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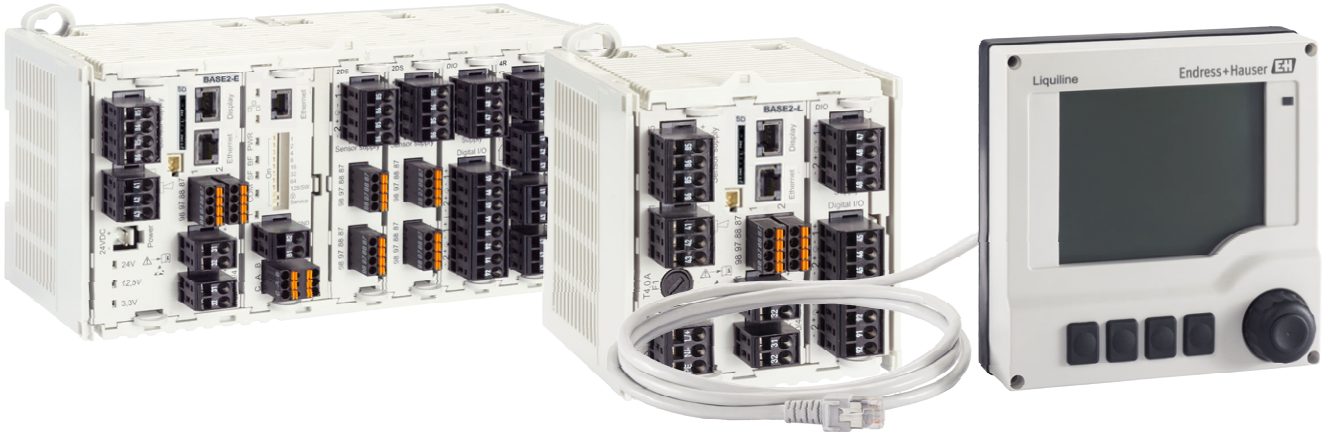
2019-11-30

Technical Information
Liquiline CM442R/CM444R/ CM448R

Cabinet controller with a maximum of eight measuring channels based on digital Memosens technology



For monitoring and controlling processes in industry and the environmental sector

Application

- Food and beverages
- Life science
- Water and wastewater
- Chemical industry

Your benefits

- Highly flexible:
  - Able to connect up to 8 Memosens sensors
  - Mathematics functions calculate new measured values
  - Digital fieldbuses (HART, PROFIBUS, Modbus, Ethernet/IP, PROFINET) and integrated web server
  - Choice of cleaning function, controller and alarm relay
  - Optional digital or analog inputs/outputs
- Maximum process safety thanks to standardized operating concept across all devices in the Liquiline, sampler and analyzer platform
- Fast commissioning thanks to:
  - Memosens: lab-calibrated sensors & hot plug-and-play
  - Preconfigured Liquiline transmitters
  - Easy extension and adaptation
- Minimum inventory:
  - Cross-platform, modular concept (e.g. identical modules irrespective of parameters)
  - Integration into FieldCare and W@M facilitates effective asset management

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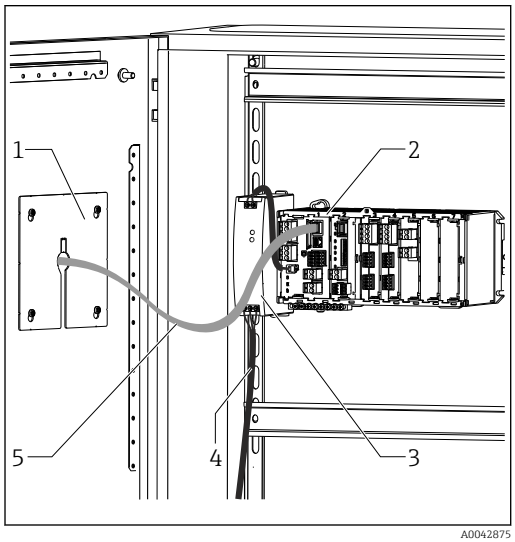
Function and system design

Measuring system

The overview shows examples of measuring systems. Other sensors and assemblies can be ordered for conditions specific to your application (www.endress.com/products).

Measuring point

A complete measuring system comprises:
- TransmitterLiquiline
- Optional display
- Sensors with Memosens technology
- Assemblies to suit the sensors used

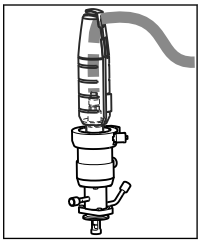


1 Cabinet installation (without sensor and signal cables)

1 Optional display (back)
2 Liquiline
3 External power unit (CM444R and CM448R only)
4 Power cable (to be provided by the customer)
5 Display cable

pH value or ORP

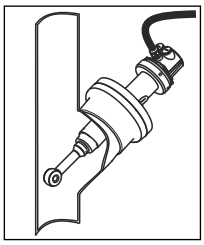
pH measurement in drinking water (→ Fig.)
- Retractable assembly Cleanfit CPA871
- Sensor Orbisint CPS11D
- Measuring cable CYK10



ORP in drinking water
- Dipfit CYA112 immersion assembly
- Sensor Orbisint CPS12D
- Measuring cable CYK10

Conductivity

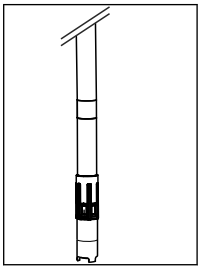
Inductive conductivity measurement in wastewater treatment
- Sensor Indumax CLS50D
- Sensor fixed cable



Conductive conductivity measurement in power plant cooling water
- Sensor Condumax CLS15D
- Measuring cable CYK10

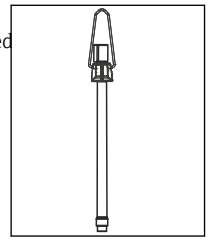
Oxygen

Oxygen in aeration basins
- Dipfit CYA112 immersion assembly
- Holder CYH112
- Sensor
  - COS61D (optical) with fixed cable (→ Fig.)
  - COS51D (amperometric), cable CYK10



Nitrate and SAC

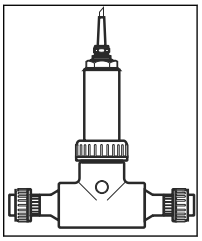
Nitrate in wastewater
- Sensor CAS51D-**A2 with fixed cable
- Dipfit CYA112 immersion assembly
- Holder CYH112



SAC in the wastewater treatment outlet
- Sensor CAS51D-**2C2 with fixed cable
- Dipfit CYA112 immersion assembly
- Holder CYH112

Turbidity and interface

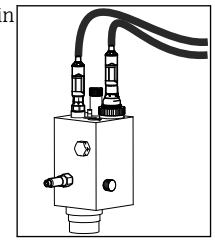
Turbidity in industrial water
- Sensor Turbimax CUS51D with fixed cable (→ Fig.)
- Assembly Flowfit CUA250
- Spray head CUR3 (optional)



Interface in the primary clarifier
- Sensor Turbimax CUS71D
- Assembly CYA112
- Holder CYH112

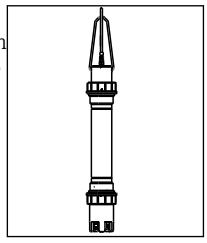
Disinfection

Free available chlorine (and pH) in drinking water
- Sensor CCS142D
- Sensor CPS11D
- Measuring cable CYK10
- Flow assembly CCA250



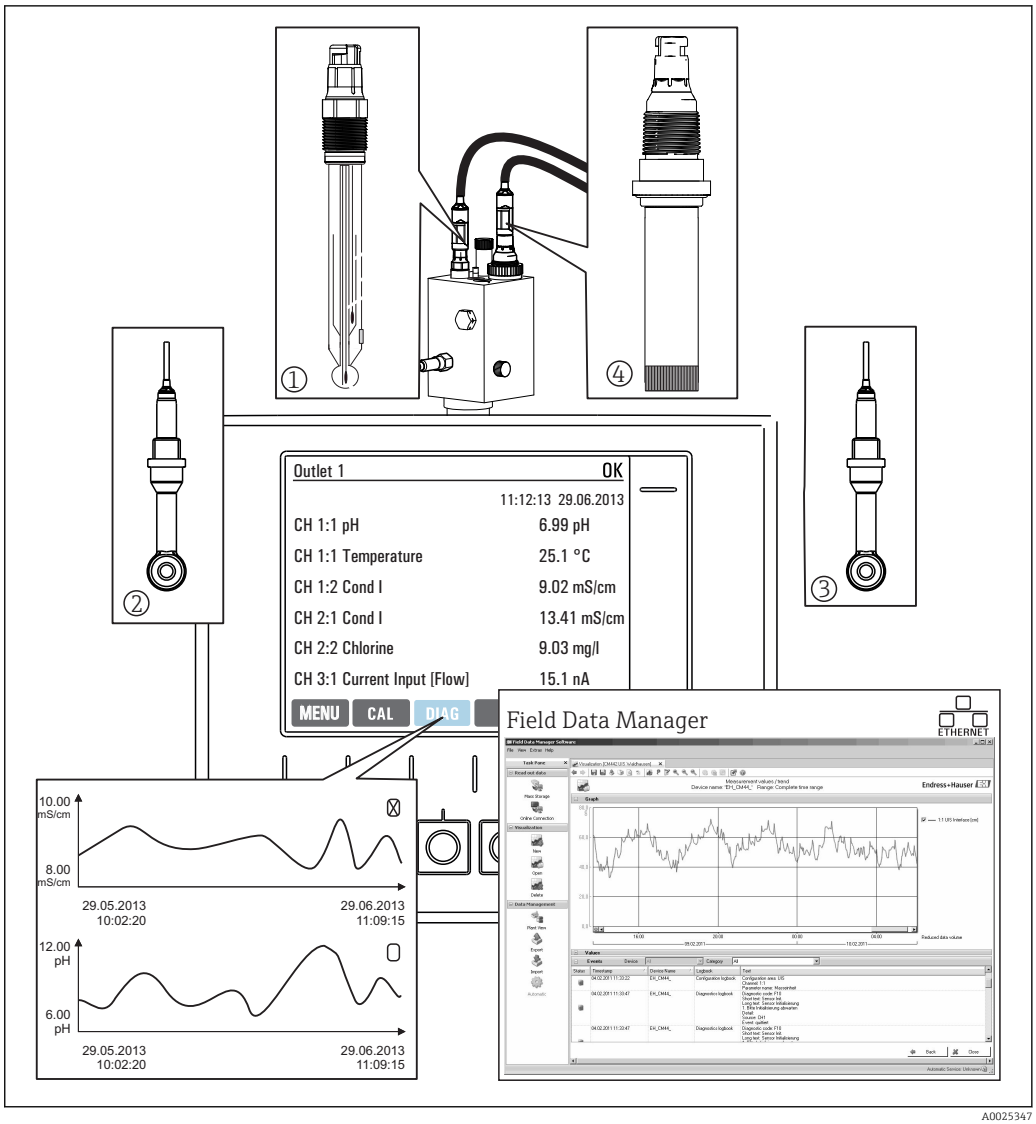
Ion-selective electrodes

Ammonium and nitrate measurement in the aeration basin
- Sensor CAS40D with fixed cable
- Holder CYH112



Application example

- Transmitter CM444R-AAM44A0FM6 with:
  4 x Memosens, Modbus TCP, 2 digital inputs and 2 digital outputs, 2 x relays for cleaning/limit value, 2 x analog current input
- pH and temperature with CPS11D, item 1 (www.endress.com/cps11d)
- Chlorine with CCS142D, item 4 (www.endress.com/ccs142d)
- 2 x conductivity, inductive measurement with CLS50D, item 2 and 3 (www.endress.com/cls50d)
- 1 x measuring range switching for conductivity via Modbus module
- Flow assembly CCA250 with optional proximity switch INS (www.endress.com/cca250)
- Chlorine regulation with dosing interrupted if no flow: proximity switch via digital input of DIO module, flow feedforward control (via digital or analog input), PFM-controlled dosing pump via digital output of DIO module



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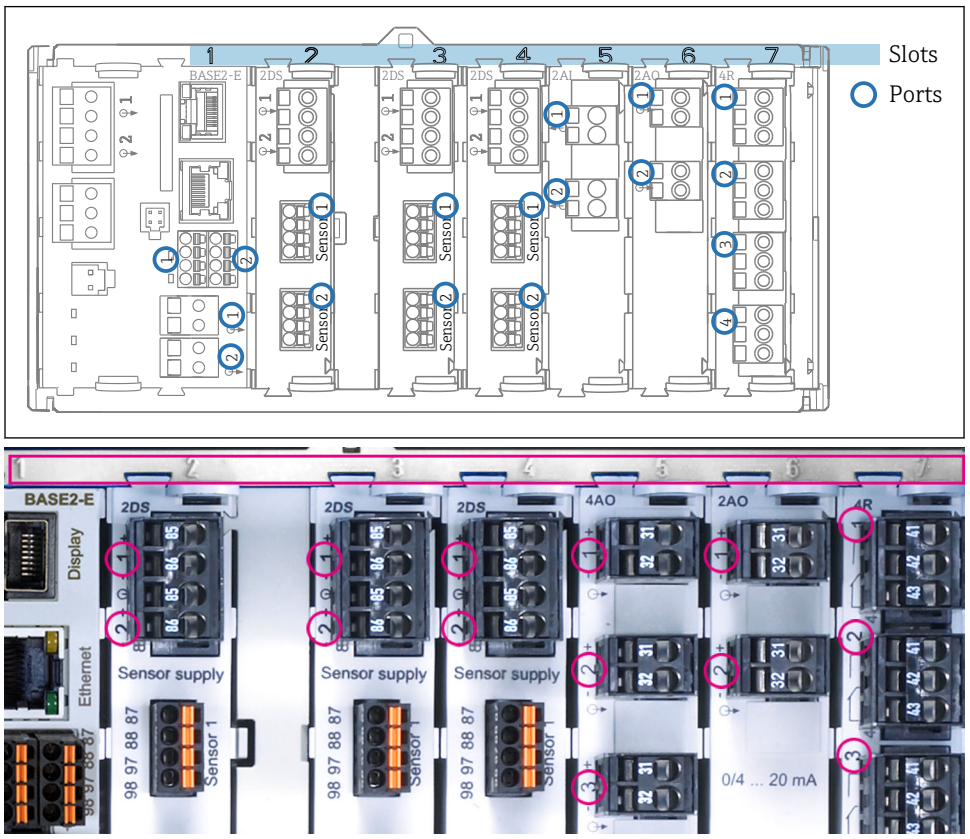
2 *Measuring point in the CIP process*

Data retention

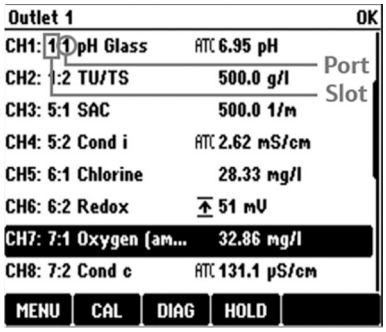
- Storage of all measured values, incl. values of external sources, in the non-volatile memory (data logbook)
- Data called up on site via user-defined measuring menu and load curve display of the data logbook
- Transmission of data by ethernet, CDI interface or SD card and storage in a tamper-proof database (Field Data Manager)
- Data export to csv file (for Microsoft Excel)

Device architecture

Slot and port assignment



3 *Slot and port assignment of the hardware modules*



4 *Slot and port assignment on the display*

- Inputs are assigned to measuring channels in the ascending order of the slots and ports.
  Adjacent example:
  "CH1: 1:1 pH glass" means:
  Channel 1 (CH1) is slot 1 (basic module) : Port 1 (input 1), pH glass sensor
- Outputs and relays are named according to their function, e.g. "current output", and are displayed in ascending order with the slot and port numbers

Order of the modules

Depending on the version ordered, the device is supplied with a number of electronic modules, which are assigned in a specific sequence in ascending order to slots 0 to 7. If you do not have a particular module, the next moves up automatically:

- The basic module (which is always present) always occupies slots 0 and 1
- Fieldbus module 485
- Memosens input module 2DS (DS = digital sensor)
- Extension module for digital inputs and outputs DIO (DIO = digital input and output)
- Current input module 2AI (AI = analog input)
- Current output module 4AO or 2AO (AO = analog output)
- Relay modules AOR, 4R or 2R (AOR = analog output + relay, R = relay)

Modules with 4 ports are connected before modules of the same type with 2 ports.

Basic rule for hardware upgrades

Please note the following if upgrading the device:

- The sum of all current inputs and outputs may not exceed 8!
- A maximum of two "DIO" modules may be used.

Determining the hardware delivery status

You must be aware of the type of modules and the number of them supplied with the device you have ordered to determine the delivery status of your Liquiline.

- Basic module
  One basic module in all versions. Always occupies slots 0 and 1.
- Fieldbus module
  Optional, and only one fieldbus module is possible.
- Input modules
  - Must be clearly assigned to the number of optional inputs ordered.
  - Examples:
    2 current inputs = module 2AI
    4 Memosens inputs = 2 inputs with basic module + module 2DS with 2 further inputs
- Current outputs and relays
  Various module combinations can exist.
  The following table will help you determine which modules your device has, depending on the type and number of outputs.

	Relays		
Current outputs	**0**	**2**	**4**
2	-	1 x 2R	1 x 4R
4	1 x 2AO	1 x AOR	1 x 2AO + 1 x 4R
6	1 x 4AO	1 x 4AO + 1 x 2R	1 x 4AO + 1 x 4R
8	1 x 4AO + 1 x 2AO	1 x 4AO + 1 x 2AO + 1 x 2R	1 x 4AO + 1x 2AO + 1 x 4R

▶ Sum up the number of modules and sort them according to the specified sequence → 📄 6.
↳ This will give you the slot assignment for your device.

Terminal diagram

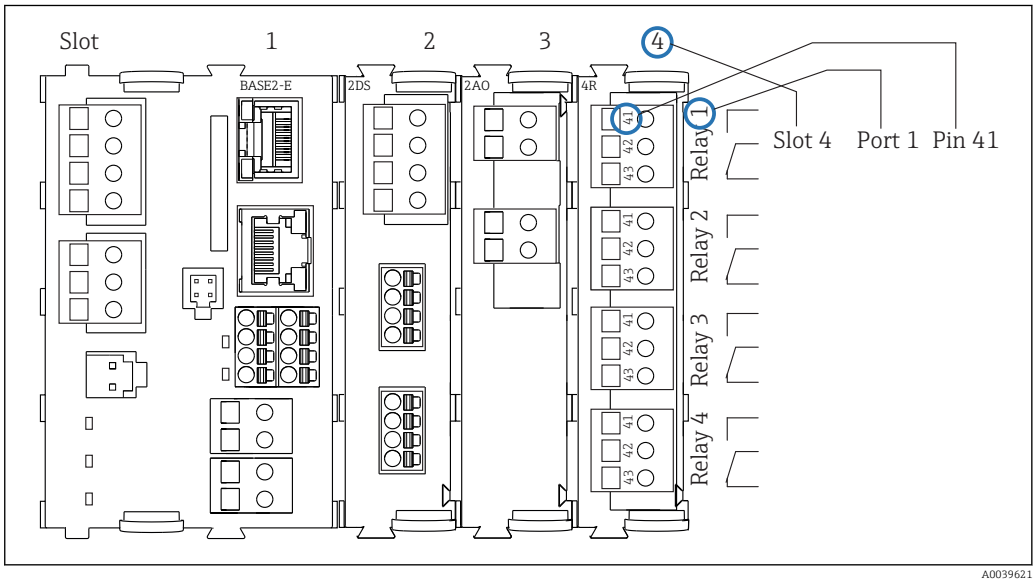
The unique terminal name is derived from:

Slot no. : Port no. : Terminal

Example, NO contact of a relay

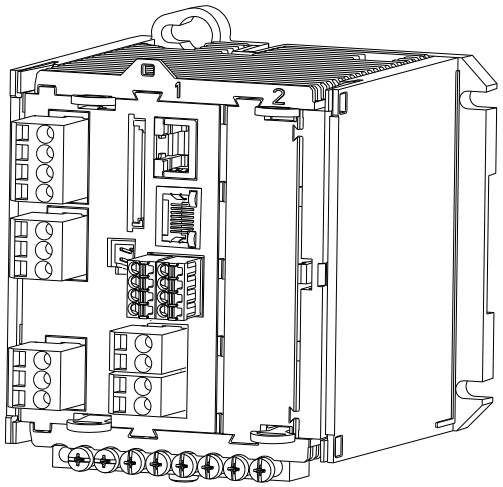
Device with 4 inputs for digital sensors, 4 current outputs and 4 relays

- Base module BASE2-E (contains 2 sensor inputs, 2 current outputs)
- 2DS module (2 sensor inputs)
- 2AO module (2 current outputs)
- 4R module (4 relays)



5 Creating a terminal diagram using the example of the NO contact (terminal 41) of a relay

Device configuration using the example of a CM442R-M1A1F0***



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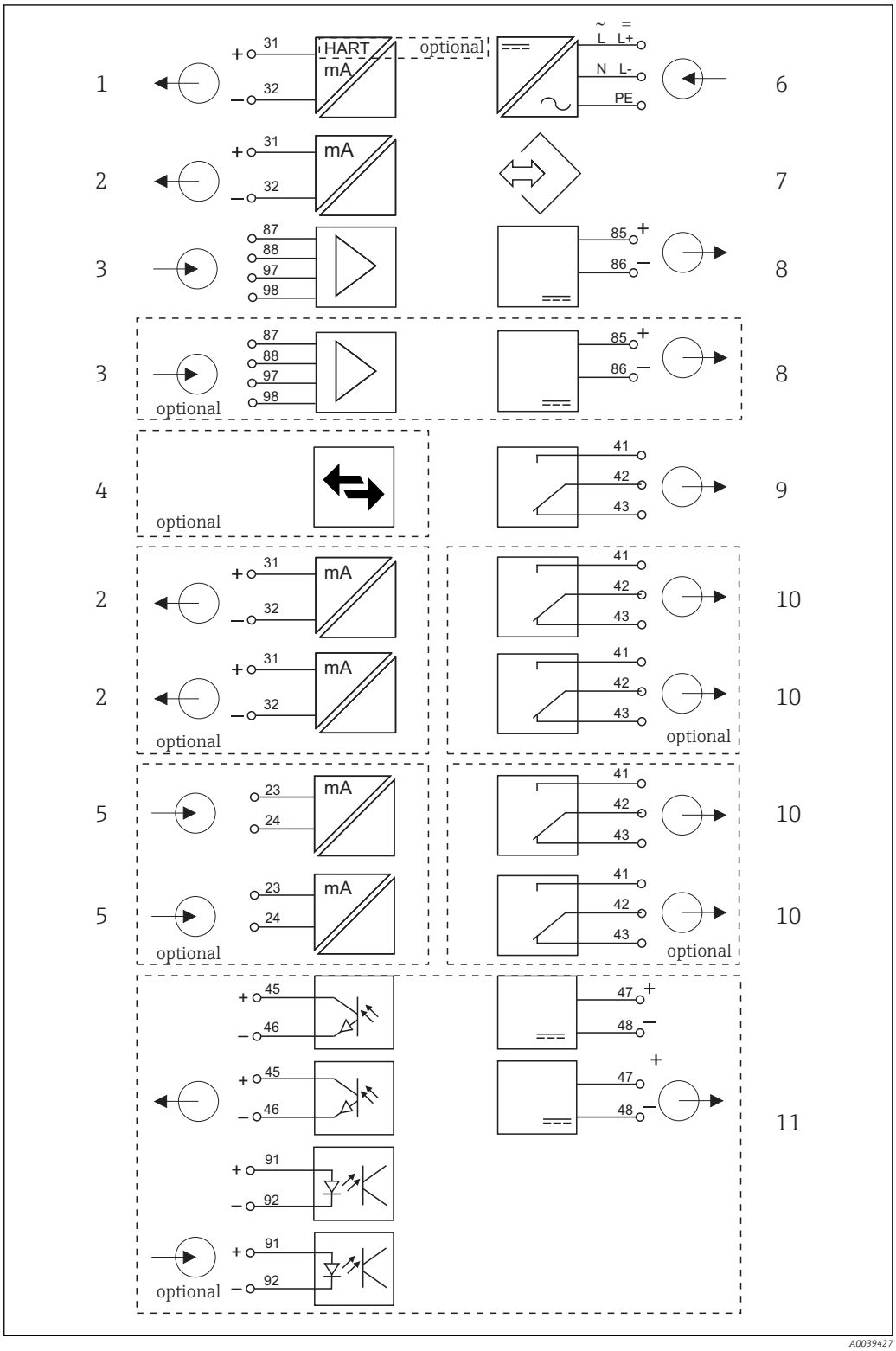
Ordered basic device (example)	▪ Order code CM442R-**M1A1F0* ▪ Functionality: 1 x Memosens, 2 current outputs without HART
Extension options without additional modules	Activation with activation code: ▪ Second Memosens input (71114663) ▪ HART (71128428) ▪ EtherNet/IP + web server (71449914) ▪ Modbus TCP + web server (71449915) ▪ PROFINET + web server (71449901) ▪ Web server (71449918)
Extension options by using an extension module in free slot 2	PROFIBUS DP or Modbus RS485 with module 485 incl. activation code: ▪ PROFIBUS DP (71140888) ▪ Modbus RS485 (71140889) If module 485 is retrofitted, any existing current outputs are disabled! Additional inputs or outputs, relays: ▪ Module 2AI (71135639): 2 current inputs ▪ Module 2AO (71135632): 2 current outputs ▪ Module AOR (71111053): 2 current outputs, 2 relays ▪ Module 2R (71125375) or 4R (71125376): 2 or 4 relays ▪ Module DIO (71135638): 2 digital inputs and 2 digital outputs
Basic rule for extensions	The sum of all current inputs and outputs may not exceed 8.
Restrictions if using CUS71D sensors for interface measurement	Only one CUS71D can be connected. The second Memosens input may not be used.
Product Configurator	www.endress.com/cm442r

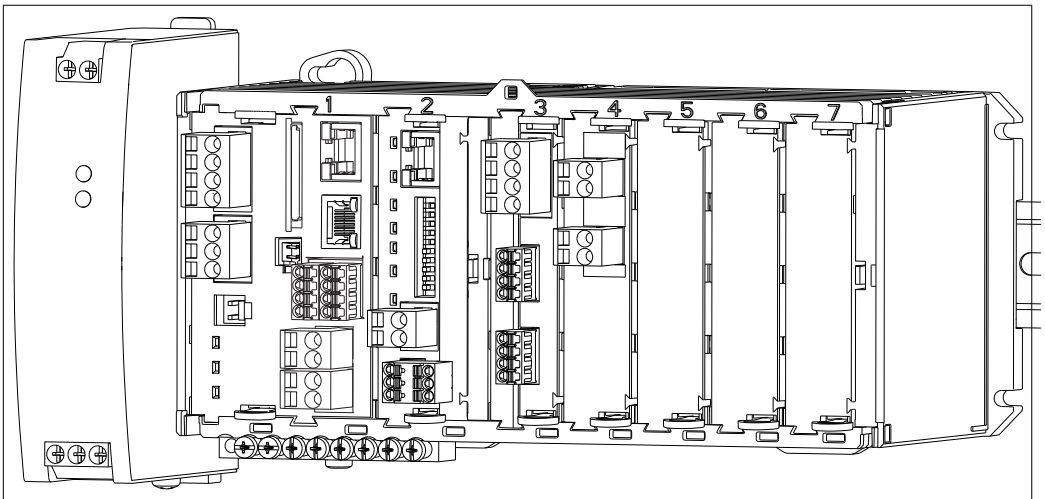
Function diagram CM442R



6 *Function diagram CM442R*

1 *Current output 1:1, + HART (optional)*
2 *Current outputs (2 x optional)*
3 *2 x Memosens input (1 x optional)*
4 *PROFIBUS DP/Modbus/Ethernet (optional)*
5 *2 x current input (optional)*
6 *Power supply*
7 *Service interface*
8 *Power supply, fixed cable sensors*
9 *Alarm relay*
10 *2 or 4 x relays (optional)*
11 *2 digital inputs and outputs (optional)*

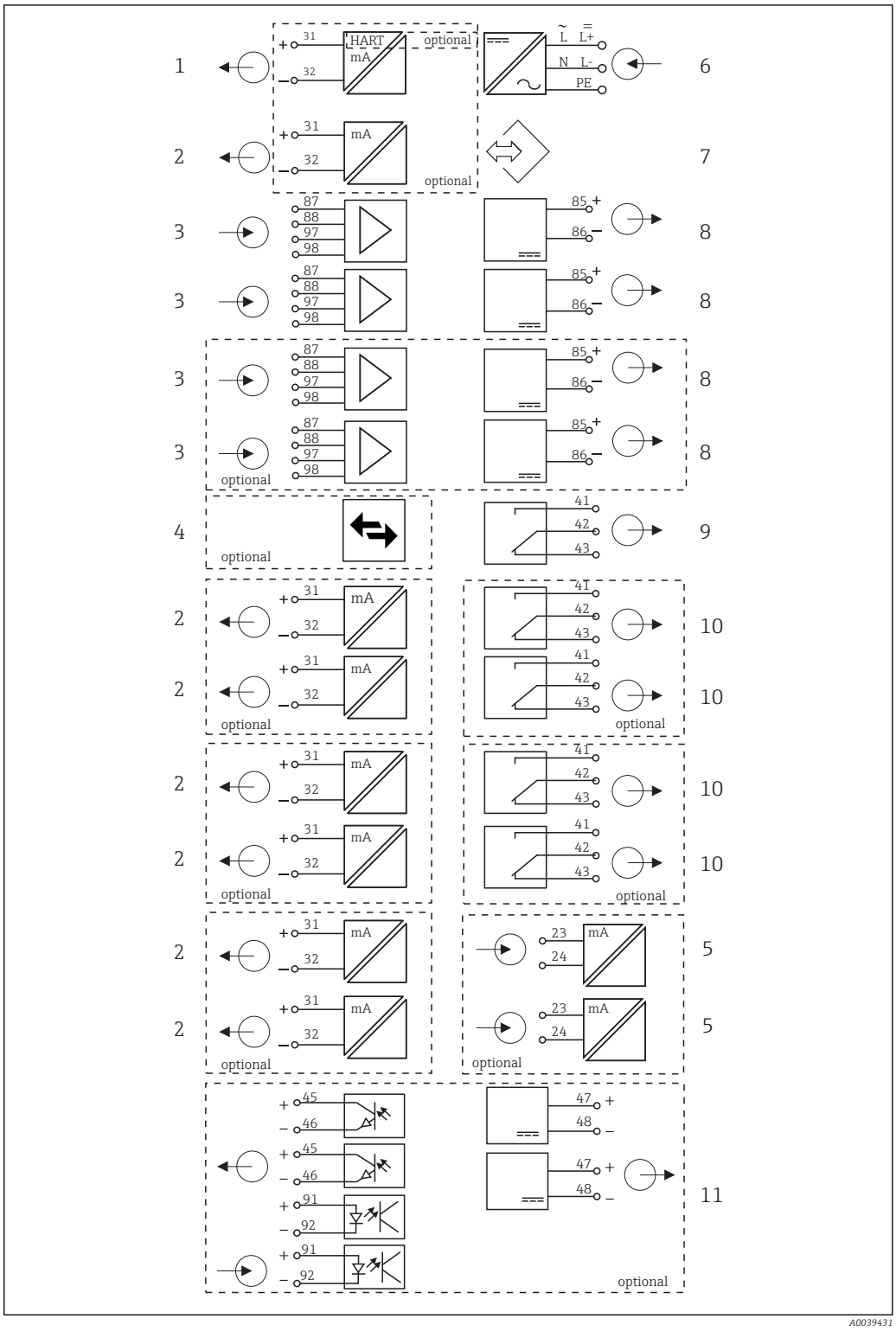
Device configuration using the example of a CM444R-M42A1FA***



Ordered basic device (example)	▪ Order code CM444R-**M42A1FA*
	▪ Functionality:
	  ▪ 4 x Memosens (2 on BASE2-E module + 2 on an extension module 2DS)
	  ▪ PROFIBUS communication (module 485)
	  ▪ Web server (BASE2-E module)
	  ▪ 2 current outputs without HART (on BASE2-E module)
	  ▪ 2 current inputs (module 2AI)
	3 slots are still free in this example. More or fewer slots can be free in other versions.

Extension options without additional modules	None
Modification options without additional modules	Communication type changed by entering activation code. This disables the communication type used previously! Modbus RS485 + web server (71135636) Retrofit by removing module 485 and entering the activation code for: ▪ Modbus TCP + web server (71449915) ▪ EtherNet/IP + web server (71449914) ▪ PROFINET + web server (71449901) ▪ HART (71128428) ▪ Web server (71449918)
Extension options by using extension modules in free slots 5-7	Only the following is possible for the example above: ▪ Module 2R (71125375) or 4R (71125376): 2 or 4 relays ▪ Module DIO (71135638): 2 digital inputs and 2 digital outputs If extending to 8 measuring channels: Module 2DS (71135631): 2 Memosens inputs Additional inputs or outputs and relays if fieldbus module 485 is removed: ▪ Module 2AO (71135632): 2 current outputs ▪ Module AOR (71111053): 2 current outputs, 2 relays ▪ Module 2R (71125375) or 4R (71125376): 2 or 4 relays ▪ Module DIO (71135638): 2 digital inputs and 2 digital outputs If module 485 is removed and an Ethernet-based fieldbus is used via BASE2-E module, a maximum of up to 6 current outputs can be operated in addition. Only two current outputs are possible with module 485.
Basic rule for extensions	The sum of all current inputs and outputs may not exceed 8.
Restrictions if using CUS71D sensors for interface measurement	▪ In the case of CM444R, every combination of Memosens sensors (max. 4) is possible. ▪ An extension to CM448R is not advisable as the maximum number of Memosens inputs when using CUS71D remains limited to 4.
Product Configurator	www.endress.com/cm444r

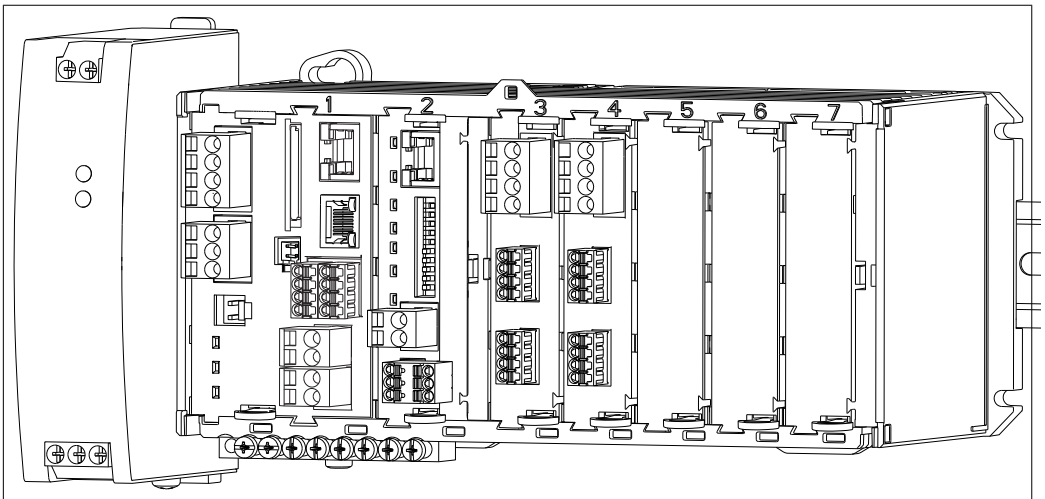
Function diagram CM444R



7 *Function diagram CM444R*

1 *Current output 1:1, + HART (both optional)*
2 *Max. 7 x current output (optional)*
3 *Memosens input (2 x standard + 2 x optional)*
4 *PROFIBUS DP/Modbus/Ethernet (optional)*
5 *2 x current input (optional)*
6 *Power supply*
7 *Service interface*
8 *Power supply, fixed cable sensors*
9 *Alarm relay*
10 *2 or 4 x relays (optional)*
11 *2 digital inputs and outputs (optional)*

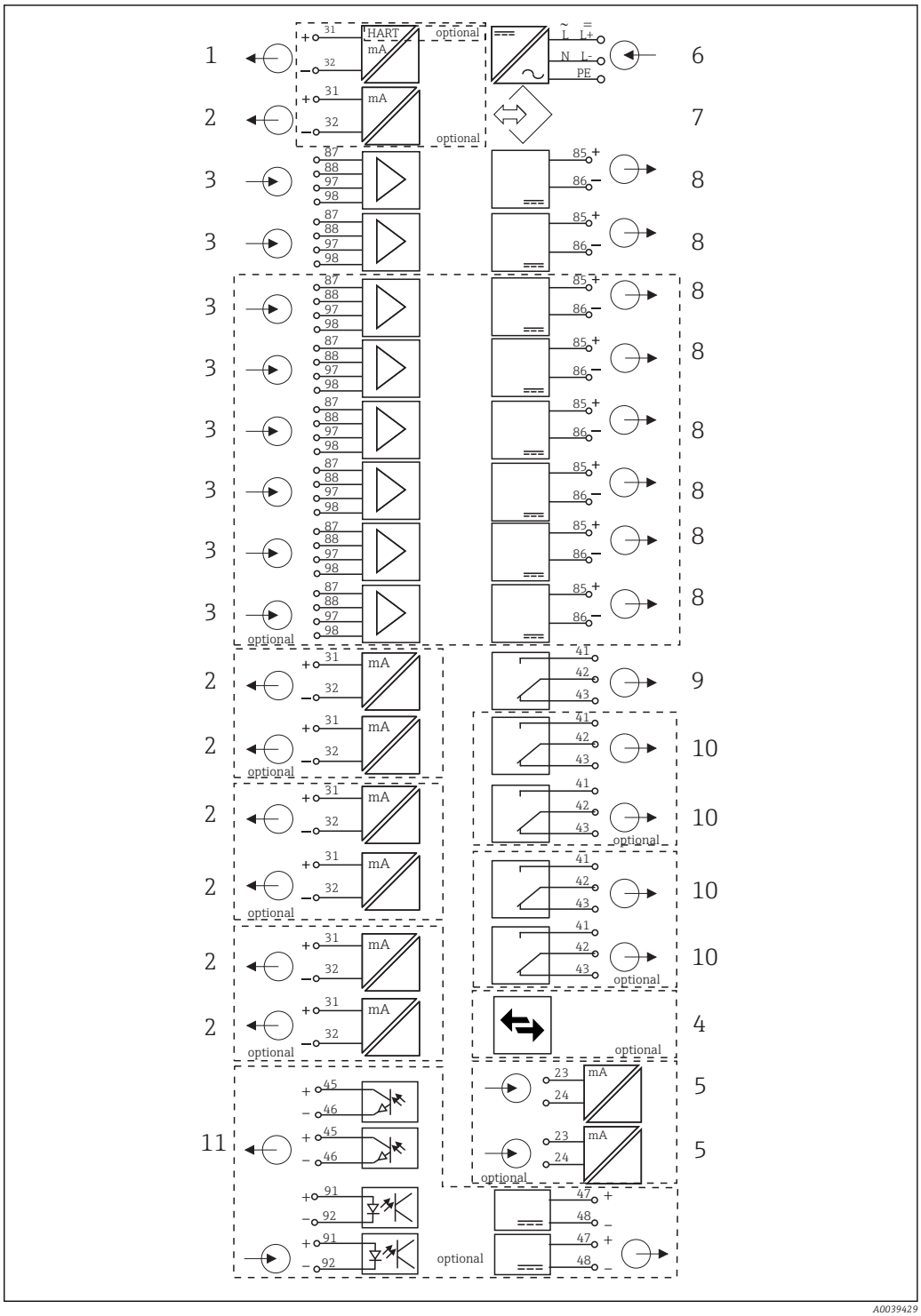
Device configuration using the example of a CM448R-26A1***



Ordered basic device (example)	▪ Order code CM448R-**26A1*
	▪ Functionality:
	  ▪ 6 x Memosens (2 on BASE2-E module + 2 on two 2DS extension modules)
	  ▪ PROFIBUS communication (module 485)
	  ▪ Web server (BASE2-E module)
	3 slots are still free in this example. More or fewer slots can be free in other versions.

Extension options without additional modules	Activation code for the use of current outputs of the basic module: 2 current outputs (71140891)
Modification options without additional modules	Communication type changed by entering activation code. This disables the communication type used previously! Modbus RS485 + web server (71135636) Retrofit by removing module 485 and entering the activation code for communication via the BASE2 module: ▪ Modbus TCP + web server (71449915) ▪ EtherNet/IP + web server (71449914) ▪ PROFINET + web server (71449901) ▪ HART (71128428) ▪ Web server (71449918)
Extension options by using extension modules in free slots 5-7	If extending to 8 measuring channels: Module 2DS (71135631): 2 Memosens inputs Additional inputs or outputs, relays: ▪ Module 2AO (71135632): 2 current outputs ▪ Module 2AI (71135639): 2 current inputs ▪ Module AOR (71111053): 2 current outputs, 2 relays ▪ Module 2R (71125375) or 4R (71125376): 2 or 4 relays ▪ Module DIO (71135638): 2 digital inputs and 2 digital outputs If module 485 is removed and an Ethernet-based fieldbus is used, a maximum of up to 6 current outputs can be operated in addition. Only two current outputs are possible with module 485.
Basic rule for extensions	The sum of all current inputs and outputs may not exceed 8.
Restrictions if using CUS71D sensors for interface measurement	The maximum number of Memosens inputs that can be used is limited to 4! Here, every combination of CUS71D and other Memosens sensors is then possible.
Product Configurator	www.endress.com/cm448r

Function diagram CM448R


HART
mA
optional
L+
N L-
PE
optional
optional
optional

Communication and data processing

Communication protocols:
Fieldbus systems
- HART
- PROFIBUS DP (Profile 3.02)
- Modbus TCP or RS485
- PROFINET
- Ethernet/IP

Only one type of Fieldbus communication can ever be active. The last activation code entered decides which bus is used.

The device drivers available make it possible to perform a basic setup and display measured values and diagnostics information via the fieldbus. A full device configuration via the fieldbus is not possible.

Extension module 485 and current outputs
For PROFIBUS DP, and Modbus RS485 communication protocols:
- CM442R
  Current outputs cannot be used in parallel. Any existing current outputs are deactivated with the installation of 485.
- CM444R/CM448R
  A maximum of 2 current outputs can be used in parallel.

Ethernet functionality via Base2 module and current outputs
- CM442R
  A maximum of 2 current outputs can be used in parallel.
- CM444R and CM448R
  A maximum of 6 current outputs can be used in parallel.

Bus termination on the device
- Via slide switch at bus module 485
- Displayed via LED "T" on bus module 485

Dependability

Reliability

Memosens MEMOSENS
Memosens makes your measuring point safer and more reliable:
- Non-contact, digital signal transmission enables optimum galvanic isolation
- No contact corrosion
- Completely watertight
- Sensor can be calibrated in a lab, thus increasing the availability of the measuring point in the process
- Intrinsically safe electronics mean operation in hazardous areas is not a problem.
- Predictive maintenance thanks to recording of sensor data, e.g.:
  - Total hours of operation
  - Hours of operation with very high or very low measured values
  - Hours of operation at high temperatures
  - Number of steam sterilizations
  - Sensor condition

Heartbeat diagnostics

- Heartbeat diagnostics screen with graphic indicators for the health of the device and sensor and with a maintenance or (sensor-dependent) calibration timer
- Heartbeat status information on the health of the device and the condition of the sensor
  - ☺: Sensor/device condition or maintenance timer > 20 %; no action is required
  - 😐: Sensor/device condition or maintenance timer > 5 ≤ 20 %, maintenance not yet urgent but should be scheduled
  - ☹: Sensor/device condition or maintenance timer < 5 %, maintenance is recommended
- The Heartbeat sensor condition is the assessment of the calibration results and the sensor diagnostic functions.

An unhappy smiley can be due to the calibration result, the measured value status or to the operating hours limit having been exceeded. These limits can be configured in the sensor setup in a way that adapts the Heartbeat diagnostics to the application.

Heartbeat and NAMUR category
The Heartbeat status indicates the sensor or device condition while the NAMUR categories (F, C, M, S) assess the reliability of the measured value. The two conditions can correlate but do not have to.
- **Example 1**
  - The number of remaining cleaning cycles for the sensor reaches 20% of the defined maximum number. The Heartbeat symbol changes from ☺ to 😐. The measured value is still reliable so the NAMUR status signal does not change.
  - If the maximum number of cleaning cycles is exceeded, the Heartbeat symbol changes from 😐 to ☹. While the measured value can still be reliable, the NAMUR status signal changes to M (maintenance required).
- **Example 2**
  The sensor breaks. The Heartbeat status changes immediately from ☺ to ☹ and the NAMUR status signal also changes immediately to F (failure).

Heartbeat Monitoring

Sensor data from Memosens sensors are transmitted via the EtherNet/IP, PROFINET, PROFIBUS DP, HART, Modbus RTU and Modbus TCP fieldbus protocols. These data can be used for predictive maintenance, for instance.

Examples include:
- Total hours of operation
- Hours of operation with very high or very low measured values
- Hours of operation at high temperatures
- Number of steam sterilizations
- Sensor identification
- Calibration information

For detailed information on "Ethernet/IP communication", see the product pages on the Internet (→ SD01293C).

For detailed information on "Modbus communication", see the product pages on the Internet (→ SD01189C).

For detailed information on "PROFINET communication", see the product pages on the internet (→ SD02490C).

For detailed information on "PROFIBUS communication", see the product pages on the Internet (→ SD01188C).

More detailed information on HART communication is provided on the product pages on the Internet (→ SD01187C).

Heartbeat Verification

Heartbeat Verification makes it possible to verify the correct operation of the measuring device without interrupting the process. This verification can be documented anytime.

Sensor Check System (SCS)

The Sensor Check System (SCS) monitors the high impedance of the pH glass. An alarm is issued if a minimum impedance value is undershot or a maximum impedance is exceeded.
- Glass breakage is the main reason for a drop in high impedance values
- The reasons for increasing impedance values include:
  - Dry sensor
  - Worn pH glass membrane

For the SCS, upper and lower limit values can be enabled or disabled independently of one another.

Process Check System (PCS)

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

The main causes of stagnating measured values are:
- Contaminated sensor, or sensor outside of medium
- Sensor defective
- Process error (e.g. through control system)

Self-monitoring functions

Current inputs are deactivated in the event of overcurrent and reactivated once the overcurrent stops. Board voltages are monitored and the board temperature is also measured.

USP and EP

The limit functions for pharmaceutical water in accordance with USP and EP specifications are implemented in the software for conductivity measurements:
- "Water for Injection" (WFI) as per USP <645> and EP
- "Highly Purified Water" (HPW) as per EP
- "Purified Water" (PW) as per EP

The uncompensated conductivity value and the temperature are measured for the USP/EP 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, it is also possible to configure an early warning alarm that signals undesired operating states before they occur.

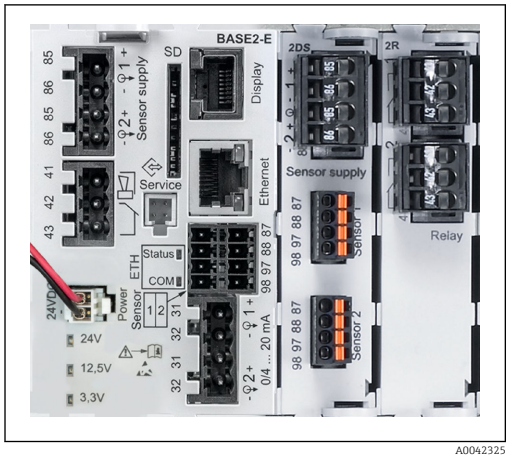
ChemocleanPlus

Freely programmable sequence control
- e.g. for automatic sensor cleaning in retractable assemblies for reliable measurement results in processes with a high risk of contamination
- Individual, time-based activation of 4 outputs e.g. relays
- Starting, stopping or pausing of activities via digital input or fieldbus signals e.g. from limit position switches

Maintainability

Modular design

The modular transmitter design means it can be easily adapted to suit your needs:
- Retrofit extension modules for new or extended range of functions, e.g. current outputs, relays and digital communication
- Upgrade to maximum eight-channel measurement
- Optional: M12 sensor connector for connecting any kind of Memosens sensor
- Optional: CDI connector for external access to the service interface (avoids having to unscrew the housing cover)



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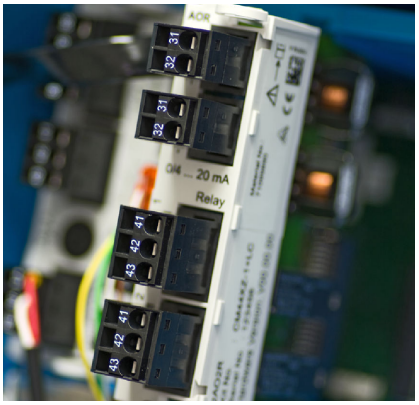
9 CM444R: example



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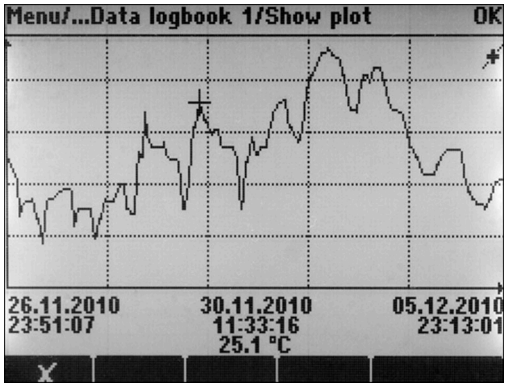
10 Extension module

Data logger function

- Adjustable scan time: 1 to 3600 s (1 h)
- Data logbooks:
  - Max. 8 data logbooks
  - 150,000 entries per logbook
  - Graphic display (load curves) or numerical list
- Calibration logbook: max. 75 entries
- Hardware version logbook:
  - Hardware configuration and modifications
  - Max. 125 entries
- Version logbook:
  - E.g. software updates
  - Max. 50 entries
- Operation logbook: max. 250 entries
- Diagnostics logbook: max. 250 entries



11 Data logbook: Graphic display

Logbooks remain unchanged even after a software update.

SD card

The exchangeable storage medium enables:
- Quick and easy software updates and upgrades
- Data storage of internal device memory (e.g. logbooks)
- Transfer of complete configurations to a device with an identical setup (backup function)
- Transfer of configurations without the TAG and bus address to devices with an identical setup (copy function)
- Saving of screenshots for documentation purposes

Endress+Hauser offers industry-approved SD cards as accessories. These memory cards provide maximum data security and integrity.

Other SD cards up to a maximum weight of 5 g can also be used. However, Endress+Hauser does not accept any responsibility for the data security of such cards.

External signals for device control and for activating external devices

Hardware options, e.g. module "DIO" with 2 digital inputs and 2 digital outputs or fieldbus module "485" enable the following:
- via a digital input signal
  - measuring range switching for conductivity (upgrade code required, see accessories)
  - switching between different calibration datasets in the case of optical sensors
  - an external hold
  - a cleaning interval to be triggered
  - switching on and off a PID controller, e.g. via the proximity switch of the CCA250
  - the use of the input as an "analog input" for pulse-frequency modulation (PFM)
- via a digital output signal
  - the static transmission (similar to a relay) of diagnostic states, point level switch states etc.
  - the dynamic transmission (comparable to a non-wearing "analog output") of PFM signals, e.g. to control dosing pumps.

FieldCare and Field Data Manager

FieldCare

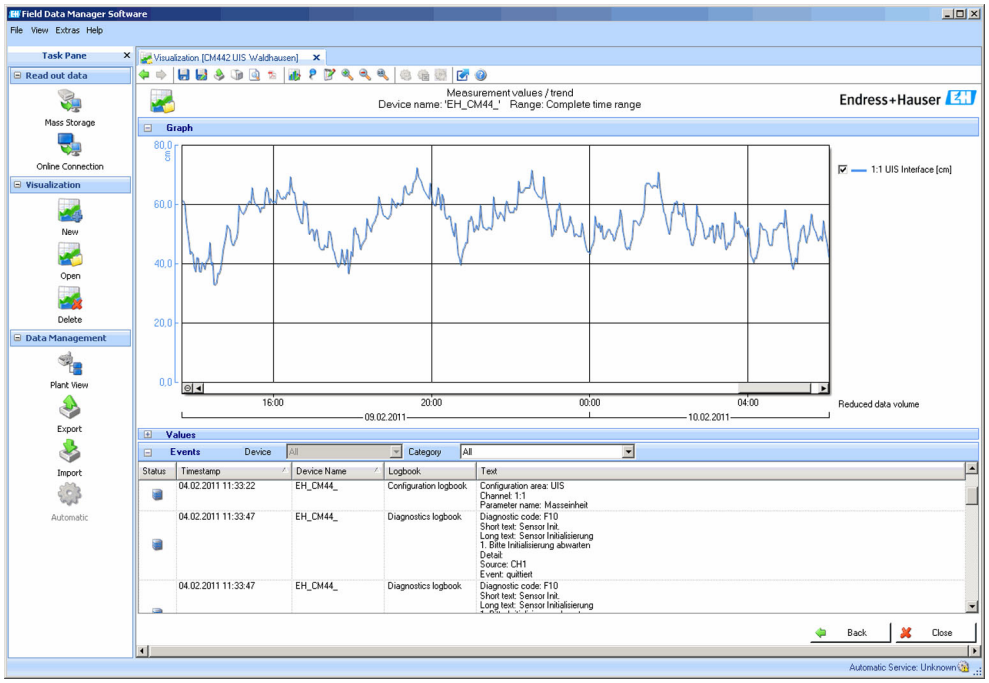
Configuration and asset management software based on FDT/DTM technology

- Complete device configuration when connected via FXA291 and service interface
- Access to a number of configuration parameters and identification, measuring and diagnostic data when connected via HART modem
- Logbooks can be downloaded in CSV format or binary format for "Field Data Manager" software

Field Data Manager

Visualization software and database for measuring, calibration and configuration data

- SQL database which is protected against manipulation
- Functions to import, save and print out logbooks
- Load curves to display measured values



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12 *Field Data Manager: Load curves*

Virtual process values (mathematical functions)

In addition to "real" process values, which are provided by connected physical sensors or analog inputs, mathematical functions can be used to calculate a maximum of 8 "virtual" process values.

The "virtual" process values can be:

- Output via a current output or a fieldbus
- Used as a controlled variable
- Assigned as a measured variable to a limit switch
- Used as a measured variable to trigger cleaning
- Displayed in user-defined measuring menus

The following mathematical functions are possible:

- Calculation of pH from two conductivity values according to VGB 405 RL, e. g. in boiler feedwater
- Difference between two measured values from different sources, e. g. for membrane monitoring
- Differential conductivity, e. g. for monitoring the efficiency of ion exchangers
- Degassed conductivity, e. g. for process controls in power plants
- Redundancy for monitoring two or three redundant sensors
- rH calculation based on the measured values of a pH and an ORP sensor
- Calculation of the remaining capacity of a cation exchanger
- Formula editor

Concentration tables

When the device is delivered from the factory, tables are saved in the device that allow inductive conductivity measurements to be converted to concentrations of certain substances. 4 user-defined tables are also possible.

The following factory concentration tables are available:

NaOH	0 to 15 %	0 to 100 °C (32 to 212 °F)
NaOH	25 to 50%	2 to 80 °C (36 to 176 °F)
HCl	0 to 20 %	0 to 65 °C (32 to 149 °F)
HNO_3	0 to 30 %	2 to 80 °C (36 to 176 °F)
H_2SO_4	0.5 to 27 % and 35 to 85 %	0 to 100 °C (32 to 212 °F)
H_2SO_4	93 to 100 %	10 to 115 °C (50 to 239 °F)
H_3PO_4	0 to 40 %	2 to 80 °C (36 to 176 °F)
NaCl	0 to 26 %	2 to 80 °C (36 to 176 °F)

Safety

Real-time clock

The device has a real-time clock, which is buffered by a button cell battery if the power supply fails.

This ensures that the device continues to keep the correct date and time when it is restarted and that the time stamp for the logbooks is correct.

Data security

All settings, logbooks etc. are stored in a non-volatile memory to ensure that the data are retained even in the event of a disruption to the power supply.

Measuring range switching for conductivity

- Can be used in CIP processes e.g. for safe monitoring of phase separations
- Switching between 4 complete parameter sets:
  - Conductivity operating mode
  - Concentration tables
  - Temperature compensation
  - Output signal range
  - Limit value switch
- Via digital inputs or fieldbus

Measured value compensation for oxygen and conductivity

- Pressure or temperature compensation
- Input signals from external sensors via current input or fieldbus
- Signals from connected temperature sensors

Password protection

Password-protected login
- For remote operation via web server
- For local operation

Process safety

Two independent PID controllers
- One- or two-sided control
- Limit switches
- 4 cleaning programs which can be programmed independently of each other

IT security

Our warranty is valid only 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 settings.

IT security measures, which provide additional protection for the device and associated data transfer, must be implemented by the operators themselves in line with their security standards.

Input

Measured variables	→ Documentation of the connected sensor
Measuring ranges	→ Documentation of the connected sensor
Types of input	▪ Digital sensor inputs for sensors with Memosens protocol ▪ Analog current inputs (optional) ▪ Digital inputs (optional)
Input signal	Depending on version: ▪ Max. 8 x binary sensor signal ▪ 2 x 0/4 to 20 mA (optional), passive, potentially isolated from one another and from the sensor inputs ▪ 0 to 30 V
Cable specification	**Cable type** Memosens data cable CYK10 or sensor fixed cable, each with cable end sleeves or M12 round-pin connector (optional) **Cable length** Max. 100 m (330 ft)

Digital inputs, passive

Electrical specification	▪ drawing power (passive) ▪ Galvanically isolated
Span	▪ High: 11 to 30 V DC ▪ Low: 0 to 5 V DC
Nominal input current	max. 8 mA
PFM function	Minimum pulse width: 500 µs (1 kHz)
Test voltage	500 V
Cable specification	Max. 2.5 mm^2 (14 AWG)

Current input, passive

Span	> 0 to 20 mA
Signal characteristic	Linear
Internal resistance	Non-linear
Test voltage	500 V

Output

Output signal

Depending on version:
- 2 x 0/4 to 20 mA, active, galvanically isolated from one another and from the sensor circuits
- 4 x 0/4 to 20 mA, active, galvanically isolated from one another and from the sensor circuits
- 6 x 0/4 to 20 mA, active, galvanically isolated from one another and from the sensor circuits
- 8 x 0/4 to 20 mA, active, galvanically isolated from one another and from the sensor circuits
- Optional HART communication (only via current output 1:1)

HART	
Signal encoding	FSK ± 0.5 mA via current signal
Data transmission rate	1200 baud
Galvanic isolation	Yes
Load (communication resistor)	250 Ω

PROFIBUS DP/RS485	
Signal encoding	EIA/TIA-485, PROFIBUS DP-compliant acc. to IEC 61158
Data transmission rate	9.6 kBd, 19.2 kBd, 45.45kBd, 93.75 kBd, 187.5 kBd, 500 kBd, 1.5 MBd, 6 MBd, 12 MBd
Galvanic isolation	Yes
Connectors	Spring terminal (max. 1.5 mm), bridged internally (T-function), optional M12
Bus termination	Internal slide switch with LED display

Modbus RS485	
Signal encoding	EIA/TIA-485
Data transmission rate	2,400, 4,800, 9,600, 19,200, 38,400, 57,600 and 115,200 baud
Galvanic isolation	Yes
Connectors	Spring terminal (max. 1.5 mm), bridged internally (T-function), optional M12
Bus termination	Internal slide switch with LED display

Ethernet and Modbus TCP	
Signal encoding	IEEE 802.3 (Ethernet)
Data transmission rate	10/100 MBd
Galvanic isolation	Yes
Connection	RJ45
IP address	DHCP (default) or configuration via menu

EtherNet/IP	
Signal encoding	IEEE 802.3 (Ethernet)
Data transmission rate	10/100 MBd
Galvanic isolation	Yes
Connection	RJ45
IP address	DHCP (default) or configuration via menu

PROFINET	
Signal encoding	IEEE 802.3 (Ethernet)
Data transmission rate	100 MBd
Galvanic isolation	Yes
Connection	RJ45
Name of station	Via DCP protocol using the configuration tool (e.g. Siemens PRONETA)
IP address	Via DCP protocol using the configuration tool (e.g. Siemens PRONETA)

Signal on alarm

Adjustable, as per NAMUR Recommendation NE 43
- In measuring range 0 to 20 mA (HART is not available with this measuring range):
  Failure current from 0 to 23 mA
- In measuring range 4 to 20 mA:
  Failure current from 2.4 to 23 mA
- Factory setting for failure current for both measuring ranges:
  21.5 mA

Load

Max. 500 Ω

Linearization/transmission behavior

Linear

Digital outputs, passive

Electrical specification

- Passive
- Open collector, max. 30 V, 15 mA
- Maximum voltage drop 3 V

External power supply

When using an onsite auxiliary voltage supply and an onsite digital input:
Recommended minimum auxiliary voltage = 3 V + V_{IHmin}
(V_{IHmin} = minimum input voltage required (high-level input voltage)

PFM function

Minimum pulse width: 500 µs (1 kHz)

Auxiliary voltage

Electrical specification
- Galvanically isolated
- Unregulated, 24 V DC
- Max. 50 mA (per DIO module)

Test voltage

500 V

Cable specification

Max. 2.5 mm^2 (14 AWG)

Current outputs, active

Span

0 to 23 mA

2.4 to 23 mA for HART communication

Signal characteristic

Linear

Electrical specification	**Output voltage** Max. 24 V **Test voltage** 500 V
Cable specification	**Cable type** Recommended: shielded cable **Cable specification** Max. 2.5 mm^2 (14 AWG)

Relay outputs

Electrical specification

Relay types
- 1 single-pin changeover contact (alarm relay)
- 2 or 4 single-pin changeover contacts (optional with extension modules)

Maximum load
- Alarm relay: 0.5 A
- All other relays: 2.0 A

Relay switching capacity

Base module (Alarm relay)

Switching voltage	Load (max.)	Switching cycles (min.)
230 V AC, cosΦ = 0.8 to 1	0.1 A	700,000
	0.5 A	450,000
115 V AC, cosΦ = 0.8 to 1	0.1 A	1,000,000
	0.5 A	650,000
24 V DC, L/R = 0 to 1 ms	0.1 A	500,000
	0.5 A	350,000

Extension modules

Switching voltage	Load (max.)	Switching cycles (min.)
230 V AC, cosΦ = 0.8 to 1	0.1 A	700,000
	0.5 A	450,000
	2 A	120,000
115 V AC, cosΦ = 0.8 to 1	0.1 A	1,000,000
	0.5 A	650,000
	2 A	170,000
24 V DC, L/R = 0 to 1 ms	0.1 A	500,000
	0.5 A	350,000
	2 A	150,000

Cable specification

Max. 2.5 mm^2 (14 AWG)

Protocol-specific data

HART

Manufacturer ID	11_h
Device type	$155D_h$
Device revision	001_h
HART version	7.2
Device description files (DD/DTM)	www.endress.com/hart Device Integration Manager DIM
Device variables	16 user-definable and 16 predefined device variables, dynamic variables PV, SV, TV, QV
Supported features	PDM DD, AMS DD, DTM, Field Xpert DD

PROFIBUS DP

Manufacturer ID	11_h
Device type	$155D_h$
Profile version	3.02
GSD files	www.endress.com/profibus Device Integration Manager DIM
Output values	16 AI blocks, 8 DI blocks
Input variables	4 AO blocks, 8 DO blocks
Supported features	▪ 1 MSCY0 connection (cyclical communication, master class 1 to slave) ▪ 1 MSAC1 connection (acyclical communication, master class 1 to slave) ▪ 2 MSAC2 connections (acyclical communication, master class 2 to slave) ▪ Device lock: The device can be locked using the hardware or software. ▪ Addressing using DIL switches or software ▪ GSD, PDM DD, DTM

Modbus RS485

Protocol	RTU/ASCII
Function codes	03, 04, 06, 08, 16, 23
Broadcast support for function codes	06, 16, 23
Output data	16 measured values (value, unit, status), 8 digital values (value, status)
Input data	4 setpoints (value, unit, status), 8 digital values (value, status), diagnostic information
Supported features	Address can be configured using switch or software

Modbus TCP

TCP port	502
TCP connections	3
Protocol	TCP
Function codes	03, 04, 06, 08, 16, 23
Broadcast support for function codes	06, 16, 23
Output data	16 measured values (value, unit, status), 8 digital values (value, status)
Input data	4 setpoints (value, unit, status), 8 digital values (value, status), diagnostic information
Supported features	Address can be configured using DHCP or software

Ethernet/IP

Log	EtherNet/IP	
ODVA certification	Yes	
Device profile	Generic device (product type: 0x2B)	
Manufacturer ID	$0x049E_h$	
Device type ID	$0x109C_h$	
Polarity	Auto-MIDI-X	
Connections	CIP	12
	I/O	6
	Explicit message	6
	Multicast	3 consumers
Minimum RPI	100 ms (default)	

Maximum RPI	10000 ms	
System integration	EtherNet/IP	EDS
	Rockwell	Add-on-Profile Level 3, Faceplate for Factory Talk SE
IO data	Input (T → O)	Device status and diagnostic message with highest priority Measured values: ▪ 16 AI (analog input) + Status + Unit ▪ 8 DI (discrete input) + Status
	Output (O → T)	Actuating values: ▪ 4 AO (analog output) + status + unit ▪ 8 DO (discrete output) + Status

PROFINET

Protocol	"Application layer protocol for decentral device periphery and distributed automation", PNIO Version 2.34
Communication type	100 MBit/s
Conformance Class	Conformance Class B
Netload Class	Netload Class II
Baud rate	Automatic 100 Mbps with full-duplex detection
Cycle times	From 32 ms
Device profile	Application interface identifier 0xF600 Generic device
PROFINET interface	1 port, Realtime Class 1 (RT_CLASS_1)
Manufacturer ID	$0x11_h$
Device type ID	$0x859C\ D_h$
Device description files (GSD)	Information and files under: ▪ www.endress.com On the product page for the device: Documents/Software → Device drivers ▪ www.profibus.com On the website under Products/Product Finder
Polarity	Auto-polarity for automatic correction of crossed TxD and RxD pairs
Supported connections	▪ 1 x AR (IO Controller AR) ▪ 1 x AR (IO-Supervisor Device AR connection allowed) ▪ 1 x Input CR (Communication Relation) ▪ 1 x Output CR (Communication Relation) ▪ 1 x Alarm CR (Communication Relation)
Configuration options for measuring device	▪ Web browser ▪ Manufacturer-specific software (FieldCare, DeviceCare) ▪ Device master file (GSD), can be read out via the integrated web server of the measuring device
Configuration of the device name	DCP protocol

Supported functions	▪ Identification & Maintenance Simple device identification via: ▪ Process control system ▪ Nameplate ▪ Measured value status The process variables are communicated with a measured value status ▪ Blinking feature (FLASH_ONCE) via the local display for simple device identification and assignment ▪ Device operation via operating tools (e.g. FieldCare, DeviceCare)
System integration	For information on system integration, see the Operating Instructions ▪ Cyclic data transmission ▪ Overview and description of the modules ▪ Status coding ▪ Startup configuration ▪ Factory setting

Web server

The Web server enables full access to the device configuration, measured values, diagnostic messages, logbooks and service data via standard WiFi/WLAN/LAN/GSM or 3G routers with a user-defined IP address.

TCP port	80
Supported features	▪ Remote-controlled device configuration(1 session) ▪ Save/restore device configuration (via SD card) ▪ Logbook export (file formats: CSV, FDM) ▪ Access to Web server via DTM or Internet Explorer ▪ Login ▪ Web server can be switched off

Power supply

Supply voltage

CM442 R

Depending on version:

- 100 to 230 V AC, 50/60 Hz
  Maximum permitted fluctuation of mains supply voltage: ± 15 % of nominal voltage
- 24 V AC/DC, 50/60 Hz
  Maximum permitted fluctuation of mains supply voltage: + 20/- 15 % of nominal voltage

CM444 R and CM448 R

Depending on the version, via external DIN rail power unit:

- 100 to 230 V AC, 50/60 Hz
  Maximum permitted fluctuation of mains supply voltage: ± 15 % of nominal voltage [1)]
- 24 V DC
  Maximum permitted fluctuation of mains supply voltage: + 20/- 15 % of nominal voltage [1)]

NOTICE

The device does not have a power switch!

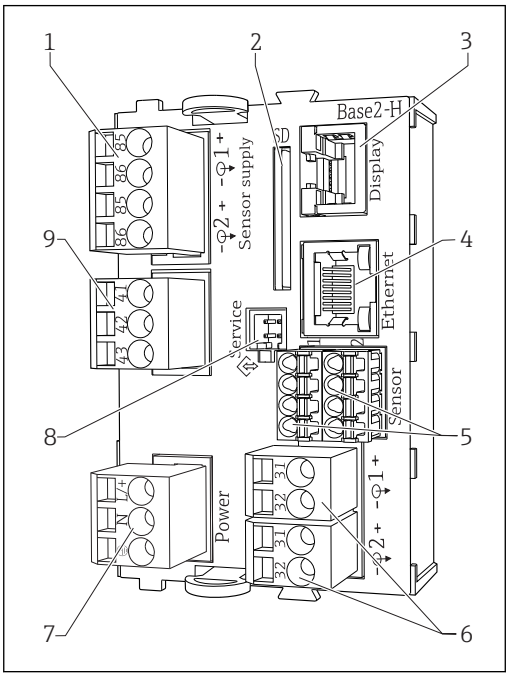
- ▶ Provide a protected circuit breaker in the vicinity of the device at the place of installation.
- ▶ The circuit breaker must be a switch or power switch, and must be labeled as the circuit breaker for the device.
- ▶ At the supply point, the power supply must be isolated from dangerous live cables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

1) *Specifications only apply if used with power unit supplied by manufacturer.

Power consumption	**CM442 R** Depending on supply voltage ▪ 100 to 230 V AC and 24 V AC: Max. 55 VA ▪ 24 V DC: Max. 22 W **CM444 R and CM448 R** Depending on supply voltage ▪ 100 to 230 V AC: Max. 150 VA [1)] ▪ 24 V DC: Max. 59 W [1)]
Fuse	Fuse not exchangeable
Overvoltage protection	Integrated overvoltage/lightning protection as per EN 61326 Protection category 1 and 3
Cable specification for optional display cable	**Length of display cable provided:** 3 m (10 ft) **Maximum permitted length of a display cable:** 5 m (16.5 ft)

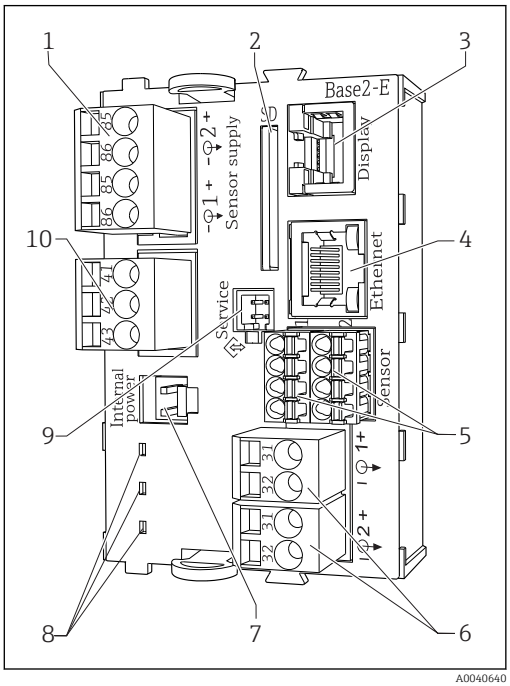
Electrical connection

Basic module



13 *Basic module BASE2-H or -L (two-channel device)*

1 *Power supply for digital fixed cable sensors with Memosens protocol*
2 *SD card slot*
3 *Slot for display cable* [1)]
4 *Ethernet interface*
5 *Connections for 2 Memosens sensors*
6 *Current outputs*
7 *Power connection*
8 *Service interface*
9 *Alarm relay connection*

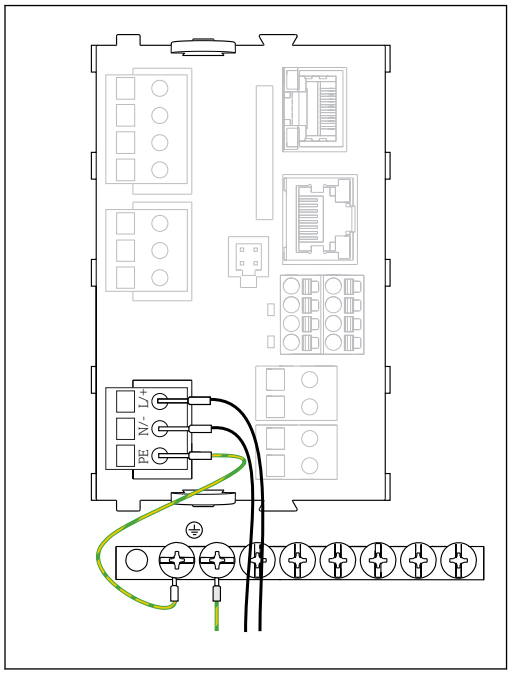


14 *Basic module BASE2-E (four- and eight-channel device)*

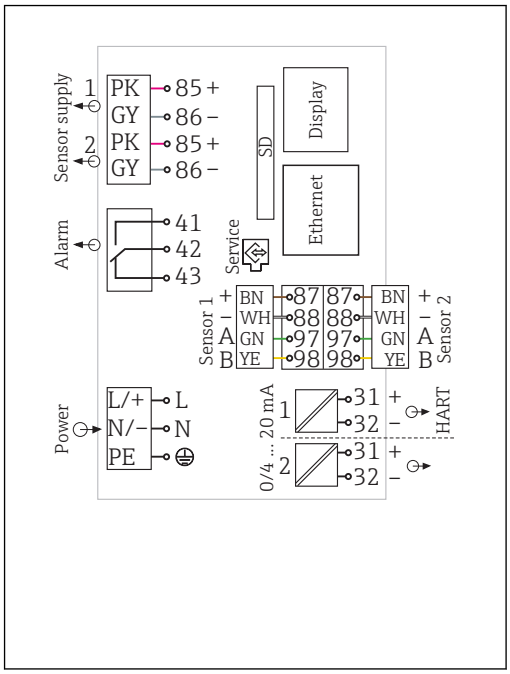
1 *Power supply for digital fixed cable sensors with Memosens protocol*
2 *SD card slot*
3 *Slot for display cable* [1)]
4 *Ethernet interface*
5 *Connections for 2 Memosens sensors*
6 *Current outputs*
7 *Socket for internal supply cable* [2)]
8 *LEDs*
9 *Service interface*
10 *Alarm relay connection*

[1)] For optional external display.
[2)] Power supply to DIN rail power unit.

Connecting supply voltage for CM442R



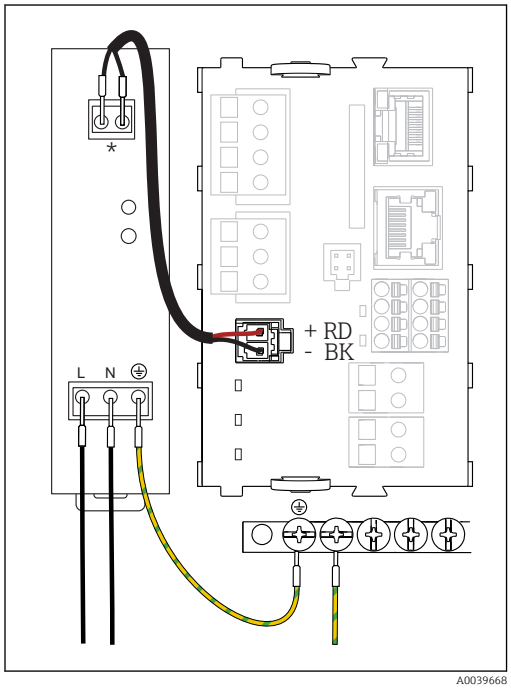
15 *Connecting power supply on the BASE2-H or -L*



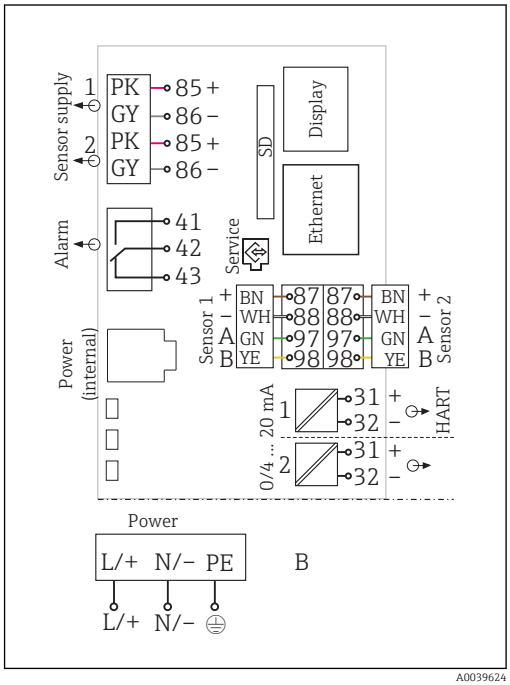
16 *Overall wiring diagram for BASE2-H or -L*

H *Power unit 100 to 230 VAC*
L *Power unit 24 VAC or 24 VDC*

Connecting supply voltage for CM444R and CM448R



17 *Connecting power supply with BASE2-E*



18 *Overall wiring diagram for BASE2-E and external power unit (B)*

* *Assignment depending on power unit, make sure to connect correctly*

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

Connecting optional modules

With extension modules you can purchase additional functions for your device.

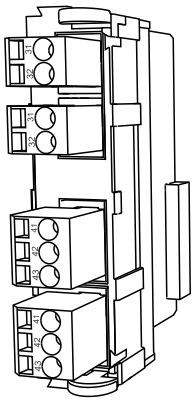
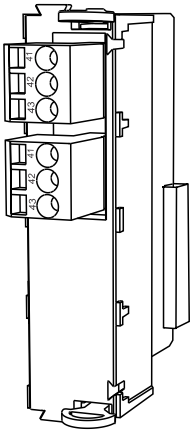
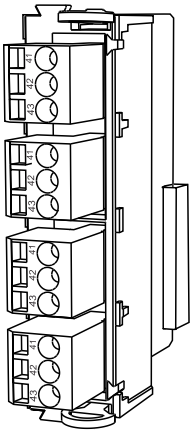
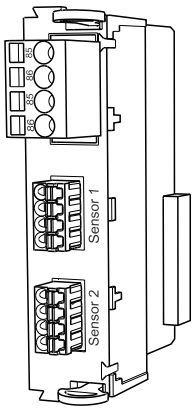
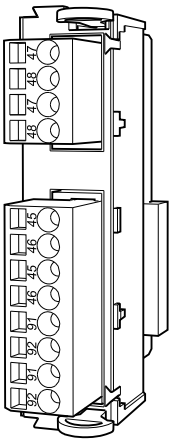
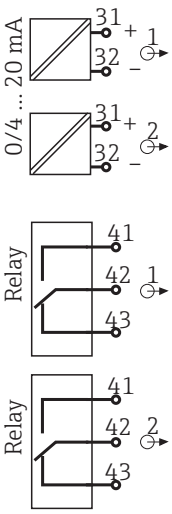
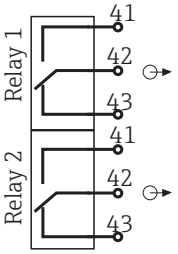
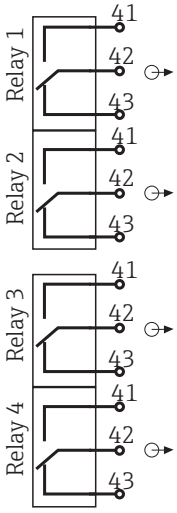
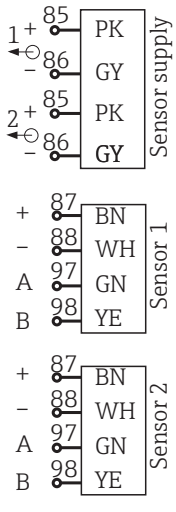
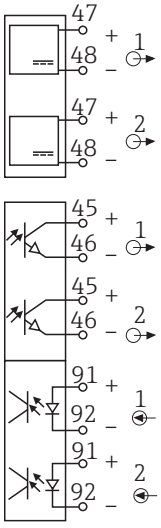
NOTICE

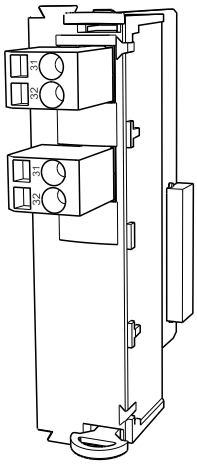
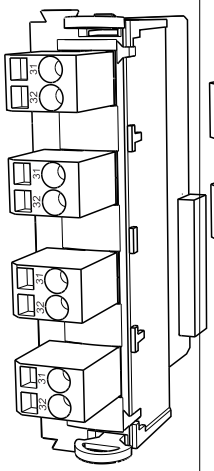
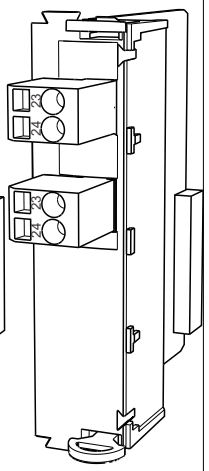
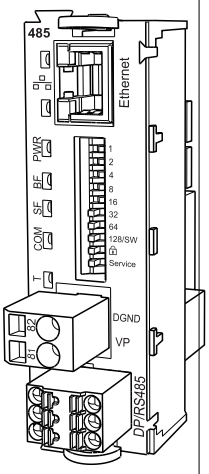
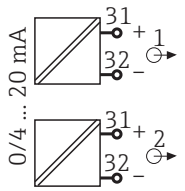
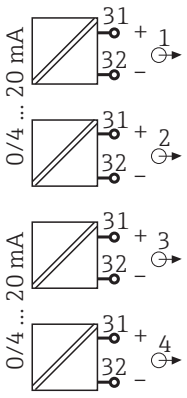
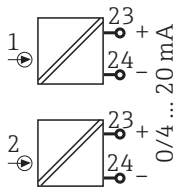
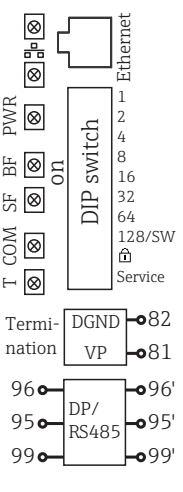
Unacceptable hardware combinations (due to conflicts in power supply)

Incorrect measurements or total failure of the measuring point as a result of heat build-up or overloading

- If you are planning to extend your controller, make sure the resulting hardware combination is permitted (Configurator at www.endress.com/CM442R or .../CM444R or .../CM448R).
- Remember that the sum of all current inputs and outputs may not exceed 8.
- Make sure not to use more than 2 "DIO" modules. More "DIO" modules are not permitted.
- Please contact your Endress+Hauser sales center should you have any questions.

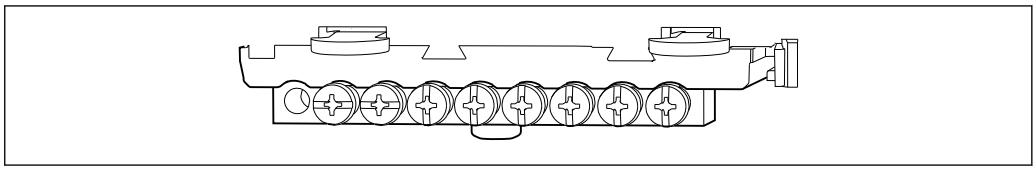
Overview of all the modules available

Module name				
AOR	**2R**	**4R**	**2DS**	**DIO**
				
▪ 2 x 0/4 to 20 mA analog outputs ▪ 2 relays ▪ Order No. 71111053	▪ 2 relays ▪ Order No. 71125375	▪ 4 relays ▪ Order No. 71125376	▪ 2 digital sensor inputs ▪ 2 power supply systems for digital sensors ▪ Order No. 71135631	▪ 2 digital inputs ▪ 2 digital outputs with auxiliary voltage ▪ Order No. 71135638
				

Module name				
2AO	**4AO**	**2AI**	**485**	
				
▪ 2 x 0/4 to 20 mA analog outputs ▪ Order No. 71135632	▪ 4 x 0/4 to 20 mA analog outputs ▪ Order No. 71135633	▪ 2 x 0/4 to 20mA analog inputs ▪ Order No. 71135639	▪ Ethernet (web server or Modbus TCP) ▪ 5V power supply for PROFIBUS DP termination ▪ RS485 (PROFIBUS DP or Modbus RS485) ▪ Use of BASE2 module disables Ethernet port of module 485 ▪ Order No. 71135634	
				

PROFIBUS DP (module 485)
Contacts 95, 96 and 99 are bridged in the connector. This ensures that PROFIBUS communication is not interrupted if the connector is disconnected.

Protective ground connection



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19 Mounting rail for functional ground connections

Sensor connection

Sensors with Memosens protocol

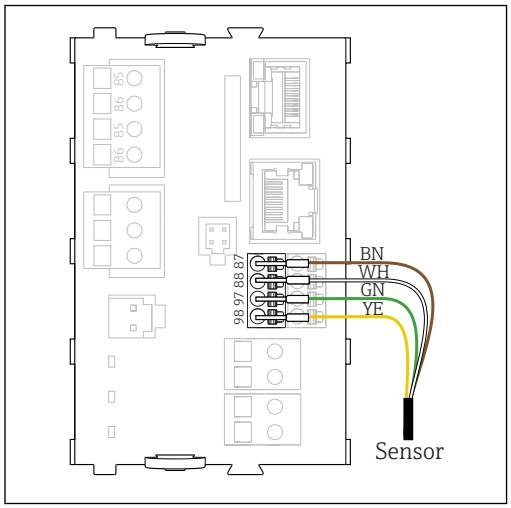
Sensor types	Sensor cable	Sensors
Digital sensors **without** additional internal power supply	With plug-in connection and inductive signal transmission	▪ pH sensors ▪ ORP sensors ▪ Combined sensors ▪ Oxygen sensors (amperometric and optical) ▪ Conductivity sensors with conductive measurement of conductivity ▪ Chlorine sensors (disinfection)
	Fixed cable	Conductivity sensors with inductive measurement of conductivity
Digital sensors with additional internal power supply	Fixed cable	▪ Turbidity sensors ▪ Sensors for interface measurement ▪ Sensors for measuring the spectral absorption coefficient (SAC) ▪ Nitrate sensors ▪ Optical oxygen sensors ▪ Ion-sensitive sensors

The following rule applies if connecting CUS71D sensors:

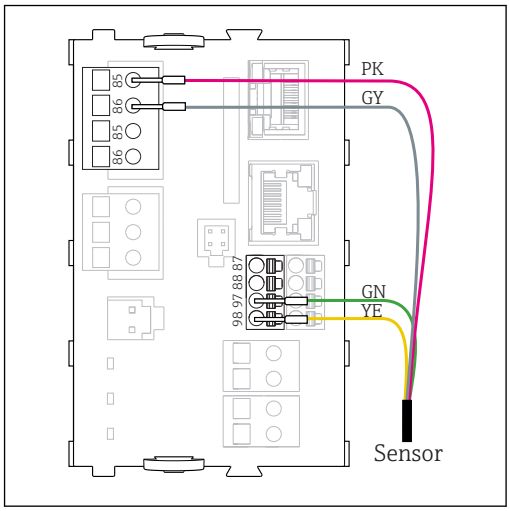
- CM442R
  - Only one CUS71D is possible; an additional sensor is not permitted.
  - The second sensor input may also not be used for another type of sensor.
- CM444R
  No restrictions. All the sensor inputs can be used as required.
- CM448R
  - If a CUS71D is connected, the number of sensor inputs that can be used is limited to a maximum of 4.
  - Of these, all 4 inputs can be used for CUS71D sensors.
  - Every combination of CUS71D and other sensors is possible, provided that the total number of connected sensors does not exceed 4.

Connection

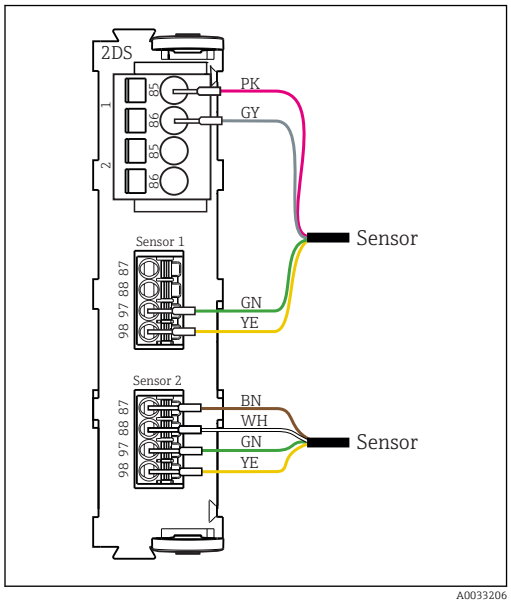
Direct connection of the sensor cable to the terminal connector of the sensor module 2DS or of the base module-L, -H or -E (→ 20 ff.)



20 *sensors without additional supply voltage*



21 *sensors with additional supply voltage*



22 *sensors with and without additional supply voltage at sensor module 2DS*

Performance characteristics

Response time	**Current outputs** t_{90} = max. 500 ms for an increase from 0 to 20 mA **Current inputs** t_{90} = max. 330 ms for an increase from 0 to 20 mA **Digital inputs and outputs** t_{90} = max. 330 ms for an increase from low to high
Reference temperature	25 °C (77 °F)
Measured error for sensor inputs	→ Documentation of the connected sensor
Measured error for current inputs and outputs	**Typical measured errors:** < 20 µA (with current values < 4 mA) < 50 µA (with current values 4 to 20 mA) at 25 °C (77 °F) each **Additional measured error depending on the temperature:** < 1.5 µA/K
Frequency tolerance of digital inputs and outputs	≤ 1%
Resolution of current inputs and outputs	< 5 µA
Repeatability	→ Documentation of the connected sensor

Installation

Mounting on DIN rail as per IEC 60715

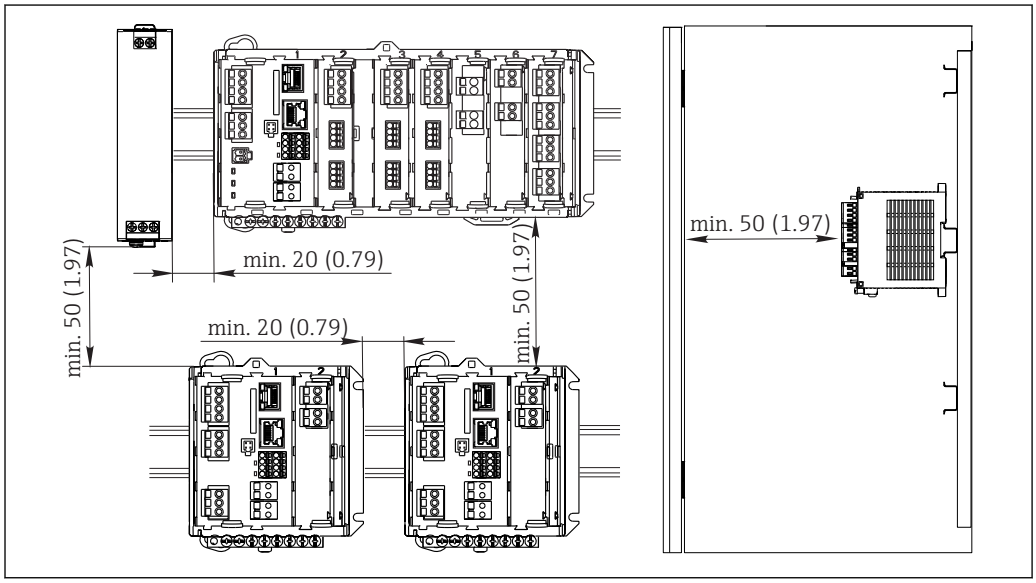
NOTICE

Incorrect mounting location in the cabinet, spacing regulations not observed

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

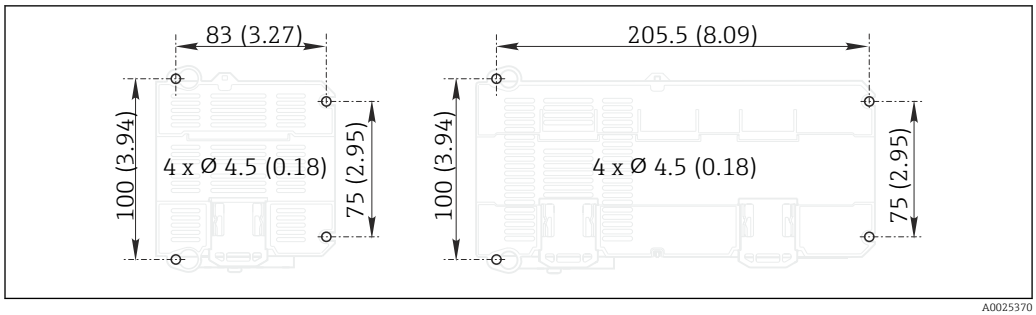
- ▶ Do not position the device directly above sources of heat. The temperature specification must be observed.
- ▶ The components are designed for convection-based cooling. Avoid heat buildup. Ensure openings are not covered, e.g. by cables.
- ▶ Observe the specified distances to other devices.
- ▶ Physically separate the device from frequency converters and high-voltage devices.
- ▶ Recommended installation direction: horizontal. The specified ambient conditions, and particularly the ambient temperatures, only apply for horizontal installation.
- ▶ Vertical orientation is also possible. However, this requires additional fixing clips at the place of installation to hold the device in position on the DIN rail.
- ▶ Recommended installation of power unit for CM444R and CM448R: to the left of the device.

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



23 Minimum clearance in mm (in)

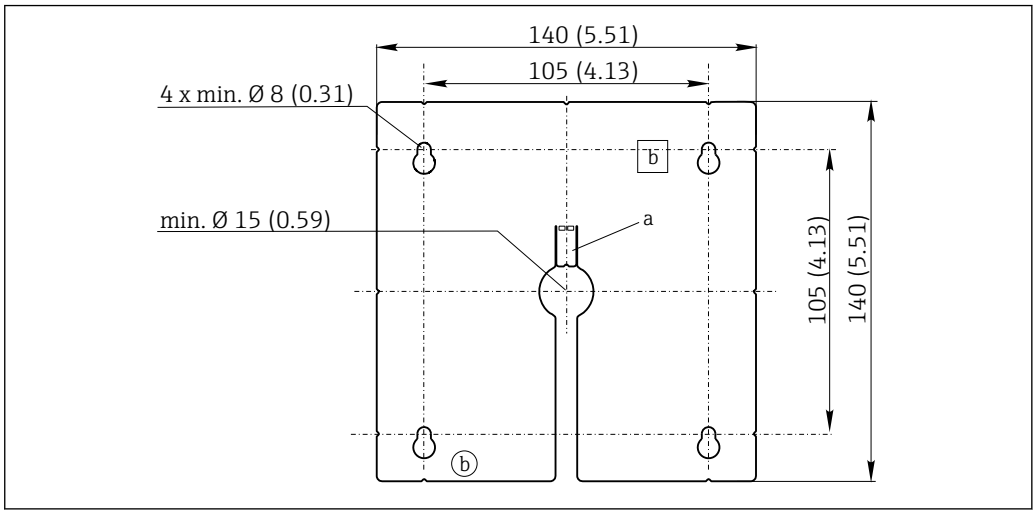
Wall mounting



24 Drilling pattern for wall mounting in mm (in)

Mounting the external display

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



25 *Mounting plate of external display, dimensions in mm (in)*

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

Environment

Ambient temperature range

CM442R
0 to 60 °C (32 to 140 °F)

CM444R
- Generally 0 to 55 °C (32 to 130 °F), with the exception of packages under the second list item
- 0 to 50 °C (32 to 120 °F) for the following packages:
  - CM444R-**M40A7FI*+...
  - CM444R-**M40A7FK*+...
  - CM444R-**M4AA5F4*+...
  - CM444R-**M4AA5FF*+...
  - CM444R-**M4AA5FH*+...
  - CM444R-**M4AA5FI*+...
  - CM444R-**M4AA5FK*+...
  - CM444R-**M4AA5FM*+...
  - CM444R-**M4BA5F4*+...
  - CM444R-**M4BA5FF*+...
  - CM444R-**M4BA5FH*+...
  - CM444R-**M4BA5FI*+...
  - CM444R-**M4BA5FK*+...
  - CM444R-**M4BA5FM*+...
  - CM444R-**M4DA5F4*+...
  - CM444R-**M4DA5FF*+...
  - CM444R-**M4DA5FH*+...
  - CM444R-**M4DA5FI*+...
  - CM444R-**M4DA5FK*+...
  - CM444R-**M4DA5FM*+...

CM448R
- Generally 0 to 55 °C (32 to 130 °F), with the exception of packages under the second list item
- 0 to 50 °C (32 to 120 °F) for the following packages:
  - CM448R-***6AA*+...
  - CM448R-***8A4*+...
  - CM448R-***8A5*+...
  - CM448R-**28A3*+...
  - CM448R-**38A3*+...
  - CM448R-**48A3*+...
  - CM448R-**58A3*+...
  - CM448R-**68A3*+...
  - CM448R-**26A5*+...
  - CM448R-**36A5*+...
  - CM448R-**46A5*+...
  - CM448R-**56A5*+...
  - CM448R-**66A5*+...
  - CM448R-**22A7*+...
  - CM448R-**32A7*+...
  - CM448R-**42A7*+...
  - CM448R-**52A7*+...
  - CM448R-**62A7*+...
  - CM448R-**A6A5*+...
  - CM448R-**A6A7*+...
  - CM448R-**B6A5*+...
  - CM448R-**B6A7*+...
  - CM448R-**C6A5*+...
  - CM448R-**C6A7*+...
  - CM448R-**D6A5*+...
  - CM448R-**D6A7*+...

External display (optional)
–20 to 60 °C (0 to 140 °F)

Storage temperature

–25 to 85 °C (–13 to 185 °F)

Humidity

DIN rail device
5 to 85%, not condensing

External display (in installed state)
5 to 95%, not condensing

Degree of protection

DIN rail device
IP20 shock protection

External display
IP66 front-panel, when installed correctly including seal for housing door

Climate class

As per IEC 60654-1: B2

Vibration resistance

Environmental tests
Vibration test based on DIN EN 60068-2, October 2008
Vibration test based on DIN EN 60654-3, August 1998

Wall mounting

Frequency range	10 to 150 Hz (sinusoidal)	
Amplitude	10 to 12.9 Hz:	0.75 mm
	12.9 to 150 Hz:	0.5 g [1)]
Test duration	10 frequency cycles/ spatial axis, in 3 spatial axes (1 oct./min)	

1) g ... gravitational acceleration (1 g ≈ 9.81 m/s^2)

Electromagnetic compatibility

Interference emission and interference immunity as per EN 61326-1:2013, Class A for Industry

Electrical safety

IEC 61010-1, Class I equipment
Low voltage: overvoltage category II
Environment < 2000 m (< 6562 ft) above MSL

Degree of contamination

DIN rail device

The product is suitable for pollution degree 2.

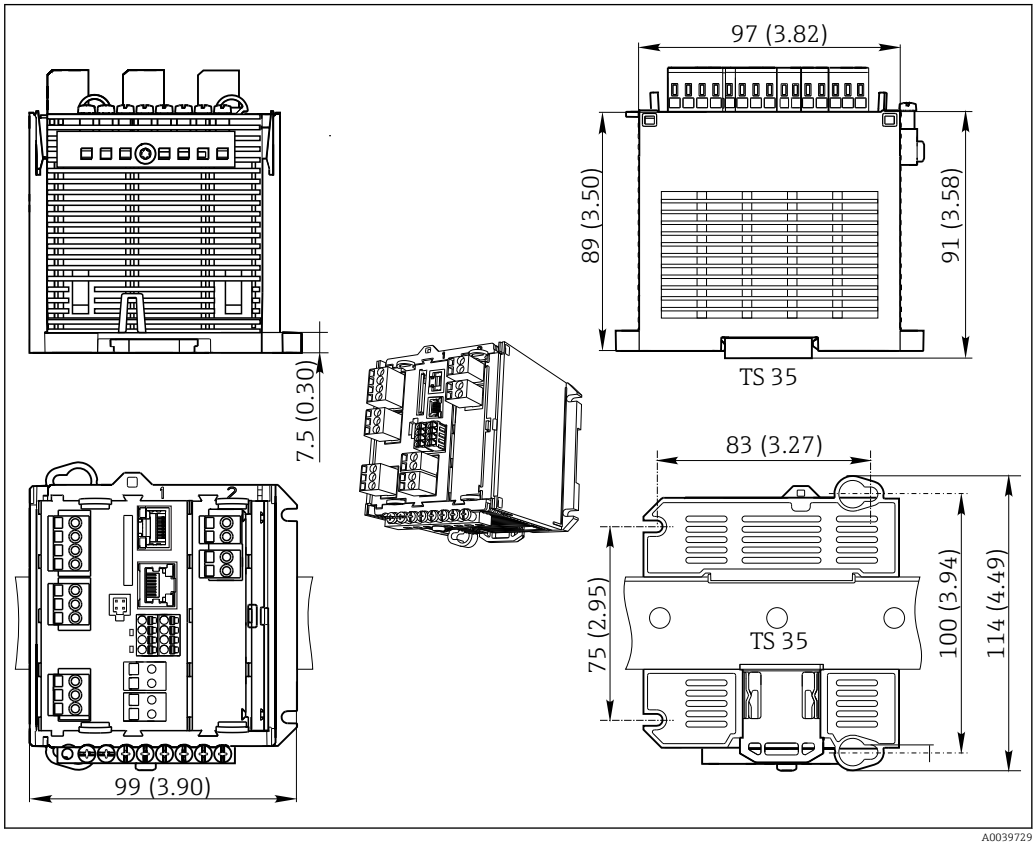
Optional display

The product is suitable for pollution degree 4.

Mechanical construction

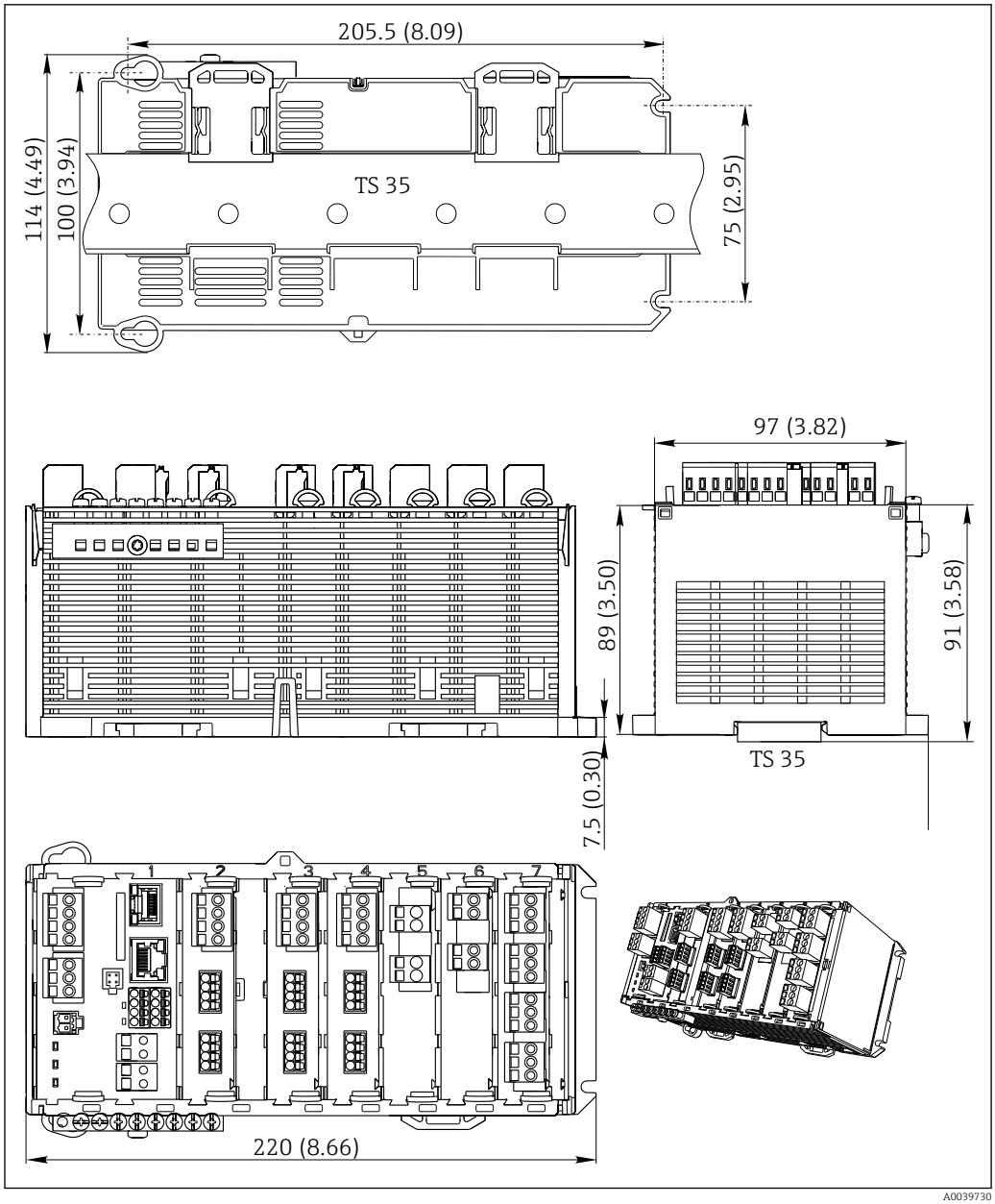
Dimensions

CM442R



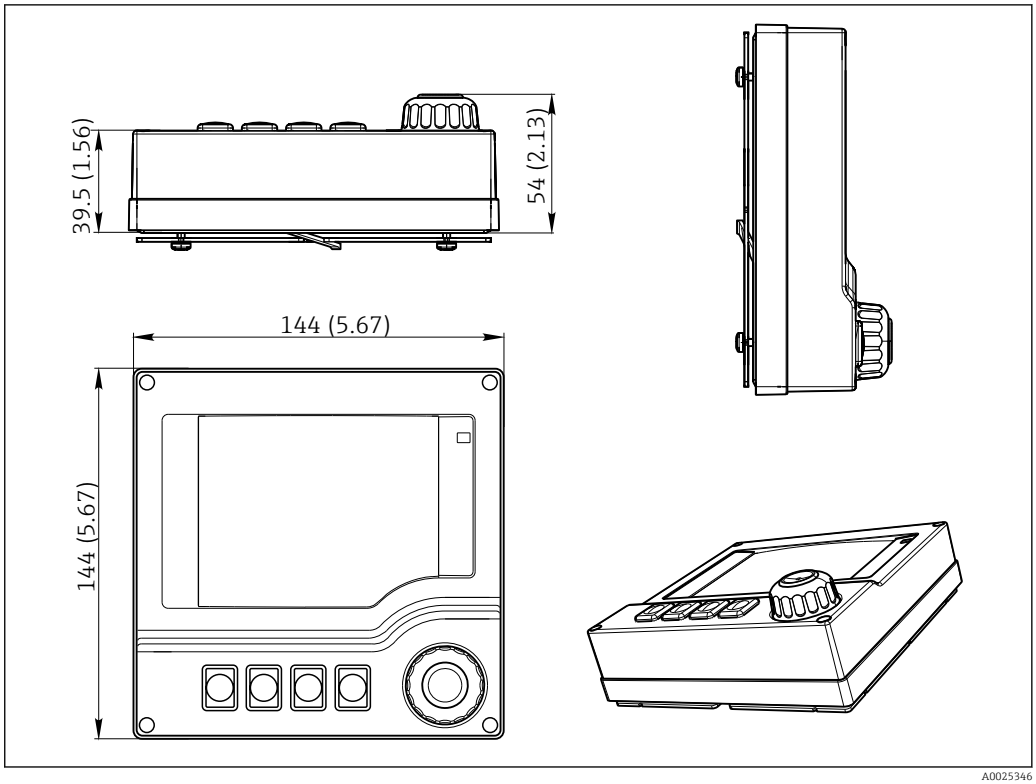
26 Dimensions in mm (inch)

CM444R and CM448R



27 Dimensions in mm (inch)

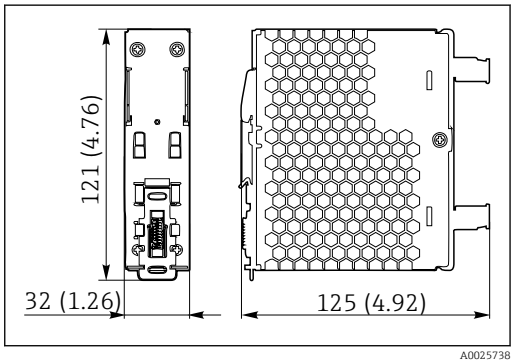
Optional display



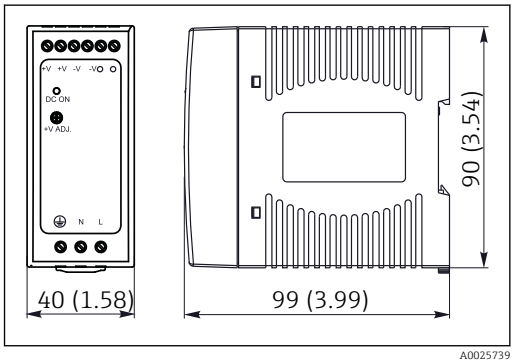
28 Dimensions in mm (inch)

External power units (CM444R and CM448R only)

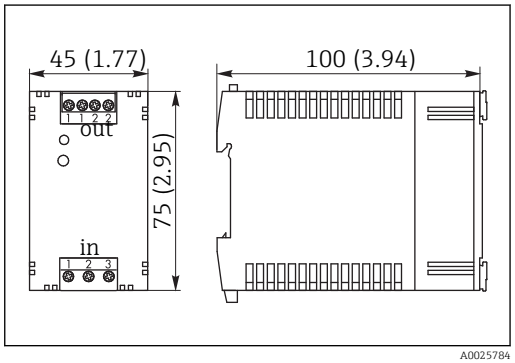
Depending on the version ordered, a power unit for connection to 230 V or 24 V is supplied. There are two delivery variants for each version (cannot be selected). The factory-preferred variant is shown on the left in each case.



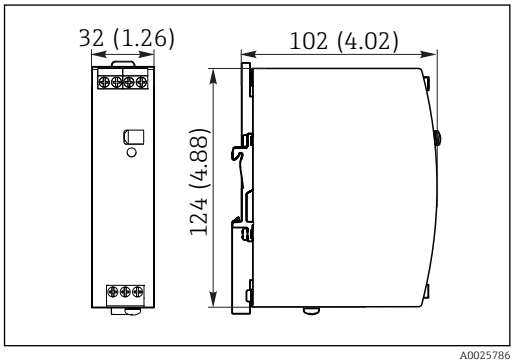
29 Power unit 230 V



30 Power unit 230 V (optional)



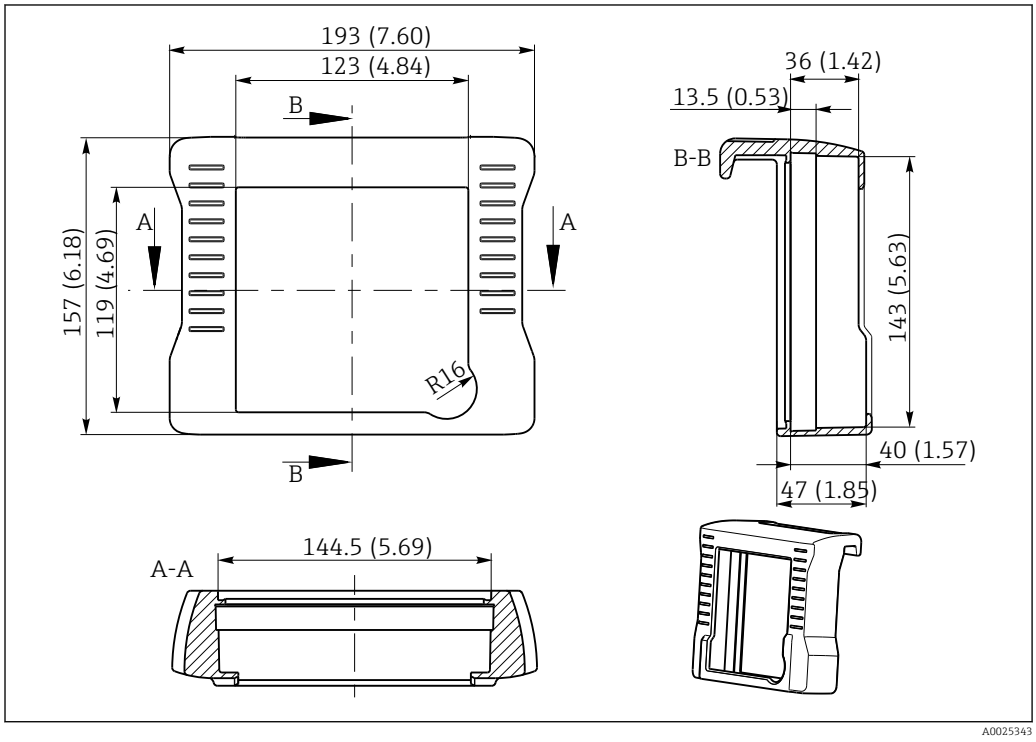
31 Power unit 24 V



32 Power unit 24 V (optional)

Service display (accessories)

The service display comprises:
- Portable display (same dimensions as under "Optional display")
- Cover to protect the display and to hook it onto the (open) cabinet door



33 *Dimensions of the service display cover in mm (inch)*

Weight

depending on the version:

CM442R (fully configured)	Approx. 0.45 kg (1 lbs)
CM444R and CM448R (fully configured)	Approx. 0.95 kg (2.1 lbs)
Individual module	Approx. 0.06 kg (0.13 lbs)
External display (excluding cables)	Approx. 0.56 kg (1.2 lbs)
Service display cover	0.46 kg (1 lbs)
External power unit (CM444R, CM448R)	0.27 to 0.42 kg (0.60 to 0.92 lbs), depending on the power unit variant

Materials

DIN rail housing	PC-FR
Display cover	PC-FR
Display seal	EPDM
Soft keys	EPDM
Module covers	PBT GF30 FR
Terminal strip	Nickel-plated brass
Ground terminals	Stainless steel 1.4301 (AISI304)
Threaded fasteners	Stainless steel 1.4301 (AISI304)
Mounting plate (optional display)	Stainless steel 1.4301 (AISI304)
Securing screws (optional display)	Steel, galvanized
Cover for service display (accessories)	EPDM

Operability

External display

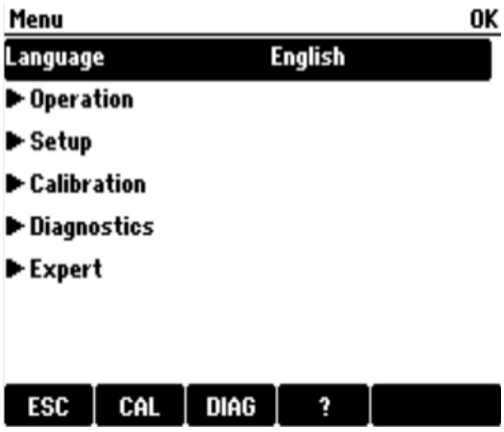
Graphic display:
- Resolution: 240 x 160 pixel
- Back light with switch-off function
- Red display background for alarms alerts users to errors
- Transflective display technology for maximum contrast even in bright environments
- User-definable measuring menus mean you can always keep track of the values that are important for your application.

Operating concept

The simple and structured operating concept sets new standards:
- Intuitive operation with the navigator and soft keys
- Fast configuration of application-specific measurement options
- Easy configuration and diagnosis thanks to plain-text display
- All languages that can be ordered are available in every device

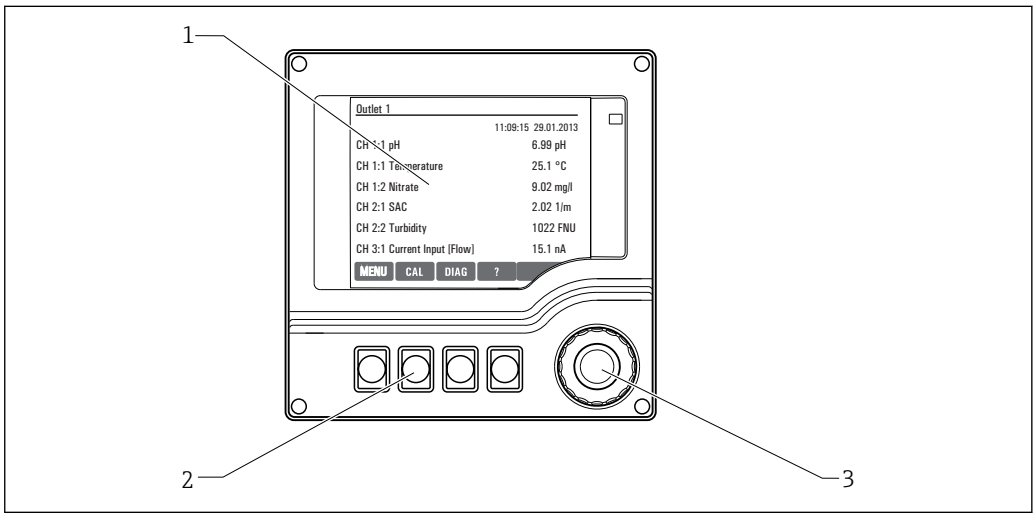
A0025229

34 Operation via external, optional display



35 Plain-text menu

Local operation via external, optional display



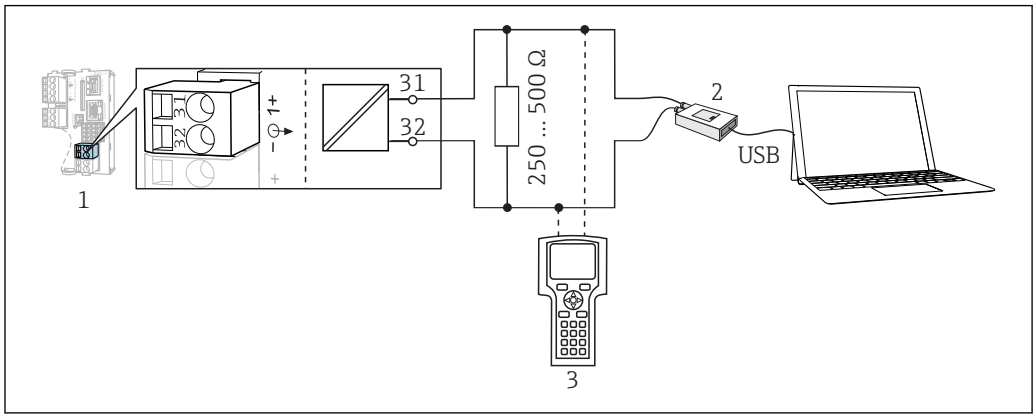
A0025231

36 Overview of operation

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

Remote operation

Via HART (e.g. via HART modem and FieldCare)

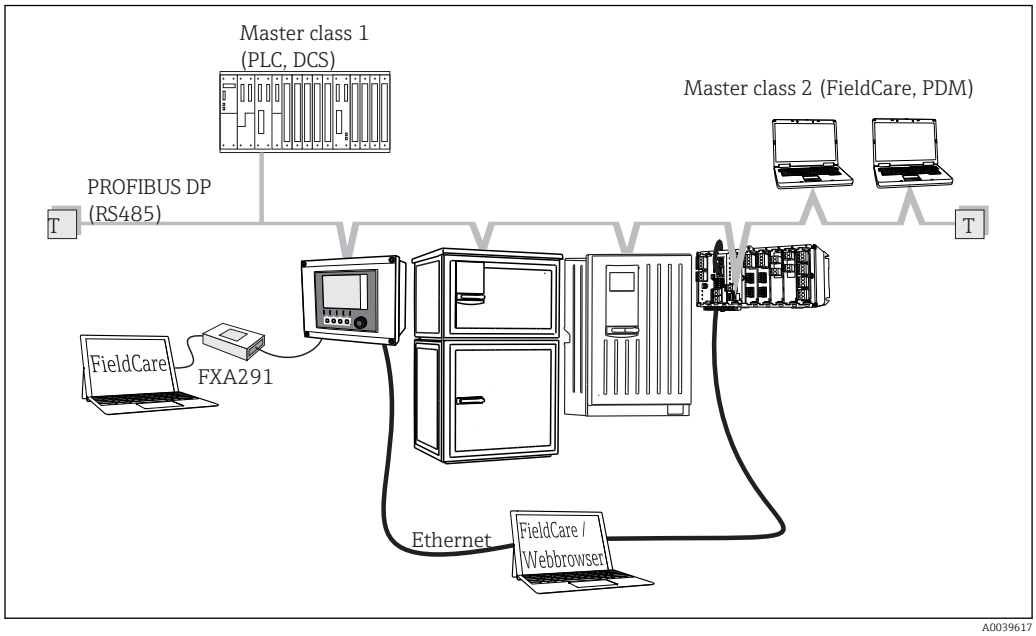


37 HART using modem

1 Device module Base2-L, -H or -E: current output 1 with HART
2 HART modem for connection to PC, e.g. Commubox FXA191 (RS232) or FXA195 [1] (USB)
3 HART handheld terminal

[1] Switch position "on" (substitutes the resistor)

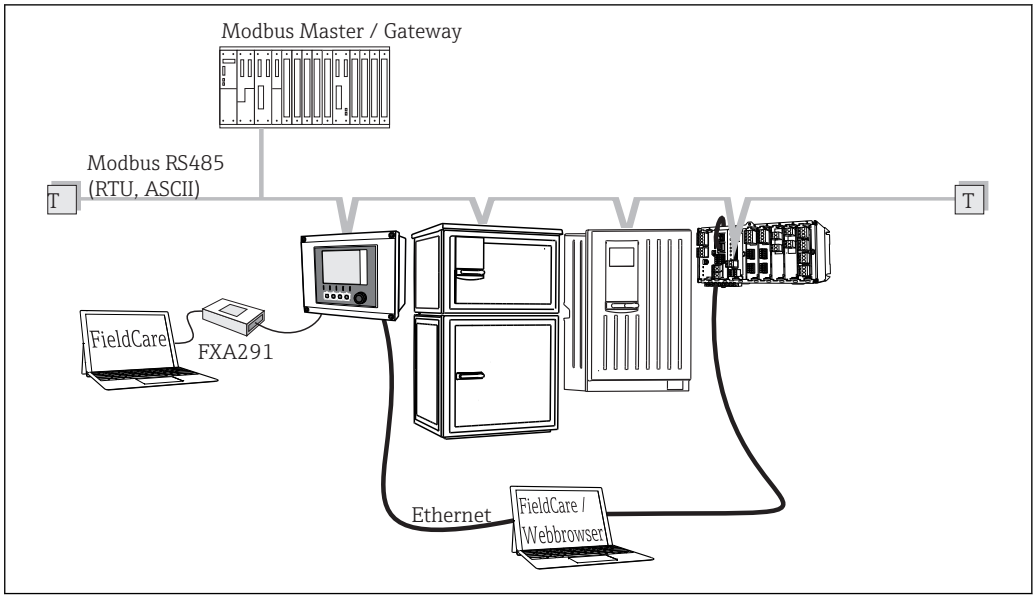
Via PROFIBUS DP



38 PROFIBUS DP

T Terminating resistor

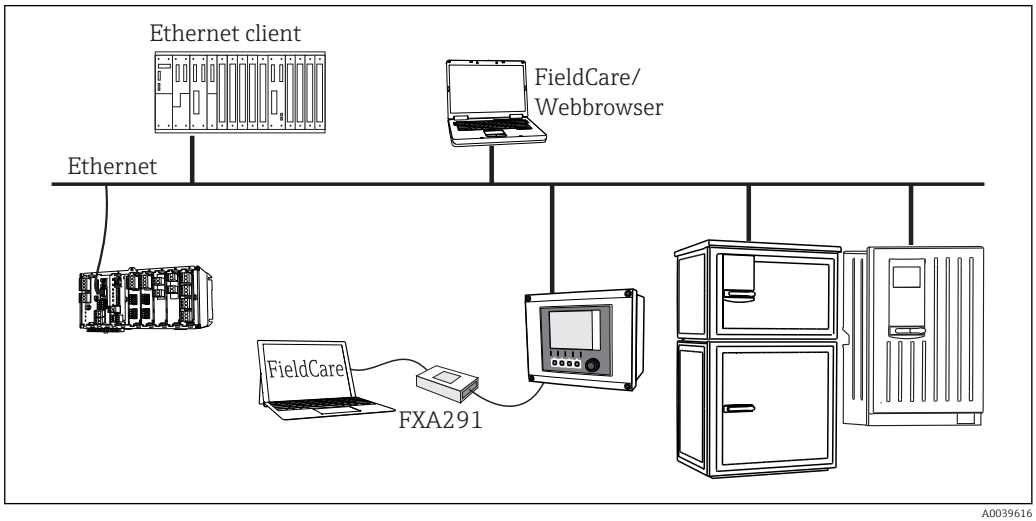
Via Modbus RS485



39 Modbus RS485

T Terminating resistor

Via Ethernet: web server/Modbus TCP/PROFINET/EtherNet/IP



40 Modbus TCP or EtherNet/IP or PROFINET

Language packages

The language selected in the product structure is the operating language preset at the factory. All other languages can be selected using the menu.

- English (US)
- German
- Chinese (Simplified, PR China)
- Czech
- Dutch
- French
- Italian
- Japanese
- Polish
- Portuguese
- Russian
- Spanish
- Swedish
- Turkish

- Hungarian
- Croatian
- Vietnamese

The availability of other languages can be checked via the product structure at www.endress.com/cm442R or .../cm444R or .../cm448R.

Certificates and approvals

CE mark

The product meets the requirements of the harmonized European standards. As such, it complies with the legal specifications of the EU directives. The manufacturer confirms successful testing of the product by affixing to it the CE mark.

EAC

The product has been certified according to guidelines TP TC 004/2011 and TP TC 020/2011 which apply in the European Economic Area (EEA). The EAC conformity mark is affixed to the product.

cCSAus

The device has been certified with regard to its electrical safety and for NI Class I Div. 2 cCSAus explosion-proof environments. It meets the requirements in accordance with:

- CLASS 2252 06 - Process Control Equipment
- CLASS 2252 86 - Process Control Equipment - Certified to US Standards
- CLASS 2258 03 - Process Control Equipment - Intrinsically Safe and Non-incendive Systems - For Hazardous Locations
- CLASS 2258 83 - Process Control Equipment - Intrinsically Safe and Non-incendive Systems - For Hazardous Locations - Certified to US Standards
- FM3600
- FM3611
- FM3810
- UL50E
- IEC 60529
- CAN/CSA-C22.2 No. 0
- CAN/CSA C22.2 No. 94
- CSA Std. C22.2 No. 213
- CAN/CSA-C22.2 No. 61010-1
- CAN/CSA-C22.2 No. 60529
- UL/ANSI/ISA 61010-1
- ANSI - ISA 12 12 01

▶ The device must be installed in a housing or cabinet where access is only possible with a tool or key.

Marine approvals

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

Ordering information

Product page

www.endress.com/cm442r

www.endress.com/cm444r

www.endress.com/cm448r

Product Configurator

On the product page there is a **Configure** button to the right of the product image.

1. Click this button.
   ↳ The Configurator opens in a separate window.

2. Select all the options to configure the device in line with your requirements.
   ↳ In this way, you receive a valid and complete order code for the device.
3. Export the order code as a PDF or Excel file. To do so, click the appropriate button on the right above the selection window.

For many products you also have the option of downloading CAD or 2D drawings of the selected product version. Click the **CAD** tab for this and select the desired file type using picklists.

Scope of delivery

The scope of delivery comprises:
- 1 multichannel controller in the version ordered
- 1 mounting plate
- 1 external display (if selected as an option) [2)]
- 1 DIN rail power unit incl. Cable (CM444R and CM448R only)
- 1 printed copy of the Operating Instructions for DIN rail power unit
- 1 printed copy of the Brief Operating Instructions in the language ordered

Accessories

The following are the most important accessories available at the time this documentation was issued.

► For accessories not listed here, please contact your Service or Sales Center.

Measuring cable

Memosens data cable CYK10
- For digital sensors with Memosens technology
- Product Configurator on the product page: www.endress.com/cyk10

Technical Information TI00118C

Memosens data cable CYK11
- Extension cable for digital sensors with Memosens protocol
- Product Configurator on the product page: www.endress.com/cyk11

Technical Information TI00118C

Sensors

Glass electrodes

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

Technical Information TI00028C

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

Technical Information TI00030C

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

Technical Information TI00079C

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

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

Technical Information TI00245C

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

Technical Information TI01254C

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

Technical Information TI00375C

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

Technical Information TI00191C

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

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

Technical Information TI00367C

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

Technical Information TI00373C

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

Technical Information TI00374C

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

Technical Information TI00191C

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

Technical Information TI00435C

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 and ORP combined sensors

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

Technical Information TI00503C

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

Technical Information TI00506C

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

Technical Information TI00507C

Conductivity sensors with inductive measurement of conductivity

Indumax CLS50D
- High-durability inductive conductivity sensor
- For standard and hazardous area applications
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cls50d

Technical Information TI00182C

Indumax H CLS54D
- Inductive conductivity sensor
- With certified, hygienic design for foodstuffs, beverages, pharmaceuticals and biotechnology
- Product Configurator on the product page: www.endress.com/cls54d

Technical Information TI00508C

Conductivity sensors with conductive measurement of conductivity

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

Technical Information TI00109C

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

Technical Information TI00227C

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

Technical Information TI00085C

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

Technical Information TI01188C

Oxygen sensors

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

Technical Information TI00446C

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

Technical Information TI00413C

Oxymax COS61D
- Optical oxygen sensor for drinking water and industrial water measurement
- Measuring principle: quenching
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cos61d

Technical Information TI00387C

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

Technical Information TI01201C

Disinfection sensors

CCS142D
- Membrane-covered amperometric sensor for free chlorine
- Measuring range 0.01 to 20 mg/l
- With Memosens technology
- Product Configurator on the product page: www.endress.com/ccs142d

Technical Information TI00419C

Ion-selective sensors

ISEmax CAS40D
- Ion selective sensors
- Product Configurator on the product page: www.endress.com/cas40d

Technical Information TI00491C

Turbidity sensors

Turbimax CUS51D
- For nephelometric measurements of turbidity and solids in wastewater
- 4-beam scattered light method
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cus51d

Technical Information TI00461C

Turbimax CUS52D
- Hygienic Memosens sensor for turbidity measurement in drinking water, process water and in utilities
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cus52d

Technical Information TI01136C

SAC and nitrate sensors

Viomax CAS51D
- SAC and nitrate measurement in drinking water and wastewater
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cas51d

Technical Information TI00459C

Interface measurement

Turbimax CUS71D
- Immersion sensor for interface measurement
- Ultrasonic interface sensor
- Product Configurator on the product page: www.endress.com/cus71d

Technical Information TI00490C

Additional functionality

Hardware extension modules

Kit, extension module AOR
- 2 x relay, 2 x 0/4 to 20 mA analog output
- Order No. 71111053

Kit, extension module 2R
- 2 x relay
- Order No. 71125375

Kit, extension module 4R
- 4 x relay
- Order No. 71125376

Kit, extension module 2AO
- 2 x 0/4 to 20 mA analog output
- Order No. 71135632

Kit, extension module 4AO
- 4 x analog output 0/4 to 20 mA
- Order No. 71135633

Kit, extension module 2DS
- 2 x digital sensor, Memosens
- Order No. 71135631

Kit, extension module 2AI
- 2 x 0/4 to 20 mA analog input
- Order No. 71135639

Kit, extension module DIO
- 2 x digital input
- 2 x digital output
- Auxiliary voltage supply for digital output
- Order No. 71135638

Kit, extension module 485
- Can be extended to PROFIBUS DP or Modbus RS485. This requires an additional activation code which can be ordered separately.
- Order No. 71135634

Upgrade kit, extension module 485 with PROFIBUS DP
- Extension module 485
- PROFIBUS DP (+ Ethernet configuration)
- Order No. 71140888

Upgrade kit, extension module 485 with Modbus RS485
- Extension module 485
- Modbus RS485 (+ Ethernet configuration)
- Order No. 71140889

Firmware and activation codes

SD card with Liquiline firmware
- Industrial Flash Drive, 1 GB
- Order No. 71127100

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

Activation code for digital HART communication
Order No. 71128428

Activation code for PROFIBUS DP
Order No. 71135635

Activation code for Modbus RS485
Order No. 71135636

Activation code for PROFINET + web server for BASE2
Order No. 71449901

Activation code for Ethernet/IP + web server for BASE2
Order No. 71449914

Activation code for Modbus TCP + web server for BASE2
Order No. 71449915

Activation code for web server for BASE2
Order No. 71449918

Kit CM442R: activation code for 2nd digital sensor input
Order No. 71114663

Kit CM444R/CM448R: upgrade code for 2 x 0/4 to 20 mA for BASE2-E
On request

Activation code for feedforward control
- Requires current input or fieldbus communication
- Order No. 71211288

Activation code for measuring range switch
- Requires digital inputs or fieldbus communication
- Order No. 71211289

Activation code for ChemocleanPlus
- Requires relays or digital outputs or fieldbus communication and optional digital inputs
- Order No. 71239104

Activation code for Heartbeat Verification and Monitoring
Order No. 71367524

Activation code for ion exchanger operating time
- Configure the mathematical function
- Order No. 71367531

Activation code for mathematics
- Formula editor
- Order No. 71367541

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

Field Data Manager Software MS20
- PC software for central data management
- Visualization of series of measurements and logbook events
- SQL database for secure data storage

FieldCare SFE500
- Universal tool for field device configuration and management
- Supplied with a complete library of certified DTMs (Device Type Manager) for operation of Endress +Hauser field devices
- Order according to product order structure
- www.endress.com/sfe500

Other accessories

External display [3)]

Graphic display
- For installation in the control cabinet door or panel
- Order No. 71185295

Service display
- Portable, for commissioning
- Order No. 71185296

SD card
- Industrial Flash Drive, 1 GB
- Order No. 71110815

Communication-specific accessories

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

Technical Information TI00404F

Commubox FXA291
Connects the CDI interface of measuring devices with the USB port of the computer or laptop

Technical Information TI00405C

3) The external display can be selected as an option in the product structure or ordered subsequently as an accessory.

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

System components

RIA14, RIA16
- Field display unit for integration into 4-20 mA circuits
- RIA14 in flameproof metal enclosure

Technical Information TI00143R and TI00144R

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

Technical Information TI01043K

www.addresses.endress.com

Endress+Hauser

People for Process Automation