

Technical Information

Liquiline CM442/CM444/CM448

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



Extensible multiparameter controller for monitoring and controlling processes in industry and the environmental sector

Application

- Possible to connect up to 8 Memosens sensors
- Mathematic functions calculate new measured values
- Max. 8 analog outputs 0/4 to 20 mA
- Digital fieldbuses (HART, PROFIBUS, Modbus, Ethernet/IP) and integrated web server
- Selectable: cleaning function, controller and alarm relay
- Optional digital inputs/outputs or current inputs for signal transmission from other devices

The rugged non-Ex plastic version is tailored to:

- Water and wastewater
- Power stations
- Chemical industry
- Other industrial applications

Your benefits

- Maximum process safety thanks to:
 - Simple and transparent menu guidance via a graphic display
 - Standardized operating concept across all devices from the Liquiline, sampler and analyzer platform
- Fast commissioning thanks to:
 - Memosens: lab-calibrated sensors & hot plug-and-play
 - Preconfigured Liquiline transmitter
 - Easy to expand and adapt system to meet new requirements
- 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

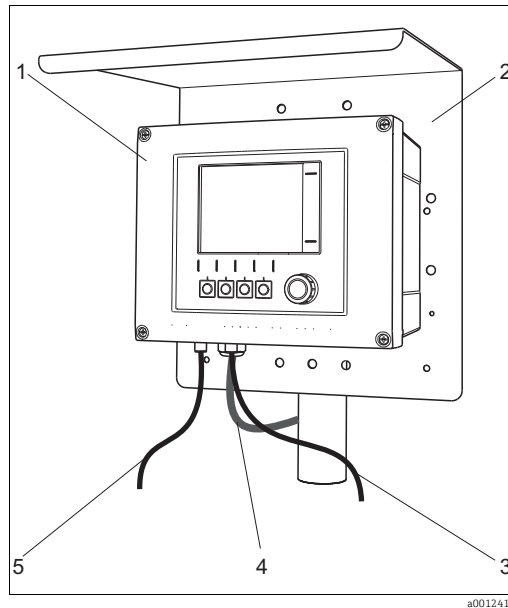
Measuring system

The following overview shows examples of the design and layout of a measuring system. Other sensors and assemblies can be ordered for conditions specific to your application (--> www.endress.com/products).

Measuring point

A complete measuring system consists of:

- Liquiline transmitter
- Sensors with Memosens technology
- Assemblies to suit the sensors used
- Post or rail mounting (optional)
- Weather protection cover (optional)



Measuring system (e.g. two-channel device)

- 1 Liquiline
- 2 Weather protection cover CYY101 (optional)
- 3, 5 Sensor cable CYK10 or fixed cable (digital fixed cable sensors with Memosens protocol)
- 4 Power supply cable (to be provided by the customer, not part of the scope of supply)

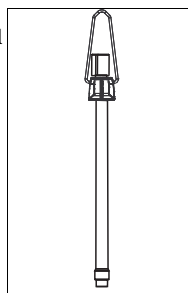
Nitrate and SAC

Nitrate in wastewater

- Sensor CAS51D-**A2 with fixed cable
- Assembly CYA112
- Holder CYH112

SAC in the wastewater treatment outlet

- Sensor CAS51D-**2C2 with fixed cable
- Assembly CYA112
- Holder CYH112

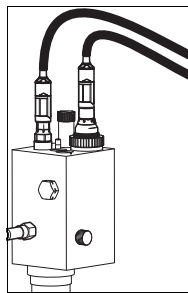


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Chlorine

Chlorine (and pH) in drinking water

- Sensor CCS142D
- Sensor CPS11D
- Measuring cable CYK10
- Flow assembly CCA250

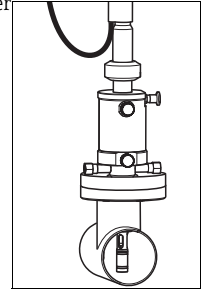


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pH value or ORP

pH measurement in drinking water

- Retractable assembly Cleanfit CPA471
 - Sensor Orbisint CPS11D
 - Measuring cable CYK10
- > graphic



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ORP in drinking water

- Immersion assembly Dipfit CYA112
- Sensor Orbisint CPS12D
- Measuring cable CYK10

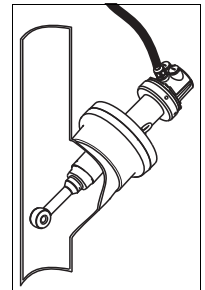
Conductivity

Inductive conductivity measurement in wastewater treatment

- Sensor Indumax CLS50D with fixed cable

Conductive conductivity measurement in power plant cooling water

- Sensor Condumax CLS15D



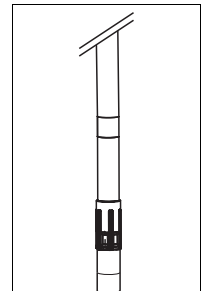
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Oxygen

Oxygen in aeration basins

- Immersion assembly Dipfit CYA112
- Holder CYH112
- Sensor
 - COS61D (optical) with fixed cable,
 - COS51D (amperometric) cable CYK10

Figure: CYA112 with COS61D



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Turbidity and interface

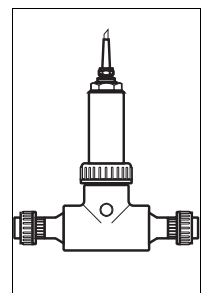
Turbidity in industrial water

- Sensor Turbimax CUS51D with fixed cable
- Assembly Flowfit CUA250
- Spray head CUR3 (optional)

Interface in the primary clarifier

- Sensor Turbimax CUS71D
- Assembly CYA112
- Holder CYH112

Figure: CUA250 with CUS51D

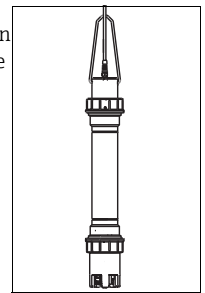


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Ion selective electrodes

Ammonium and nitrate measurement in the aeration basin

- Sensor CAS40D with fixed cable
- Holder CYH112



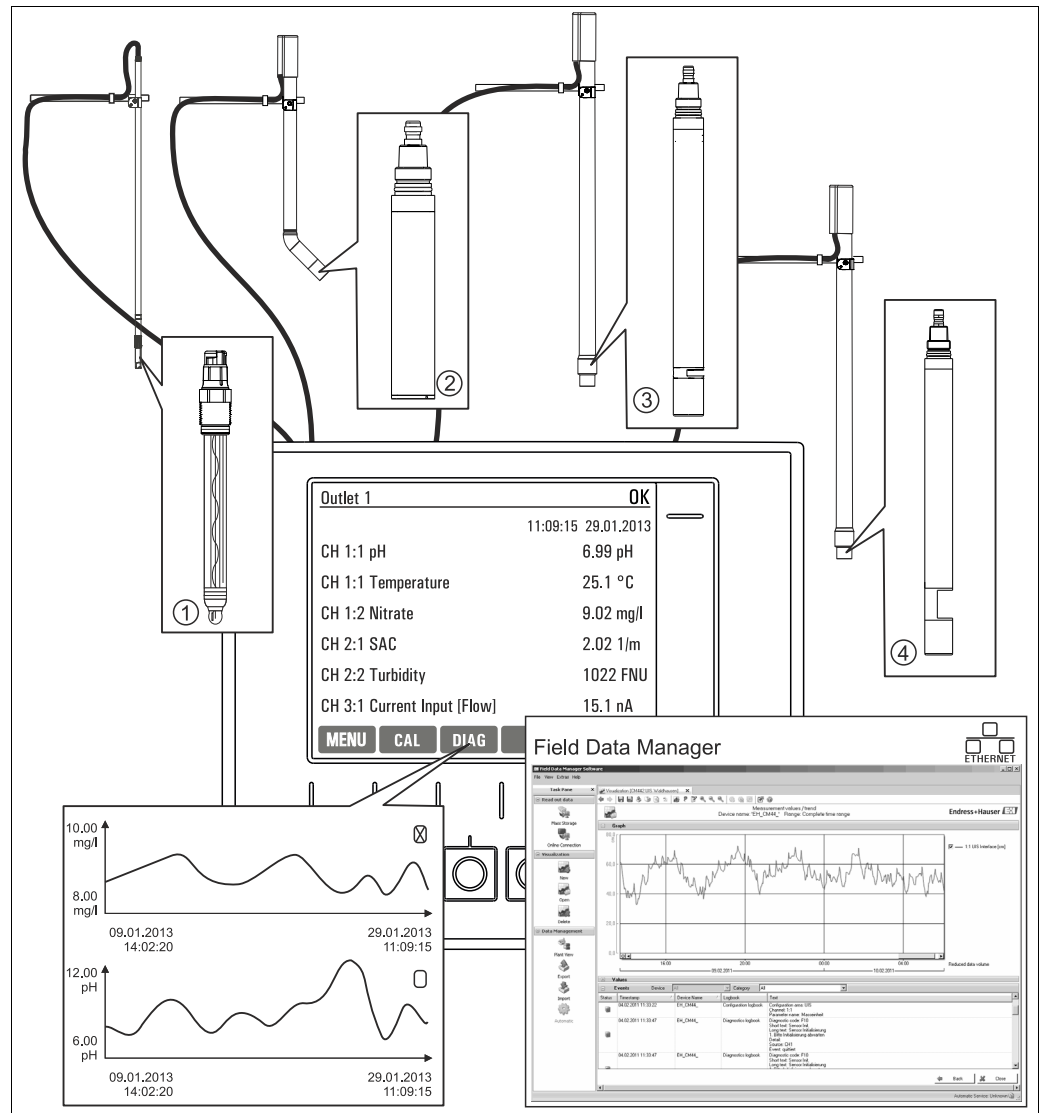
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If mounting outdoors, always use the weather protection cover (see "Accessories") to protect the transmitter against weather conditions.

Application example

Measuring point at wastewater treatment plant outlet (open channel)

- Transmitter CM444-AAM44A0FF with:
 - 4x Memosens, Modbus TCP, 4 x relays for cleaning/limit value, 2 x analog current input
- pH and temperature with CPS11D, item 1, (www.products.endress.com/cps11d)
- Turbidity with CUS51D, item 2, (www.products.endress.com/cus51d)
- Nitrate with CAS51D, item 3, (www.products.endress.com/cas51d)
- Spectral absorption coefficient with CAS51D, item 4, (www.products.endress.com/cas51d)
- Flow from external measurement via current input
- Assembly holder CYH112 with assemblies CYA112 (www.products.endress.com/cyh112)



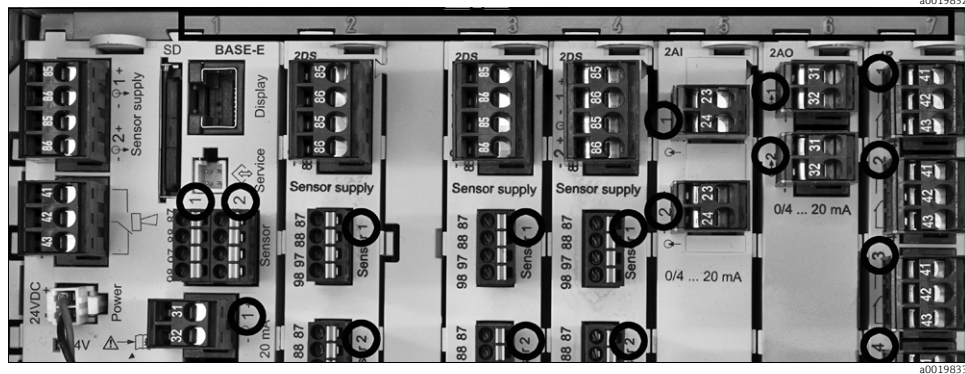
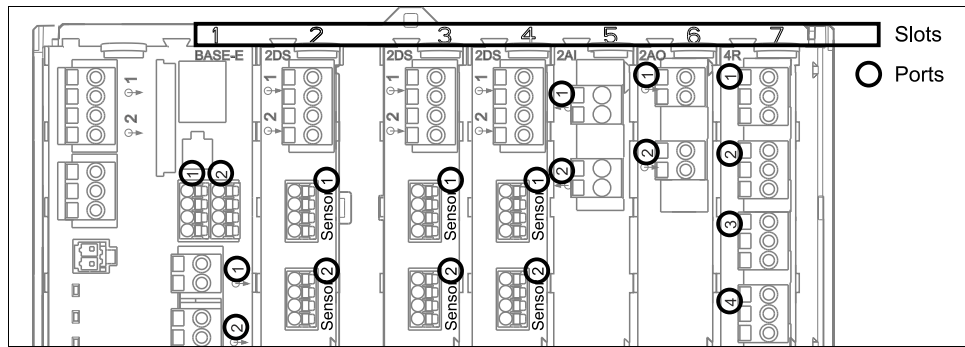
Measuring point at wastewater treatment plant outlet

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 and storage in a tamper-proof database (Field Data Manager)
- Data export to csv file (for Microsoft Excel)

Equipment architecture

Slot and port assignment



Slot and port assignment of the hardware modules

Outlet 1		OK
CH1: 1:1	pH Glass	ATC 6.95 pH
CH2: 1:2	TU/TS	500.0 g/l
CH3: 5:1	SAC	500.0 1/m
CH4: 5:2	Cond i	ATC 2.62 mS/cm
CH5: 6:1	Chlorine	28.33 mg/l
CH6: 6:2	Redox	± 51 mV
CH7: 7:1	Oxygen (am...)	32.86 mg/l
CH8: 7:2	Cond c	ATC 131.1 µS/cm
MENU CAL DIAG HOLD		

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 with the slot and port numbers in ascending order

Order of the modules

Depending on the version ordered, the device is supplied with a number of electronic modules, which are assigned in a specific sequence in ascending order to slots 0 to 7.

If you do not have a particular module, the next moves up automatically:

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

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

Basic rule for hardware upgrades

- i** Please note the following if upgrading the device:
The sum of all current inputs and outputs may not exceed 8!

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 find out which modules you get depending on the type and number of outputs.

Current outputs	Relay		
	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.
 - ↳ This will give you the slot assignment for your device.

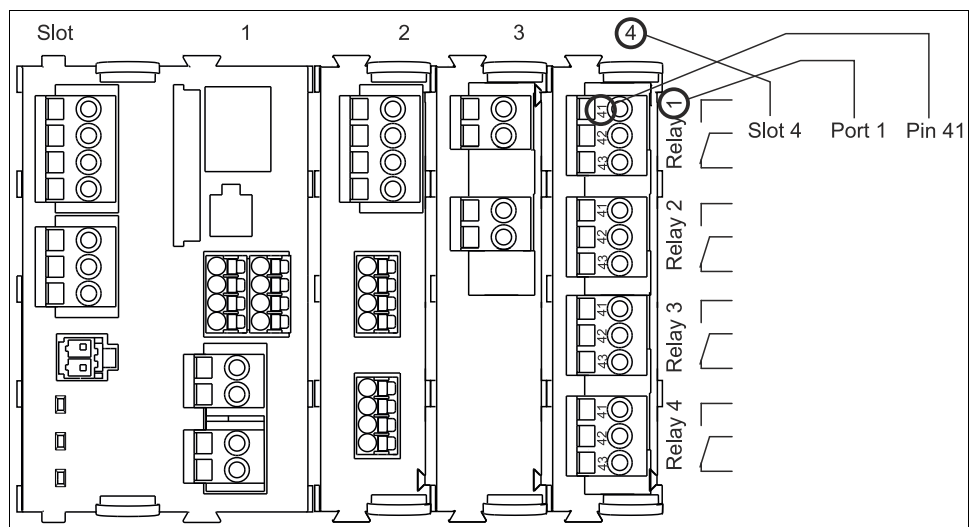
Terminal diagram

- The unique terminal name is derived from the following:
Slot no. : Port no. : Terminal

Example, NO contact of a relay:

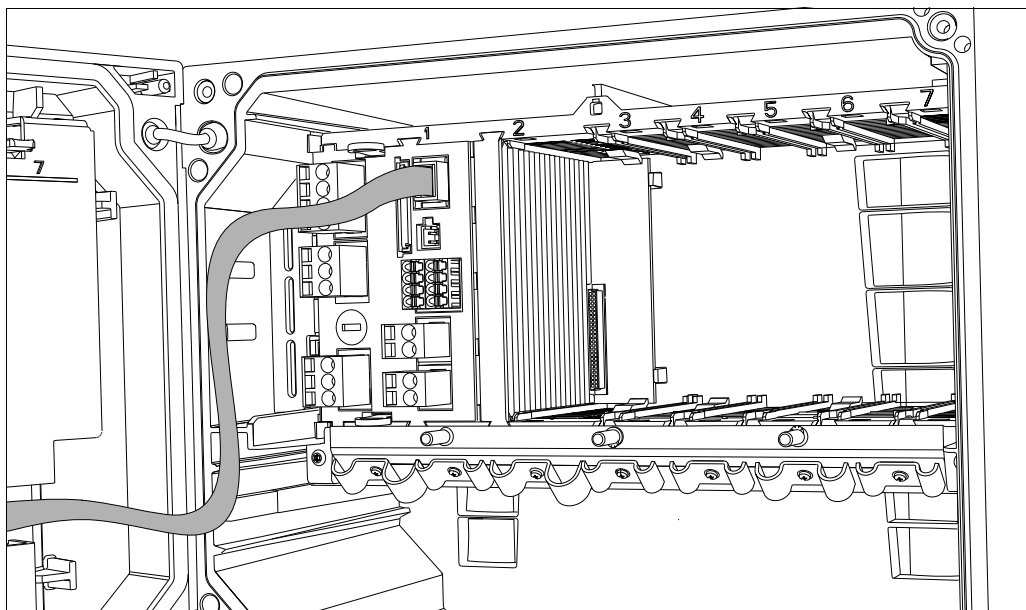
Device with 4 inputs for digital sensors, 4 current outputs and 4 relays

- Basic module BASE-E (contains 2 sensor inputs, 2 current outputs)
- Module 2DS (2 sensor inputs)
- Module 2AO (2 current outputs)
- Module 4R (4 relays)



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

Device configuration CM442
using the example of a
CM442-**M1A1F0*

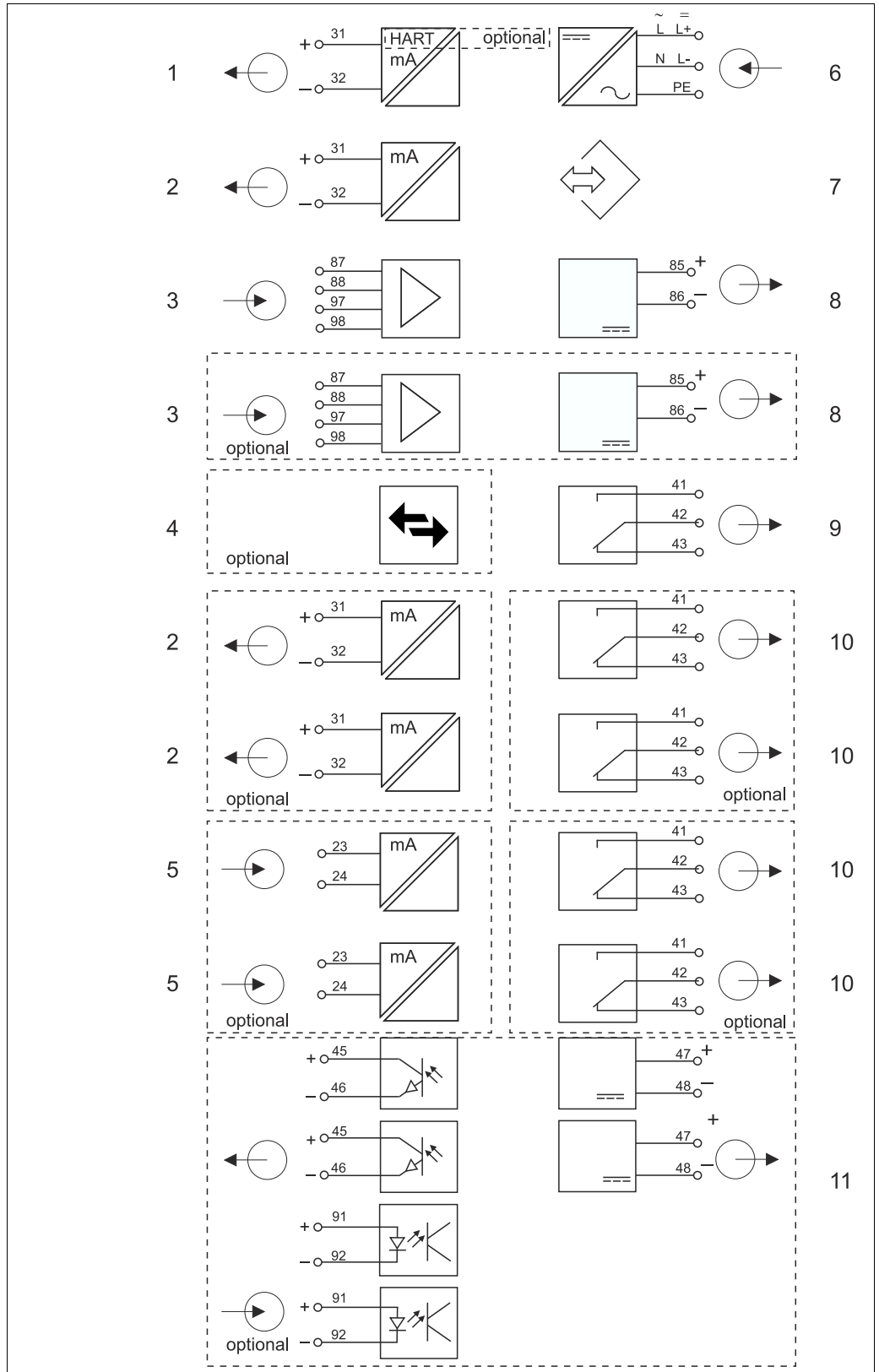


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CM442-**M1A1F0*

<p>Ordered basic device (example)</p>	<ul style="list-style-type: none"> ▪ Order code CM442-**M1A1F0* ▪ Functionality: 1 x Memosens, 2 current outputs without HART, no extension module
<p>Extension options without additional modules</p>	<ul style="list-style-type: none"> ▪ Second Memosens input (71114663) ▪ HART with activation code (71128428)
<p>Extension options by using an extension module in free slot 2</p>	<ul style="list-style-type: none"> ▪ Ethernet/PROFIBUS DP/Modbus with module 485 incl. activation code for the desired communication type: <ul style="list-style-type: none"> - PROFIBUS DP (71140888) - Modbus RS485 (71140889) - Modbus TCP (71140890) - EtherNet/IP (71219868) - Only Ethernet without fieldbus (71135634) If fieldbus communication is subsequently required, an activation code is needed for this. i If you retrofit a 485 module, any existing current outputs are disabled! ▪ Additional inputs or outputs, relays: <ul style="list-style-type: none"> - 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
<p>Device upgrade to CM444 or CM448</p>	<ul style="list-style-type: none"> ▪ Upgrade kit 71135644 (100 to 230 V AC) or 71211434 (24 V DC) <ul style="list-style-type: none"> - Extension power supply unit and backplane - Basic module BASE-E (Memosens inputs same as for base device) - 6 slots for extension modules ▪ Extension options: <ul style="list-style-type: none"> - Second Memosens input (71114663), additional modules same as for CM442 - Up to 8 measuring channels by using an appropriate number of Memosens input modules 2DS (71135631)
<p>Basic rule for extensions</p>	<p>The sum of all current inputs and outputs may not exceed 8!</p>
<p>Restrictions if using CUS71D sensors for interface measurement</p>	<ul style="list-style-type: none"> ▪ CM442: Only one CUS71D can be connected. The second Memosens input may not be used. ▪ If extending to CM444: Every combination of CUS71D or other sensors is possible. All Memosens inputs (max. 4) can be used. ▪ An extension to CM448 is not advisable as the maximum number of Memosens inputs remains limited to 4.
<p>Product Configurator</p>	<p>www.products.endress.com/cm442</p>

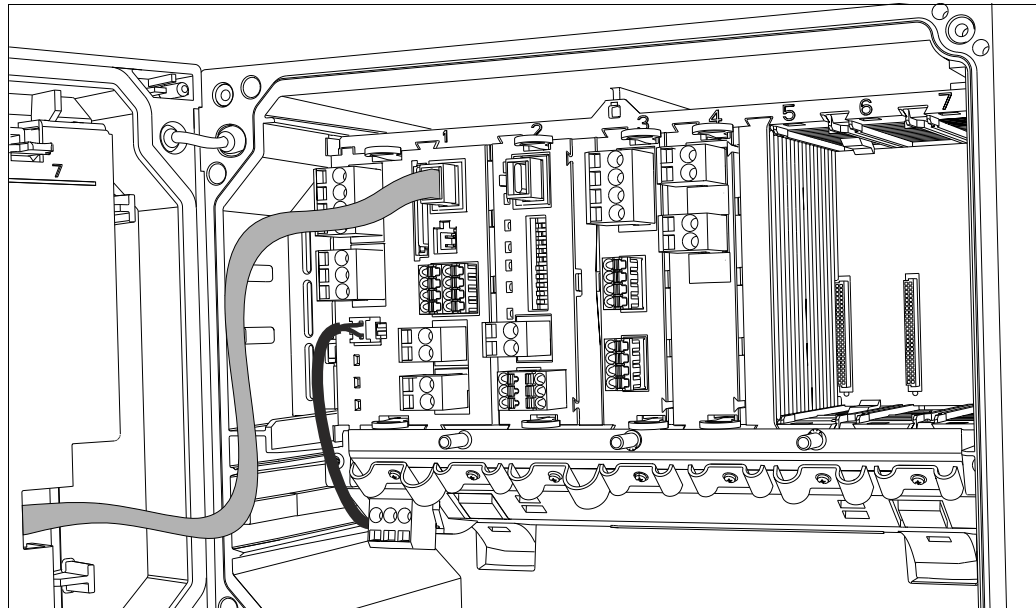
Function diagram CM442



Function diagram CM442

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

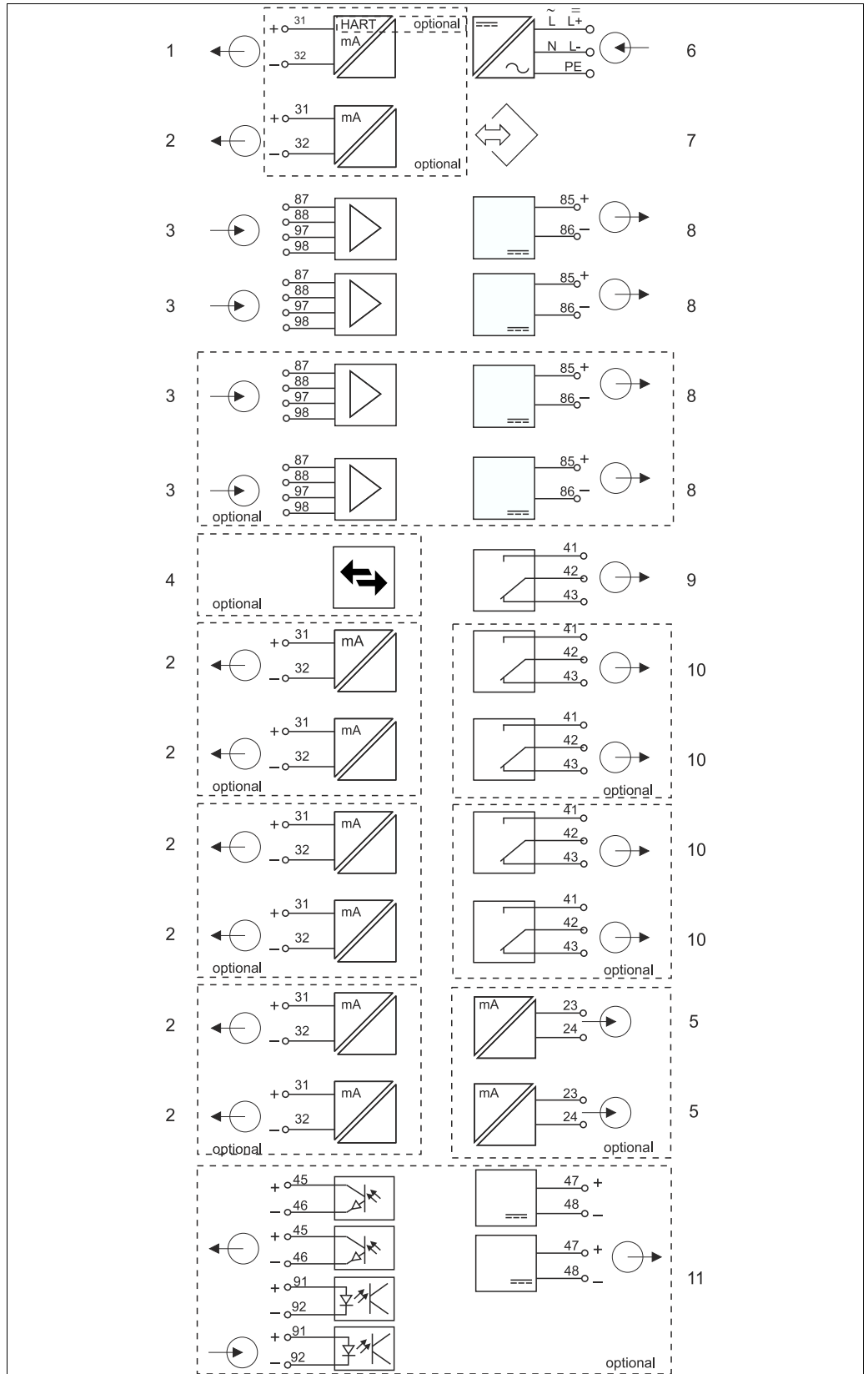
Device configuration using the example of a CM444-****M42A1FA***



CM444-****M42A1FA***

<p>Ordered basic device (example)</p>	<ul style="list-style-type: none"> ■ Order code CM444-**M42A1FA* ■ Functionality: <ul style="list-style-type: none"> - 4 x Memosens (2 on BASE-E module + 2 on an extension module 2DS) - PROFIBUS communication (module 485) - 2 current outputs without HART (on BASE-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.
<p>Extension options without additional modules</p>	<p>None</p>
<p>Modification options without additional modules</p>	<ul style="list-style-type: none"> ■ Communication type changed by entering activation code This disables the communication type used previously! <ul style="list-style-type: none"> - Modbus RS485 (71135636) - Modbus TCP (71135637) - EtherNet/IP (71219868) ■ Retrofit to HART by removing module 485 and entering activation code for HART (71128428)
<p>Extension options by using extension modules in free slots 5-7</p>	<ul style="list-style-type: none"> ■ Additional inputs or outputs, relays: <ul style="list-style-type: none"> - 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 fieldbus module 485 is used, no other current outputs are available!
<p>Device upgrade to CM448</p>	<p>6 or 8 measuring channels by using one or two Memosens input modules 2DS (71135631)</p>
<p>Basic rule for extensions</p>	<p>The sum of all current inputs and outputs may not exceed 8!</p>
<p>Restrictions if using CUS71D sensors for interface measurement</p>	<ul style="list-style-type: none"> ■ With the CM444, any combination of maximum 4 Memosens sensors is possible. ■ An extension to CM448 is not advisable as the maximum number of Memosens inputs remains limited to 4 if a CUS71D is used.
<p>Product Configurator</p>	<p>www.products.endress.com/cm444</p>

Function diagram CM444

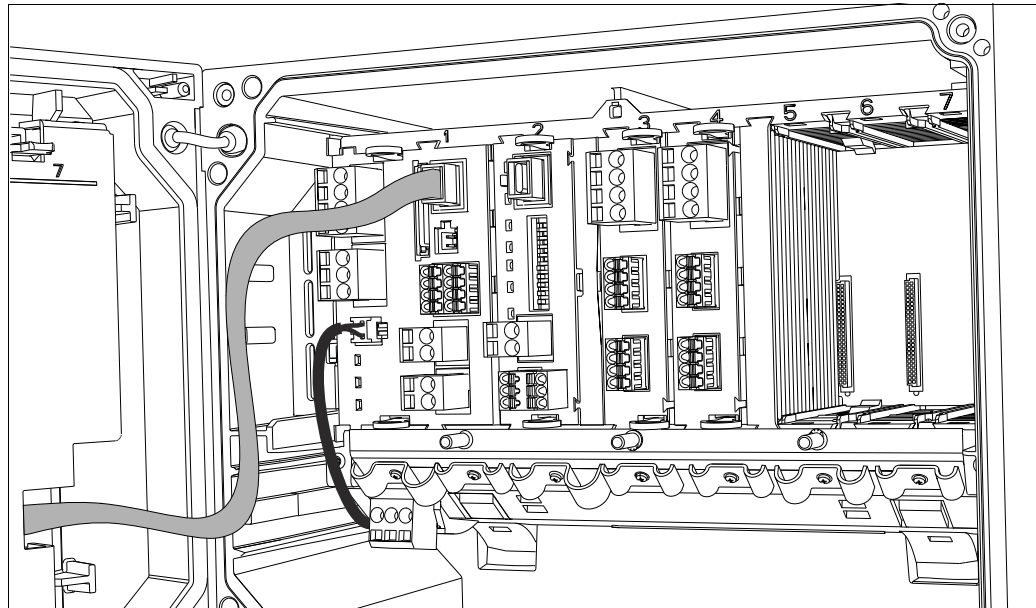


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Function diagram CM444

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

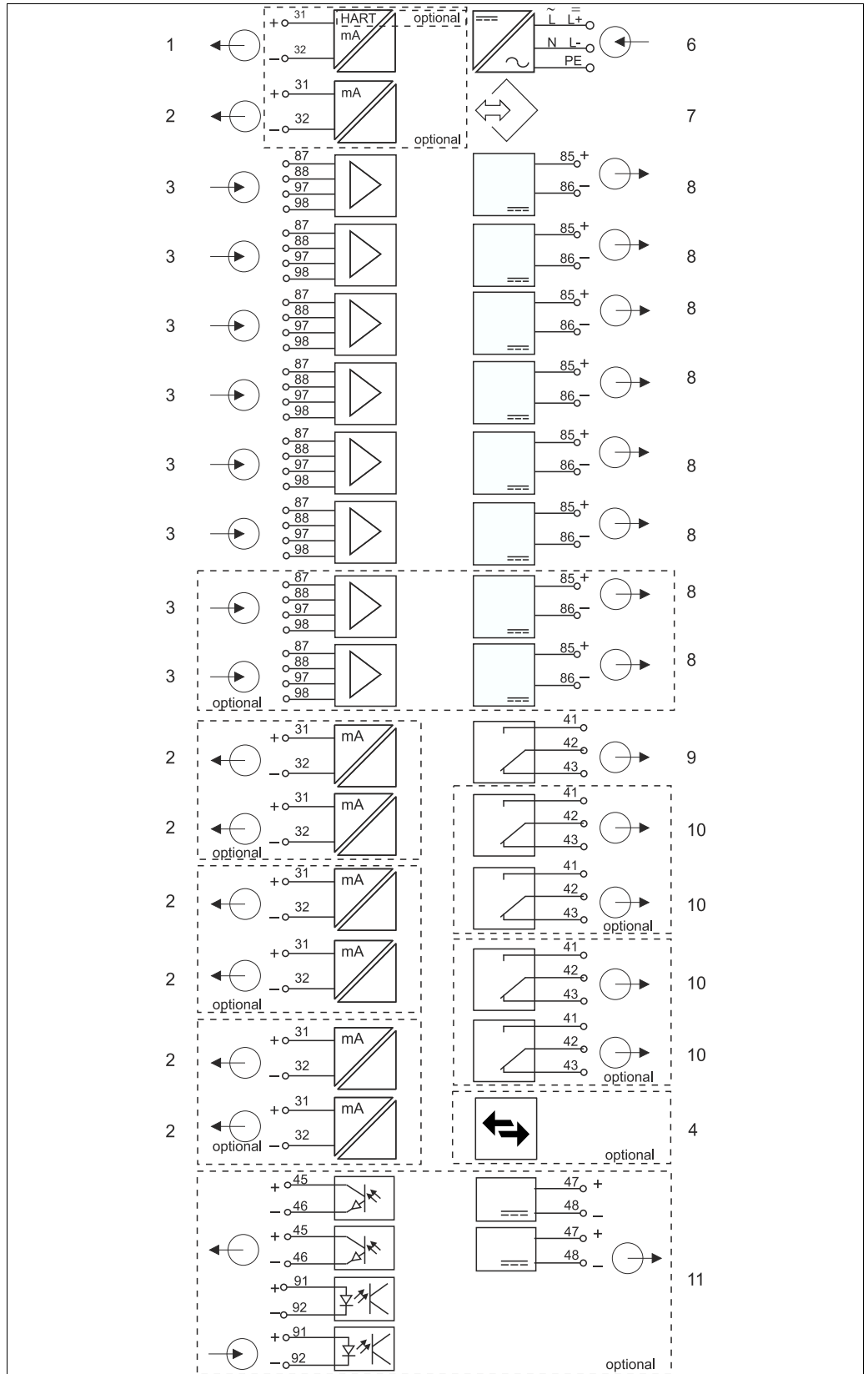
Device configuration using the example of a CM448-****26A1***



CM448-****26A1***

Ordered basic device (example)	<ul style="list-style-type: none"> ▪ Order code CM448-**26A1* ▪ Functionality: <ul style="list-style-type: none"> - 6 x Memosens (2 on BASE-E module + 2 on two extension modules 2DS) - PROFIBUS communication (module 485) ▪ 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	<ul style="list-style-type: none"> ▪ Communication type changed by entering activation code This disables the communication type used previously! <ul style="list-style-type: none"> - Modbus RS485 (71135636) - Modbus TCP (71135637) - EtherNet/IP (71219868) ▪ Retrofit to HART by removing module 485 and entering activation code for HART (71128428)
Extension options by using extension modules in free slots 5-7	<p>Only the following is possible for the example above:</p> <ul style="list-style-type: none"> ▪ Module 2R (71125375) or 4R (71125376): 2 or 4 relays <p>If extending to eight measuring channels:</p> <ul style="list-style-type: none"> ▪ Module 2DS (71135631): 2 Memosens inputs ▪ Use of the 2 current outputs in the basic module by entering activation code (71140891) <p>Additional inputs or outputs and relays if fieldbus module 485 is removed:</p> <ul style="list-style-type: none"> ▪ Module 2AO (71135632): 2 current outputs ▪ Module AOR (71111053): 2 current outputs, 2 relays ▪ Module 2R (71125375) or 4R (71125376): 2 or 4 relays ▪ Module DIO (71135638): 2 digital inputs and 2 digital outputs
Basic rule for extensions	The sum of all current inputs and outputs may not exceed 8!
Restrictions if using CUS71D sensors for interface measurement	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.products.endress.com/cm448

Function diagram CM448



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Function diagram CM448

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

Communication and data processing

Types of communication:

- Fieldbuses
 - HART
 - PROFIBUS DP (Profile 3.02)
 - Modbus TCP or RS485
 - EtherNet/IP
- Configuration via Ethernet

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

Extension module 485 and current outputs

For communication types PROFIBUS DP, Modbus and Ethernet:

- CM442:
 - Current outputs cannot be used in parallel. Any existing current outputs are deactivated with the installation of 485.
- CM444/CM448:
 - Max. of 2 current outputs can be used in parallel.

Bus termination on the device

- Via slide switch at bus module 485
- Displayed via LED "T" on bus module 485

Dependability

Reliability

Memosens technology



Memosens makes your measuring point safer and more reliable:

- Non-contact, digital signal transmission enables optimum galvanic isolation
- No contact corrosion
- Completely watertight
- Laboratory sensor calibration possible, thus increasing measured value availability
- 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 with high temperatures
 - Number of steam sterilizations
 - Sensor condition

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.

i 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 failure
- Process error (e.g. through control system)

Sensor Condition Check (SCC)

This function monitors the condition of the electrode and the degree of electrode aging. The status is indicated by the messages "SCC bad" or "SCC sufficient". The condition of the electrode is updated after every calibration.

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

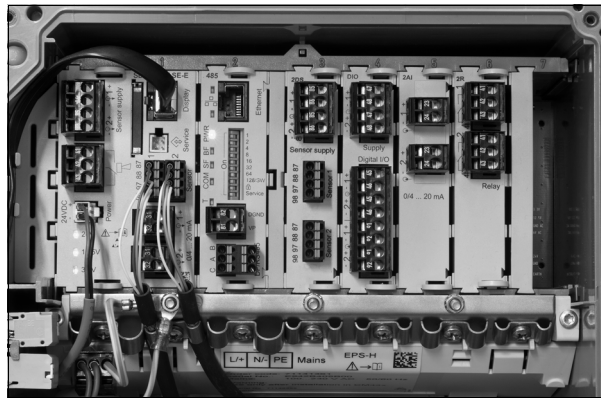
- e.g. for automatic sensor cleaning in retractable assemblies for reliable measurement results in processes with a high risk of contamination
- Individual, time-based activation of 4 outputs e.g. relays
- Starting, stopping or pausing of activities via digital input or fieldbus signals e.g. from limit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

Maintainability

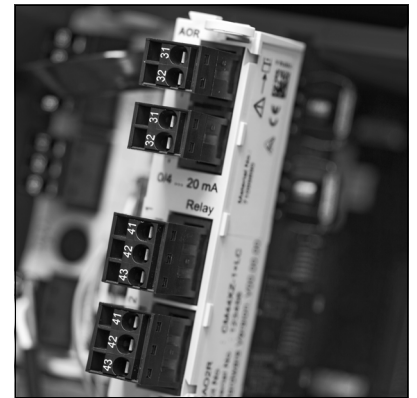
Modular design

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 of eight-channel measurement
- Optional: M12 sensor connector for connecting any kind of Memosens sensor



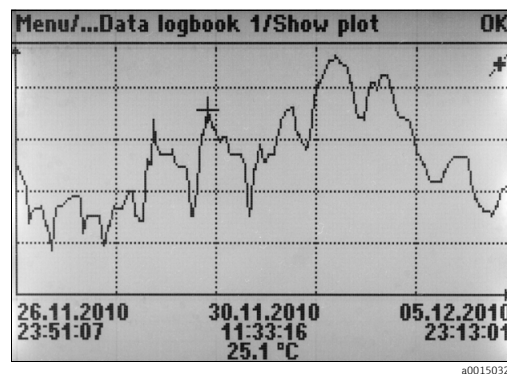
CM444: Sample



Fitting the 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



Data logbook: Graphic display

i 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. logs)
- 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)

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

Other SD cards can also be used. However, Endress+Hauser does not accept any responsibility for the data security of such cards.

External signals for device control and for activating external devices

Hardware options, e.g. module "DIO" with 2 digital inputs and 2 digital outputs or fieldbus module "485" enable the following:

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

FieldCare and Field Data Manager

FieldCare

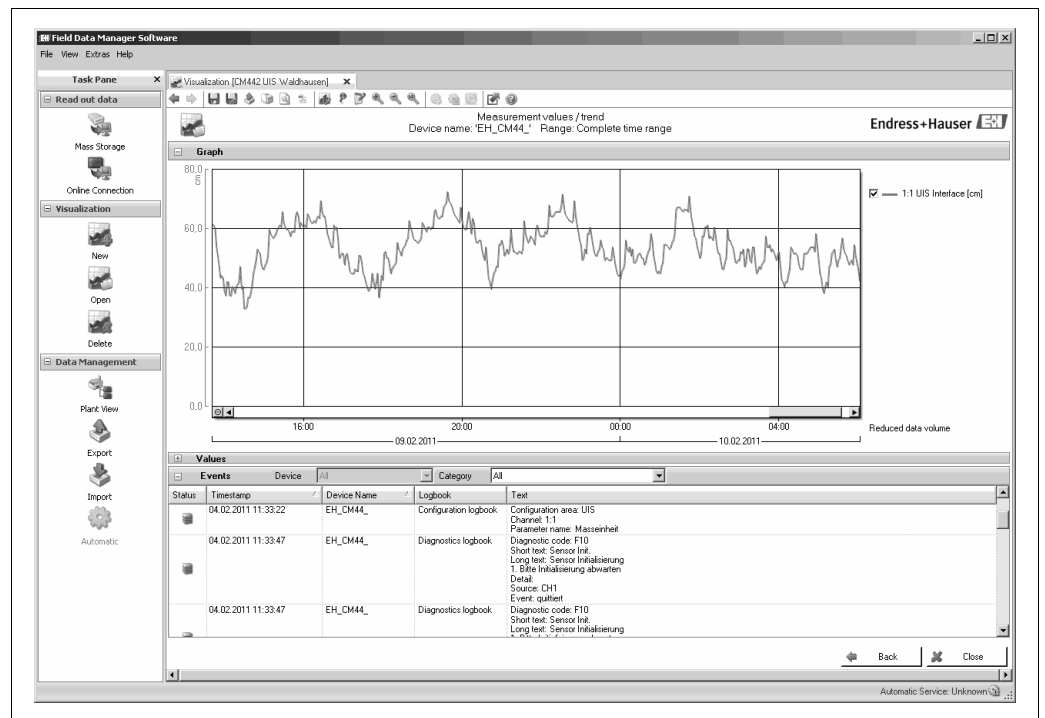
Configuration and asset management software based on FDT/DTM technology

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

Field Data Manager

Visualization software and database for measuring, calibration and configuration data

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



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 6 "virtual" process values.

The "virtual" process values can be:

- Output via a current output or a Fieldbus
- Used as a regulating control variable
- Assigned as a measured variable to a limit contactor
- Used as a measured variable to trigger cleaning
- Displayed in user-defined measuring menus.

The following mathematical functions are possible:

- pH calculation based on two conductivity values acc. to VGB 405 RL, e.g. in boiler feed water
- Difference between two measured values from different sources, e.g. for membrane monitoring
- Differential conductivity, e.g. monitoring the efficiency of ion exchangers
- Degassed conductivity, e.g. for process controls in power plants
- Redundancy for monitoring two or three redundantly measuring sensors
- rH calculation based on the measured values of a pH and an ORP sensor

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 ... 15 %	0 to 100 °C (32 to 212 °F)
HCl	0 ... 20 %	0 to 65 °C (32 to 149 °F)
HNO ₃	0 ... 30 %	2 to 80 °C (36 to 176 °F)
H ₂ SO ₄	0 to 28 % and 35 to 85 %	0 to 100 °C (32 to 212 °F)
H ₂ SO ₄	93 ... 100 %	0 to 100 °C (32 to 212 °F)
H ₃ PO ₄	0 ... 40 %	2 to 80 °C (36 to 176 °F)
NaCl	0 ... 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

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

IT security measures in line with operators' security standards and designed to provide additional protection for the device and device data transfer must be implemented by the operators themselves. Support in the performance of this task can be requested from Endress+Hauser.

Input

Measured variables	--> Documentation of the connected sensor
Measuring ranges	--> Documentation of the connected sensor
Types of input	<ul style="list-style-type: none"> ▪ Digital sensor inputs for sensors with Memosens protocol ▪ Analog current inputs (optional) ▪ Digital inputs (optional)
Input signal	Depending on version <ul style="list-style-type: none"> ▪ Max. 8 x binary sensor signal ▪ 2 x 0/4 to 20 mA (optional), passive, potentially isolated from one another and from the sensor inputs ▪ 0 to 30 V
Cable specification	<p>Cable type</p> <p>Memosens data cable CYK10 or sensor fixed cable, each with cable end sleeves or M12 round-pin connector</p> <p>Cable length</p> <p>Max. 100 m (330 ft)</p>

Digital inputs, passive

Electrical specification	<ul style="list-style-type: none"> ▪ drawing power (passive) ▪ galvanically isolated 				
Span	<table style="border: none;"> <tr> <td style="padding-right: 20px;">High:</td> <td>11 to 30 V DC</td> </tr> <tr> <td>Low:</td> <td>0 to 5 V DC</td> </tr> </table>	High:	11 to 30 V DC	Low:	0 to 5 V DC
High:	11 to 30 V DC				
Low:	0 to 5 V DC				
Nominal input current	Max. 8 mA				
PFM function	Minimum pulse width: 500 µs (1 kHz)				
Test voltage	500 V				
Cable specification	Max. 2.5 mm ² (14 AWG)				

Current input, passive

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

Output

Output signal

Depending on version:

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

HART

Signal coding	FSK \pm 0.5 mA above current signal
Data transmission rate	1200 baud
Galvanic isolation	Yes
Load (communication resistance)	250 Ω

PROFIBUS DP/RS485

Signal coding	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-cage terminal (max. 1.5 mm) bridged internally in the connector (T function), M12 optional
Bus termination	Internal slide switch with LED display

Modbus RS485

Signal coding	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-cage terminal (max. 1.5 mm) bridged internally in the connector (T function), M12 optional
Bus termination	Internal slide switch with LED display

Ethernet and Modbus TCP

Signal coding	IEEE 802.3 (Ethernet)
Data transmission rate	10/100 MBd
Galvanic isolation	Yes
Connection	RJ45, M12 optional
IP address	DHCP or configuration using menu

EtherNet/IP

Signal coding	IEEE 802.3 (Ethernet)
Data transmission rate	10/100 MBd
Galvanic isolation	Yes
Connection	RJ45, optional M12 (D-encoded)
IP address	DHCP (default) or configuration via menu

Signal on alarm	Adjustable, as per NAMUR Recommendation NE 43 <ul style="list-style-type: none"> ▪ In measuring range 0 to 20 mA (HART is not available with this measuring range): Error current from 0 to 23 mA ▪ In measuring range 4 to 20 mA: Error current from 2.4 to 23 mA ▪ Factory setting for error current for both measuring ranges: 21.5 mA
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Load	Max. 500 Ω
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Linearization/transmission behavior	Linear
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Digital outputs, passive

Electrical specification	<ul style="list-style-type: none"> ▪ passive ▪ open collector, max. 30 V, 15 mA
---------------------------------	---

PFM function	Minimum pulse width: 500 μ s (1 kHz)
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Auxiliary voltage	Electrical specification <ul style="list-style-type: none"> ▪ galvanically isolated ▪ unregulated, 24 V DC \pm 20% ▪ max. 50 mA
--------------------------	--

Test voltage	500 V
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Cable specification	Max. 2.5 mm ² (14 AWG)
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Current outputs, active

Span	0 to 23 mA 2.4 to 23 mA for HART communication
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Signal characteristic	Linear
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Electrical specification	Output voltage Max. 24 V Test voltage 500 V
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Cable specification	Cable type Recommended: shielded cable Cross-section Max. 2.5 mm ² (14 AWG)
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Relay outputs

Electrical specification

Relay types

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

Relay switching capacity

Basic module (alarm relay)

Switching voltage	Load (max.)	Switching cycles (min.)
230 V AC, $\cos\phi = 0.8$ to 1	0.1 A	700,000
	0.5 A	450,000
115 V AC, $\cos\phi = 0.8$ 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, $\cos\phi = 0.8$ to 1	0.1 A	700,000
	0.5 A	450,000
	2 A	120,000
115 V AC, $\cos\phi = 0.8$ 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

Minimum load (typical)

- Min. 100 mA with 5 V DC
- Min. 1 mA with 24 V DC
- Min. 5 mA with 24 V AC
- Min. 1 mA with 230 V AC

Cable specification

Cross-section

Max. 2.5 mm² (14 AWG)

Protocol-specific data

HART

Manufacturer ID	11 _h
Device type	119C _h (CM44x), 119D _h (CSFxx)
Device revision	001 _h
HART version	7.2
Device description files (DD/DTM)	www.endress.com 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 (CM44x)
Profile version	3.02
GSD files	www.products.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	<ul style="list-style-type: none"> ▪ 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

Protocol	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 (max.)	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 FactoryTalk SE
IO data	Input (T --> O)	Device status and diagnostic message with highest priority Measured values: <ul style="list-style-type: none"> ▪ 16 AI (analog input) + Status + Unit ▪ 8 DI (discrete input) + Status
	Output (O --> T)	Actuating values: <ul style="list-style-type: none"> ▪ 4 AO (analog output) + status + unit ▪ 8 DO (discrete output) + Status

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 router with a user-defined IP address.

TCP port	80
Supported features	<ul style="list-style-type: none"> ▪ Remote-controlled device configuration (1 session) ▪ Save/restore device configuration ▪ 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

Depending on version:
 100 to 230 V AC \pm 15 %, 50/60 Hz
 24 V AC/DC +20/-15 %, 50/60 Hz

CM444 and CM448

Depending on version:
 100 to 230 V AC \pm 15 %, 50/60 Hz
 24 V DC +20 / -15 %

NOTICE

The device does not have a mains switch.

- ▶ The customer must provide a protected circuit breaker in the vicinity of the device.
- ▶ This must be a switch or a power-circuit breaker and must be labeled as the circuit breaker for the device.
- ▶ At the supply point, the power supply for the 24 V versions must be isolated from dangerous live cables by double or reinforced insulation.

Fieldbus connection

Supply voltage: not applicable

Power consumption

CM442

Depending on supply voltage

- 100 to 230 V AC and 24 V AC:
 Max. 55 VA
- 24 V DC:
 Max. 22 W

CM444 and CM448

Depending on supply voltage

- 100 to 230 V AC:
 Max. 73 VA
- 24 V DC:
 Max. 68 W

Fuse

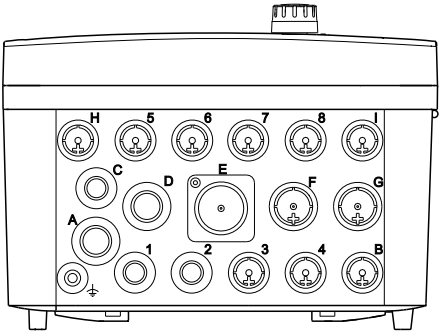
CM442

5x20 mm, 250 V, 4.0 A, slow-blow (T4.0A)

CM444 and CM448

Fuse not exchangeable

Cable entries

Identification of the cable entry on housing base	Suitable gland
B, C, H, I, 1-8	M16x1.5 mm/NPT3/8"/G3/8
A, D, F, G	M20x1.5 mm/NPT1/2"/G1/2
E	-
\perp	M12x1.5 mm
	Recommended assignment 1-8 Sensors 1-8 A Power supply B RS485 In or M12 DP/RS485 C Do not use D,F,G Current outputs and inputs, relays H Do not use I RS485 Out or M12 Ethernet E Do not use

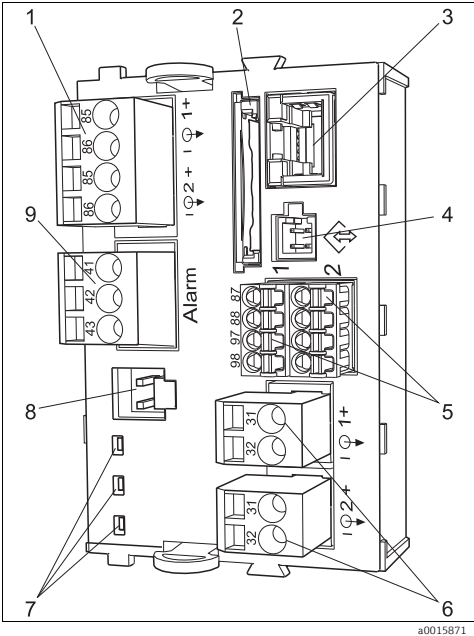
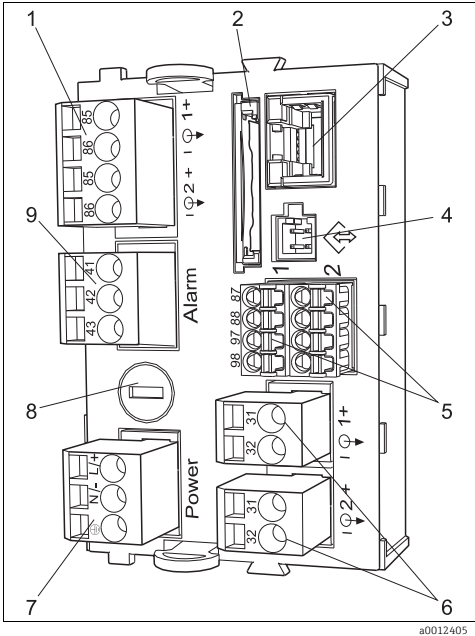
Cable specification

Cable gland	Permitted cable diameter
M16x1.5 mm	4 to 8 mm (0.16 to 0.32")
M12x1.5 mm	2 to 5 mm (0.08 to 0.20")
M20x1.5 mm	6 to 12 mm (0.24 to 0.48")
NPT3/8"	4 to 8 mm (0.16 to 0.32")
G3/8	4 to 8 mm (0.16 to 0.32")
NPT1/2"	6 to 12 mm (0.24 to 0.48")
G1/2	7 to 12 mm (0.28 to 0.48")

i Cable glands mounted at the factory are tightened with 2 Nm.

Electrical connection

Basic module



Basic module BASE-H or -L (two-channel device)

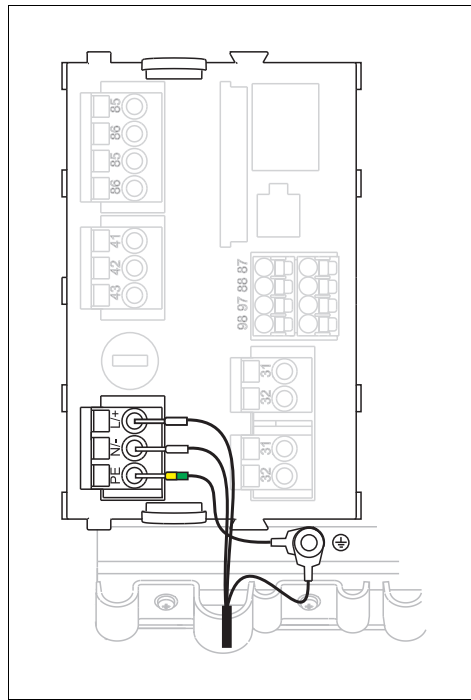
- 1 Power supply for digital fixed cable sensors with Memosens protocol
- 2 SD card slot
- 3 Slot for display cable¹⁾
- 4 Service interface
- 5 Connections for 2 Memosens sensors
- 6 Current outputs
- 7 Power connection
- 8 Fuse
- 9 Alarm relay connection

Basic module BASE-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 cable¹⁾
- 4 Service interface
- 5 Connections for 2 Memosens sensors
- 6 Current outputs
- 7 LEDs
- 8 Socket for internal supply cable ¹⁾
- 9 Alarm relay connection

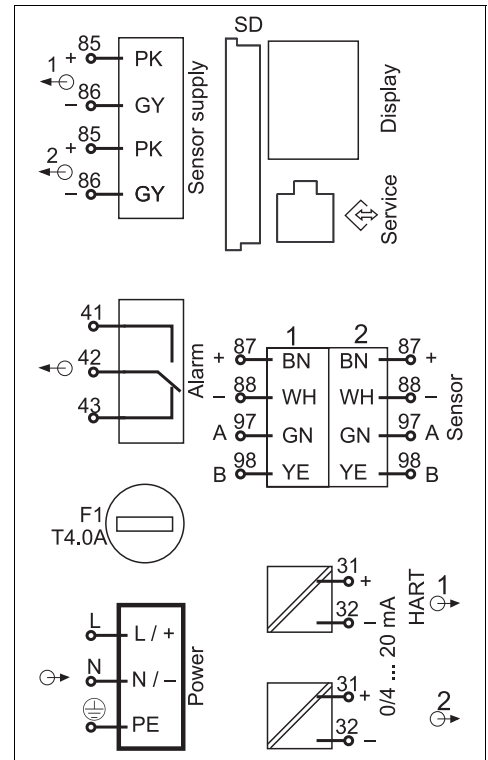
1) Internal device connection. Do not disconnect the plug!

Connecting supply voltage for CM442



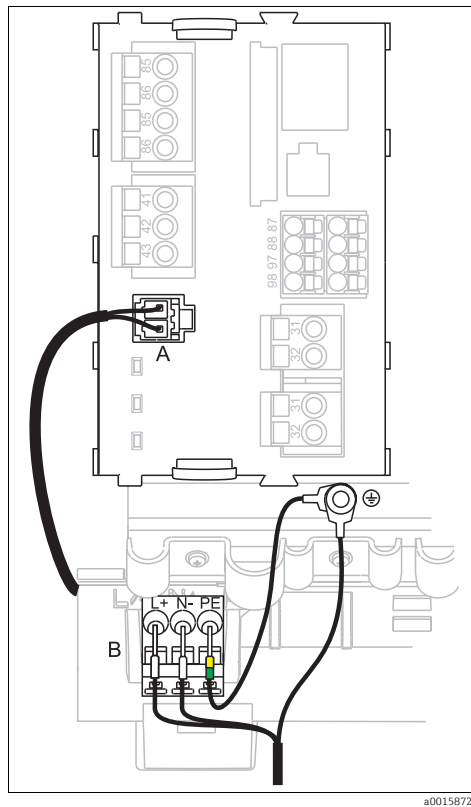
Connecting power supply on the BASE-H or -L

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



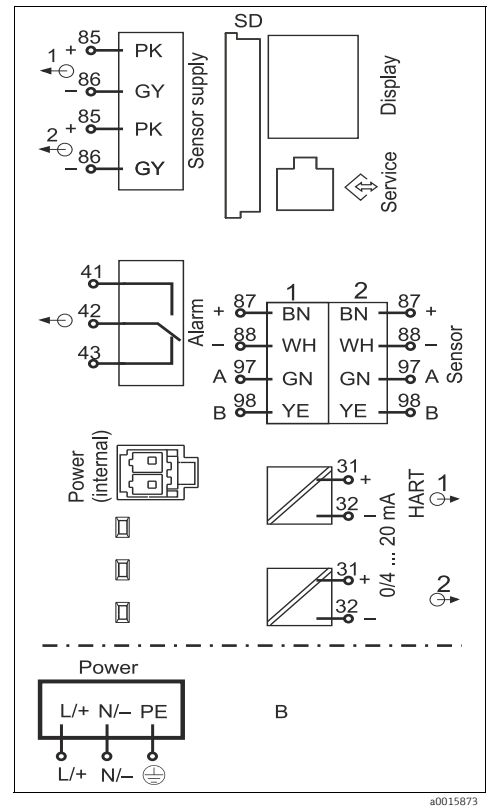
Overall wiring diagram for BASE-H or -L

Connecting supply voltage for CM444 and CM448



Connecting power supply with BASE-E

- A Internal supply cable
- B Extension power supply unit



Overall wiring diagram BASE-E and extension power unit (B)

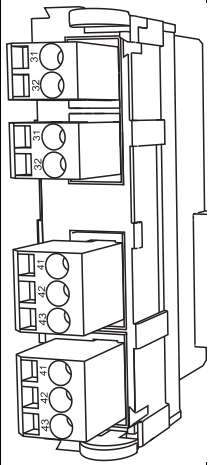
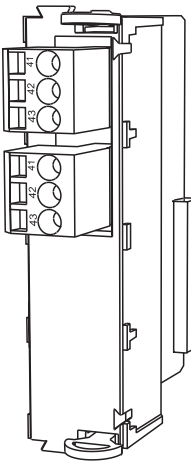
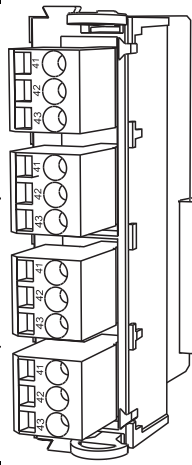
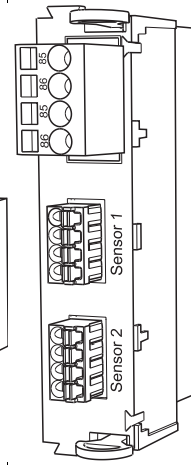
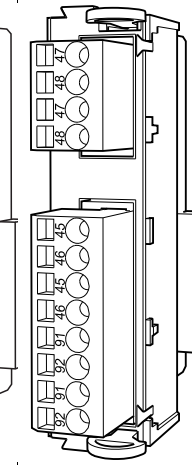
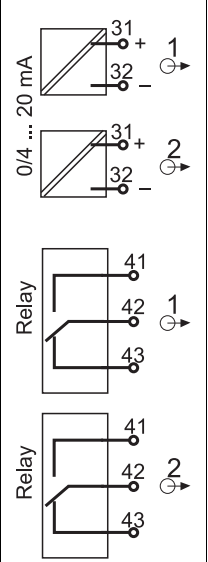
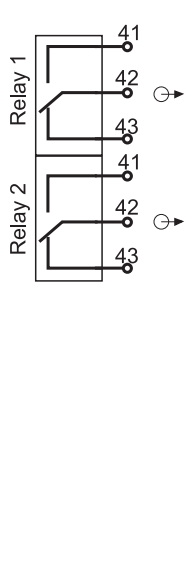
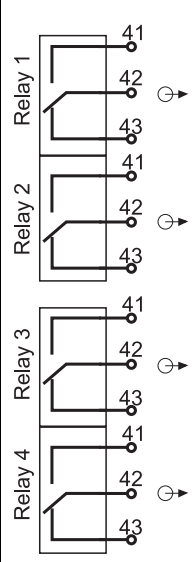
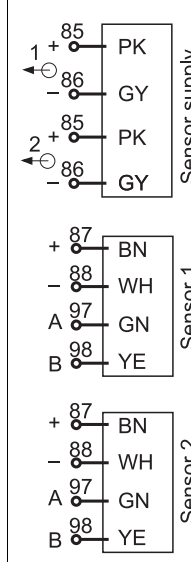
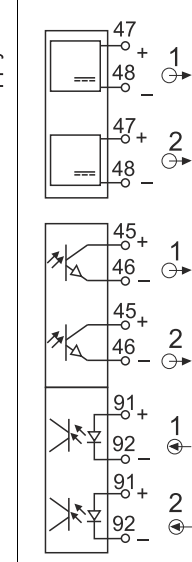
Connecting optional modules With extension modules you can purchase additional functions for your device.

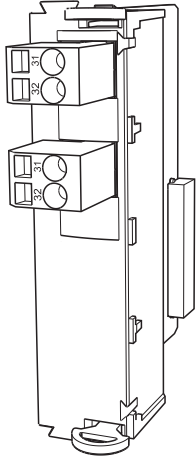
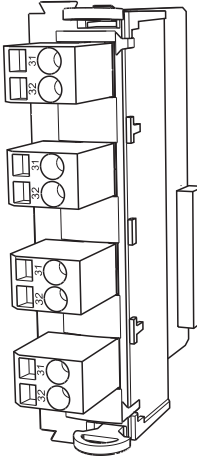
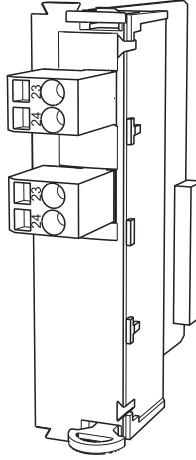
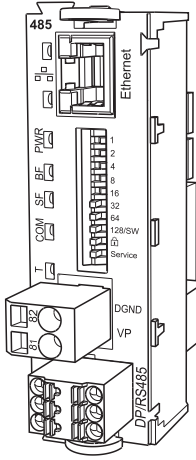
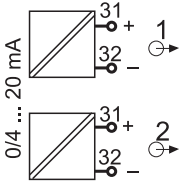
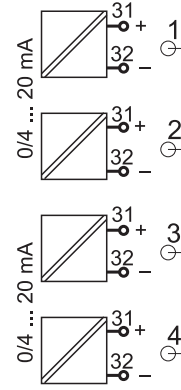
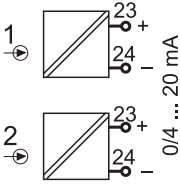
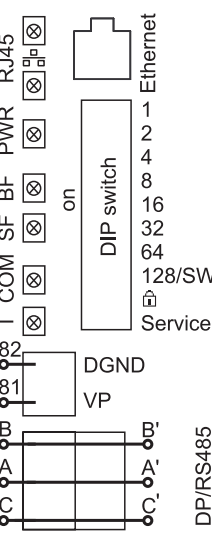
NOTICE

Unacceptable hardware combinations (due to conflicts in power supply)

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

- ▶ If you are planning to extend your controller, make sure the resulting hardware combination is permitted (Configurator on www.products.endress.com/cm442 or .../cm444 or .../CM448).
- ▶ Please note that if you are extending CM442 to CM444 or CM448, you must additionally fit an extension power supply unit and an extension backplane. You must then also use basic module BASE-E.
- ▶ Remember that the sum of all current inputs and outputs may not exceed 8!
- ▶ Please contact your Endress+Hauser sales center should you have any questions.

Module name				
AOR	2R	4R	2DS	DIO
				
a0015747	a0015748	a0015749	a0015754	a0019835
<ul style="list-style-type: none"> ▪ 2 x 0/4 to 20 mA analog outputs ▪ 2 relays ▪ Order no. 71111053 	<ul style="list-style-type: none"> ▪ 2 relays ▪ Order no. 71125375 	<ul style="list-style-type: none"> ▪ 4 relays ▪ Order no. 71125376 	<ul style="list-style-type: none"> ▪ 2 digital sensor inputs ▪ 2 power supply systems for digital sensors ▪ Order no. 71135631 	<ul style="list-style-type: none"> ▪ 2 digital inputs ▪ 2 digital outputs with auxiliary voltage ▪ Order no. 71135638
				
a0015755	a0015758	a0015757	a0015756	a0019836

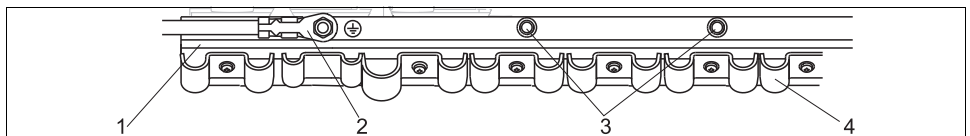
Module name			
2AO	4AO	2AI	485
 a0015750	 a0015751	 a0015752	 a0015753
<ul style="list-style-type: none"> 2 x 0/4 to 20 mA analog outputs Order no. 71135632 	<ul style="list-style-type: none"> 4 x 0/4 to 20 mA analog outputs Order no. 71135633 	<ul style="list-style-type: none"> 2 x 0/4 to 20 mA analog inputs Order no. 71135639 	<ul style="list-style-type: none"> Ethernet (web server or Modbus TCP) 5V power supply for PROFIBUS DP termination RS485 (PROFIBUS DP or Modbus RS485) Order no. 71135634
 a0015759	 a0015760	 a0015761	 a0015762



PROFIBUS DP (module 485)

Contacts A - A', B - B' and C - C' are bridged in the connector. This ensures that PROFIBUS communication is not interrupted if the connector is disconnected.

Protective ground connection



Cable mounting rail and associated function

- | | | | |
|---|---|---|---|
| 1 | Cable mounting rail | 3 | Additional threaded bolts for ground connections |
| 2 | Threaded bolt (protective ground connection, central grounding point) | 4 | Cable clamps (fixing and grounding the sensor cables) |

Sensor connection

Sensors with Memosens protocol

Sensor types	Sensor cables	Sensors
Digital sensors without additional internal power supply	CYK10 with plug-in connection and inductive signal transmission	<ul style="list-style-type: none"> ▪ pH sensors ▪ ORP sensors ▪ Combi sensors ▪ Amperometric oxygen sensors ▪ Conductive conductivity sensors ▪ Chlorine sensors
	Fixed cable	Inductive conductivity sensors
Digital sensors with additional internal power supply	Fixed cable	<ul style="list-style-type: none"> ▪ Turbidity sensors ▪ Sensors for interface measurement ▪ Sensors for measuring the spectral absorption coefficient (SAC) ▪ Nitrate sensors ▪ Optical oxygen sensors ▪ Ion-sensitive sensors

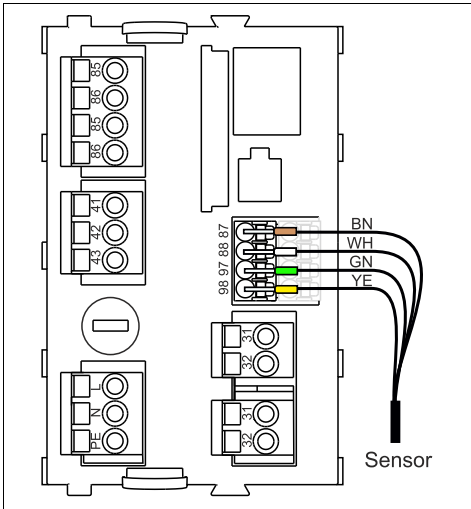
The following rule applies if connecting CUS71D sensors:

- CM442
 - 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.
- CM444
 - No restrictions. All the sensor inputs can be used as required.
- CM448
 - 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.

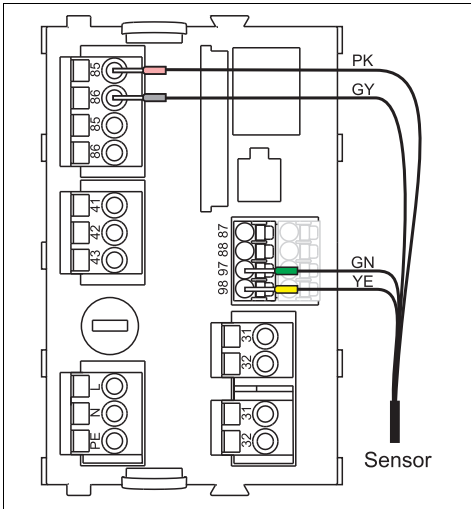
Connection methods

1. Sensor cable connected directly to the terminal connector of the sensor module 2DS or of the basic module L, H or E
2. Optional: plug connection of the sensor cable connected to the M12 sensor socket on the underside of the device. With this type of connection, the device is already wired at the factory.

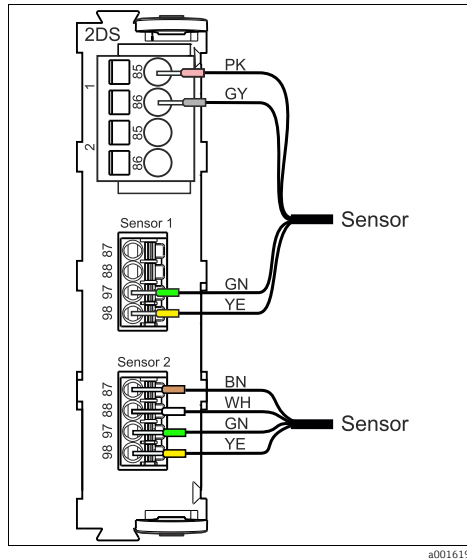
1. Sensor cable connected directly



Sensors without additional supply voltage

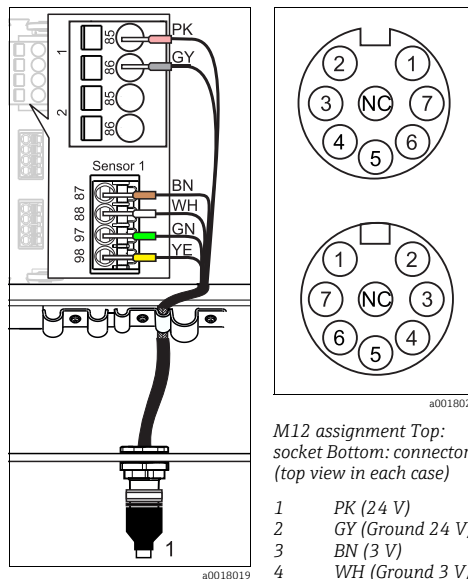


Sensors with additional supply voltage



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

2. Connection via M12 plug-in connection



M12 assignment Top: socket Bottom: connector (top view in each case)

- 1 PK (24 V)
- 2 GY (Ground 24 V)
- 3 BN (3 V)
- 4 WH (Ground 3 V)
- 5 GN (Memosens)
- 6 YE (Memosens)
- 7, NC Not connected

M12 plug-in connection (e.g. at sensor module)

- 1 Sensor cable with M12 connector

Device versions with a pre-installed M12

socket are ready-wired upon delivery. Install an M12 socket, which is available as an accessory, in a suitable cable gland opening in the base of the housing, and connect the cables to the Memosens terminals of the sensor or basic module as per the wiring diagram (→).

Connecting the sensor

- Connect the sensor cable plug (pos. 1) directly to the M12 socket.

Please note the following for these device versions:

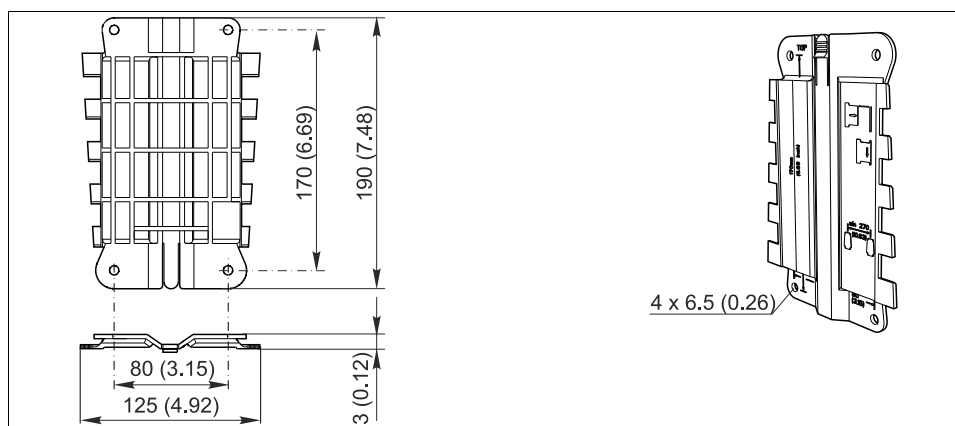
- The internal device wiring is always the same regardless of what kind of sensor you connect to the M12 socket (plug&play).
- The signal and power supply cables are assigned in the sensor plug-in head in such a way that the PK and GY power supply cables are either used (e.g. optical sensors) or not (e.g. pH or ORP sensors).

Performance characteristics

Response time	<p>Current outputs t_{90} = max. 500 ms for an increase from 0 to 20 mA</p> <p>Current inputs t_{90} = max. 330 ms for an increase from 0 to 20 mA</p> <p>Digital inputs and outputs t_{90} = max. 330 ms for an increase from low to high</p>
Reference temperature	25 °C (77 °F)
Maximum measured error of sensor inputs	--> Documentation of the connected sensor
Measured error for current inputs and outputs	<p>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</p> <p>Additional measured error depending on the temperature: < 1.5 μA/K</p>
Frequency tolerance of digital inputs and outputs	≤ 1 %
Resolution of current inputs and outputs	< 5 μ A
Repeatability	--> Documentation of the connected sensor

Installation

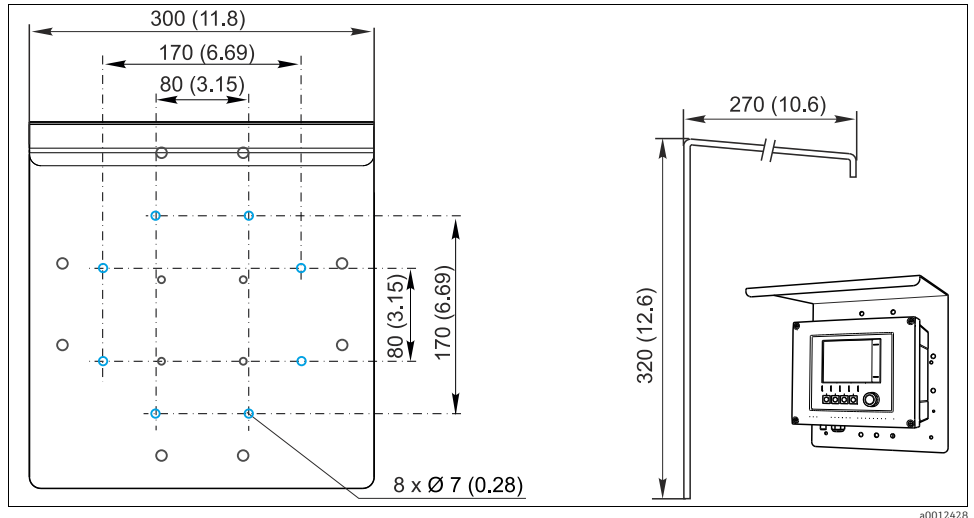
Mounting plate



Mounting plate in mm (inch)

a0012426

Weather protection cover

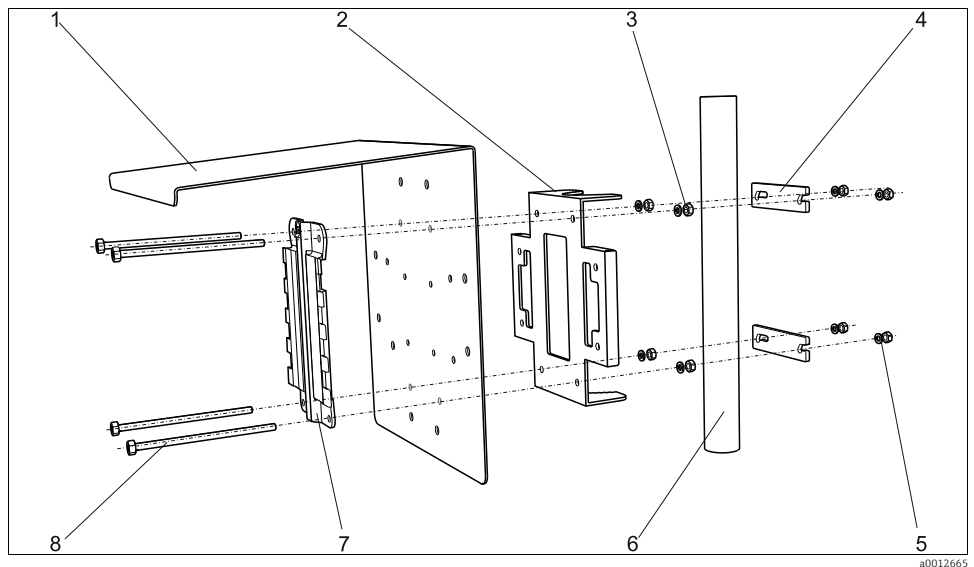


Weather protection cover in mm (inch)

Installation instructions

You require the post mounting kit (optional) to mount the unit on a pipe, post or railing (square or circular, span range 20 to 61 mm (0.79 to 2.40")).

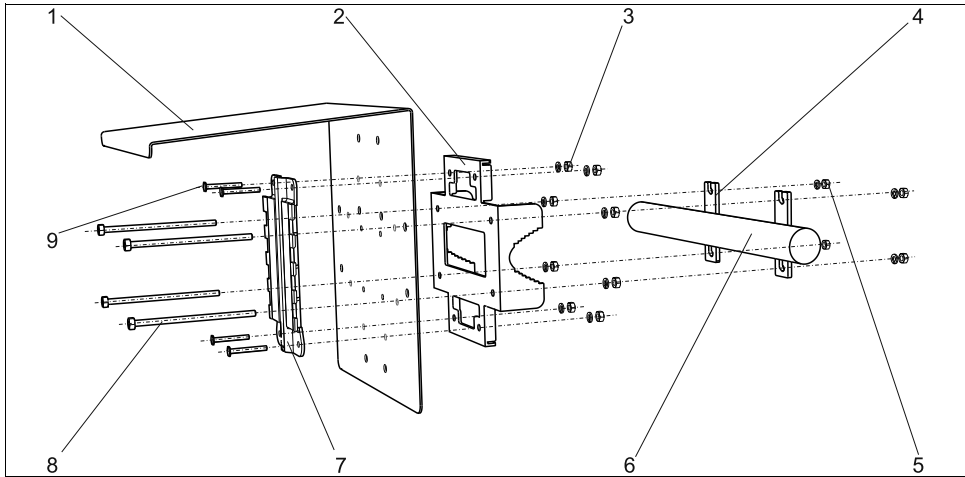
Post mounting



Post mounting

- | | |
|--|--|
| 1 Weather protection cover (optional) | 5 Spring washers, nuts (post mounting kit) |
| 2 Post mounting plate (post mounting kit) | 6 Pipe or railing (circular/square) |
| 3 Spring washers, nuts (post mounting kit) | 7 Mounting plate |
| 4 Pipe clamps (post mounting kit) | 8 Threaded rods (post mounting kit) |

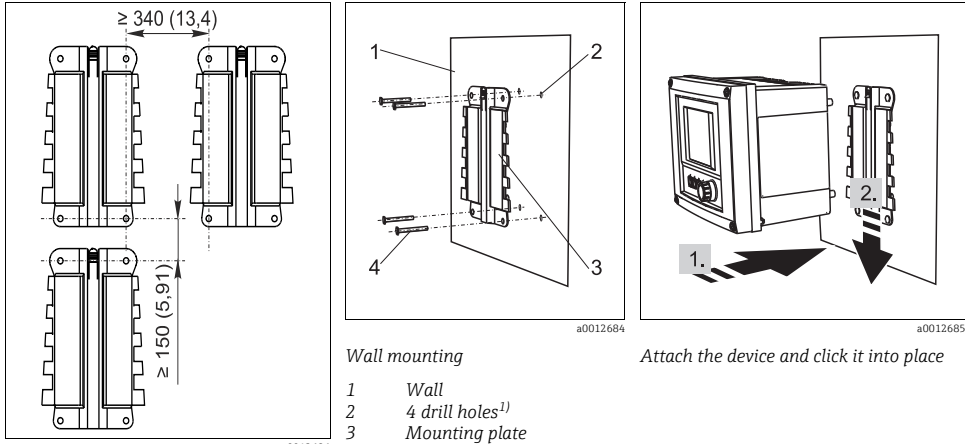
Rail mounting



- Rail mounting*
- | | |
|--|-------------------------------------|
| 1 Weather protection cover (optional) | 6 Pipe or railing (circular/square) |
| 2 Post mounting plate (post mounting kit) | 7 Mounting plate |
| 3 Spring washers, nuts (post mounting kit) | 8 Threaded rods (post mounting kit) |
| 4 Pipe clamps (post mounting kit) | 9 Screws (post mounting kit) |
| 5 Spring washers, nuts (post mounting kit) | |

Wall mounting

Mount the controller in such a way that the wall support surface is at least the size of the rear housing panel.



- Mounting distance in mm (inch)*
- Wall mounting*
- | |
|---|
| 1 Wall |
| 2 4 drill holes ¹⁾ |
| 3 Mounting plate |
| 4 Screws Ø 6 mm (not part of scope of supply) |

1) The size of the drill holes depends on the wall plugs used. The wall plugs and screws must be provided by the customer.

Environment

Ambient temperature range	CM442 -20 to 60 °C (0 to 140 °F)											
	CM444 <ul style="list-style-type: none"> ■ Generally -20 to 55 °C (0 to 130 °F), with the exception of packages under the second point in the list. ■ -20 to 50 °C (0 to 120 °F) for the following packages: <ul style="list-style-type: none"> - CM444-**M40A7FI*****+... - CM444-**M40A7FK*****+... - CM444-**N40A7FI*****+... - CM444-**N40A7FK*****+... 											
	CM448 <ul style="list-style-type: none"> ■ Generally -20 to 55 °C (0 to 130 °F), with the exception of packages under the second point in the list. ■ -20 to 50 °C (0 to 120 °F) for the following packages: <ul style="list-style-type: none"> - CM448-***6AA*****+... - CM448-***8A4*****+... - CM448-***8A5*****+... - CM448-**28A3*****+... - CM448-**38A3*****+... - CM448-**48A3*****+... - CM448-**58A3*****+... - CM448-**68A3*****+... - CM448-**26A5*****+... - CM448-**36A5*****+... - CM448-**46A5*****+... - CM448-**56A5*****+... - CM448-**66A5*****+... - CM448-**22A7*****+... - CM448-**32A7*****+... - CM448-**42A7*****+... - CM448-**52A7*****+... - CM448-**62A7*****+... 											
Storage temperature	-40 to 80 °C (-40 to 175 °F)											
Humidity	10 to 95%, not condensing											
Degree of protection	IP 66/67, impermeability and corrosion resistance in accordance with NEMA TYPE 4X											
Vibration resistance	Environmental tests Vibration test based on DIN EN 60068-2, October 2008 Vibration test based on DIN EN 60654-3, August 1998											
	Post or pipe mounting <table border="0" style="width: 100%;"> <tr> <td>Frequency range</td> <td colspan="2">10 to 500 Hz (sinusoidal)</td> </tr> <tr> <td rowspan="2">Amplitude</td> <td>10 to 57.5 Hz:</td> <td>0.15 mm</td> </tr> <tr> <td>57.5 to 500 Hz:</td> <td>2 g¹⁾</td> </tr> <tr> <td>Test duration</td> <td colspan="2">10 frequency cycles/ spatial axis, in 3 spatial axes (1 oct./min)</td> </tr> </table>	Frequency range	10 to 500 Hz (sinusoidal)		Amplitude	10 to 57.5 Hz:	0.15 mm	57.5 to 500 Hz:	2 g ¹⁾	Test duration	10 frequency cycles/ spatial axis, in 3 spatial axes (1 oct./min)	
Frequency range	10 to 500 Hz (sinusoidal)											
Amplitude	10 to 57.5 Hz:	0.15 mm										
	57.5 to 500 Hz:	2 g ¹⁾										
Test duration	10 frequency cycles/ spatial axis, in 3 spatial axes (1 oct./min)											
	Wall mounting <table border="0" style="width: 100%;"> <tr> <td>Frequency range</td> <td colspan="2">10 to 150 Hz (sinusoidal)</td> </tr> <tr> <td rowspan="2">Amplitude</td> <td>10 to 12.9 Hz:</td> <td>0.75 mm</td> </tr> <tr> <td>12.9 to 150 Hz:</td> <td>0.5 g¹⁾</td> </tr> <tr> <td>Test duration</td> <td colspan="2">10 frequency cycles/ spatial axis, in 3 spatial axes (1 oct./min)</td> </tr> </table>	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)	
Frequency range	10 to 150 Hz (sinusoidal)											
Amplitude	10 to 12.9 Hz:	0.75 mm										
	12.9 to 150 Hz:	0.5 g ¹⁾										
Test duration	10 frequency cycles/ spatial axis, in 3 spatial axes (1 oct./min)											
	1) g ... gravitational acceleration (1 g ≈ 9.81 m/s ²)											
Electromagnetic compatibility	Interference emission and interference immunity as per EN 61326-1: 2006, class A for industry											

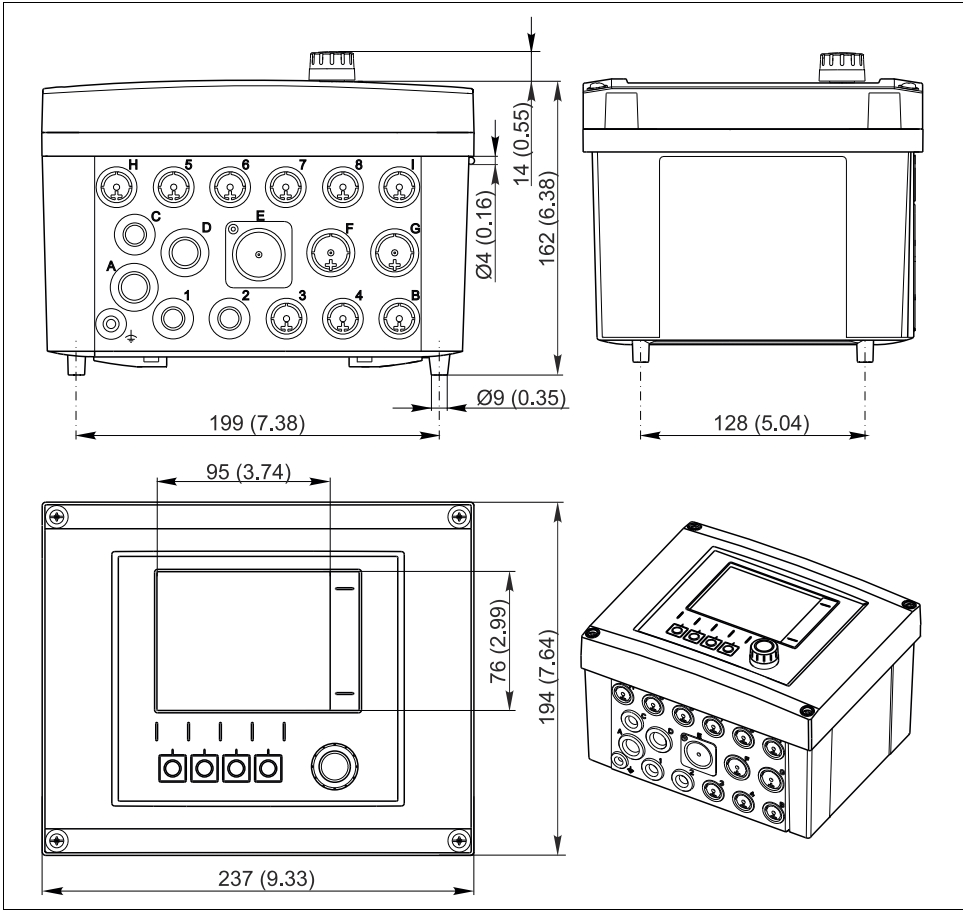
Electrical safety IEC 61010-1, Class I equipment
Low voltage: overvoltage category II
Environment < 3000 m (< 9840 ft) above MSL

Pollution degree The product is suitable for pollution degree 4.

Pressure compensation to environment Filter made of GORE-TEX used as pressure compensation element
Ensures pressure compensation to environment and guarantees IP protection.

Mechanical construction

Dimensions



Dimensions of field housing in mm (inch)

Weight Approx. 2.1 kg (4.63 lbs), depending on the version

Materials

Lower housing section	PC-FR
Display cover	PC-FR
Display film and soft keys	PE
Housing seal	EPDM
Module side panels	PC-FR
Module covers	PBT GF30 FR
Cable mounting rail	PBT GF30 FR, stainless steel 1.4301 (AISI304)
Clamps	Stainless steel 1.4301 (AISI304)
Screws	Stainless steel 1.4301 (AISI304)
Cable glands	Polyamide V0 as per UL94

Operability

Display

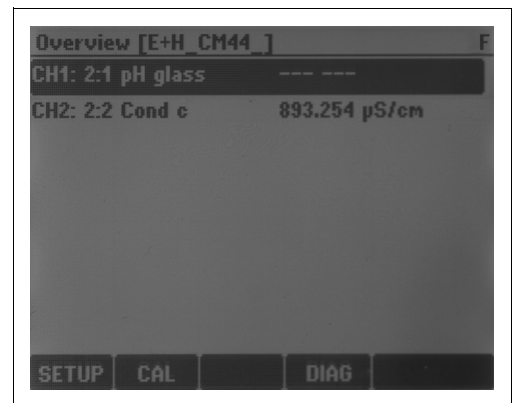
Graphic display:

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



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Backlit display



a0012438

Red background indicates an error

Operating concept

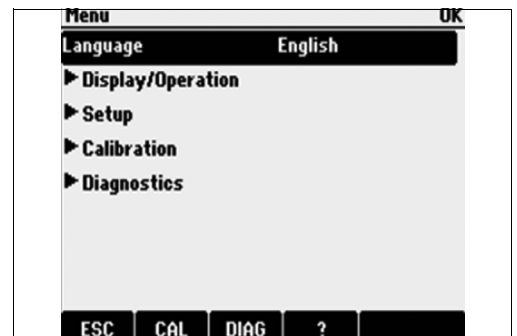
The simple and structured operating concept sets new standards:

- Intuitive operation with the navigator and soft keys
- Fast configuration of application-specific measurement options
- Easy configuration and diagnosis thanks to plain-text display
- All languages that can be ordered are available in every device



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Easy operation

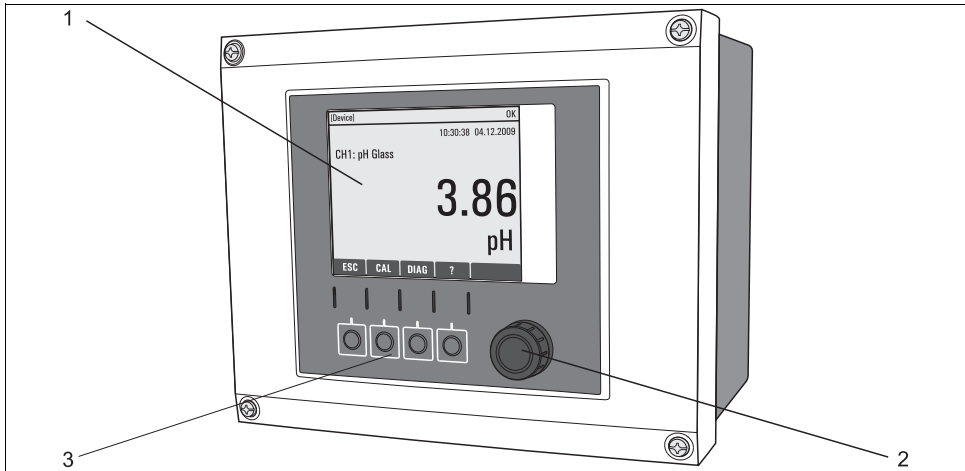


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Plain-text menu

Local operation

Human interface

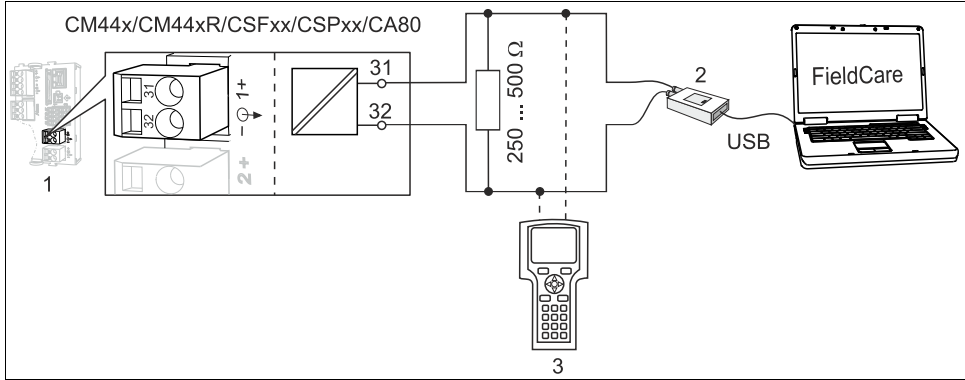


Overview of operation

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

Remote operation

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

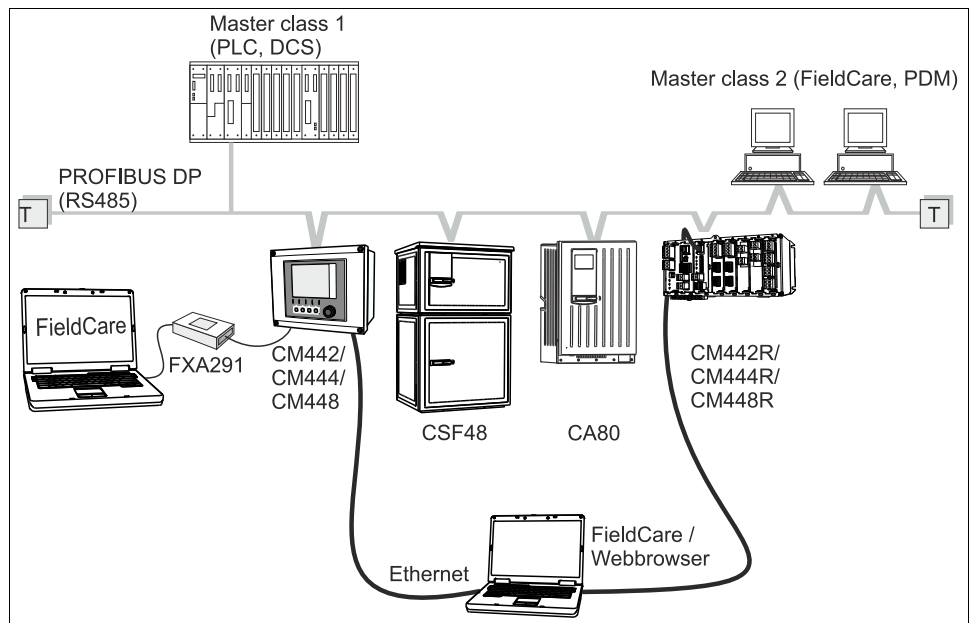


HART using modem

- 1 Device module Base-L, -H or -E: current output 1 with HART
- 2 HART modem to connect to PC, e.g. FXA195¹⁾
- 3 HART handheld terminal

1) Switch position "on" (replaces resistance)

Via PROFIBUS DP

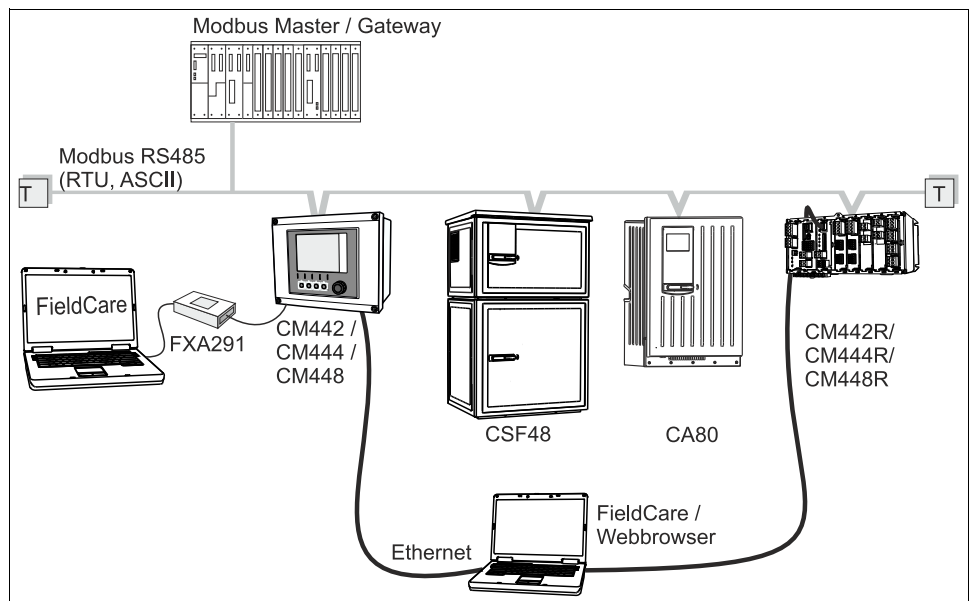


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PROFIBUS DP

T Terminating resistor

Via Modbus RS485

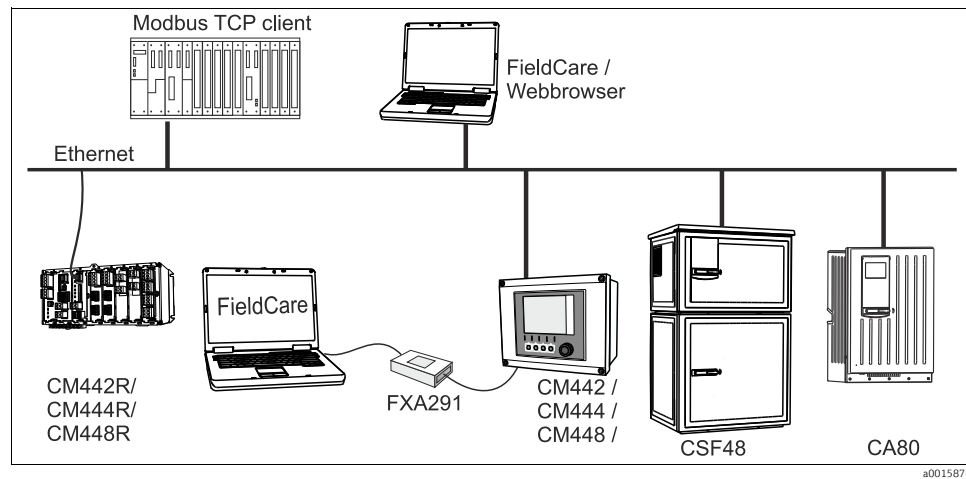


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Modbus RS485

T Terminating resistor

Via Ethernet/Web server/Modbus TCP/EtherNet/IP



Modbus TCP and/or Ethernet

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

Ordering information

Product structure

You can create a valid and complete order code using the Endress + Hauser Configurator tool on the Internet.

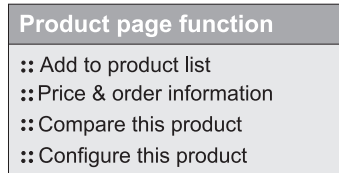
Enter the following addresses in your browser to access the relevant product page:

www.products.endress.com/cm442

www.products.endress.com/cm444

www.products.endress.com/cm448

1. The following options are available on the right-hand side of the page:



2. Select "Configure this product".
3. A new window opens with the Configurator. Using this tool, you can configure your device and you will receive a valid and complete order code for this.
4. Then export the order code as a PDF or as an Excel file selecting from the buttons provided at the top of the page.

Scope of delivery

- 1 controller in the version ordered
- 1 mounting plate
- 1 wiring label (attached at the factory to the inside of the display cover)
- 1 CD with Operating Instructions
- 1 printed copy of the Brief Operating Instructions in the language ordered

Certificates and approvals

CE mark

Declaration of Conformity

The product meets the requirements of the harmonized European standards.

As such, it complies with the legal specifications of the EC directives.

The manufacturer confirms successful testing of the product by affixing to it the CE mark.

cCSAus

The product complies with "CLASS 2252 05 - Process Control Equipment" and "CLASS 2252 85 - Process Control Equipment - Certified to US Standards" requirements.

FM/CSA

CM442 only

FM/CSA Cl. I, Div. 2


The device has been developed and tested according to the following standards:

- FM3600 (1998)
- FM3611 (2004)
- FM3810 (2005)
- ANSI/ISA NEMA250 (1999)
- ANSI/IEC 60529 (2001)

MCERTS

Application made for CM442

Accessories

-  The most important accessories that could be delivered at the time this document went to print are listed below. For information on accessories that are not listed here, please contact your local service or sales representation.

Weather protection cover	<p>CYY101 weather protection cover for field devices, absolutely essential if operating the unit outdoors</p> <ul style="list-style-type: none"> ■ Material: stainless steel 1.4301 (AISI 304) ■ Order No. CYY101-A
Post mounting kit	<p>Post mounting kit CM44x</p> <ul style="list-style-type: none"> ■ For securing the field housing to horizontal and vertical posts and pipes ■ Order no. 71096920
Measuring cable	<p>Memosens data cable CYK10</p> <ul style="list-style-type: none"> ■ For digital sensors with Memosens technology pH, redox, oxygen (amperometric), chlorine, conductivity (conductive) ■ Order as per product structure (--> online Configurator, www.products.endress.com/cyk10) ■ Technical Information TI00118C/07/EN <p>Memosens data cable CYK11</p> <ul style="list-style-type: none"> ■ Extension cable for digital sensors with Memosens protocol ■ Order as per product structure (--> online Configurator, www.products.endress.com/cyk11) <p>Measuring cable CYK81</p> <ul style="list-style-type: none"> ■ Underminated cable for extending sensor cables (e.g. Memosens) ■ 2 x 2 cores, twisted with shielding and PVC sheath (2 x 2 x 0.5 mm² + shielding) ■ Material sold by the meter, Order No.: 51502543
Sensors	<p>Glass electrodes</p> <p>Orbisint CPS11D</p> <ul style="list-style-type: none"> ■ pH sensor with Memosens technology ■ Dirt-repellent PTFE diaphragm ■ Order as per product structure (--> online Configurator, www.products.endress.com/cps11d) ■ Technical Information TI00028C/07/EN <p>Memosens CPS31D</p> <ul style="list-style-type: none"> ■ pH sensor with Memosens technology ■ Gel-filled reference system with ceramic diaphragm ■ Order as per product structure (--> online Configurator, www.products.endress.com/cps31d) ■ Technical Information TI00030C/07/EN <p>Ceraliquid CPS41D</p> <ul style="list-style-type: none"> ■ pH sensor with Memosens technology ■ Ceramic diaphragm and KCl liquid electrolyte ■ Order as per product structure (--> online Configurator, www.products.endress.com/cps41d) ■ Technical Information TI00079C/07/EN <p>Ceragel CPS71D</p> <ul style="list-style-type: none"> ■ pH sensor with Memosens technology ■ Poison-resistant reference with ion trap ■ Order as per product structure (--> online Configurator, www.products.endress.com/cps71d) ■ Technical Information TI00245C/07/EN <p>Orbipore CPS91D</p> <ul style="list-style-type: none"> ■ pH sensor with Memosens technology ■ Open aperture diaphragm for media with high dirt load ■ Order as per product structure (--> online Configurator, www.products.endress.com/cps91d) ■ Technical Information TI00375C/07/EN <p>Orbipac CPF81D</p> <ul style="list-style-type: none"> ■ Compact pH sensor for installation or immersion operation in process water and wastewater ■ Order as per product structure (--> online Configurator, www.products.endress.com/cpf81d) ■ Technical Information TI191C/07/EN

Enamel pH electrodes

Ceramax CPS341D

- pH electrode with pH-sensitive enamel
- Meets highest demands of measuring accuracy, pressure, temperature, sterility and durability
- Order as per product structure (--> online Configurator, www.products.endress.com/cps341d)
- Technical Information TI00468C/07/EN

ORP sensors

Orbisint CPS12D

- ORP sensor with Memosens technology
- Dirt-repellent PTFE diaphragm;
- Order as per product structure (--> online Configurator, www.products.endress.com/cps12d)
- Technical Information TI367C/07/EN

Ceraliquid CPS42D

- ORP sensor with Memosens technology
- Ceramic diaphragm and KCl liquid electrolyte
- Order as per product structure (--> online Configurator, www.products.endress.com/cps42d)
- Technical Information TI373C/07/EN

Ceragel CPS72D

- ORP sensor with Memosens technology
- Poison-resistant reference with ion trap
- Order as per product structure (--> online Configurator, www.products.endress.com/cps72d)
- Technical Information TI374C/07/EN

Orbipac CPF82D

- Compact ORP sensor for installation or immersion operation in process water and wastewater
- Order as per product structure (--> online Configurator, www.products.endress.com/cpf82d)
- Technical Information TI191C/07/EN

Orbipore CPS92D

- ORP sensor with Memosens technology
- Open aperture diaphragm for media with high dirt load
- Order as per product structure (--> online Configurator, www.products.endress.com/cps92d)
- Technical Information TI435C/07/EN

pH ISFET sensors

Tophit CPS471D

- Sterilizable and autoclavable ISFET sensor with Memosens technology
- For the food and pharmaceutical industries, process engineering, water treatment and biotechnology
- Order as per product structure (--> online Configurator, www.products.endress.com/cps471d)
- Technical Information TI283C/07/EN

Tophit CPS441D

- Sterilizable ISFET sensor with Memosens technology
- For media with low conductivity, with liquid KCl electrolyte
- Order as per product structure (--> online Configurator, www.products.endress.com/cps441d)
- Technical Information TI352C/07/EN

Tophit CPS491D

- ISFET sensor with Memosens technology
- Open aperture diaphragm for media with high dirt load
- Order as per product structure (--> online Configurator, www.products.endress.com/cps491d)
- Technical Information TI377C/07/EN

pH and ORP combined sensors

Memosens CPS16D

- pH and ORP combined sensor for process engineering, with dirt-repellent PTFE diaphragm
- With Memosens technology
- Order as per product structure (--> online Configurator, www.products.endress.com/cps16d)
- Technical Information TI00503C/07/EN

Memosens CPS76D

- pH and ORP combined sensor for process engineering, hygiene and sterile applications
- With Memosens technology
- Order as per product structure (--> online Configurator, www.products.endress.com/cps76d)
- Technical Information TI00506C/07/EN

Memosens CPS96D

- pH and ORP combined sensor for chemical processes
- With poison-resistant reference with ion trap
- With Memosens technology
- Order as per product structure (--> online Configurator, www.products.endress.com/cps96d)
- Technical Information TI00507C/07/EN

Inductive conductivity sensors

Indumax CLS50D

- High-stability inductive conductivity sensor for standard, Ex and high-temperature applications
- Memosens protocol
- Order as per product structure (--> online Configurator, www.products.endress.com/cls50d)
- Technical Information TI182C/07/EN

Indumax H CLS54D

- Inductive conductivity sensor with certified, hygienic design for foodstuffs, beverages, pharmaceuticals and biotechnology
- Order as per product structure, (--> Online Configurator, www.products.endress.com/cls54d)
- Technical Information TI00508C/07/EN

Conductive conductivity sensors

Condumax CLS15D

- Conductive conductivity sensor for measurement in pure and ultrapure water and in Ex applications
- Order as per product structure (--> online Configurator, www.products.endress.com/cls15d)
- Technical Information TI00109C/07/EN

Condumax CLS16D

- Hygienic conductivity sensor for measurement in pure and ultrapure water and in Ex applications
- With EHEDG and 3A certificates
- Order as per product structure (--> online Configurator, www.products.endress.com/cls16d)
- Technical Information TI227C/07/EN

Condumax CLS21D

- Two-electrode sensor in fixed cable and plug-in head version
- Order as per product structure (--> online Configurator, www.products.endress.com/cls21d)
- Technical Information TI085C/07/EN

Oxygen sensors

Oxymax COS51D

- Amperometric sensor for dissolved oxygen, with Memosens technology
- Order as per product structure (--> online Configurator, www.products.endress.com/cos51d)
- Technical Information TI00413C/07/EN

Oxymax COS61D

- Optical oxygen sensor for drinking water and industrial water measurement
- Measuring principle: quenching
- Memosens protocol
- Material: stainless steel 1.4571 (AISI 316Ti)
- Order as per product structure (--> online Configurator, www.products.endress.com/cos61d)
- Technical Information TI387C/07/EN

Oxymax COS22D

- Sterilizable sensor for dissolved oxygen
- Order as per product structure (--> online Configurator, www.products.endress.com/cos22d)
- Technical Information TI446C/07/EN

Chlorine sensors

CCS142D

- Membrane-covered amperometric sensor for free chlorine
- Memosens technology
- Measuring range 0.01 to 20 mg/l
- Order as per product structure (--> online Configurator, www.products.endress.com/ccs142d)
- Technical Information TI419C/07/EN

Ion selective sensors

ISEmax CAS40D

- Ion selective sensors
- Order as per product structure (--> online Configurator, www.products.endress.com/cas40d)
- Technical Information TI491C/07/EN

Turbidity sensors

Turbimax CUS51D

- For nephelometric measurements of turbidity and solids in wastewater
- 4-beam scattered light method
- With Memosens protocol
- Order as per product structure (--> online Configurator, www.products.endress.com/cus51d)
- Technical Information TI461C/07/EN

SAC and nitrate sensors

Viomax CAS51D

- SAC and nitrate measurement in drinking water and wastewater
- With Memosens protocol
- Order as per product structure (--> online Configurator, www.products.endress.com/cas51d)
- Technical Information TI459C/07/EN

Interface measurement

Turbimax CUS71D

- Immersion sensor for interface measurement
- Ultrasonic interface sensor
- Order as per product structure (--> online Configurator, www.products.endress.com/cus71d)
- Technical Information TI490C/07/EN

Additional functionality**Hardware extension modules**

Kit CM442/CM444/CM448/CM442R/CM444R/CM448R/CSF48: extension module AOR

- 2 x relay, 2 x 0/4 to 20 mA analog output
- Order no. 71111053

Kit CM442/CM444/CM448/CM442R/CM444R/CM448R/CSF48: extension module 2R

- 2 x relay
- Order no. 71125375

Kit CM442/CM444/CM448/CM442R/CM444R/CM448R/CSF48: extension module 4R

- 4 x relay
- Order no. 71125376

Kit CM442/CM444/CM448/CM442R/CM444R/CM448R/CSF48: extension module 2AO

- 2 x 0/4 to 20 mA analog output
- Order no. 71135632

Kit CM444/CM448/CM444R/CM448R/CSF48: extension module 4AO

- 4 x analog output 0/4 to 20 mA
- Order no. 71135633

Kit CM444/CM448/CM444R/CM448R/CSF48: extension module 2DS

- 2 x digital sensor, Memosens
- Order no. 71135631

Kit CM442/CM444/CM448/CM442R/CM444R/CM448R/CSF48: extension module 2AI

- 2 x 0/4 to 20 mA analog input
- Order no. 71135639

Kit CM442/CM444/CM448/CM442R/CM444R/CM448R/CSF48: extension module DIO

- 2 x digital input
- 2 x digital output
- Auxiliary voltage supply for digital output
- Order no. 71135638

Kit CM442/CM444/CM448/CM442R/CM444R/CM448R/CSF48: extension module 485

- Ethernet configuration
- Can be extended to PROFIBUS DP or Modbus RS485 or Modbus TCP or EtherNet/IP. This requires an additional activation code which can be ordered separately (→ 47).
- Order no. 71135634

Upgrade kit CM442/CM444/CM448/CM442R/CM444R/CM448R/CSF48

- Extension module 485
- PROFIBUS DP (+ Ethernet configuration)
- Order no. 71140888

Upgrade kit CM442/CM444/CM448/CM442R/CM444R/CM448R/CSF48

- Extension module 485
- Modbus RS485 (+ Ethernet configuration)
- Order no. 71140889

Upgrade kit CM442/CM444/CM448/CM442R/CM444R/CM448R/CSF48

- Extension module 485
- Modbus TCP (+ Ethernet configuration)
- Order no. 71140890

Upgrade kit CM442/CM444/CM448/CM442R/CM444R/CM448R/CSF48

- Extension module 485
- EtherNet/IP
(+ Ethernet configuration)
- Order no. 71219868

Kit CM442: upgrade kit to CM444/CM448

- Extension power supply unit 100 to 230 V AC and extension backplane
- Basic module BASE-E
- Order no. 71135644

Kit CM442: upgrade kit to CM444/CM448

- Extension power supply unit 24 V DC and extension backplane
- Basic module BASE-E
- Order no. 71211434

Firmware and activation codes

SD card with Liquiline firmware

- Industrial Flash Drive, 1 GB
- Order no. 71127100

Activation code for digital HART communication

- Order no. 71128428

Activation code for PROFIBUS DP

- Order no. 71135635

Activation code for Modbus RS485

- Order no. 71135636

Activation code for Modbus TCP

- Order no. 71135637

Activation code for EtherNet/IP

- Order no. 71219871

Kit CM442: activation code for 2nd digital sensor input

- Order no. 71114663

Kit CM444/CM448: upgrade code for 2 x 0/4 to 20 mA for BASE-E

- Order no. 71140891

Activation code for feedforward control

- Order no. 71211288

Activation code for measuring range switch

- Order no. 71211289

Software

Memobase Plus CYP71D

- PC software to support laboratory calibration
- Visualization and documentation of sensor management
- Sensor calibrations saved in the database
- Order as per product structure, www.products.endress.com/cyp71d
- Technical Information TI00502C/07/EN

Field Data Manager Software MS30

- PC software for central data management
- Visualization of series of measurements and logbook events
- SQL database for secure data storage
- Order no. 71129799

Other accessories

SD card

SD card

- Industrial Flash Drive, 1 GB
- Order no. 71110815

Cable glands

Kit CM44x: gland M

- Set, 6 pieces
- Order no. 71101768

Kit CM44x: gland NPT

- Set, 6 pieces
- Order no. 71101770

Kit CM44x: gland G

- Set, 6 pieces
- Order no. 71101771

Kit CM44x: dummy plug for cable gland

- Set, 6 pieces
- Order no. 71104942

M12 socket and cable junction

Kit CM442/CM444/CM444/CM448: external CDI socket

- Socket with terminated connecting cables and counter nut
- Order no. 51517507

Kit CM442/CM444/CM448/CSF48: M12 socket for digital sensors

- Pre-terminated
- Order no. 71107456

Kit CM442/CM444/CM448/CSF48: M12 socket for PROFIBUS DP/Modbus RS485

- B-coded, pre-terminated
- Order no. 71140892

Kit CM442/CM444/CM448/CSF48: M12 socket for Ethernet

- D-coded, pre-terminated
- Order no. 71140893

Cable junction with Velcro strip

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

Communication-specific accessories

Commubox FXA195 HART

- 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

WirelessHART 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

Fieldgate FXA320

- Gateway for the remote interrogation of 4-20 mA measuring devices via a Web browser
- Technical Information TI00025S

Fieldgate FXA520

- Gateway for the remote diagnostics and configuration of connected HART devices via a Web browser
- Technical Information TI00051S

Field Xpert SFX100

- Compact, flexible and robust industrial handheld terminal for remote configuration and for obtaining measured values via the HART current output
- Operating Instructions BA00060S

System components

RIA14, RIA16

- Field display unit for integration into 4 to 20 mA circuits
- RIA14 in flameproof metal enclosure
- Technical Information TI00143R and TI00144R

RIA15

- Process display unit, digital display unit for integration into 4 to 20 mA circuits
- Panel mounting
- With optional HART communication
- Technical Information TI01043K

www.addresses.endress.com
