 3. Deactivate monitoring
195	Operating time	M	Warning	C, O	No	▶ Operating time warning Measurement is still possible The configured limit of operating time > 120 ℃ is reached 1. Replace sensor 2. Adjust limit 3. Deactivate monitoring
197	Operating time	M	Warning	C	No	▶ Operating time warning Measurement is still possible The configured limit of operating time > 140 ℃ is reached 1. Replace sensor 2. Adjust limit 3. Deactivate monitoring
198	Operating time	M	Warning	C	No	▶ Operating time warning Measurement is still possible The configured limit of operating time > 150 ℃ is reached 1. Replace sensor 2. Adjust limit 3. Deactivate monitoring

No.	Message	Factory settings		Sensor type	Configurable	Tests or remedial action
		S	D			
199	Operating time	M	Warning	All	No	▸ Operating time warning Measurement is still possible The configured limit of operating time is reached. Current values are displayed under DIAG / Sensor information. 1. Replace sensor 2. Adjust limit
202	Selftest active	F	Alarm	O	No	▸ Selftest active, please wait
215	Simulation active	C	Warning	All	No	▸ Simulation active, please wait. Simulation can be stopped in the diagnostic menu, or by restarting the device
216	Hold active	C	Warning	All	No	▸ Hold active, please wait. Operation mode with modified measurement output Output and status of all channels on hold
241	Firmware failure	F	Alarm	All	No	▸ Software failure - internal 1. Please update software 2. Please exchange backplane board 3. Please contact service and report the indicated number
243	Firmware failure	F	Alarm	All	No	▸ Firmware failure - internal 1. Update software 2. Replace backplane board 3. Contact service and report the indicated number
284	Firmware update	F	Alarm	All	No	▸ Firmware update active, please wait.
285	Update failure	F	Alarm	All	No	▸ Firmware update failure possible reasons: - firmware transmission incomplete - corrupt firmware with invalid signature 1. Repeat update 2. Use firmware with valid signature
384	Firmware failure	F	Alarm	All	No	▸ Firmware failure - internal 1. Update software 2. Contact service
408	Calibration aborted	M	Warning	All	No	▸ The calibration has been aborted.
411	Up-/Download active, please wait	C	Warning	All	No	▸ Up-/Download active, please wait
460	Output below limit	S	Warning	All	No	▸ Current output below limit Measurement value out of spec. range possible reasons: - sensor / sample line in air - air cushion in assembly - wrong sensor inflow - sensor / sample line dirty 1. Check application 2. Check the current output parameterization 3. Clean sensor / sample line

No.	Message	Factory settings		Sensor type	Configurable	Tests or remedial action
		S	D			
461	Output above limit	S	Warning	All	No	▶ Current output above limit Measurement value out of spec. range possible reasons: - sensor / sample line in air - air cushion in assembly - wrong sensor inflow - sensor / sample line dirty 1. Check application 2. Check configuration of current output 3. Clean sensor / sample line
500	Sensor calibration	M	Warning	All	No	▶ Sensor calibration aborted Main measurement value fluctuating possible reasons: - sensor over-ranged - sensor temporary dry - buffer solution value not stable 1. Check sensor, replace as necessary 2. Check buffer solution
501	Sensor calibration	M	Warning	All	No	▶ Sensor calibration aborted Temperature measurement value fluctuating possible reasons: - sensor over-ranged - sensor temporarily dry - temperature of buffer not stable 1. Check sensor, replace as necessary 2. Check buffer temperature
505	Sensor calibration	M	Warning	P, O	No	▶ Max. zero point (pH/DO) / offset (ORP) warning Measurement is still possible until alarm message. Possible reasons: - sensor aged or defective - pH/ORP: diaphragm blocked - pH/ORP: buffer solution expired or contaminated - DO: electrolyte consumed - DO: sensor pin damaged 1. Check sensor, replace as necessary 2. Check buffer or electrolyte, replace as necessary 3. Repeat calibration
507	Sensor calibration	M	Warning	P, O	No	▶ Min. zero point (pH/DO) / offset (ORP) warning Measurement is still possible until alarm message. Possible reasons: - sensor aged or defective - pH/ORP: diaphragm blocked - pH/ORP: buffer solution expired or contaminated - DO: electrolyte consumed - DO: sensor pin damaged 1. Check sensor, replace as necessary 2. Check buffer or electrolyte, replace as necessary 3. Repeat calibration

No.	Message	Factory settings		Sensor type	Configurable	Tests or remedial action
		S	D			
509	Sensor calibration	M	Warning	P, O	No	▶ Min. slope warning Measurement is still possible until alarm message possible reasons: - sensor aged or defective - diaphragm blocked - buffer solution expired or contaminated 1. Check sensor, replace as necessary 2. Check buffer, replace as necessary 3. Repeat the calibration
511	Sensor calibration	M	Warning	P, O	No	▶ Max. slope warning Measurement is still possible until alarm message possible reasons, depending on sensor type: - sensor aged or defective - diaphragm blocked - buffer solution expired or contaminated - electrolyte consumed - sensor pin damaged 1. Check sensor, replace as necessary 2. Check buffer or electrolyte, replace as necessary 3. Repeat the calibration
515	Sensor calibration	M	Warning	P (ISFET)	No	▶ Max. operating point warning Measurement is still possible until alarm message possible reasons: - sensor aged or defective - diaphragm blocked - buffer solution expired or contaminated 1. Check sensor, replace as necessary 2. Check buffer, replace as necessary 3. Repeat the calibration
517	Sensor calibration	M	Warning	P (ISFET)	No	▶ Min. operating point warning Measurement is still possible until alarm message possible reasons: - sensor aged or defective - diaphragm blocked - buffer solution expired or contaminated 1. Check sensor, replace as necessary 2. Check buffer, replace as necessary 3. Repeat the calibration
518	Sensor calibration	M	Warning	P, O	No	▶ Delta slope warning Measurement is still possible. The calibration shows a large change of sensor slope. 1. Check sensor, replace as necessary 2. Check buffer or electrolyte, replace as necessary 3. Repeat calibration

No.	Message	Factory settings		Sensor type	Configurable	Tests or remedial action
		S	D			
520	Sensor calibration	M	Warning	P, O	No	▸ Delta zero point warning Measurement is still possible. The calibration shows a large change of sensor zero point. 1. Check sensor, replace as necessary 2. Check buffer or electrolyte, replace as necessary 3. Repeat calibration
522	Sensor calibration	M	Warning	P (ISFET)	No	▸ Delta operating point warning Measurement is still possible The calibration shows a large change of sensor operating point 1. Check sensor, replace as necessary 2. Check buffer, replace as necessary 3. Repeat calibration
532	License error	M	Warning	All	No	▸ License error
535	Sensor check	M	Warning	O (amp.)	No	▸ The configured max. number of sensor cap calibrations reached Measurement is still possible. 1. Replace sensor cap
724	Sensor reference	F	Alarm	P	Yes	▸ Sensor reference limit upper value exceeded Reference membrane impedance too high 1. Check the sensor, replace as needed 2. Check the reference limit value, correct as needed 3. Replace sensor
725	Sensor reference	M	Warning	P	Yes	▸ Sensor reference limit upper value reached Reference membrane impedance high 1. Check the sensor, replace as needed 2. Check the reference limit value, correct as needed 3. Replace sensor
734	Calibration quality	M	Warning	O	No	▸ Min. calibration quality warning Measurement is still possible. The calibration quality shows a large change since last calibration. 1. Repeat calibration 2. Check sensor, replace as necessary
740	Sensor defective	F	Alarm	C	No	▸ Sensor defective Internal sensor connection broken 1. Replace sensor 2. Contact service
770	Sensor deactivated	F	Alarm	P	No	▸ Sensor deactivated Sensor has been deactivated by user. 1. Replace sensor
832	Temp. range exceeded	S	Warning	All	Yes	▸ Out of temperature range 1. Check application 2. Check sensor

No.	Message	Factory settings		Sensor type	Configurable	Tests or remedial action
		S	D			
841	Operating range	S	Warning	All	Yes	▶ Process value out of operating range 1. Check application 2. Check sensor
842	Process value	S	Warning	P	Yes	▶ Process value too high Process value out of spec. range possible reasons: - Sensor in air - Air cushion in assembly - Wrong sensor installation - Sensor defective 1. Decrease process value 2. Check measurement 3. Change sensor type
843	Process value	S	Warning	P	Yes	▶ Process value too low Process value out of spec. range possible reasons: - Sensor in air - Air cushion in assembly - Wrong sensor installation - Sensor defective 1. Increase process value 2. Check measurement 3. Change sensor type
904	Process check alarm	F	Alarm	All	No	▶ Process check system alarm Measurement signal long time without variation possible reasons: - sensor blocked or in air - no sensor inflow - sensor defective - software failure 1. Check application 2. Check measurement line 3. Check sensor
914	USP/ EP alarm	M	Warning	C	Yes	▶ USP / EP alarm conductivity limit for USP or EP exceeded 1. Check process
915	USP / EP warning	M	Warning	C	Yes	▶ USP / EP warning Conductivity value close to the limit for USP or EP 1. Check process
942	Process value	S	Warning	P	No	▶ Process value high possible reasons: - Sensor in air - Air cushion in assembly - Wrong sensor installation - Sensor defective 1. No process value increase 2. Check measurement 3. Change sensor type

No.	Message	Factory settings		Sensor type	Configurable	Tests or remedial action
		S	D			
943	Process value	S	Warning	P	No	▸ Process value low possible reasons: - Sensor in air - Air cushion in assembly - Wrong sensor installation - Sensor defective 1. No process value decrease 2. Check measurement 3. Change sensor type
987	Calibration required	M	Warning	O	No	▸ Due to a sensor maintenance a calibration is required.

12.6   Event logbook

Main menu/Diagnostics/Diagnostics logbook	
Function	Info
Diagnostic code	Diagnostic number and short text
Time	Time when diagnostic message occurred.
Event	Displays whether the message is **going** or **coming**.
Status signal	Error category and fault elimination
Long text	Tests or remedial action

12.7   Resetting the measuring device

Path: System/Device management/Reset		
Function	Options	Info
Device restart	**Continue** restarts the device. **X** cancels the wizard. The device is not restarted.	Restart and keep all the settings
Factory default	**Continue** resets the device to the factory settings and restarts the device. **X** cancels the wizard. The device is not reset.	Restart with factory settings

12.8   Device information

12.8.1   Squawk

Main menu/system

Path: System/Device management/Squawk		
Function	**Options**	**Info**
Squawk	**Selection** • Off • On **Factory setting** Off	Squawk is signaled briefly while the connection is established. The app can also be used to enable Squawk. This allows the device to be located more quickly in large installations.

12.9   Firmware history

Date	Version	Changes to firmware	Documentation
02/2018	01.01.00	**Release**	BA01845C/07/EN/01.18
07/2020	01.02.00	**Firmware release** Support for Memosens 2.0 sensors • Support for pH parameter • Support for ORP parameter	BA01845C/07/EN/02.20

12.9.1   Firmware update

Information about firmware updates is available from the sales office or on the product page www.endress.com/CM82.

The current firmware version and device type can be found under:**System**/**Firmware update**

13   Maintenance

The maintenance of the measuring point comprises:
• Calibration
• Cleaning the controller, assembly and sensor
• Checking the cables and connections.

> **⚠ WARNING**
>
> **Process pressure and temperature, contamination**
> Risk of serious or fatal injury
> ▶ If the sensor has to be removed during maintenance work, avoid hazards posed by pressure, temperature and contamination.

> **NOTICE**
>
> **Electrostatic discharge (ESD)**
> Risk of damaging the electronic components
> ▶ Take personal protective measures to avoid ESD, such as discharging beforehand at PE or permanent grounding with a wrist strap.

13.1   Maintenance tasks

13.1.1   Cleaning

> **NOTICE**
>
> **Cleaning agents not permitted**
> Damage to housing surface and optical waveguide
> ▶ Never use concentrated mineral acids or alkaline solutions for cleaning.
> ▶ Never use organic cleaners such as acetone, benzyl alcohol, methanol, methylene chloride, tetrahydrofuran, xylene or concentrated glycerol cleaner.

The device is resistant to:
• Ethanol (for a short time)
• Diluted acids (max. 2% HCl)
• Diluted bases (max. 3% NaOH)
• Soap-based household cleaning agents
• Washing-up liquid

14   Repair

14.1   General notes

▸ Only use spare parts from Endress + Hauser to guarantee the safe and stable functioning of the device.

Detailed information on the spare parts is available at:
www.endress.com/device-viewer

14.2   Return

The product must be returned if repairs or a factory calibration are required, or if the wrong product was ordered or delivered. As an ISO-certified company and also due to legal regulations, Endress+Hauser is obliged to follow certain procedures when handling any returned products that have been in contact with medium.

To ensure the swift, safe and professional return of the device:

▸ Refer to the website www.endress.com/support/return-material for information on the procedure and conditions for returning devices.

14.3   Disposal

The device contains electronic components. The product must be disposed of as electronic waste.

▸ Observe the local regulations.

If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to Endress+Hauser for disposal under the applicable conditions.

15 Accessories

15.1 Sensors

15.1.1 Glass electrodes

Orbisint CPS11D
- pH sensor for process technology
- With dirt-repellent PTFE diaphragm
- Product Configurator on the product page: www.endress.com/cps11d

📖 Technical Information TI00028C

Memosens CPS31D
- pH electrode with gel-filled reference system with ceramic diaphragm
- Product Configurator on the product page: www.endress.com/cps31d

📖 Technical Information TI00030C

Ceraliquid CPS41D
- pH electrode with ceramic junction and KCl liquid electrolyte
- Product Configurator on the product page: www.endress.com/cps41d

📖 Technical Information TI00079C

Ceragel CPS71D
- pH electrode with reference system including ion trap
- Product Configurator on the product page: www.endress.com/cps71d

📖 Technical Information TI00245C

Memosens CPS171D
- pH electrode for bio-fermenters with digital Memosens technology
- Product Configurator on the product page: www.endress.com/cps171d

📖 Technical Information TI01254C

Orbipore CPS91D
- pH electrode with open aperture for media with high dirt load
- Product Configurator on the product page: www.endress.com/cps91d

📖 Technical Information TI00375C

Orbipac CPF81D
- Compact pH sensor for installation or immersion operation
- In industrial water and wastewater
- Product Configurator on the product page: www.endress.com/cpf81d

📖 Technical Information TI00191C

Orbisint CPS11D
- pH sensor for process technology
- With dirt-repellent PTFE diaphragm
- Product Configurator on the product page: www.endress.com/cps11d

📖 Technical Information TI00028C

15.1.2 Enamel pH electrodes

Ceramax CPS341D
- pH electrode with pH-sensitive enamel
- Meets highest demands of measuring accuracy, pressure, temperature, sterility and durability
- Product Configurator on the product page: www.endress.com/cps341d

  📖 Technical Information TI00468C

15.1.3 ORP sensors

Orbisint CPS12D
- ORP sensor for process technology
- Product Configurator on the product page: www.endress.com/cps12d

  📖 Technical Information TI00367C

Ceraliquid CPS42D
- ORP electrode with ceramic junction and KCl liquid electrolyte
- Product Configurator on the product page: www.endress.com/cps42d

  📖 Technical Information TI00373C

Ceragel CPS72D
- ORP electrode with reference system including ion trap
- Product Configurator on the product page: www.endress.com/cps72d

  📖 Technical Information TI00374C

Orbipac CPF82D
- Compact ORP sensor for installation or immersion operation in process water and wastewater
- Product Configurator on the product page: www.endress.com/cpf82d

  📖 Technical Information TI00191C

Orbipore CPS92D
- ORP electrode with open aperture for media with high dirt load
- Product Configurator on the product page: www.endress.com/cps92d

  📖 Technical Information TI00435C

15.1.4 pH ISFET sensors

Tophit CPS441D
- Sterilizable ISFET sensor for low-conductivity media
- Liquid KCl electrolyte
- Product Configurator on the product page: www.endress.com/cps441d

  📖 Technical Information TI00352C

Tophit CPS471D
- Sterilizable and autoclavable ISFET sensor for food and pharmaceutics, process engineering
- Water treatment and biotechnology
- Product Configurator on the product page: www.endress.com/cps471d

  📖 Technical Information TI00283C

Tophit CPS491D
- ISFET sensor with open aperture for media with high dirt load
- Product Configurator on the product page: www.endress.com/cps491d

📖 Technical Information TI00377C

15.1.5 pH and ORP combined sensors

Memosens CPS16D
- Combined pH/ORP sensor for process technology
- With dirt-repellent PTFE diaphragm
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cps16D

📖 Technical Information TI00503C

Memosens CPS76D
- Combined pH/ORP sensor for process technology
- Hygienic and sterile applications
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cps76d

📖 Technical Information TI00506C

Memosens CPS96D
- Combined pH/ORP sensor for chemical processes
- With poison-resistant reference with ion trap
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cps96d

📖 Technical Information TI00507C

15.1.6 Conductivity sensors with conductive measurement of conductivity

Condumax CLS15D
- Conductive conductivity sensor
- For pure water, ultrapure water and hazardous area applications
- Product Configurator on the product page: www.endress.com/CLS15d

📖 Technical Information TI00109C

Condumax CLS16D
- Hygienic, conductive conductivity sensor
- For pure water, ultrapure water and Ex applications
- With EHEDG and 3A approval
- Product Configurator on the product page: www.endress.com/CLS16d

📖 Technical Information TI00227C

Condumax CLS21D
- Two-electrode sensor in plug-in head version version
- Product Configurator on the product page: www.endress.com/CLS21d

📖 Technical Information TI00085C

Memosens CLS82D
- Four-electrode sensor
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cls82d

📖 Technical Information TI01188C

15.1.7 Oxygen sensors

Oxymax COS22D
- Sterilizable sensor for dissolved oxygen
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cos22d

📖 Technical Information TI00446C

Oxymax COS51D
- Amperometric sensor for dissolved oxygen
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cos51d

📖 Technical Information TI00413C

Memosens COS81D
- Sterilizable, optical sensor for dissolved oxygen
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cos81d

📖 Technical Information TI01201C

15.2 Software

Memobase Plus CYZ71D
- PC software to support laboratory calibration
- Visualization and documentation of sensor management
- Sensor calibrations stored in database
- Product Configurator on the product page: www.endress.com/cyz71d

📖 Technical Information TI00502C

DeviceCare SFE100
Configuration tool for HART, PROFIBUS and FOUNDATION Fieldbus field devices
DeviceCare is available for download at www.software-products.endress.com. You need to
register in the Endress+Hauser software portal to download the application.

📖 Technical Information TI01134S

15.3 Other accessories

15.3.1 Activation codes

ℹ️ You must quote the serial number of the device when ordering the activation code.

Activation code: Bluetooth
Order No. 71401176

15.3.2   Cable junction with Velcro strip

Cable junction with Velcro strip
- 4 pieces, for sensor cable
- Order No. 71092051

15.3.3   Communication-specific accessories

Commubox FXA195
Intrinsically safe HART communication with FieldCare via the USB port

[📖] Technical Information TI00404F

Wireless HART adapter SWA70
- Wireless device connection
- Easily integrated, offers data protection and transmission safety, can be operated in parallel with other wireless networks, minimum cabling complexity

[📖] Technical Information TI00061S

15.3.4   System components

RIA15
- Process display unit, Digital display unit for integration into 4-20 mA circuits
- Panel mounting
- With optional HART communication

[📖] Technical Information TI01043K

16 Technical data

16.1 Input

Measured variables	• pH • ORP • pH/ORP • Oxygen • Conductivity
Measuring ranges	→ Documentation of the connected sensor
Types of input	Digital sensor inputs for Memosens-sensors
Cable specification	**Cable length:** • Max. 3 m (10 ft) • Max. 7 m (23 ft) • Max. 15 m (49 ft)

16.2 Output

Output signal	4 … 20 mA/HART, galvanically isolated from the sensor circuits
Linearization/transmission behavior	Linear

16.3 Performance characteristics

Response time of current output	t_{90} = max. 500 ms for an increase from 0 to 20 mA
Tolerance of current output	**Typical measuring tolerances:** < ±20 µA (if current value = 4 mA) < ±50 µA (for current values 4 to 20 mA) at 25 ˚C (77˚ F) each **additional tolerance depending on the temperature:** < 1.5 µA/K
Resolution of current output	< 5 µA
Repeatability	→ Documentation of the connected sensor

16.4 Power supply

Supply voltage	12.6 to 30 VDC (with setting error current > 20 mA)
	14 to 30 VDC (with setting error current < 4 mA)
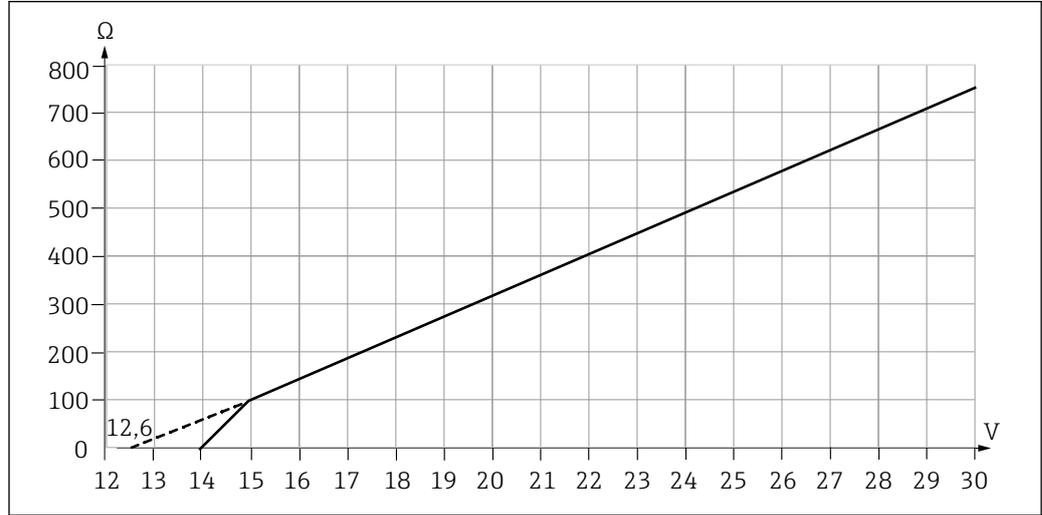
🖪 15   Supply voltage and load

The lower voltage value in each case applies only to a load resistance of 0 Ohm.

NOTICE

The device does not have a power switch

▸ At the supply point, the power supply must be isolated from dangerous live cables by double or reinforced insulation in the case of devices with a 24 V power supply.

Overvoltage protection	IEC 61 000-4-4 and IEC 61 000-4-5 with +/- 1 kV

Sensor connection	*Sensors with Memosens protocol*

Sensor types	Sensors
Digital Sensors with inductive memosens plug head	• pH sensors • ORP sensors • pH/ORP combination sensors • Oxygen sensors • Conductivity sensors

16.5 Environment

Ambient temperature	−20 to 85 ℃ (−4 to 185 ℉)

ℹ️ The maximum ambient temperature depends on the process temperature and the installation situation of the transmitter.

Make sure that the ambient temperature at the transmitter does not exceed +85 ℃ (185 ℉).

Example of environmental conditions in Endress+Hauser fittings:
- with open installation (without protective cover, i.e. free convection at the transmitter), e.g. CPA442, CPA842
- for enclosed installation (with protective cover), e.g. CPA871, CPA875, CPA842

$T_{ambient}$ = max. 60 °C (140 °F)

$T_{prozess}$ = max. 100 °C (212 °F), in continuous operation

$T_{prozess}$ = max. 140 °C (284 °F), < 2h (for sterilization)

Ambient temperature

Process temperature
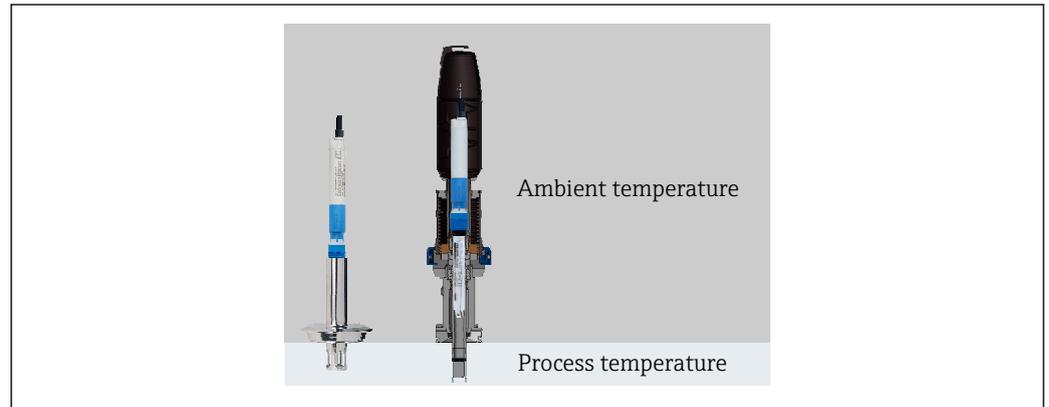
A0036933-EN

🖻 *16   Mounting situation of the transmitter with or without protective cover*

Storage temperature	-40 to +85 °C (-40 to 185 °F)

Humidity	5 to 95 %

Degree of protection	IP67
	IP 68 (10 m (33 ft) head of water at 25 °C (77 °F) over 45 days, 1 mol/l KCl)
	NEMA Type 6

Electromagnetic compatibility	• EN 61326-1 • EN 61326-2-3 • EN 301489-1 • EN 301489-17 • NAMUR NE 21

Electrical safety	EN 61010-1

Max. altitude above MSL	< 2000 m (< 6562 ft) above MSL

Degree of contamination	Complete device:	Pollution level 4
	Internal:	Pollution level 2

Radio standards	• EN 300 328 (Europe) • 47 CFR 15.247 (United States) • RSS-247 Issue 1 (Canada) • RSS-GEN Issue 4 (Canada) • 202-LSF040 (Japan) • CMIIT ID: 2017DJ6495 (China)

- R-CRM-E1H-CM82A (South Korea)
- Anatel 00182-18-11036 (Brazil)
- IFETEL: RCPENCM18-0926-A1 (Mexico)
- SDoC procedure (Thailand)
- IMDA Standards DA108204 (Singapore)
- CNC ID: C-23309 (Argentina)

16.6 Mechanical construction

Materials

Components	Material
Housing, cover	Peek 151
Strain relief	EPDM (peroxide crosslinked)
Axial ring	Peek 450 G
Optical waveguide	PC transparent

Impact loads

The product is designed for mechanical impact loads of 1 J (IK06) as per the requirements of EN61010-1.

Weight

without cable	Approx. 42 g (1.5 oz)
3 m (9 f) cable	Approx. 190 g (7 oz)
7 m (23 f) cable	Approx. 380 g (13 oz)
15 m (49 f) cable	Approx. 760 g (27 oz)
For every 1 m (3 f) of cable	Approx. 48 g (2 oz)

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Endress+Hauser

People for Process Automation