Operating Instructions Liquiline Compact CM82

Compact multi-parameter transmitter for Memosens sensors





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1 About this document

1.1 Warnings

Structure of information	Meaning		
A 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

i	Additional information,	tips
---	-------------------------	------

- Permitted
- Recommended
- Forbidden or not recommended
- Reference to device documentation
- Reference to page
- Reference to graphic
- ► Result of a step

1.3 Symbols on the device

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

1.4 Documentation

The following 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 the personnel

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

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

2.2 Intended use

The Liquiline CM82 is a transmitter for connecting digital sensors with Memosens technology, configurable, with 4 to 20 mA/HART or 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 Workplace 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.

ACAUTION

Programs not switched off during maintenance activities.

Risk of injury due to medium or cleaning agent!

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

2.5 Product safety

The product is designed to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate. The relevant regulations and international standards have been observed.

2.6 IT security

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

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

3 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 an 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

Manufacturer address

Endress+Hauser Conducta GmbH+Co. KG Dieselstraße 24 D-70839 Gerlingen

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.** Page search (magnifying glass symbol): Enter valid serial number.
- 3. Search (magnifying glass).
 - └ The product structure is displayed in a popup window.
- 4. Click the product overview.
 - ← A new window opens. Here you fill information pertaining to your device, including the product documentation.

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.

5 Mounting

5.1 Mounting requirements

5.1.1 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 Connecting requirements

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

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

I 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.

HART+ HART-	
0/420 mA Source+ 1 0/420 mA Source+ 2 0/420 mA Source- 3 Display+ 4 Display(Bridge) 5 Display- or LED 6 Sensor+ (w/Display) 7 Sensor+ (w/o Display) 8 Sensor- 9 Shield 11	
	A003471

4 Terminal diagram

I 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 operation 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 the operating menu via the operating tool

7.2.1 Access to operating menu via SmartBlue (app)

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

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



5 Download links



☑ 6 SmartBlue app

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	A0035111



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 5th generation or higher from iOS9.0
- Android devices: from Android 4.4 KitKat and Bluetooth[®] 4.0

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).

					 1
	SIM fehit 🗢		10:04 Home	\$ 100 %	
	at 19	Device tag Device type Serial number Firmware version Order code	CM82_N2002305611 N2002305611 <u>N2002305611</u> 01.01.00-0012 CM82-AAVAB2C1A1A1	2	 2
3	Measurement value Partial pressure 111.72 hPa % saturation 54.2 %Sat Conc. (liquid)	25			
	4.58 mg/l Conc. (gaseous) 11.03 %vol Raw value nA 29.11 nA Temperature				
	23.5 °C Current output Current output 8.5 mA				
	()	f	=	0	

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

Operation is via four main menus:

- Guidance
- Diagnostics
- Application
- System

SIM feb	ilt 🕈 10:06	* 100 % 🚍 +
		enu
CM82	_N2002305G11	PV 111.70 hPa SV 23.6 °C
+	Guidance	>
4-	Diagnostics	>
₽	Application	>
0	System	>
Ŷ	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 the configuration of the diagnostic behavior.
Application	Sensor data for specific optimization and for detailed process adjustment. Adapts the measuring point to the application.
System	These menus contain parameters for configuring the overall system.

7.2.2 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.



IO RIA15 process indicator

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 Preliminaries

- ► 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 indicators

LED indicators signal the device status and sensor status.

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 RIA15 process indicator can be used to display the measured values as well as for the basic commissioning 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.



■ 13 Remote operation of CM82 via RIA15

- 1 PLC
- 2 Loop-powered RIA15 process indicator
- 3 Transmitter CM82
- 4 Memosens sensor (e.g. pH sensor)
- A 4 to 20 mA (HART optional)
- B 4 to 20 mA with HART



I4 Display and operating elements of the process indicator

- 1 Operating menu locked
- 2 Problem
- 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.



RIA15 operating matrix

In HART mode, the RIA15 with the "Analysis" option can be used for the basic commissioning 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 commissioning 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
рН	Glass	Raw value in mV	Glass impedance in MOhm
рН	ISFET	Raw value in mV	Leak current in nA
рН	ORP	Relative ORP value as %	Raw value in mV

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

If "UC170" is displayed instead of the unit: Configure the unit manually → 🗎 23

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 commissioning 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	
СТ				This menu contains the parameters for configuring the CM82 compact transmitter.
CSET				Access the "CM82 setup" submenu
	TUNIT		°C °F °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.
				Depending on the sensor type connected, only certain measured values can be configured/displayed.
		pH glass se	ensors	
		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 °C/°F/K (unit as per setting in TUNIT)
		pH-ISFET s	ensors	
		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 °C/°F/K (unit as per setting in TUNIT)
		pH ORP ser	isors	

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 °C/°F/K (unit as per setting in TUNIT)
	pH/ORP co	mbined 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 °C/°F/K (unit as per setting in TUNIT)
	Oxygen ser	isors	
	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 °C/°F/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
	Conductivit	ty sensors	
	CMAIN	COND RESIS RAWC TEMP	COND: Specific conductivity (unit as per setting in UCOND) RESIS: Resistivity (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: nillisiemens/cm S/cm: siemens/cm uS/m: microsiemens/m mS/m: millisiemens/m S/m: siemens/m
	for all sens	ors	

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 °C (depending on the unit configured under TEMP) -58.0 to 302.0°F 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 999.9.9 nA RTIME: 0.0 to 100.0 μs TEMP: -10.0 to 140.0 °C 14.0 to 284 °F 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 299.99 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 99.999 mS/cm 0.000 to 99.999 uS/cm 0.000 to 99.999 uS/m 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 °C -58.0 to 482.0 °F 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 SENOC SENSN		Device serial number	Display the serial number of the CM82 (use +/- keys to scroll through text)
			Sensor order code	Display the oder code of the sensor (use +/- keys to scroll through text)
			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 \rightarrow B 23

I 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
рН	Leak current (LEAKC)	nA
рН	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. Log in.
- 5. Enter the 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	SelectionSignal strengthName	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 Configuring the measuring device

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

9.6.1 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

9.6.2 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	Check sensor name or determine sensor group.	
	Factory setting Off		
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	 Selection: Linear NaCl (IEC 746-3) Water ISO7888 (20 °C) Water ISO7888 (25 °C) UPW (NaCl) UPW (HCl) Factory setting: Linear 	Various methods are available to compensate for the temperature dependency.	
Meas. ref. temp.	-5.0 to 100.0 °C (23.0 to 212.0 °F) Factory setting 25.0 °C (77.0 °F)	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:	1	1	

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
Туре	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	The lower temperature threshold of the CIP criteria. One CIP cycle is taken into consideration within the temperature thresholds.
	85 ℃ (185 °F)	

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 consideration 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 Air pressure Altitude Measured value	 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) 	
	Factory setting Air pressure	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 	Specify salinity.	
	Factory setting Fixed value		
Diagnostic settings		For diagnostic settings of sensor, see section $\rightarrow \textcircled{B} 41$	
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	Measured value depending on connected sensor	
	Factory setting 1 mV		
Duration	0 to 60 s		
	Factory setting 0 s		
Temp. compensation	Selection • Off • Automatic • Manual	 Configure compensation of buffer temperature: Automatically using the temperature sensor of your sensor (ATC) Manually by entering the medium temperature 	
	Factory setting Automatic	• 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 in Buffer manufacturer. Automatic The device recognizes the buffer automatically. The recognition depends on the setting in Buffer manufacturer. 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 options and 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	Timeframe within which the permitted measured
	Factory setting 20 s	value variation may not be exceeded
Ambient conditions		
Medium pressure	Selection Process pressure Air pressure Altitude As in measurement Factory setting	
	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).	
Air pressure Medium pressure = Air pressure	500 to 1200 hPa Factory setting 1013 hPa	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	
Altitude	-300 to 4000 m Factory setting 0 m	pressure is then independent of the altitude.	
Rel. hum. (air variable)	0 to 100 % Factory setting 100 %		
Calibration monitoring	Selection Off During operation When connecting Factory setting Off	 This function checks the time elapsed since the last sensor calibration. This may occur continuously during operation or just once while the calibration data are being read (sensor connection, device start, calibration kit replacement). During operation: During continuous operation, this function informs the user of the time elapsed since the last calibration. When connecting: During a batch process, this function ensures that only recently calibrated sensors are used. No error message is generated during the batch process. 	

1) Only pH or pH/ORP combined sensor

9.6.3 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	Depends on connected sensor	
	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		

Path: Application			
Function	Options	Info	
Range lower value (4mA)	The unit depends on the	Enter the measuring range. The lower and	
Range upper value (20mA)	sensor configured.	upper range value are assigned the 4 mA value and the 20 mA value, respectively. The system uses the engineering unit which you entered beforehand.	

9.6.4 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	
P V Value	output/Output value	Primary process value	
SV value	pH, ISFET, ORP and	Protocol-specific data, dynamic variables of	
TV value	■ pH	SV = Secondary (temperature preselection)	
QV value	 Raw value pH Glass impedance Impedance reference rH ISFET Leakage current ORP mV ORP % Temperature 	TV = Tertiary QV = Quaternary	
	Oxygen Partial pressure % saturation Conc. (liquid) Conc. (gaseous) Raw value µs Raw value nA Temperature		
	Conductivity • Conductivity • Resistivity • Raw value (cond. uncomp.) • Temperature		

9.6.5 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	

Path:System/Hold			
Function	Options	Info	
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"	

9.7 Advanced settings

9.7.1 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...)

9.8 Configuration management

Display the following configurations:

System/System information

- TAG
- Order code
- Order code extended
- Serial number
- Software version
- Hardware version
- Modbus
- HART

System/Sensor information

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

9.9 Protecting settings from unauthorized access

9.9.1 Unauthorized access via Bluetooth[®] LE

The device is protected against unauthorized access via Bluetooth with a password. The password can be changed:

- Immediately after entering the password
- In the menu under:
 - System/Security/Bluetooth password

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.

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.

RIA15 locking

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

I 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:

AG
evice type
erial number
rmware version
rder code

10.1.1 Changing the parameters

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

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 Calibration

The device displays the following message text if calibration is not enabled: Calibration functions are not unlocked on this device.



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, "precalibrated" sensors can be used and there is no need to interrupt process monitoring for the calibration.

1. Menu: Select Guidance/Calibration.

- 2. Select the calibration type.
- 3. Follow the instructions of the software.

The calibration can be canceled at any time with ${\bf X}$. No data are then used to adjust the sensor.

Types of calibration

Path: Guidance/Calibration		
Type of calibration	Info	
Oxygen (amperometric)		
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.	

Path: Guidance/Calibration			
Type of calibration	Info		
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.		
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 membrane, 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 (optical with Memosens coupling)			
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 does not follow a linear function. It follows the Stern-Vollmer relationship instead. In this case, the measuring principle cannot be equated 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.		
Path: Guidance/Calibration			
--------------------------------	---	--	--
Type of calibration	Info		
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.		
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 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):			

Path: Guidance/Calibration		
Type of calibration	Info	
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):		
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. The calibration is possible with or without temperature compensation.	
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. The calibration is possible with or without temperature compensation.	

10.2.2 Medium compensation (in the process) for oxygen

Path: Application/Sensor/Extended setup			
Function	Options	Info	
Medium pressure	SelectionProcess pressureAir pressureAltitude	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	IED actting and	(
10.2.3	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 °C (86 to 266 °F) Factory setting 80 °C (176 °F)		
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 Life science - standard Life science - strong Off Low Medium High Very high Factory setting Medium	Use this function to select how strong or weak the signal filtering in the sensor should be. Life science - standard Optimized filter for use of the sensor in fermenter applications. (not for COS81D) Life science - strong Strong filter for use of the sensor in fermenter applications in which oxygen regulation is complicated by small accumulations of air bubbles on the sensor due to the consistency of the medium. (not for COS81D) Off No signal filtering takes place. The recorded signals are passed on virtually unfiltered. Low Signal filtering is weak. Medium Signal filtering is normal. High Signal filtering is strong. Very high Signal filtering is very strong. Widely fluctuating raw signals are greatly attenuated by the sensor.	

10.2.4 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.

Diagnostics and troubleshooting 11

Diagnostic information via LED 11.1

See LED display in Commissioning section. ($\rightarrow \square$ 18)

Adapting the diagnostic information 11.2

Adapting the diagnostic information 11.2.1

Path: Diagnostics/Diagnostic settings		
Function	Options	Info
Sensor change alarm delay	0 to 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 mA Factory setting If the IB option is ordered: 22.5 mA Without the IB option: 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	

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* 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
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

11.2.2 Adapting sensor diagnostic information

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

Impedance monitoring

Path: Application/Sensor/Extended setup/Diagnostic settings		
Function	Options	Info
Glass impedance	I	I
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.

Path: Application/Sensor/Extended setup/Diagnostic settings			
Function	Options	Info	
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.	
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	

Slope

рН, охудеп

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

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.
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

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)		

Path: Application/Sensor/Extended setup/Diagnostic settings		
Function	Options	Info
Upper warning limit	pH 6.00 to pH 12.00 Upper warning limit 900 mV to Upper warning limit ²⁾	Associated diagnostics code and message text: 505 Sensor calibration 515 Sensor calibration ²⁾
	Factory setting pH 8.00 / -300 mV	
Lower warning limit	Lower warning limit H 2.00 to pH 8.00 ¹⁾ Lower warning limit to -900 mV ²⁾	Associated diagnostics code and message text: 507 Sensor calibration 517 Sensor calibration ²⁾
	Factory setting pH 6.00 / 300 mV	
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

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.	
	p	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	Switches the function on or off
	Factory setting 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

Operating hours limit values

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 °C	Factory setting Depends on the sensor	Diagnostic code and message: 193 Operating time
Operating time > 80 °C < 100 nS/cm	Factory setting Depends on the sensor	Only conductive conductivity sensors
Operating time > 100 °C	Factory setting Depends on the sensor	Diagnostic code and message: 194 Operating time
Operating time > 120 °C Not for pH	Factory setting Depends on the sensor	Diagnostic code and associated message: 195 Operating time
Operating time > 150 °C 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

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 cap or 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 membrane cap needs to be replaced. The number depends heavily on the process and must be determined individually. Associated diagnostics code and message text: 109 SIP, CIP, autoclav cap

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

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	Switches the function on or off	
	Off		
Duration	Selection 0 to 240 min	If the measured value stagnates over this time period, the	
	Factory setting 60 min	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	
pH glass	0.02 pH	interval are regarded as stagnating.	
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	

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

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

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.	

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

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					

Calibration quality index (only optical oxygen sensors)

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

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					

11.3 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	Switch on or off simulation							
	Factory setting Off								
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	Switch on or off simulation						
	Factory setting Off							
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						

11.4 Diagnostics list

11.4.1 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

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

No.	Message	Fa set	ctory tings	Sensor type	Configur able	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 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 Change to a sensor of configured type 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 Replace sensor
022	Temperature sensor	F	Alarm	All	Yes	 Temperature sensor defective 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 Check sensor cable connection Check for short-circuit of the cables Replace sensor Update the sensor FW again

No.	Message	Fa set	ctory tings	Sensor type	Configur able	Te	sts 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	С	Warning	All	No	►	Sensor calibration is active, please wait.
108	SIP, CIP, autoclaving	М	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	М	Warning	0	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	0	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
113	Incompatible filter	М	Warning	0	No	►	
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	Fac set	ctory tings	Sensor type	Configur able	Te	sts 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	М	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	М	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	М	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	Fa set	ctory tings	Sensor type	Configur able	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	М	Warning	0	No	 Sensor relaxation time underrange Measurement is still possible possible reasons: high oxygen content wrong calibration data Repeat calibration Replace sensor cap
132	Sensor calibration	М	Warning	0	No	 Sensor relaxation time overrange Measurement is still possible possible reasons: low oxygen content wrong calibration data Repeat calibration Replace sensor cap
133	Sensor signal	F	Alarm	0	No	 Sensor low signal decay Replace sensor cap
134	Sensor signal	М	Warning	0	No	 Sensor low signal amplitude Measurement is still possible Replace sensor cap
141	Polarization	S	Warning	С	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 Use sensor with greater cell constant
142	Sensor signal	S	Warning	С	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	С, О	Yes	 Sensor temperature out of spec. Range Check temperature Check measurement Change sensor type
154	Sensor data invalid	М	Warning	С	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	С	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	Fac set	ctory tings	Sensor type	Configur able	Te	sts or remedial action
		S	D				
168	Polarization	S	Warning	С	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	М	Warning	Р	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	Ρ	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	М	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	М	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	М	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	М	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	С	No	•	Operating time warning Measurement is still possible The configured limit of operating time > 80 °C and < 100 nS/cm is reached 1. Replace sensor 2. Adjust limit 3. Deactivate monitoring

No.	Message	Fa set	ctory tings	Sensor type	Configur able	Tests or remedial action
		s	D			
189	Operating time	М	Warning	0	No	 Operating time warning Measurement is still possible The configured limit of operating time > 5 °C is reached Replace sensor Adjust limit Deactivate monitoring
191	Operating time	М	Warning	0	No	 Operating time warning Measurement is still possible The configured limit of operating time > 30 °C is reached Replace sensor Adjust limit
192	Operating time	М	Warning	0	No	 Operating time warning Measurement is still possible The configured limit of operating time > 40 °C is reached Replace sensor Adjust limit Deactivate monitoring
193	Operating time	М	Warning	All	No	 Operating time warning Measurement is still possible The configured limit of operating time > 80 °C is reached Replace sensor Adjust limit Deactivate monitoring
194	Operating time	М	Warning	Р, С	No	 Operating time warning Measurement is still possible The configured limit of operating time > 100 °C is reached Replace sensor Adjust limit Deactivate monitoring
195	Operating time	М	Warning	C, O	No	 Operating time warning Measurement is still possible The configured limit of operating time > 120 °C is reached Replace sensor Adjust limit Deactivate monitoring
197	Operating time	М	Warning	C	No	 Operating time warning Measurement is still possible The configured limit of operating time > 140 °C is reached Replace sensor Adjust limit Deactivate monitoring
198	Operating time	М	Warning	C	No	 Operating time warning Measurement is still possible The configured limit of operating time > 150 °C is reached Replace sensor Adjust limit Deactivate monitoring

No.	Message	Fac set	ctory tings	Sensor type	Configur able	Te	sts or remedial action
		S	D				
199	Operating time	М	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	0	No	►	Selftest active, please wait
215	Simulation active	С	Warning	All	No	•	Simulation active, please wait. Simulation can be stopped in the diagnostic menu, or by restarting the device
216	Hold active	С	Warning	All	No	•	Hold active, please wait. Operation mode with modified measurement output Output and status of all channels on hold
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
383	Firmware failure	F	Alarm	All	No	•	Unspecific failure 1. Update software 2. Check external fieldbus configuration 3. Check connected sensors 4. Contact service and report the indicated number
384	Firmware failure	F	Alarm	All	No	►	Unspecific failure 1. Update software 2. Check external fieldbus configuration 3. Check connected sensors 4. Contact service and report the indicated number
408	Calibration aborted	М	Warning	All	No	►	The calibration has been aborted.
411	Up-/Download active, please wait	С	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	Configur able	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 Check application Check configuration of current output Clean sensor / sample line
500	Sensor calibration	М	Warning	All	No	 Sensor calibration aborted Main measurement value fluctuating possible reasons: sensor over-ranged sensor temporary dry buffer solution value not stable Check sensor, replace as necessary 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 Check sensor, replace as necessary Check buffer temperature
505	Sensor calibration	М	Warning	Ρ, Ο	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 Check sensor, replace as necessary Check buffer or electrolyte, replace as necessary Repeat calibration
507	Sensor calibration	M	Warning	Р, О	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 Check sensor, replace as necessary Check buffer or electrolyte, replace as necessary Repeat calibration

No.	Message	Factory settings		Sensor type	Configur able	Tests or remedial action
		S	D			
509	Sensor calibration	M	Warning	Ρ, Ο	No	 Min. slope warning Measurement is still possible until alarm message possible reasons: sensor aged or defective diaphragm blocked buffer solution expired or contaminated Check sensor, replace as necessary Check buffer, replace as necessary Repeat the calibration
511	Sensor calibration	М	Warning	Ρ, Ο	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 Check sensor, replace as necessary Check buffer or electrolyte, replace as necessary 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 Check sensor, replace as necessary Check buffer, replace as necessary Repeat the calibration
517	Sensor calibration	М	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 Check sensor, replace as necessary Check buffer, replace as necessary Repeat the calibration
518	Sensor calibration	М	Warning	Ρ, Ο	No	 Delta slope warning Measurement is still possible. The calibration shows a large change of sensor slope. Check sensor, replace as necessary Check buffer or electrolyte, replace as necessary Repeat calibration

No.	Message	Fa set	ctory tings	Sensor type	Configur able	Tests or remedial action
520	Sensor calibration	M	Warning	Ρ, Ο	No	 Delta zero point warning Measurement is still possible. The calibration shows a large change of sensor zero point. Check sensor, replace as necessary Check buffer or electrolyte, replace as necessary 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 Check sensor, replace as necessary Check buffer, replace as necessary Repeat calibration
532	License error	М	Warning	All	No	► License error
535	Sensor check	М	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	Р	Yes	 Sensor reference limit upper value exceeded Reference membrane impedance too high Check the sensor, replace as needed Check the reference limit value, correct as needed Replace sensor
725	Sensor reference	М	Warning	Р	Yes	 Sensor reference limit upper value reached Reference membrane impedance high Check the sensor, replace as needed Check the reference limit value, correct as needed Replace sensor
734	Calibration quality	М	Warning	0	No	 Min. calibration quality warning Measurement is still possible. The calibration quality shows a large change since last calibration. Repeat calibration Check sensor, replace as necessary
740	Sensor defective	F	Alarm	С	No	 Sensor defective Internal sensor connection broken Replace sensor Contact service
770	Sensor deactivated	F	Alarm	Р	No	 Sensor deactivated Sensor has been deactivated by user. Replace sensor
832	Temp. range exceeded	S	Warning	All	Yes	 Out of temperature range 1. Check application 2. Check sensor
841	Operating range	S	Warning	All	Yes	 Process value out of operating range 1. Check application 2. Check sensor

No.	Message	Factory settings		Sensor type	Configur able	Te	sts or remedial action
		S	D				
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	Ρ	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	F	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	М	Warning	С	Yes	•	USP / EP alarm conductivity limit for USP or EP exceeded 1. Check process
915	USP / EP warning	М	Warning	С	Yes	•	USP / EP warning Conductivity value close to the limit for USP or EP 1. Check process
942	Process value	S	Warning	Р	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
943	Process value	S	Warning	Р	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	М	Warning	0	No	•	Due to a sensor maintenance a calibration is required.

11.5 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		

11.6 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		

11.7 Device information

11.7.1 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.	

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
08/2022	01.03.00	 Firmware release Calibration, conductivity cell constant optionally possible with temperature compensation Calibration, conductivity installation factor optionally possible with temperature compensation Measured value filter for optical oxygen sensors Life science - standard Life science - strong 	BA01845C/07/EN/03.22

11.8.1 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**

12 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.

12.1 Maintenance tasks

12.1.1 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

13 Repair

13.1 General information

 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

13.2 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.

13.3 Disposal

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

• Observe the local regulations.

X

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 the manufacturer for disposal under the applicable conditions.

14 Accessories

14.1 Device-specific accessories

14.1.1 Sensors

pH glass electrodes

Memosens CPS11E

- pH sensor for standard applications in process and environmental engineering
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps11e

Technical Information TI01493C

Memosens CPS31E

- pH sensor for standard applications in drinking water and swimming pool water
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps31e

Technical Information TI01574C

Memosens CPS41E

- pH sensor for process technology
- With ceramic junction and KCl liquid electrolyte
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps41e

Technical Information TI01495C

Memosens CPS71E

- pH sensor for chemical process applications
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps71e

Technical Information TI01496C

Memosens CPS171D

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

Technical Information TI01254C

Memosens CPS91E

- pH sensor for heavily polluted media
- With open aperture
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps91e

Technical Information TI01497C

Memosens CPF81E

- pH sensor for mining operations, industrial water and wastewater treatment
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cpf81e

Technical Information TI01594C

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

ORP sensors

Memosens CPS12E

- ORP sensor for standard applications in process and environmental engineering
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps12e

Technical Information TI01494C

Memosens CPS42E

- ORP sensor for process technology
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps42e

Technical Information TI01575C

Ceragel CPS72D

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

Technical Information TI00374C

Memosens CPF82E

- ORP sensor for mining operations, industrial water and wastewater treatment
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cpf82e

Technical Information TI01595C

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

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

pH/ORP combined sensors

Memosens CPS16E

- pH/ORP sensor for standard applications in process technology and environmental engineering
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps16e

Technical Information TI01600C

Memosens CPS76E

- pH/ORP sensor for process technology
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps76e

Technical Information TI01601C

Memosens CPS96E

- pH/ORP sensor for heavily polluted media and suspended solids
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps96e

Technical Information TI01602C

Conductivity sensors with conductive measurement of conductivity

Memosens CLS15E

- Digital conductivity sensor for measurements in pure and ultrapure water
- Conductive measurement
- With Memosens 2.0
- Product Configurator on the product page: www.endress.com/cls15e

Technical Information TI01526C

Memosens CLS16E

- Digital conductivity sensor for measurements in pure and ultrapure water
- Conductive measurement
- With Memosens 2.0
- Product Configurator on the product page: www.endress.com/cls16e

Technical Information TI01527C

Memosens CLS21E

- Digital conductivity sensor for media with medium or high conductivity
- Conductive measurement
- With Memosens 2.0
- Product Configurator on the product page: www.endress.com/cls21e

Technical Information TI01528C

Memosens CLS82E

- Hygienic conductivity sensor
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cls82e

Technical Information TI01529C

Oxygen sensors

Memosens COS22E

- Hygienic amperometric oxygen sensor with maximum measurement stability over multiple sterilization cycles
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cos22e

Technical Information TI01619C

Memosens COS51E

- Amperometric oxygen sensor for water, wastewater and utilities
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cos51e

Technical Information TI01620C

Memosens COS81E

- Hygienic optical oxygen sensor with maximum measurement stability over multiple sterilization cycles
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cos81e

Technical Information TI01558C

14.1.2 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 <u>www.software-products.endress.com</u>. You need to register in the Endress+Hauser software portal to download the application.

Technical Information TI01134S

14.1.3 Activation codes

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

Activation code: Bluetooth

Order No. 71401176

14.1.4 Cable junction with Velcro strip

Cable junction with Velcro strip

- 4 pieces, for sensor cable
- Order No. 71092051

14.2 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

14.3 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

15 Technical data

15.1 Input

Measured variables	 pH ORP pH/ORP Oxygen Conductivity
Measuring ranges	ightarrow 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)

15.2 Output

Output signal	4 20 mA/HART, galvanically isolated from the sensor circuits				
Linearization/transmission behavior	Linear				
	15.3 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: $< \pm 20 \ \mu\text{A}$ (if current value = 4 mA) $< \pm 50 \ \mu\text{A}$ (for current values 4 to 20 mA) at 25 °C (77° F) each				
	additional tolerance depending on the temperature: $< 1.5 \ \mu A/K$				
Resolution of current output	< 5 μΑ				
Repeatability	\rightarrow Documentation of the connected sensor				
15.4 Power supply

Supply voltage

12.6 to 30 VDC (when failure current setting > 20 mA)

14 to 30 VDC (when failure current setting < 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-in head	 pH sensors ORP sensors pH/ORP combined sensors Oxygen sensors Conductivity sensors 	

15.5 Environment

Ambient temperature	–20 to 85 °C (–4 to 185 °F)
	The maximum ambient temperature depends on the process temperature and the transmitter's installation position.
	Make sure that the ambient temperature at the transmitter does not exceed 85 °C (185 °F).

Example for ambient conditions in Endress+Hauser assemblies:

- for 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

 $T_{ambient} = max. 60 \degree C (140 \degree F)$

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

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



■ 16 Installation position of transmitter with or without protective cover

1 Ambient temperature T_{ambient}

2 Process temperature T_{process}

Storage temperature	-40 to +85 °C (-40 to 185 °F)		
Relative 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 M	SL	
Pollution degree	Complete device:	Pollution level 4	
	Internal:	Pollution level 2	
Radio standards	 EN 300 328 (Europe) 47 CFR 15.247 (United State PSS 247 Januar 1 (Canada) 	rs)	

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)

15.6 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 EN 61010-1.

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)
	without cable 3 m (9 f) cable 7 m (23 f) cable 15 m (49 f) cable For every 1 m (3 f) of cable

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