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Technical Information
Liquiline CM442R/CM444R/ CM448R

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



For monitoring and controlling processes in industry and the environmental sector

Applications

- Food and beverages
- Life sciences
- Water and wastewater
- Chemical industry
- Power plants
- Other industrial applications

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

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People for Process Automation

[Continued from front page]

- 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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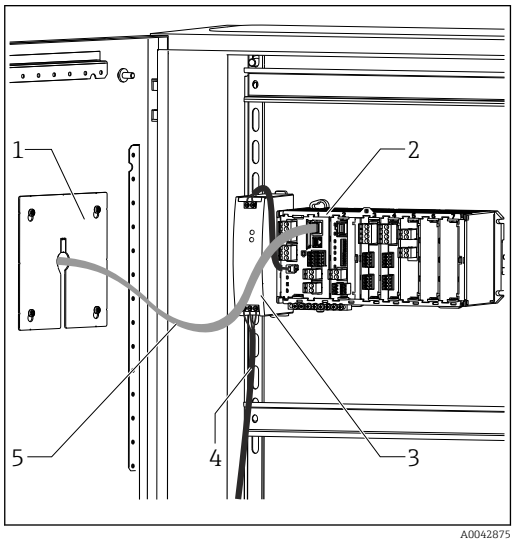
Function and system design

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:
- Liquiline transmitter
- Optional display
- Sensors with Memosens technology
- Assemblies to suit the sensors used



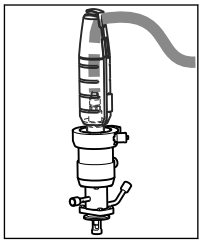
1 Cabinet installation (without sensor and signal cables)

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
- Cleanfit CPA871 retractable assembly
- Memosens CPS11E sensor
- Measuring cable CYK10

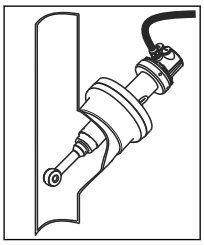
ORP in drinking water
- Dipfit CYA112 immersion assembly
- Memosens CPS12E sensor
- Measuring cable CYK10



Conductivity

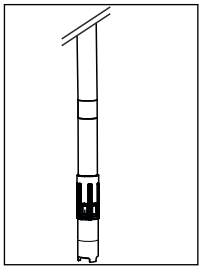
Inductive conductivity measurement in wastewater treatment
- Indumax CLS50D sensor
- Sensor fixed cable

Conductive conductivity measurement in power plant cooling water
- Memosens CLS15E sensor
- Measuring cable CYK10



Oxygen

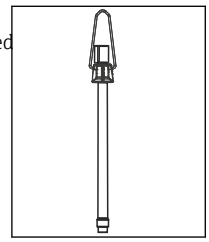
Oxygen in aeration basins
- Dipfit CYA112 immersion assembly
- CYH112 holder
- Sensor
  - COS61D (optical) with fixed cable
  - COS51E (amperometric), CYK10 cable



Nitrate and SAC

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

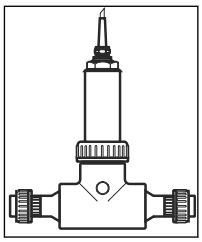
SAC in the wastewater treatment outlet
- Sensor CAS51D-**2C2 with fixed cable
- Dipfit CYA112 immersion assembly
- CYH112 holder



Turbidity and interface

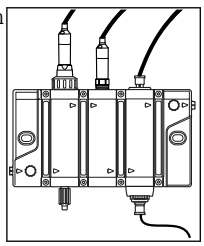
Turbidity in industrial water
- Turbimax CUS51D sensor with fixed cable
- Flowfit CUA250 assembly
- CUR3 spray head (optional)

Interface in the primary clarifier
- Turbimax CUS71D sensor
- CYA112 assembly
- CYH112 holder



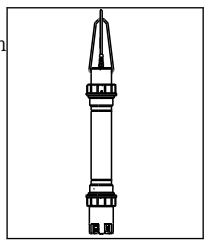
Disinfection

Free available chlorine (and pH) in drinking water
- CCS51D sensor
- Memosens CPS11E sensor
- Measuring cable CYK10
- CYA27 flow assembly



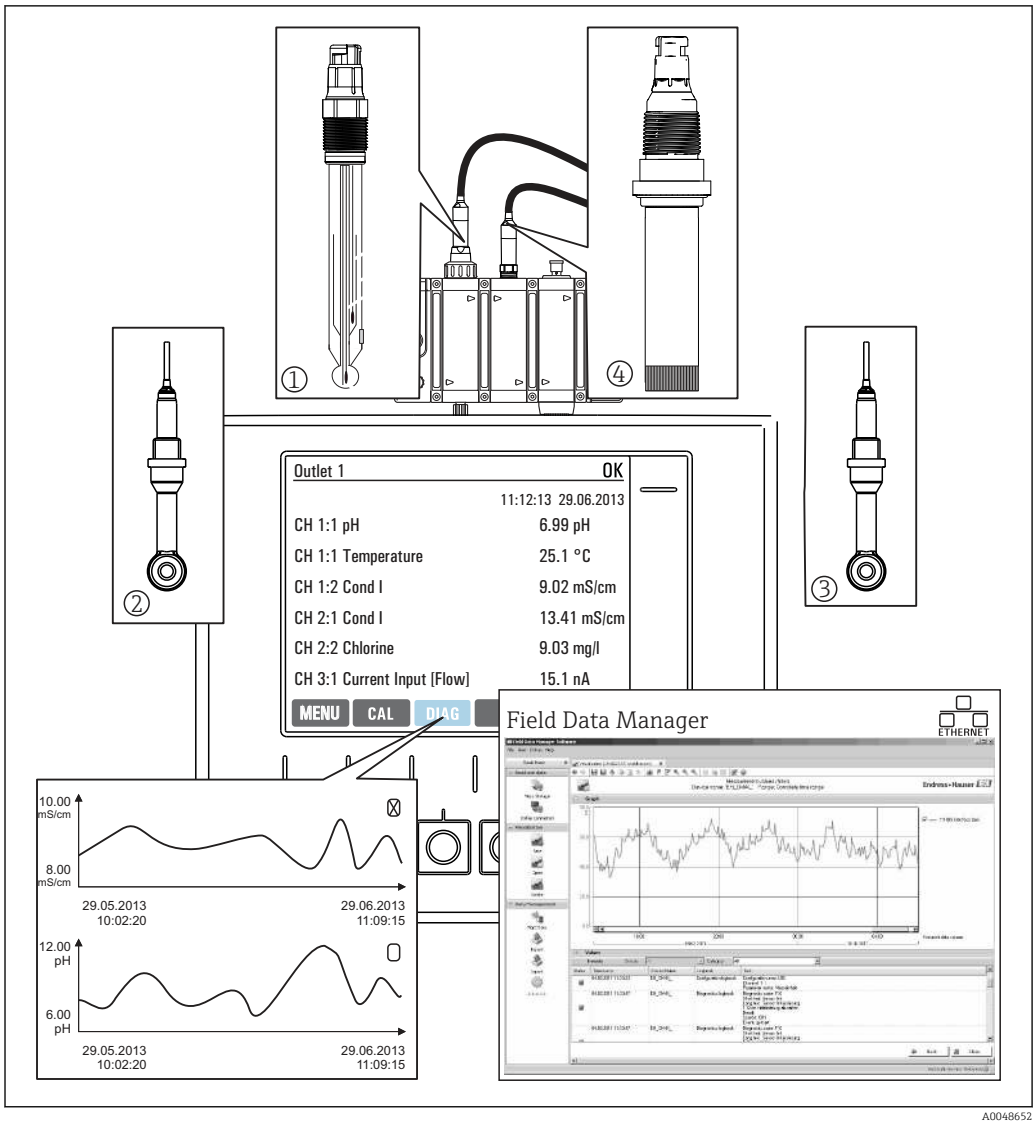
Ion-selective electrodes

Ammonium and nitrate measurement in the aeration basin
- CAS40D sensor with fixed cable
- CYH112 holder



Application example

- Transmitter CM444R-AAM44A0FM6 with:
  4 x Memosens, Modbus TCP, 2 digital inputs and outputs each, 2 x relays for cleaning/limit value, 2 x analog current input
- pH and temperature with CPS11E, item 1 (www.endress.com/cps11e)
- Free available chlorine with CCS51D, item 4 (www.endress.com/ccs51d)
- 2 x inductive conductivity with CLS50D, items 2 and 3 (www.endress.com/cls50d)
- 1 x measuring range switching for conductivity via Modbus module
- CYA27 flow assembly (www.endress.com/cya27)
- 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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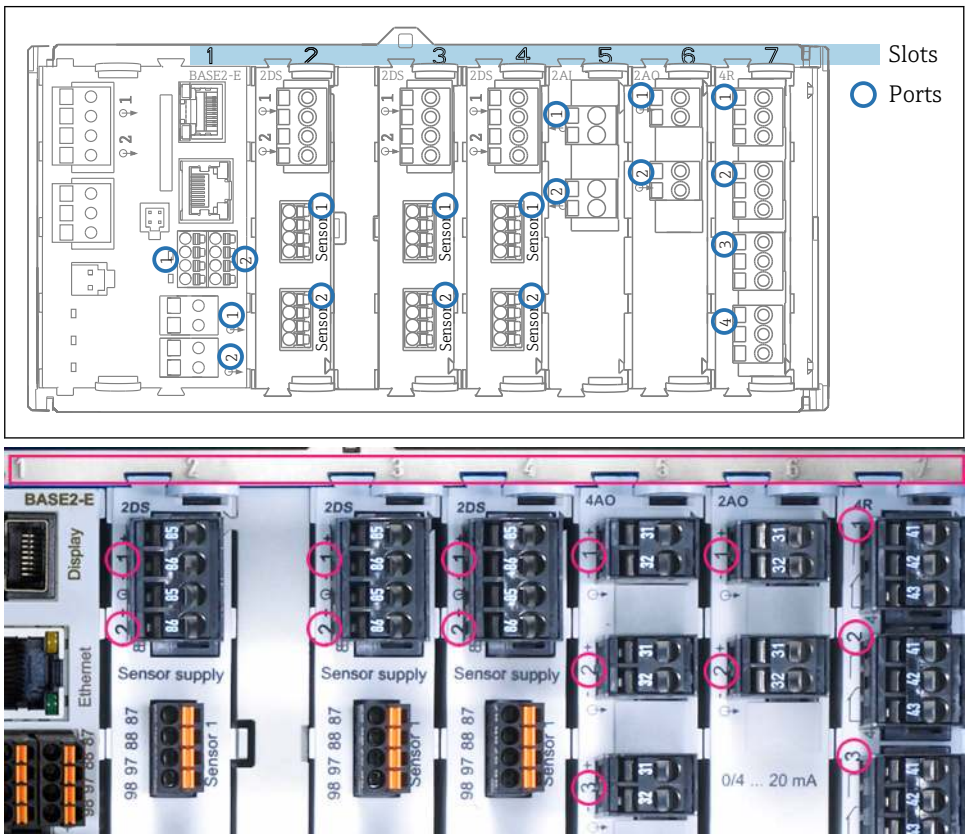
2 Measuring point in the CIP process

Data retention

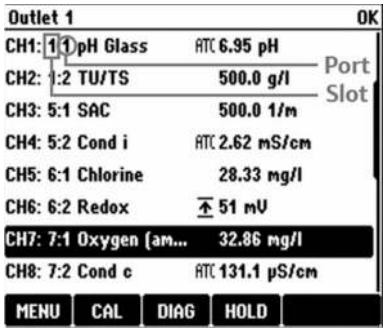
- Storage of all measured values, incl. values of external sources, in the non-volatile memory (data logbook)
- Data called up on site via user-defined measuring menu and load curve display of the data logbook
- Transmission of data by Ethernet, CDI interface or SD card and storage in a tamper-proof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

Equipment 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 485DP or 485MB
- 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 modules 4AO or 2AO (AO = analog output)
- Relay modules AOR, 4R or 2R (AOR = analog output + relay, R = relay)

With intrinsically safe sensor communication module 2DS Ex-i:

- CM442/CM442R: always in slot 2
- CM444/CM444R: always in slot 7 (two channel) and slot 6 (four channel)
- CM448/CM448: slot 7, 6, 5

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:
- Upgrade only to 1x 4 AO module possible
- 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

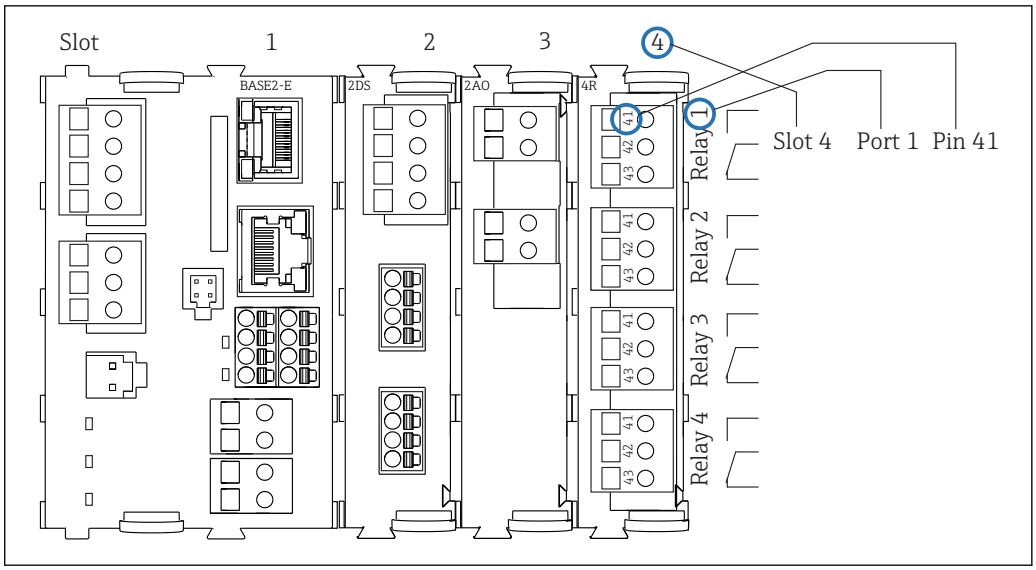
▶ Sum up the number of modules and sort them according to the specified sequence → 🖹 7.
  ↳ This will give you the slot assignment for your device.

Terminal diagram

The unique terminal name is derived from:

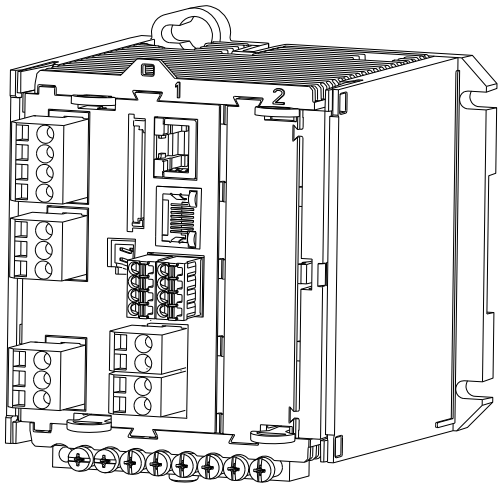
Slot no. : Port no. : Terminal

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*

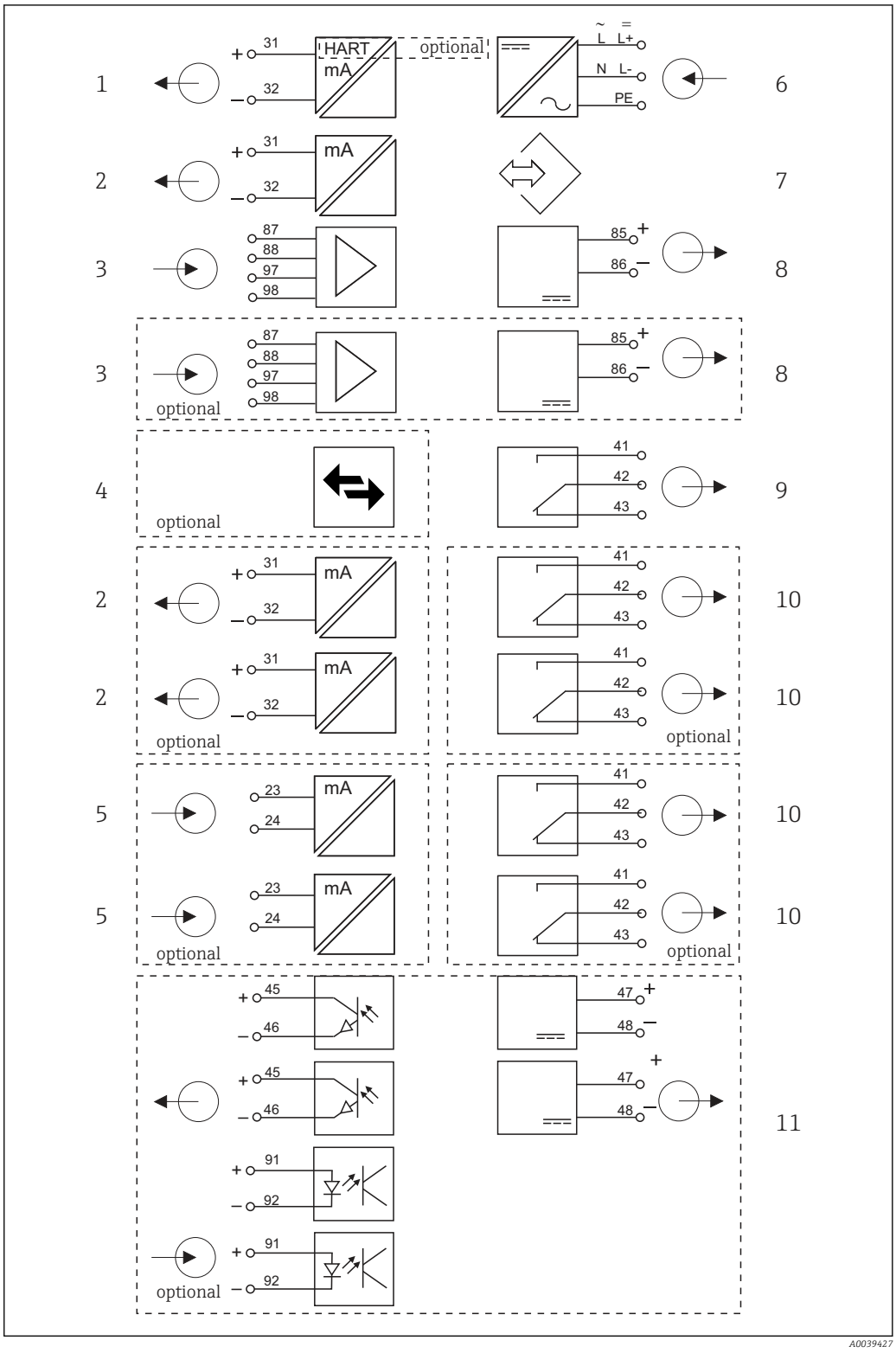
Device configuration using the example of a CM442R-M1A1F0***



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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 with module 485DP or Modbus RS485 with module 485MB: ▪ PROFIBUS DP Module 485DP (71575177) ▪ Modbus RS485 Module 485MB (71575178) If module 485DP or 485MB 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 must 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

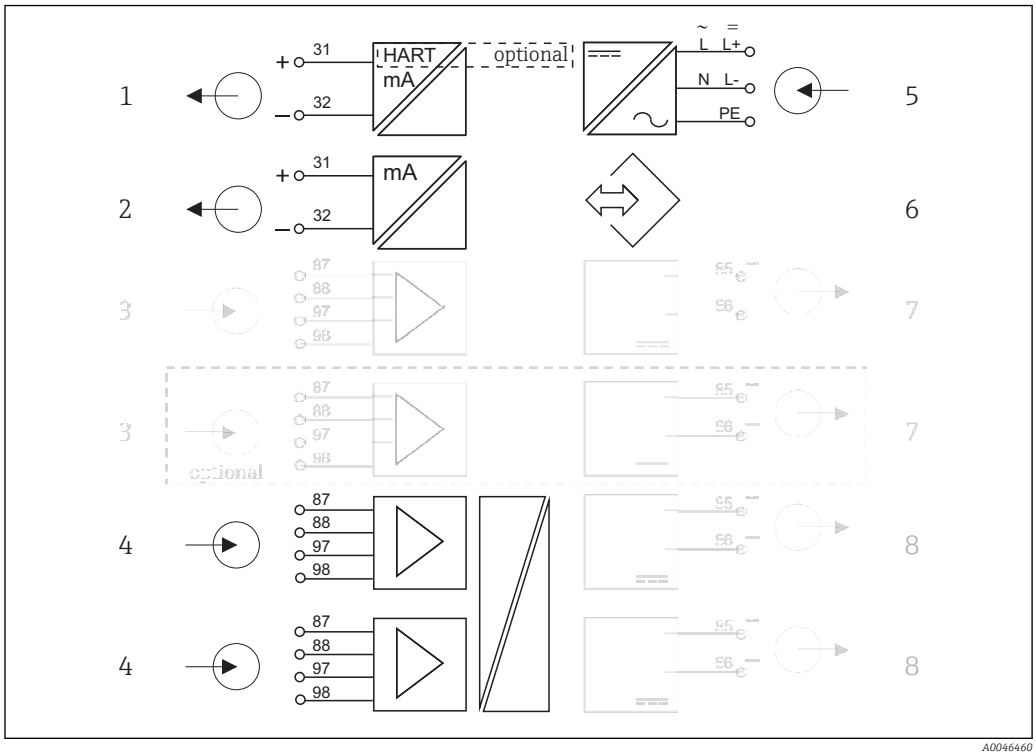
Block circuit diagram CM442R



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)*

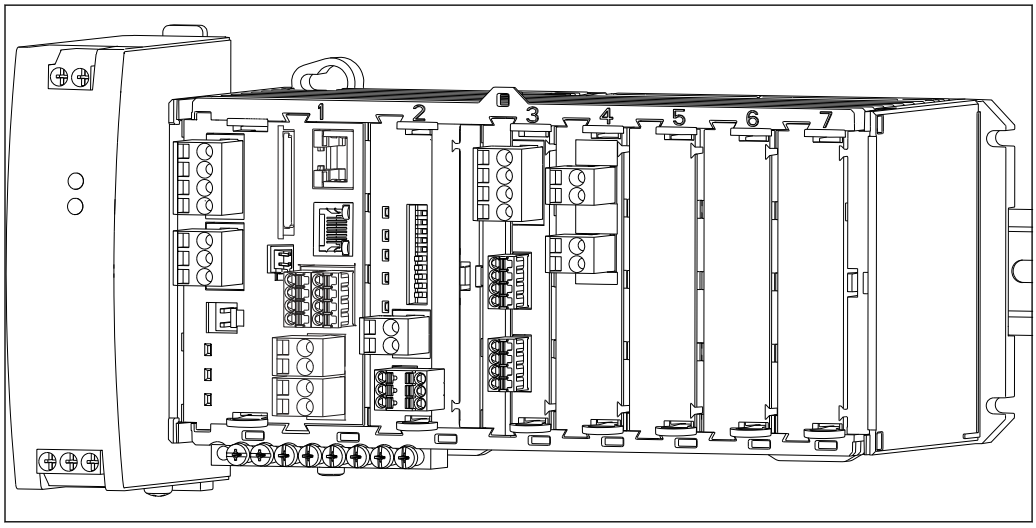
Block circuit diagram CM442R with sensor communication module 2DS Ex-i



7 *Block circuit diagram CM442Rwith intrinsically safe sensor communication module 2DS Ex-i*

1	*Current output 1:1, + HART (optional)*	*5*	*Power supply*
2	*Current outputs (2 x optional)*	*6*	*Service interface*
3	*2 x Memosens input BASE2 (disabled)*	*7*	*Power supply, fixed cable sensors BASE2 (disabled)*
4	*2 x Memosens input 2DS Ex-i for intrinsically safe Memosens sensors*	*8*	*Power supply, fixed cable sensors*

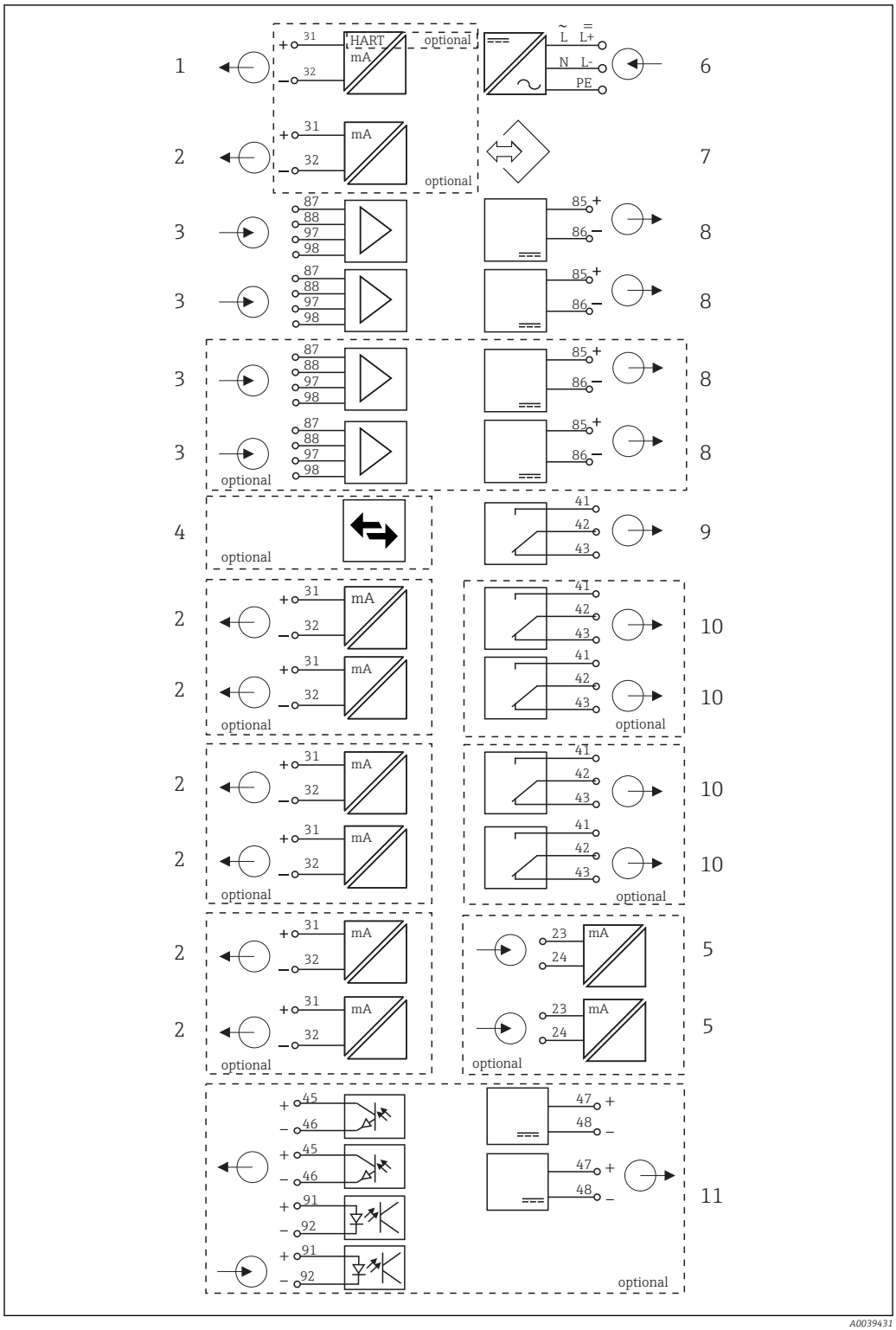
Device configuration using the example of a CM444R-M42A1FA***



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 485DP)
	  ▪ 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	Retrofit by removing module 485DP 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)
Modification options by replacing existing modules	Change the communication type by replacing module 485DP with module 485MB. This disables the communication type used previously! Module 485MB: Modbus RS485 + web server (Order No. 71575178)
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 485DP 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 485DP 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 485DP.
Basic rule for extensions	The sum of all current inputs and outputs must 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

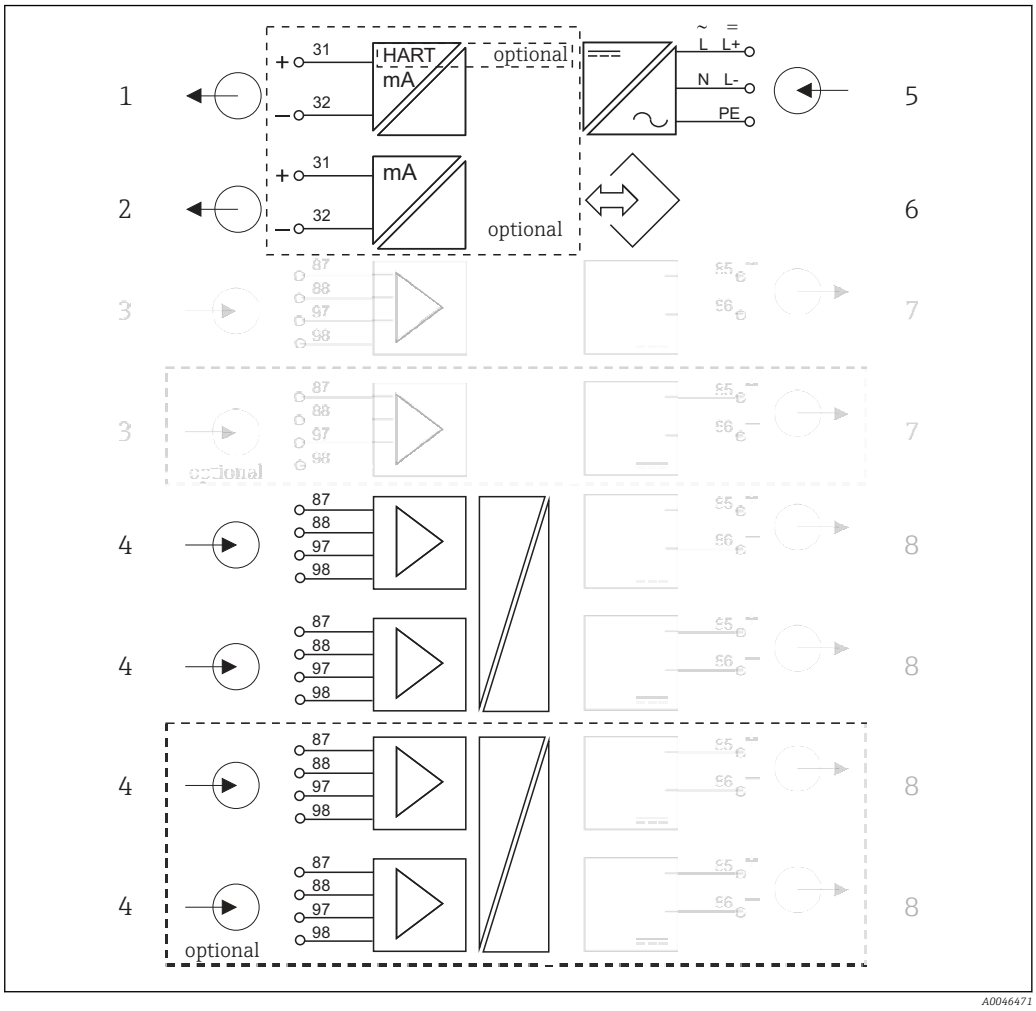
Block circuit diagram CM444R



8 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)*

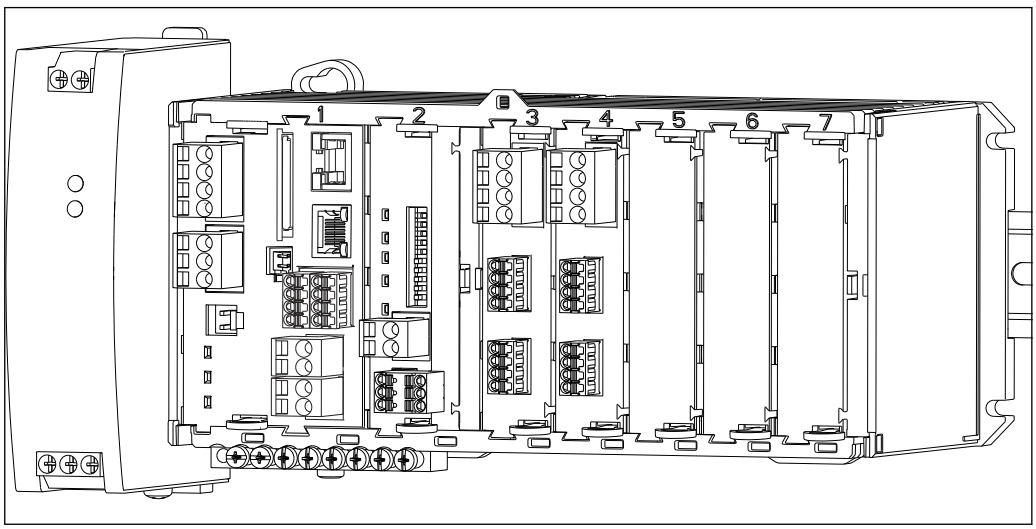
Block circuit diagram CM444R with sensor communication module 2DS Ex-i



9 *Block circuit diagram CM444R with intrinsically safe sensor communication module 2DS Ex-i*

1	*Current output 1:1, + HART (optional)*	5	*Power supply*
2	*Current outputs (2 x optional)*	6	*Service interface*
3	*2 x Memosens input BASE2 (disabled)*	7	*Power supply, fixed cable sensors BASE2 (disabled)*
4	*2 x Memosens input 2DS Ex-i for intrinsically safe Memosens sensors*	8	*Power supply, fixed cable sensors*

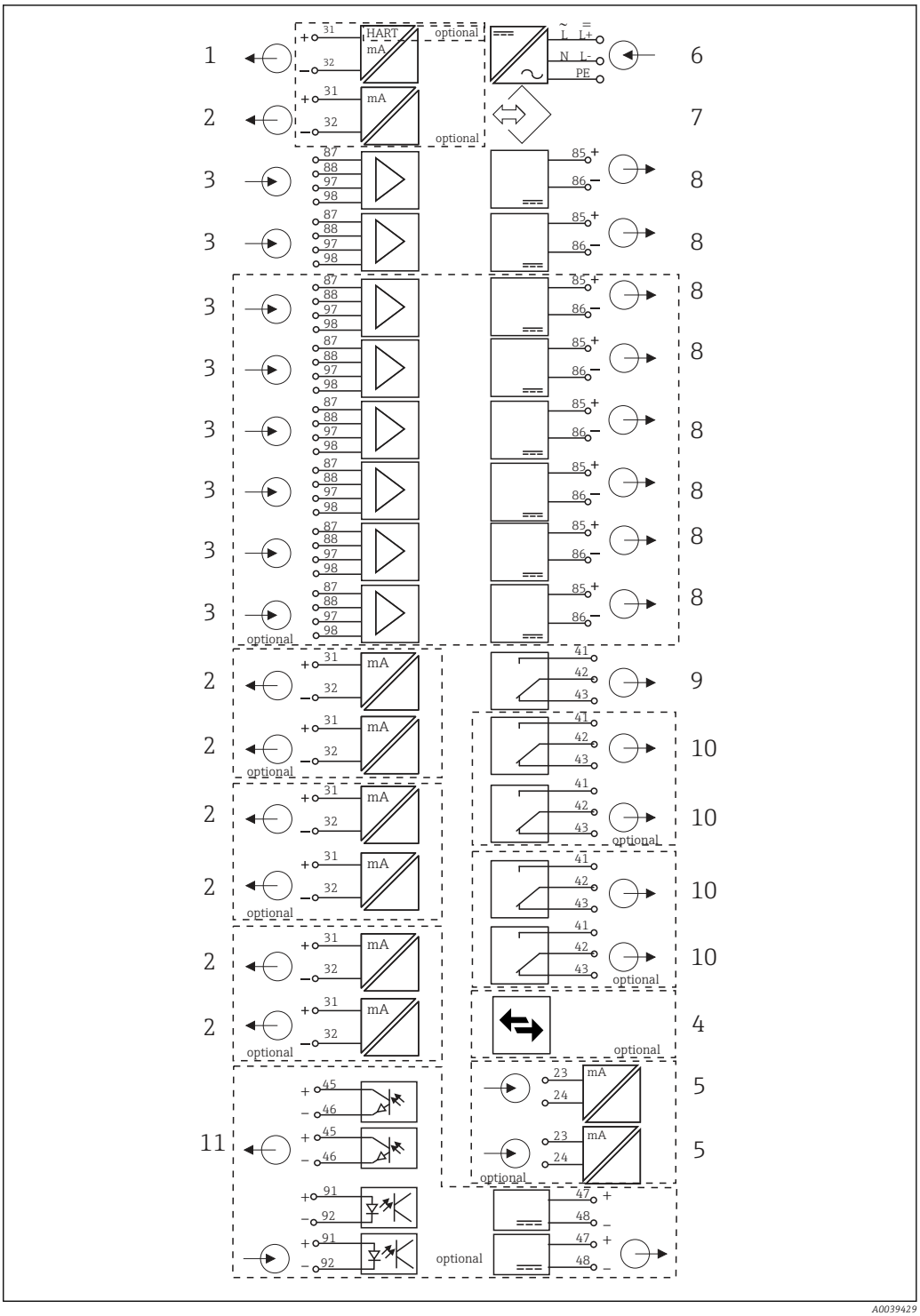
Device configuration using the example of a CM448R-26A1***



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 485DP)
	  ▪ 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	Retrofit by removing module 485DP 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)
Modification options by replacing existing modules	Change the communication type by replacing module 485DP with module 485MB. This disables the communication type used previously! Module 485MB: Modbus RS485 + web server (Order No. 71575178)
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 485DP 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 485DP.
Basic rule for extensions	The sum of all current inputs and outputs must 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

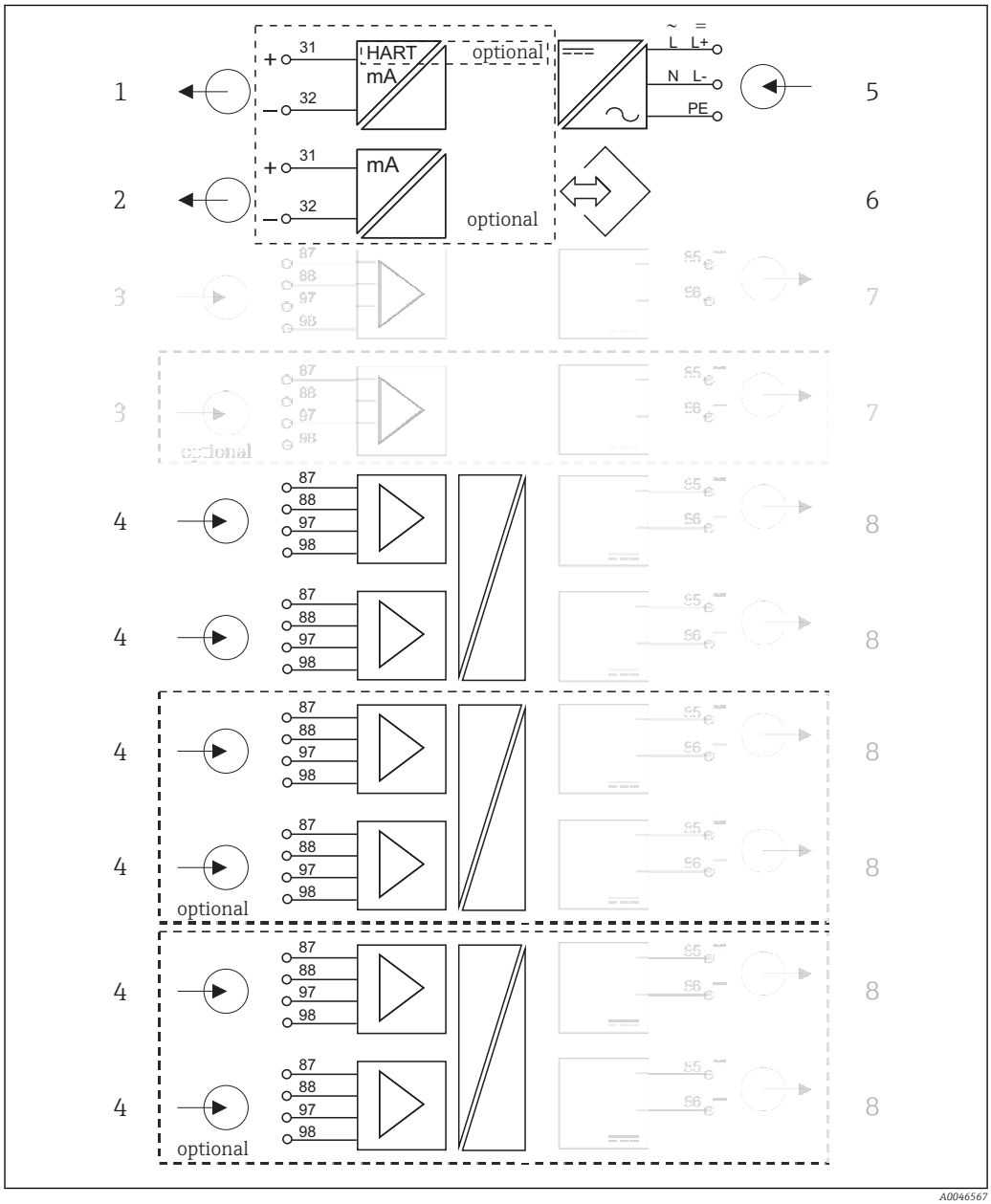
Block circuit diagram CM448R



10 *Function diagram CM448R*

1 *Current output 1:1, + HART (both optional)*
2 *Max. 7 x current output (optional)*
3 *Max 8 x Memosens input (2 x of which are 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)*

Block circuit diagram CM448R with sensor communication module 2DS Ex-i



11 Block circuit diagram CM448R with intrinsically safe sensor communication module 2DS Ex-i

1	*Current output 1:1, + HART (optional)*	*5*	*Power supply*
2	*Current outputs (2 x optional)*	*6*	*Service interface*
3	*2 x Memosens input BASE2 (disabled)*	*7*	*Power supply, fixed cable sensors BASE2 (disabled)*
4	*2 x Memosens input 2DS Ex-i for intrinsically safe Memosens sensors*	*8*	*Power supply, fixed cable sensors*

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 485DP/485MB 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 485DP/485MB.
  PROFIBUS DP and Modbus RS485 are not possible in conjunction with the sensor communication module 2DS Ex-i.
- 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 485DP/485MB
- Displayed via LED "T" on bus module 485DP/485MB

Dependability

Reliability

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 condition of the sensor
  - ☺: Sensor/device condition and 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.

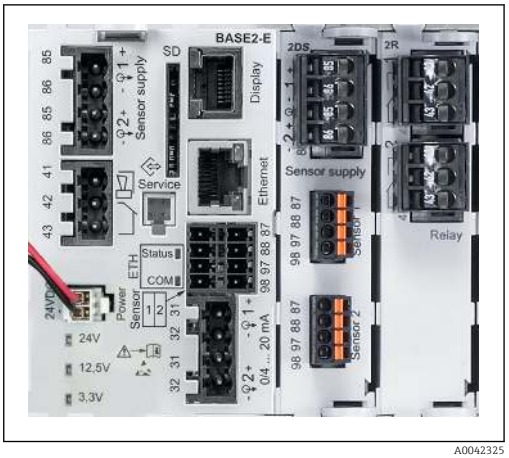
ChemocleanPlus

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

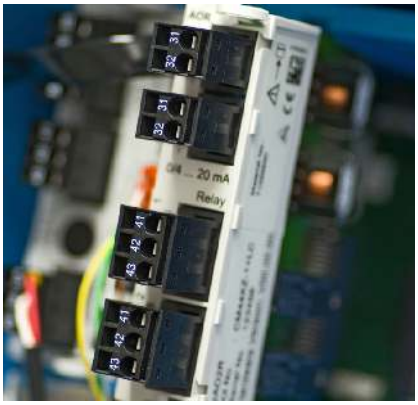
Modular design

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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12 CM444R: example

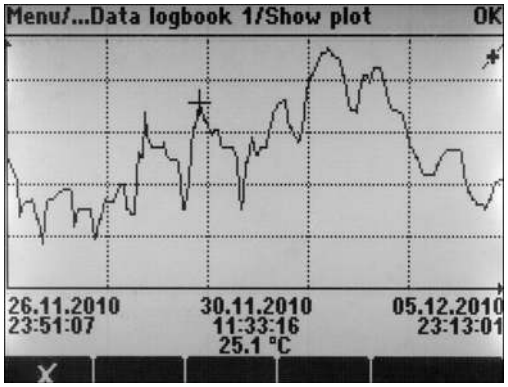


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13 Extension module

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



14 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 industrial quality SD cards, 1 to 32 GB and with 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.

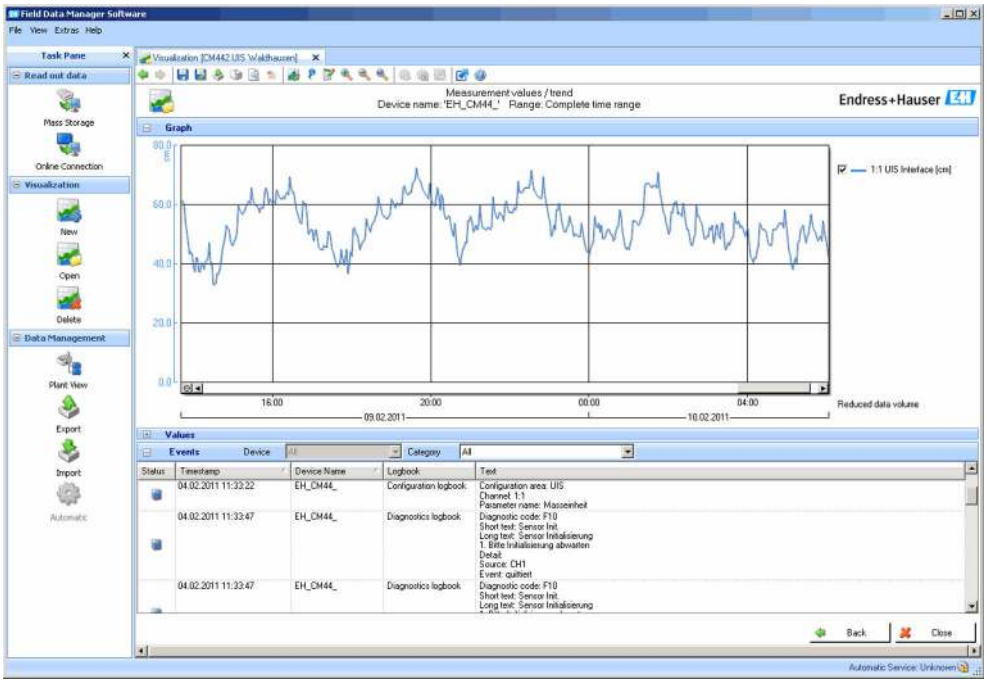
External signals for device control and for activating external devices

Hardware options, e.g. the "DIO" module with 2 digital inputs and 2 digital outputs or fieldbus module 485DP/485MB 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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15 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 from the measured values of a pH sensor and an ORP sensor
- Calculation of the remaining capacity of a cation exchanger
- Calculation of the combined chlorine concentration. This calculation involves subtracting the free chlorine concentration from the total chlorine concentration. This requires both a sensor for free chlorine CCS51E and a sensor for total chlorine CCS53E.
- 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)

Security

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

The manufacturer warranty is valid only if the product is installed and used as described in the Operating Instructions. The product is equipped with security mechanisms to protect it against any inadvertent changes to the settings.

IT security measures, which provide additional protection for the product 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

Input types

- Digital sensor inputs for sensors with Memosens protocol
- Analog current inputs (optional)
- Digital inputs (optional)
- Digital sensor inputs for intrinsically safe sensors with Memosens protocol and Ex approval (optional)

Input signal

Depending on version:
- Without sensor communication module 2DS Ex-i: max. 8 x binary sensor signal
- With sensor communication module 2DS Ex-i: max. 6 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

- Without sensor communication module 2DS Ex-i: Memosens data cable CYK10 or sensor fixed cable, each with cable end sleeves or M12 circular plug (optional)
- With sensor communication module 2DS Ex-i: Memosens data cable CYK10 or sensor fixed cable, each with cable end sleeves

Only Memosens data cables CYK10 with an appropriate approval may be connected to the intrinsically safe digital sensor inputs of the sensor communication module 2DS Ex-i.

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 specifications

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 above 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 by means of configuration tool (e.g. Siemens PRONETA)
IP address	Via DCP protocol by means of 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 specifications

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 specifications	**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 specifications

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
Device database files (GSD files)	www.endress.com/profibus Device Integration Manager DIM
Output variables	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!

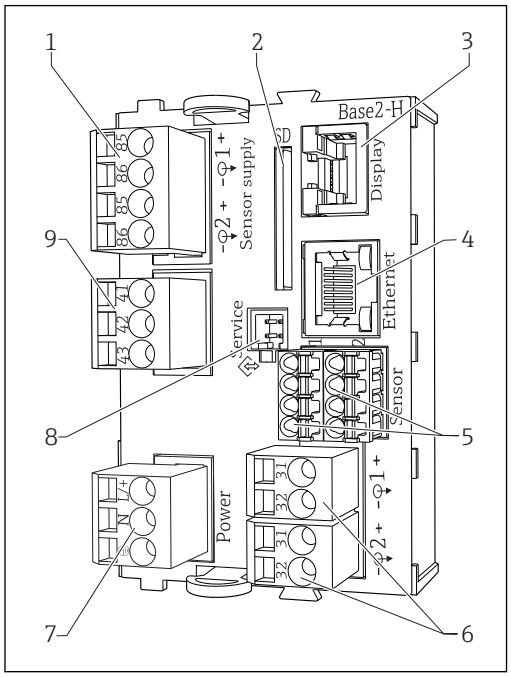
- ▶ Provide a protected circuit breaker in the vicinity of the device at the place of installation.
- ▶ The circuit breaker must be a switch or power switch, and must be labeled as the circuit breaker for the device.
- ▶ Secondary circuits must be separated from mains supply circuits by reinforced insulation or double insulation.

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	Overvoltage protection: integrated protection against transient overvoltages according to EN 61326-1 (Table 2, industrial environment) Additional overvoltage protection in accordance with EN 61643-21: The Endress+Hauser HAW562 overvoltage protection device can be installed on a DIN rail to protect the electronics against damage caused by overvoltage in the supply lines.
Cable specification for optional display cable	**Length of display cable provided:** 3 m (10 ft) **Maximum permitted length of a display cable:** 3 m (10 ft)

Electrical connection

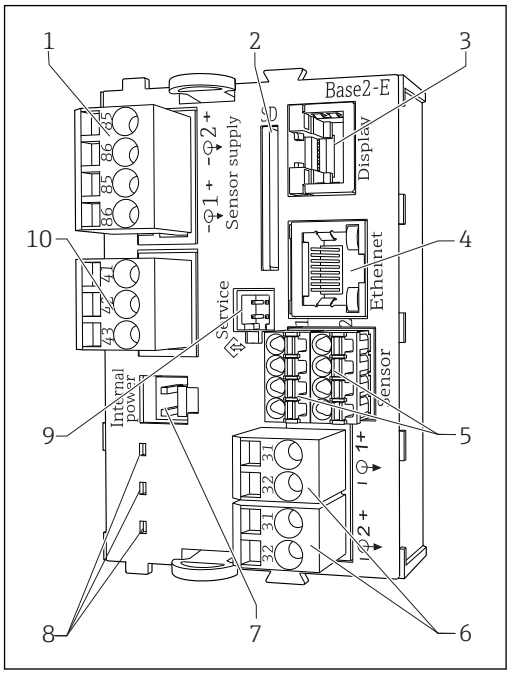
Basic module



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16 *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*



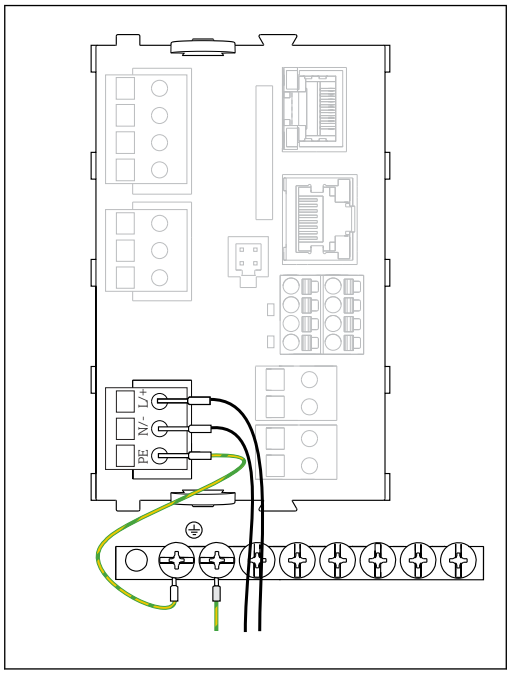
A0040640

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

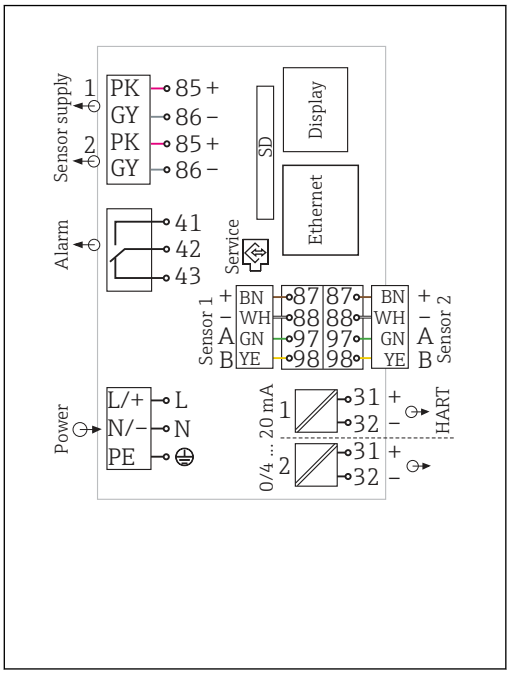
1 *Power supply for digital fixed cable sensors with Memosens protocol*
2 *SD card slot*
3 *Slot for display cable* [1)]
4 *Ethernet interface*
5 *Connections for 2 Memosens sensors*
6 *Current outputs*
7 *Socket for internal power supply cable* [2)]
8 *LEDs*
9 *Service interface*
10 *Alarm relay connection*

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

Connecting the supply voltage for CM442R



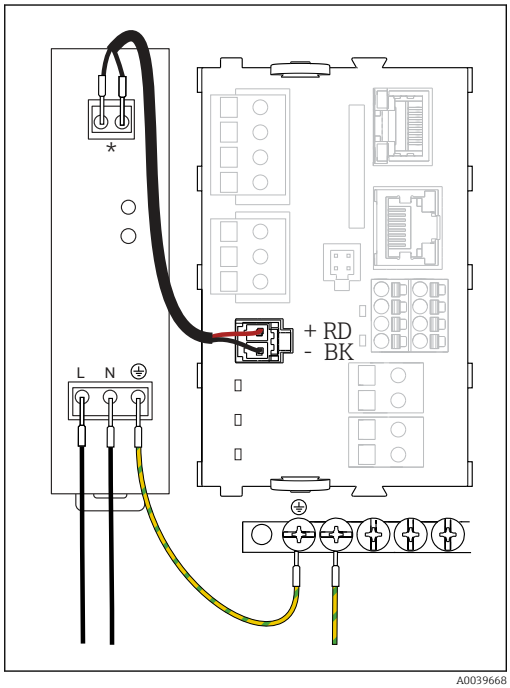
18 *Connecting the power supply using the example of the BASE2-H or -L*



19 *Complete wiring diagram using the example of the BASE2-H or -L*

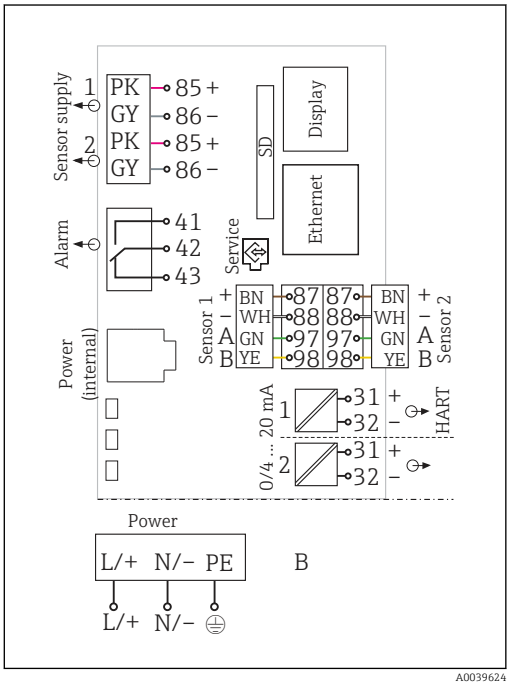
H Power unit 100 to 230 VAC
L Power unit 24 VAC or 24 VDC

Connecting the supply voltage for CM444R and CM448R



20 *Connecting the power supply using the example of the BASE2-E*

* *Assignment depends on power supply unit; make sure it is correctly connected.*



21 *Complete wiring diagram using the example of the BASE2-E and external power supply unit (B)*

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 instructions supplied for the power unit.

Connecting optional modules

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

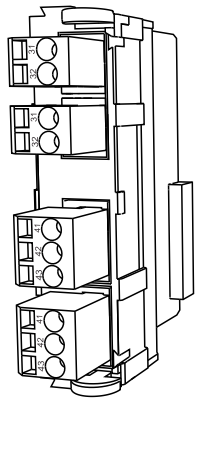
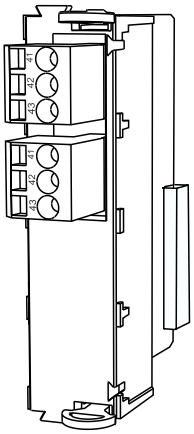
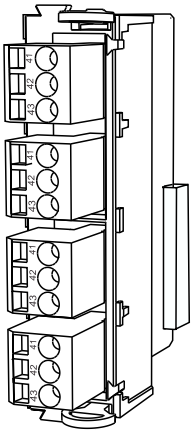
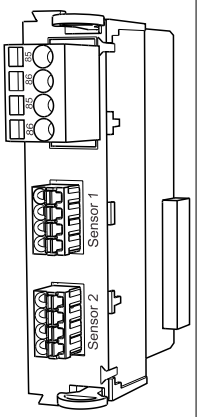
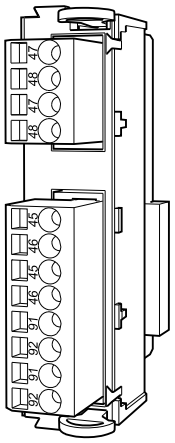
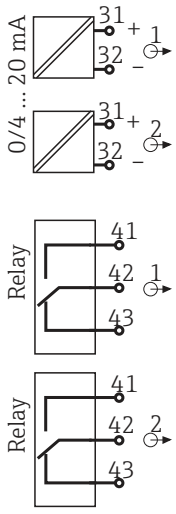
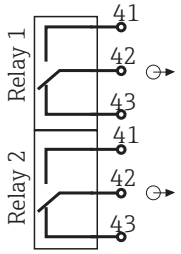
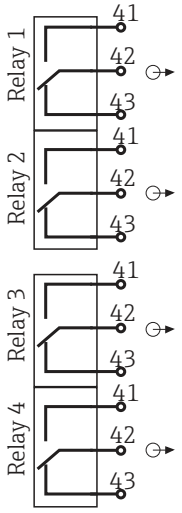
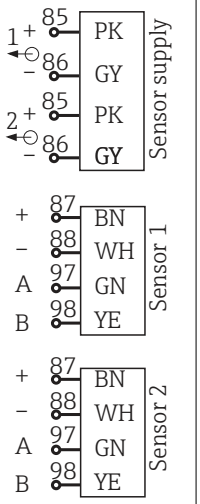
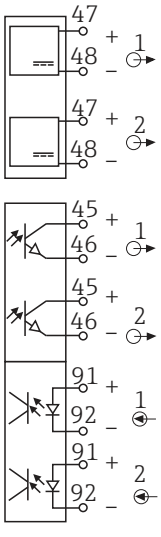
NOTICE

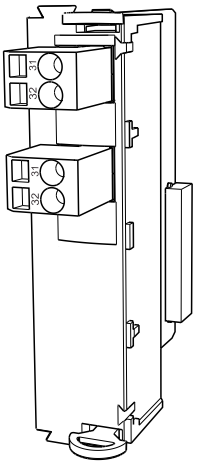
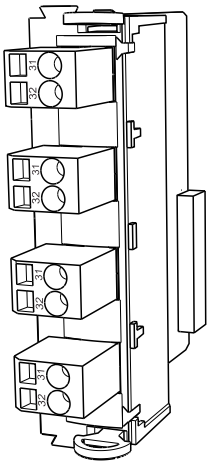
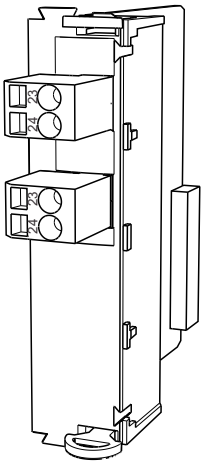
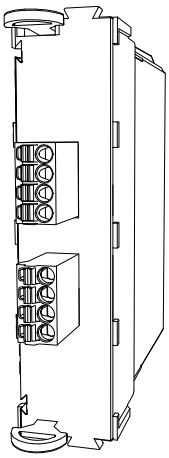
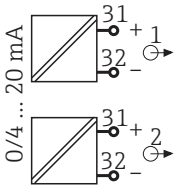
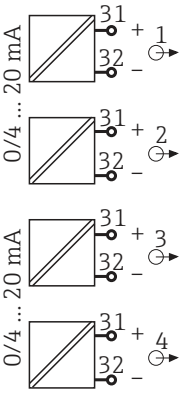
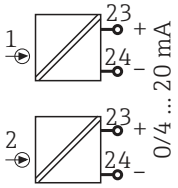
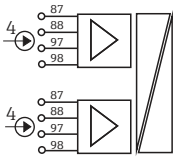
Unacceptable hardware combinations (due to conflicts in power supply)

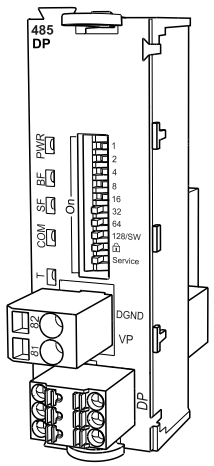
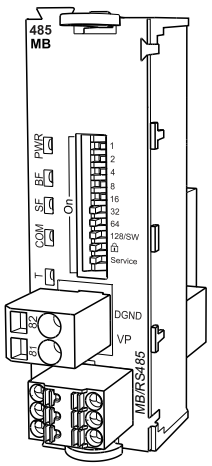
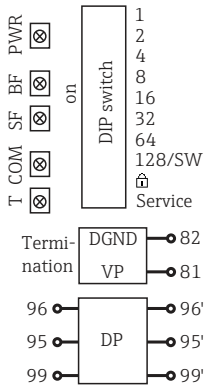
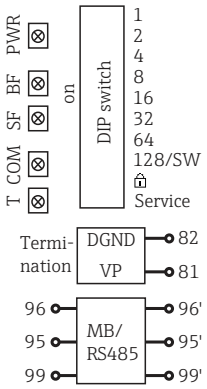
Incorrect measurements or total failure of the measuring point as a result of heat build-up or overloading

- ▶ Find out whether the planned extension for your transmitter results in a permitted hardware combination (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

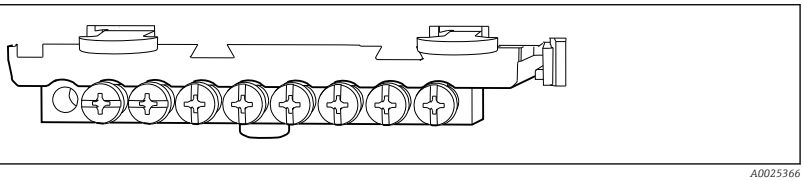
Module name				
AOR	**2R**	**4R**	**2DS**	**DIO**
 A0025110	 A0025111		 A0025113	 A0025114
▪ 2 x 0/4 to 20 mA analog outputs ▪ 2 relays ▪ Order No. 71111053	▪ 2 relays ▪ Order No. 71125375	▪ 4 relays ▪ Order No. 71125376	▪ 2 digital sensor inputs ▪ 2 power supply systems for digital sensors ▪ Order No. 71135631	▪ 2 digital inputs ▪ 2 digital outputs with auxiliary voltage ▪ Order No. 71135638
 A0033234	 A0033235	 A0025125	 A0025128	 A0025129

Module name			
2AO	**4AO**	**2AI**	**2DS Ex-i**
 A0025132	 A0025133	 A0025135	 A0046513
▪ 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	▪ 2 intrinsically safe digital inputs for Memosens sensors with Ex approval ▪ Inputs on BASE2 module are disabled ▪ Module 2DS EX-i is equipped in the right slot of the device ▪ Order No. 71477718
 A0025137	 A0025138	 A0025139	 A0046512

Module name	
485DP	**485MB**
 A0050399	 A0050401
▪ 5V power supply for PROFIBUS DP termination ▪ RS485 (PROFIBUS DP) ▪ Order No. 71575177	▪ RS485 (Modbus RS485) ▪ Order No. 71575178
 A0050400	 A0050402

PROFIBUS DP (module 485DP)
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


A0025366

22 *Mounting rail for functional ground connections*

Sensor connection

Sensor types with Memosens protocol for non-hazardous area

Sensors with Memosens protocol

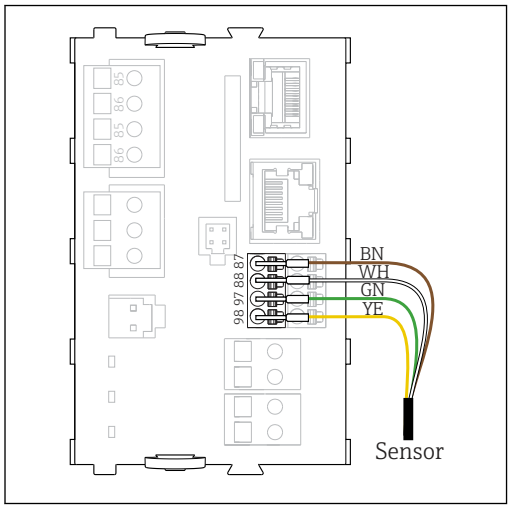
Sensor types	Sensor cable	Sensors
Digital sensors **without** additional internal power supply	With plug-in connection and inductive signal transmission	▪ pH sensors ▪ ORP sensors ▪ Combined sensors ▪ Oxygen sensors (amperometric and optical) ▪ Conductivity sensors with conductive measurement of conductivity ▪ 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:

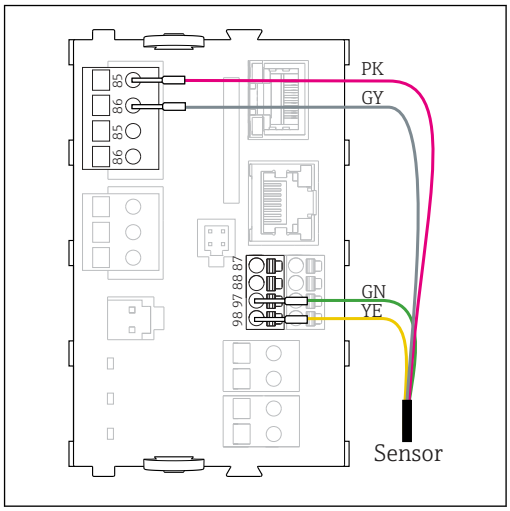
- CM442R
  - Only one CUS71D is possible; an additional sensor is not permitted.
  - The second sensor input may also not be used for another type of sensor.
- CM444R
  No restrictions. All the sensor inputs can be used as required.
- CM448R
  - If a CUS71D is connected, the number of sensor inputs that 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

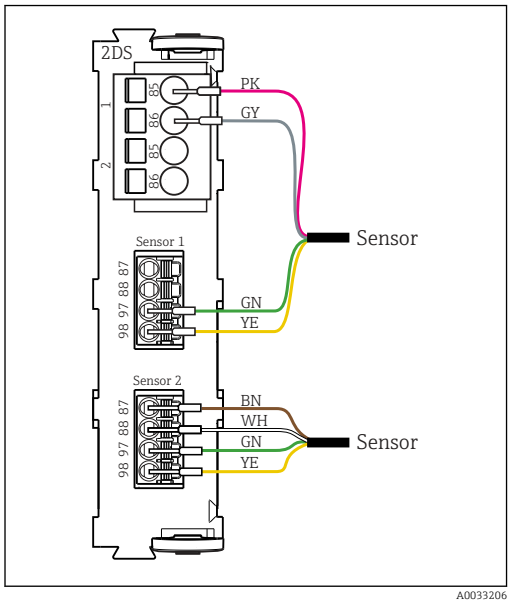
Direct connection of the sensor cable to the terminal connector of the sensor module 2DS or the base module-L, -H or -E (→ 🖹 23 ff.)



23 *sensors without additional supply voltage*



24 *sensors with additional supply voltage*



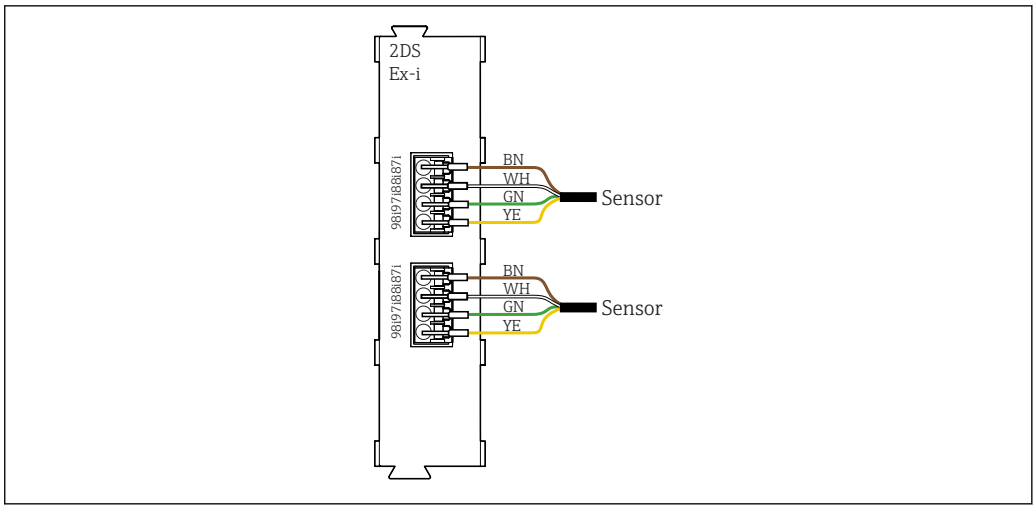
25 *Sensors with and without additional supply voltage at sensor module 2DS*

Single-channel device:
The left Memosens input on the base module must be used!

Connecting intrinsically safe sensors to sensor communication module type 2DS Ex i

Sensor cable connected directly

- Connect the sensor cable to the terminal connector of the sensor communication module 2DS Ex-i.



26 Sensors without additional supply voltage at sensor communication module type 2DS Ex-i

Intrinsically safe sensors for use in explosive atmospheres may only be connected to the sensor communication module type 2DS Ex-i. Only the sensors covered by the certificates may be connected (see XA).

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)
Measurement error for sensor inputs	→ Documentation of the connected sensor
Measurement 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

Installing on DIN rail as per IEC 60715

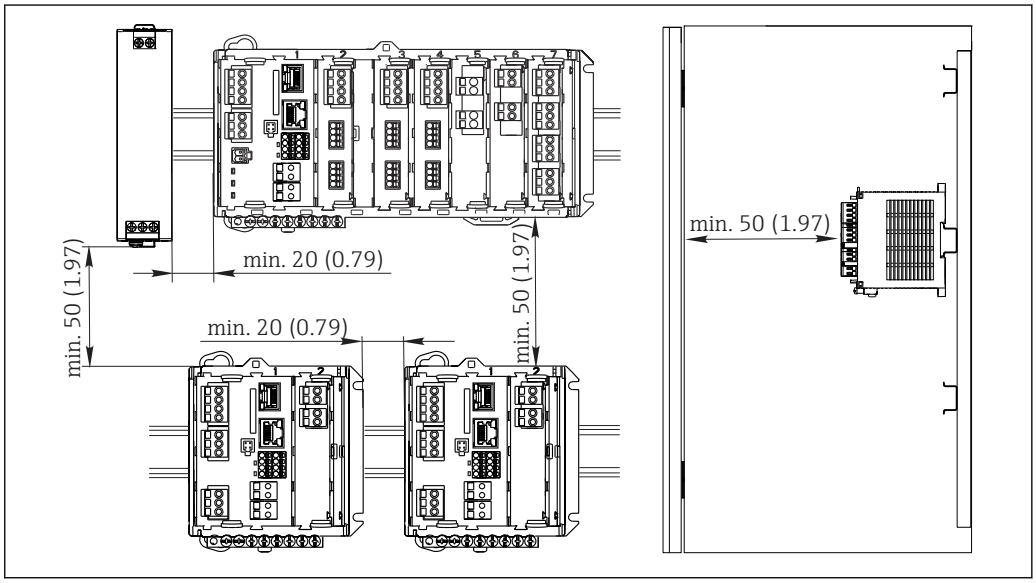
NOTICE

Incorrect mounting location in the cabinet, spacing regulations not observed

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

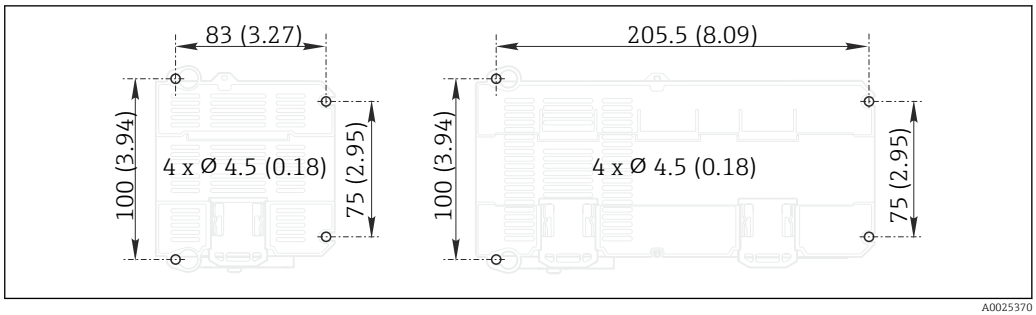
- ▶ Do not position the device directly above sources of heat. The temperature specification must be observed.
- ▶ The components are designed for convection-based cooling. Avoid heat buildup. Ensure openings are not covered, e.g. by cables.
- ▶ Observe the specified distances to other devices.
- ▶ Physically 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)



27 *Minimum clearance in mm (in)*

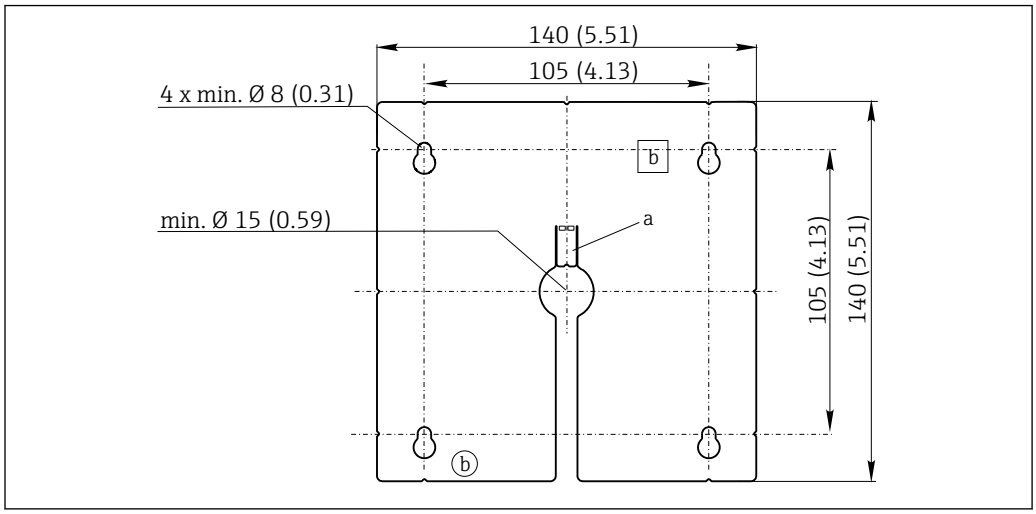
Wall mounting



28 *Drilling pattern for wall mounting in mm (in)*

Mounting the external display

The mounting plate also serves as the drilling template. The side markings are used to mark the drill holes.



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

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

Environment

Ambient temperature

CM442R
- 0 to 60 °C (32 to 140 °F)
- 0 to 50 °C (32 to 122 °F) for the following devices:
  - CM442R-BM
  - CM442R-IE
  - CM442R-CL
  - CM442R-UM

CM444R
- Generally 0 to 55 °C (32 to 131 °F), with the exception of packages under the second point in the list
- 0 to 50 °C (32 to 122 °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*+...
  - CM444R-BM
  - CM444R-IE
  - CM444R-CL
  - CM444R-UM

CM448R
- Generally 0 to 55 °C (32 to 131 °F), with the exception of packages under the second point in the list
- 0 to 50 °C (32 to 122 °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*+...
  - CM448R-BM
  - CM448R-IE
  - CM448R-CL
  - CM448R-UM

External display (optional)
−20 to 60 °C (-4 to 140 °F)

Storage temperature

−25 to 85 °C (−13 to 185 °F)

Relative humidity

DIN rail device
5 to 85%, not condensing

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

Degree of protection

DIN rail device
IP20

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 according to DIN EN 60068-2
Vibration test according to DIN EN 60654-3

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 ... acceleration due to gravity (1 g ≈ 9.81 m/s^2)

Electromagnetic compatibility

Interference emission and interference immunity as per EN 61326-1, class A for industrial areas

Electrical safety

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

Pollution degree

DIN rail device

The product is suitable for pollution degree 2.

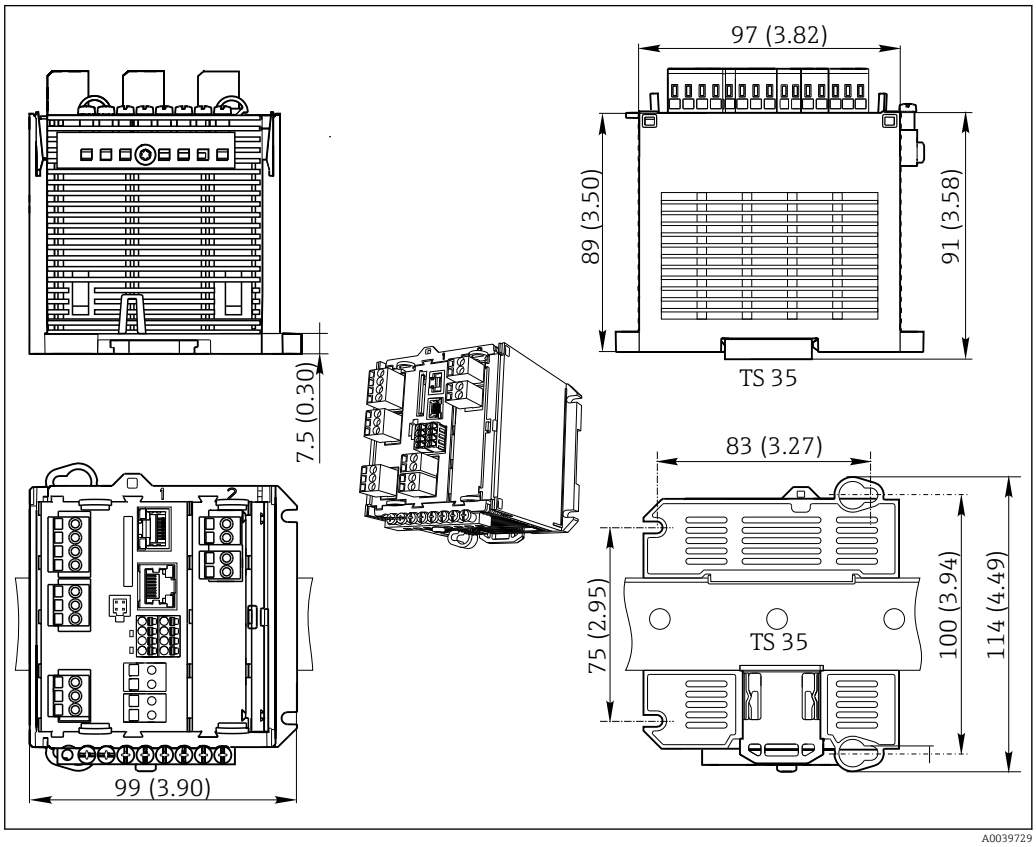
Optional display

The product is suitable for pollution degree 4.

Mechanical construction

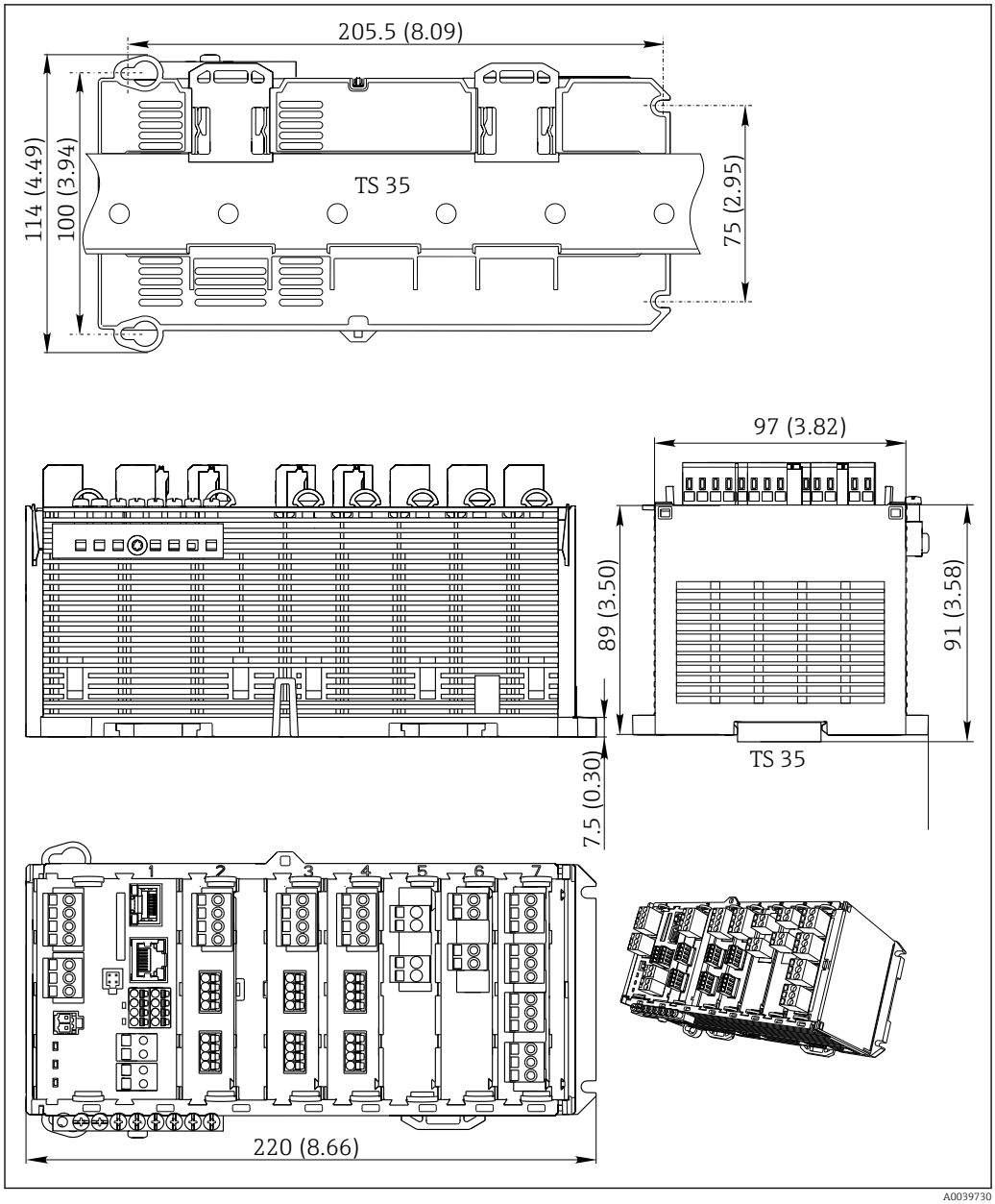
Dimensions

CM442R



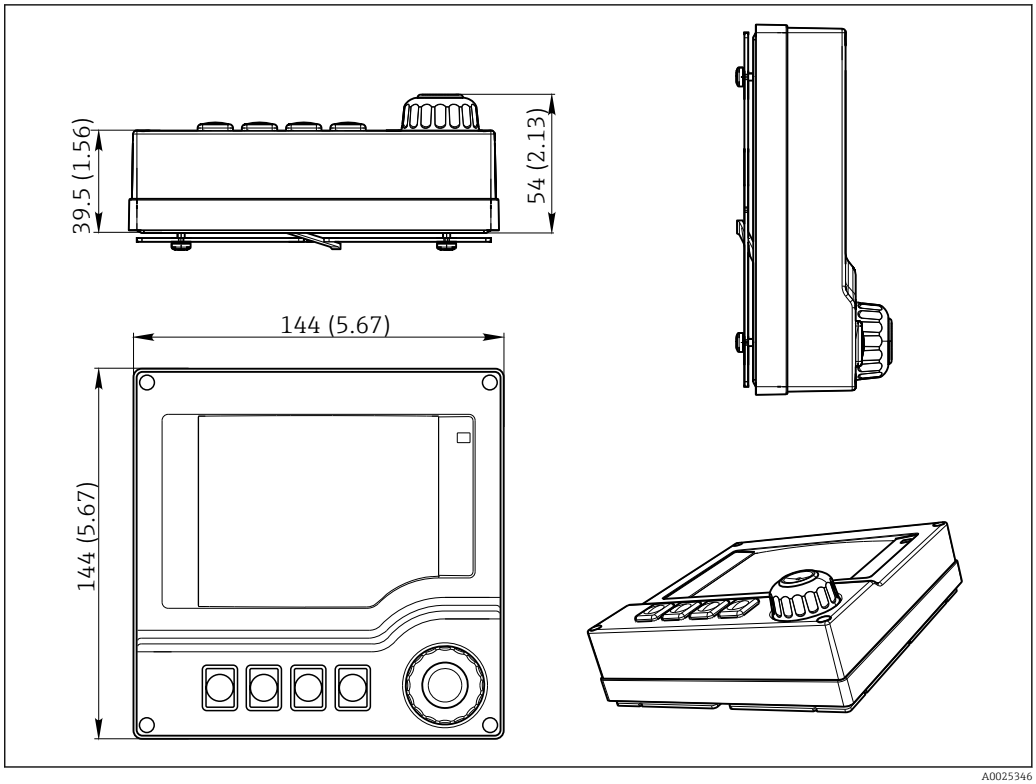
30 Dimensions in mm (inch)

CM444R and CM448R



31 Dimensions in mm (inch)

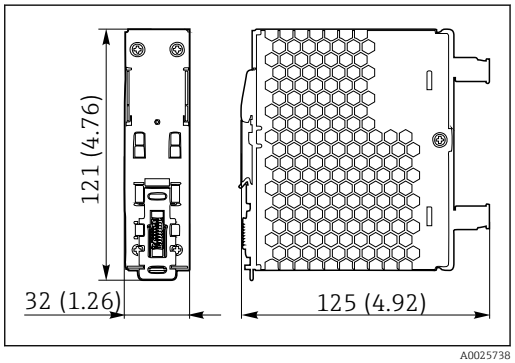
Optional display



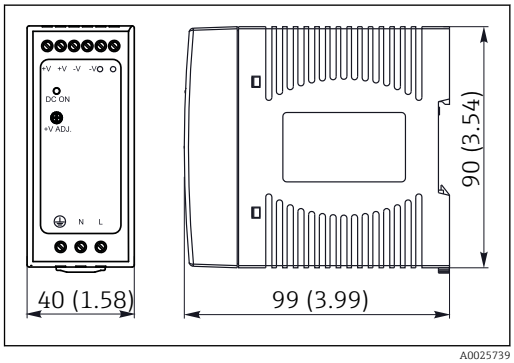
32 Dimensions in mm (inch)

External power units (CM444R and CM448R only)

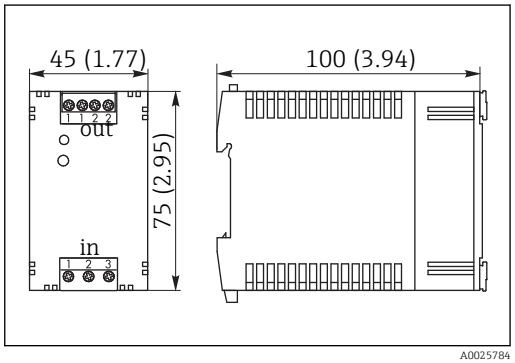
Depending on the version ordered, a power unit for connection to 230 V or 24 V is supplied. There are two delivery variants for each version (cannot be selected). The factory-preferred variant is shown on the left in each case.



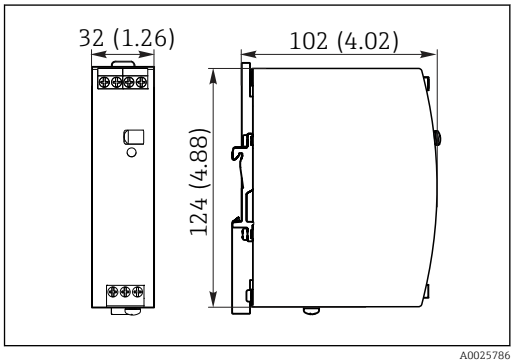
33 Power unit 230 V



34 Power unit 230 V (optional)



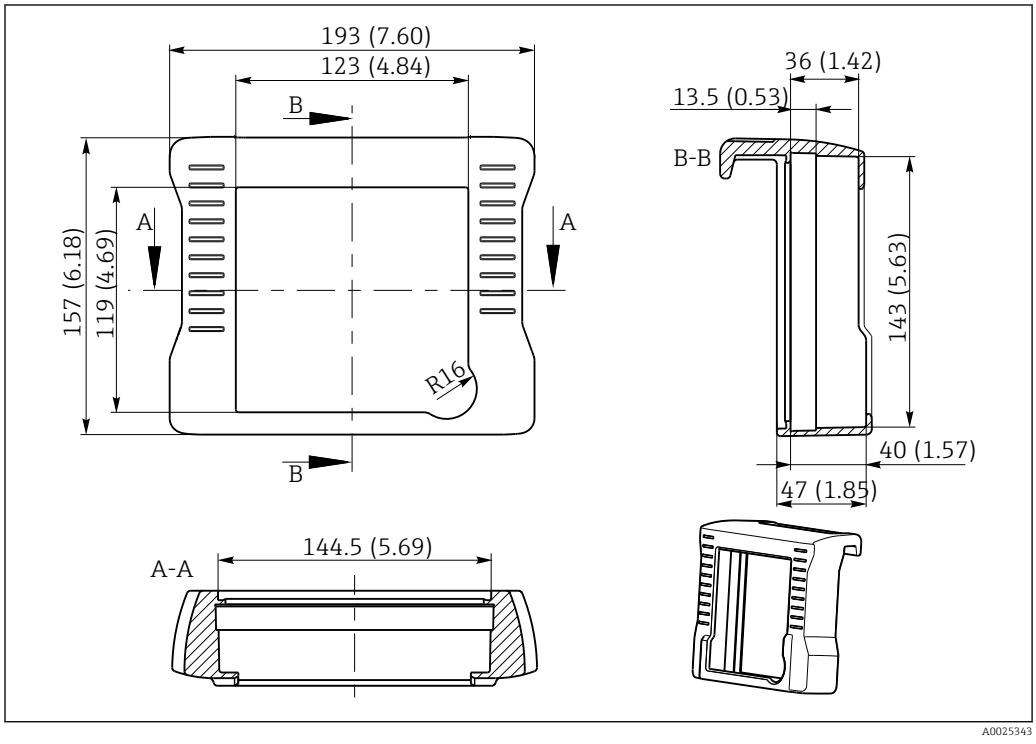
35 Power unit 24 V



36 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



37 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 plastic display (excluding cables)	Approx. 0.56 kg (1.2 lbs)
External stainless steel display (excluding cables)	Approx. 1.32 kg (2.91 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 (plastic)	PC-FR
Display cover (stainless steel)	Stainless steel 1.4408
Display seal	EPDM
Soft keys	EPDM
Module housing 2DS Ex-i	PC-PBT
Module covers	PBT GF30 FR
Terminal strip	Nickel-plated brass
Ground terminals	Stainless steel 1.4301 (AISI304)
Screws	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

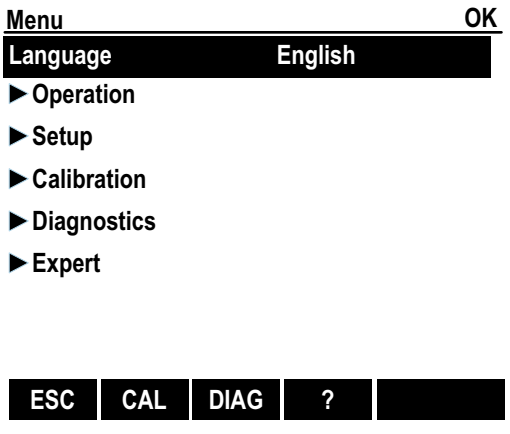
Operation concept

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

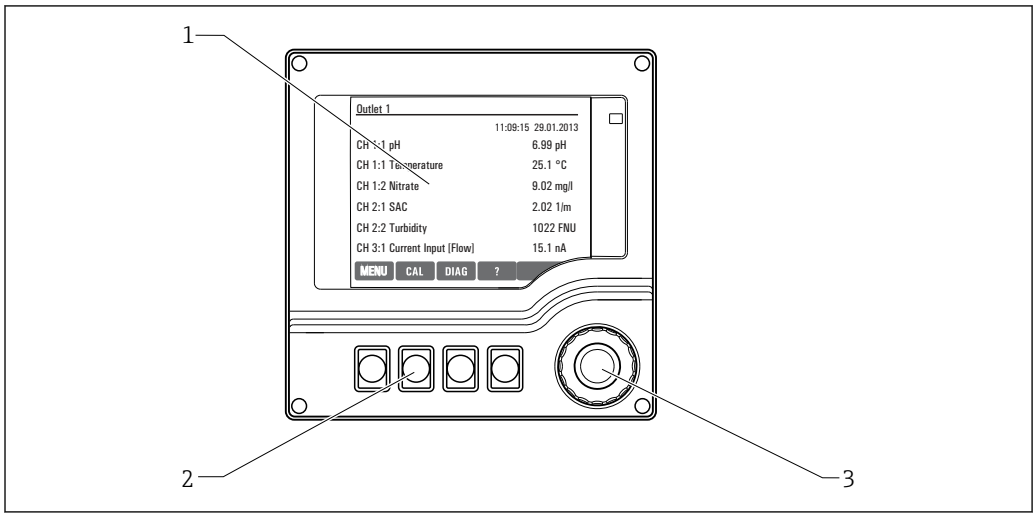
38 Operation via external, optional display



A0061175

39 Plain-text menu

Local operation via external, optional display

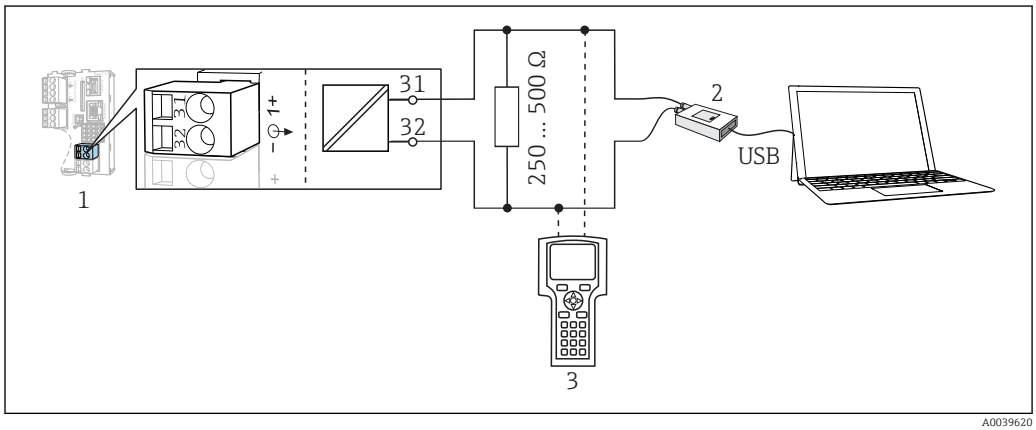


40 Overview of operation

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)



41 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)

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

Current certificates and approvals for the product are available at www.endress.com on the relevant product page:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Downloads**.

Ordering information

Product page

www.endress.com/cm442r

www.endress.com/cm444r

www.endress.com/cm448r

Product Configurator

1. **Configure**: Click this button on the product page.
2. Select **Extended selection**.
   ↳ The Configurator opens in a separate window.
3. Configure the device according to your requirements by selecting the desired option for each feature.
   ↳ In this way, you receive a valid and complete order code for the device.
4. **Add to cart**: Add the configured product to the shopping cart.

For many products, you also have the option of downloading CAD or 2D drawings of the selected product version.

5. **CAD**: Open this tab.
   ↳ A drawing window is displayed. You have a choice between different views. You can download these in selectable formats.

Scope of delivery

The scope of delivery comprises:
- 1 multichannel transmitter 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 the DIN rail power unit
- 1 printed copy of the Brief Operating Instructions in the language ordered
- Separation element (pre-installed on hazardous area version type 2DS Ex-i)
- Safety instructions for the hazardous area (for hazardous area version type 2DS Ex-i)
- Terminal strip

Accessories

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

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

Listed accessories are technically compatible with the product in the instructions.

1. Application-specific restrictions of the product combination are possible.
   Ensure conformity of the measuring point for the application. This is the responsibility of the operator of the measuring point.
2. Pay attention to the information in the instructions for all products, particularly the technical data.
3. For accessories not listed here, please contact your Service or Sales Center.

Device-specific accessories

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

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 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
- With ion trap for poison-resistant reference
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps71e

Technical Information TI01496C

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 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 CPS61E
- pH sensor for bioreactors in life sciences and for the food industry
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps61e

Technical Information TI01566C

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

Memosens CPS72E
- ORP sensor for chemical process applications
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps72e

Technical Information TI01576C

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

Memosens CPS92E
- ORP sensor for use in heavily polluted media
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps92e

Technical Information TI01577C

Memosens CPS62E
- ORP sensor for hygienic and sterile applications
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps62e

Technical Information TI01604C

pH ISFET sensors

Memosens CPS47E
- ISFET sensor for pH measurement
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps47e

Technical Information TI01616C

Memosens CPS77E
- Sterilizable and autoclavable ISFET sensor for pH measurement
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps77e

Technical Information TI01396

Memosens CPS97E
- ISFET sensor for pH measurement
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps97e

Technical Information TI01618C

Combined pH/ORP 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 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 CLS54D
- Inductive conductivity sensor
- With certified, hygienic design for food, beverages, pharmaceuticals, and biotechnology
- Product configurator on the product page: www.endress.com/cls54d

Technical Information TI00508C

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

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 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

Disinfection sensors

Memosens CCS51D
- Sensor for measuring free available chlorine
- Product Configurator on the product page: www.endress.com/ccs51d

Technical Information TI01423C

ISE 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

Spectrometer sensors

Memosens Wave CAS80E
- Measurement of various parameters in liquid media
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cas80e

Technical Information TI01522C

Fluorescence sensors

Memosens CFS51
- Sensor for fluorescence measurement
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cfs51

Technical Information TI01630C

Communication-specific accessories

Device Care SFE100
- Configuration of Endress+Hauser devices
- Fast and easy installation, online application updates, one-click connection to devices
- Automatic hardware identification and driver catalog update
- Device configuration with DTMs

Technical Information Device Care SFE100, TI01134S

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

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

Field Data Manager Software MS20/21
- 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

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

Service-specific accessories

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 2DS Ex-i
- 2 x digital sensor, Memosens, Ex approval
- Order No. 71477718

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

Upgrade kit, extension module 485DP
- Extension module 485DP
- PROFIBUS DP
- Order No. 71575177

Upgrade kit, extension module 485MB
- Extension module 485MB
- Modbus RS485
- Order No. 71575178

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.

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

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 mathematics
- Formula editor
- Order No. 71367541

Activation code for Ethernet/IP and web server
Order No. XPC0018

Activation code for Modbus TCP and web server
Order No. XPC0020

Activation code for web server for BASE2
Order No. XPC0021

Activation code for PROFINET and web server Base2
Order No. XPC0022

Activation code for HART
Order No. XPC0023

Activation code for Profibus DP for module 485
Order No. XPC0024

Activation code for module 485 Modbus RS485
Order No. XPC0025

Activation code for Liquiline inputs/outputs
Order No. XPC0026

Activation code for additional functions
Order No. XPC0027

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

Other accessories

External display [3)]

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

Graphic display, stainless steel
- For installation in the control cabinet door or panel
- Order No. 71749101

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

SD card
- Industrial Flash Drive, 1 GB
- Order number: 71110815

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



www.addresses.endress.com

Endress+Hauser

People for Process Automation