Technical Information

Liquiline CM442/CM444/CM448

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

Application

Liquiline CM442/CM444/CM448 is an extensible multiparameter controller for monitoring and controlling processes in industry and the environmental sector.
Depending on the version ordered, up to 8 digital sensors with Memosens technology can be connected.
The measuring signals can be linked by means of the mathematical function and new measured values calculated (e.g. pH calculation based on differential conductivity measurement).
Furthermore, up to eight 0/4 to 20 mA analog outputs are available. Digital Fieldbuses (HART, PROFIBUS, Modbus) and the integrated web server offer additional options for connecting to process control systems. A cleaning function, controller and alarm relay can be selected.
Optional current inputs are available for processing measured values from other devices, e.g. flow or level.

The rugged plastic version is tailored to the following non-hazardous area applications:
- 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 intuitive operating concept for all the devices of the new Liquiline, sampler and analyzer platform
- Fast commissioning thanks to:
  - Memosens: use of lab-calibrated sensors thanks to plug-and-play capabilities
  - 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

Memosens technology

MEMO⬡SENS

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

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
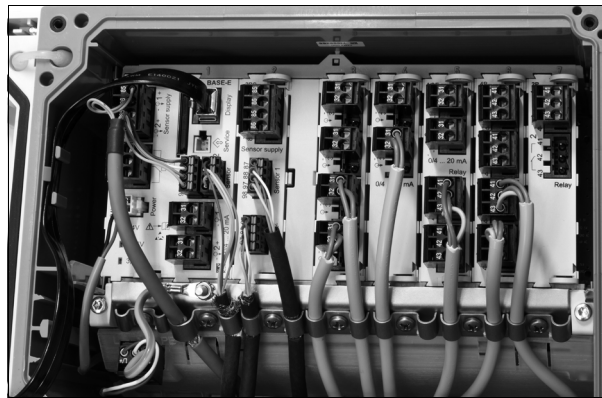
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CM448: Sample
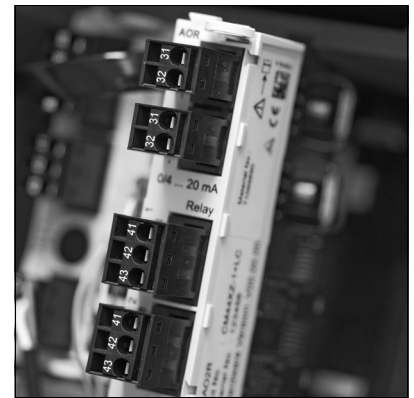
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Fitting the extension module

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

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Red background indicates an error

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)
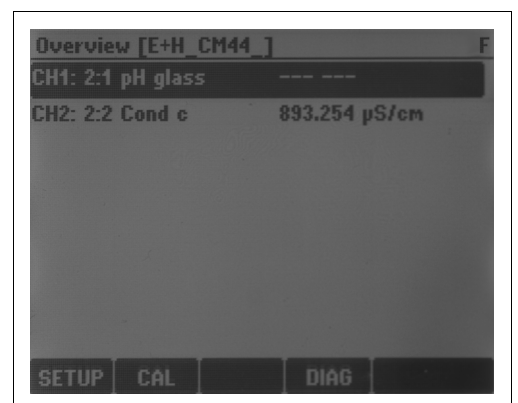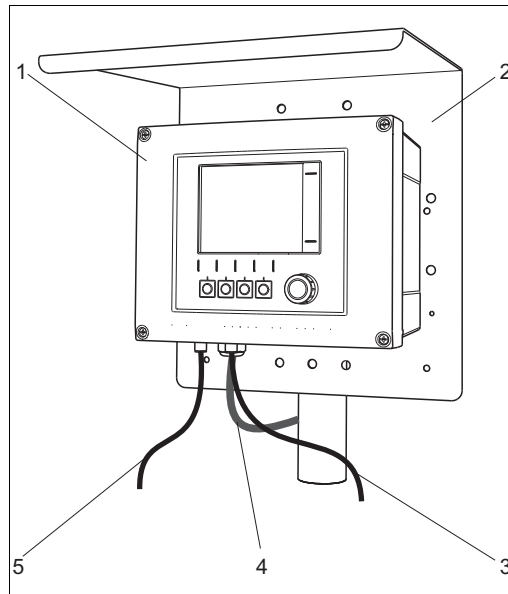

Measuring system (e.g. two-channel device)

1   *Liquiline M*
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)*

pH value or ORP

pH measurement in drinking water
- Retractable assembly Cleanfit CPA471
- Sensor Orbisint CPS11D
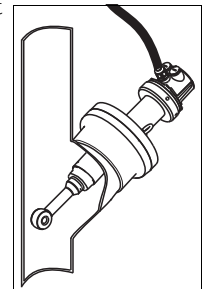- Measuring cable CYK10
  —> *graphic*
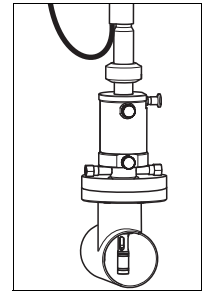
ORP in drinking water
- Immersion assembly Dipfit CYA112
- Sensor Orbisint CPS12D
- Measuring cable CYK10

Conductivity

Inductive conductivity measurement in wastewater treatment
- Immersion assembly Dipfit CLA111
- Sensor Indumax CLS50D with fixed cable

Conductive conductivity measurement in power plant cooling water
- Immersion assembly Dipfit CLA111
- Sensor Condumax CLS15D

Oxygen

Oxygen in aeration basins
- Immersion assembly Dipfit CYA112
- Holder CYH112
- Sensor
  – COS61D (optical) with fixed cable,
  – COS51D (amperometric) cable CYK10
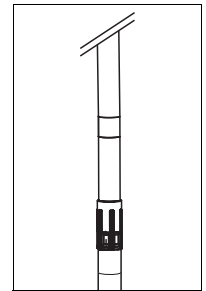
Figure: CYA112 with COS61D

Nitrate and SAC

Nitrate in wastewater
- Sensor CAS51D-**A2 with fixed cable
- Assembly CYA112
- Holder CYH112
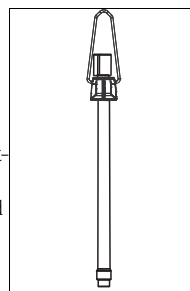
SAC in the wastewater treatment outlet
- Sensor CAS51D-**2C2 with fixed cable
- Assembly CYA112
- Holder CYH112

Chlorine

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

Turbidity and interface

Turbidity in industrial water
- Sensor Turbimax CUS51D with fixed cable
- Assembly Flowfit CUA250
- Spray head CUR3 (optional)
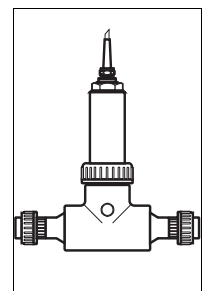
Interface in the primary clarifier
- Sensor Turbimax CUS71D
- Assembly CYA112
- Holder CYH112

Figure: CUA250 with CUS51D
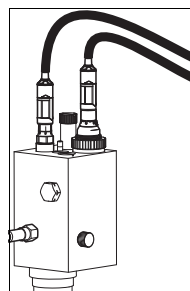
Ion selective electrodes

Ammonium and nitrate measurement in the aeration basin
- Sensor CAS40D with fixed cable
- Holder CYH112
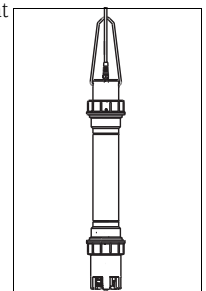
If mounting outdoors, always use the weather protection cover (see "Accessories") to protect the transmitter against weather conditions.

Device architecture

Slot and port assignment
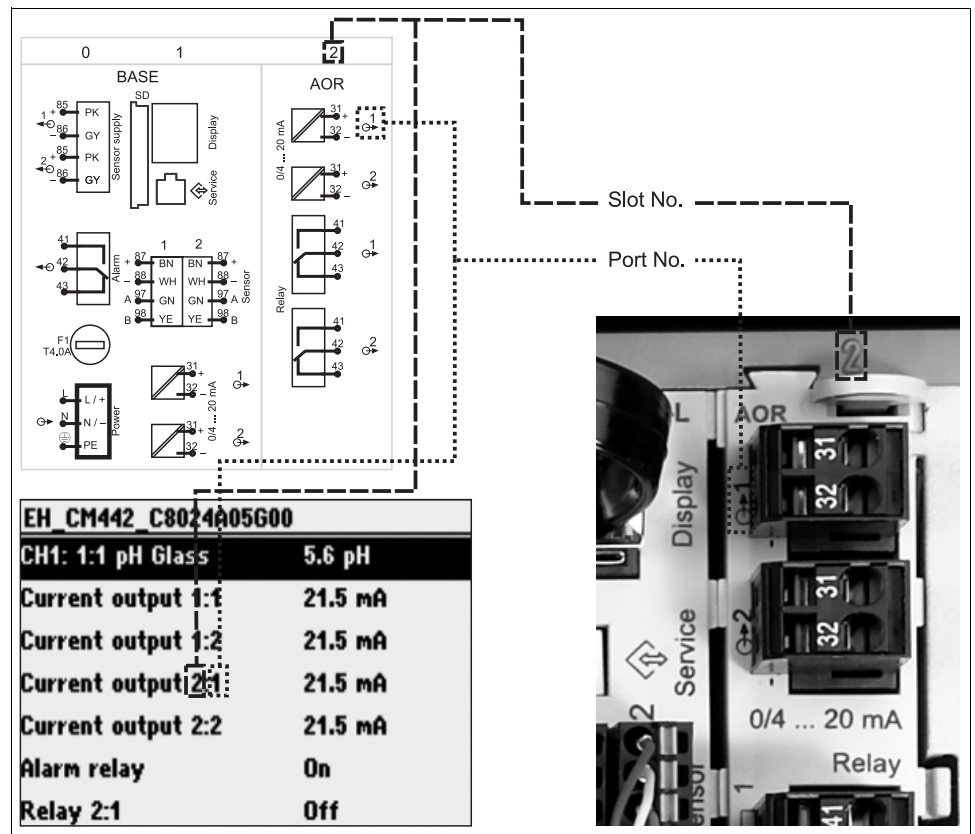
Slot and port assignment for hardware and how this information appears on the display

The electronic components are modular in design:
- There are several points available to connect electronic modules. They are known as "slots".
- The slots are numbered consecutively in the housing. Slots 0 and 1 are always reserved for the basic module.
- Each electronic module has one or more input(s) and output(s) or relays, collectively termed "ports" here.
- The ports are numbered consecutively for each electronic module and are automatically detected by the software.
- 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
  Example, → 🖻 :
  – "Current output 2:1" means:
    Slot 2 (e.g. module AOR) : Port 1 (current output 1 of module AOR)
- Inputs are assigned to measuring channels in ascending order "Slot:Port number"
 Example:
  – "CH1: 1:1 pH glass" means:
    Channel 1 (CH1) is slot 1 (basic module) : Port 1 (input 1) and a pH glass sensor is connected to it

🛈 The unique terminal name can be explained as follows:
   Slot no. : Port no. : Terminal

Electronic components ex works

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)
- Current input module 2AI (AI = analog input)
- Current output module 4AO or 2AO (AO = analog output)
- Relay modules AOR, 4R or 2R (AOR = analog output + relay, R = relay)

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

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
  - Is always present and there is only ever one.
- Fieldbus module
  - Optional and there can only be one.
- Input modules
  - Must be clearly assigned to the number of optional inputs ordered.
  - Examples:
    2 current inputs = module 2AI
    4 Memosens inputs = basic module with 2 inputs + 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 out-puts	Relay				
	0	2	4	6	8
2	–	1 x 2R	1 x 4R	1 x 4R + 1 x 2R	2 x 4R
4	1 x 2AO	1 x AOR	1 x 2AO + 1 x 4R	1 x AOR + 1 x 4R	1 x 2AO + 2 x 4R
6	1 x 4AO	1 x 4AO + 1 x 2R	1 x 4AO + 1 x 4R	1 x 4AO + 1 x 4R + 1 x 2R	1 x 4AO + 2 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	1 x 4AO + 1 x 2AO + 1 x 4R + 1 x 2R	1 x 4AO + 1 x 2AO + 2 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.

Example for creating a terminal diagram:
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)
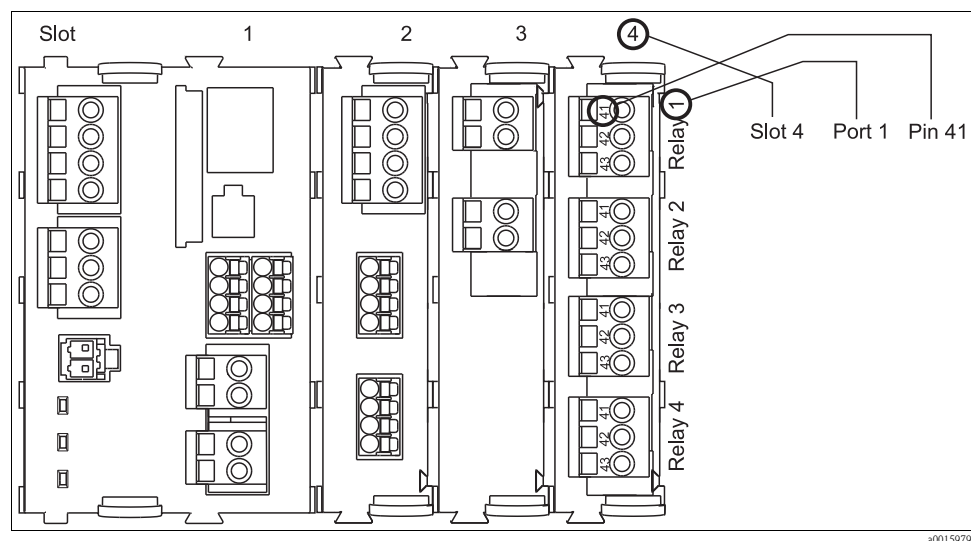
Creating a terminal diagram using the example of the NO contact (terminal 41) of a relay
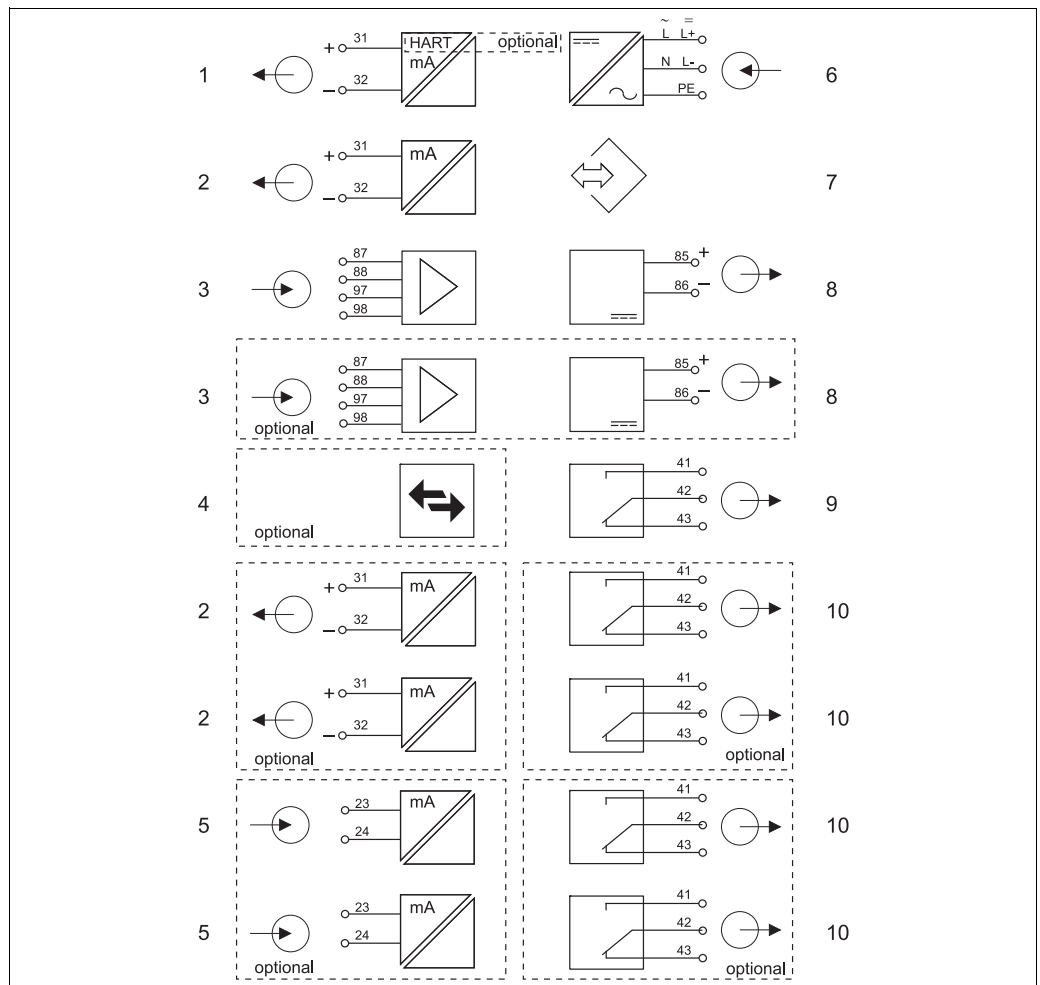
Block diagram CM442

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Block 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)

Block diagram CM444
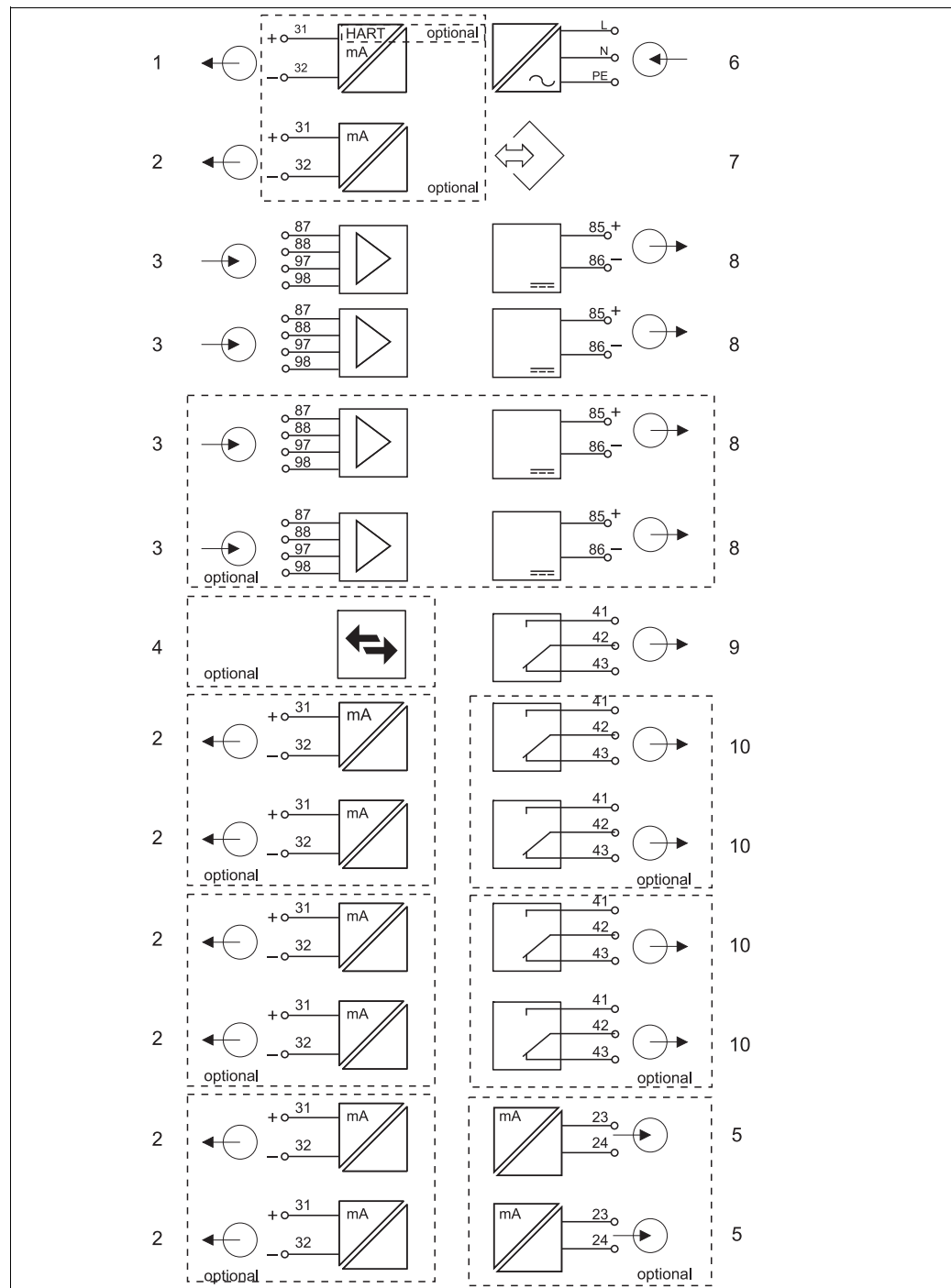
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Block diagram CM444

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)
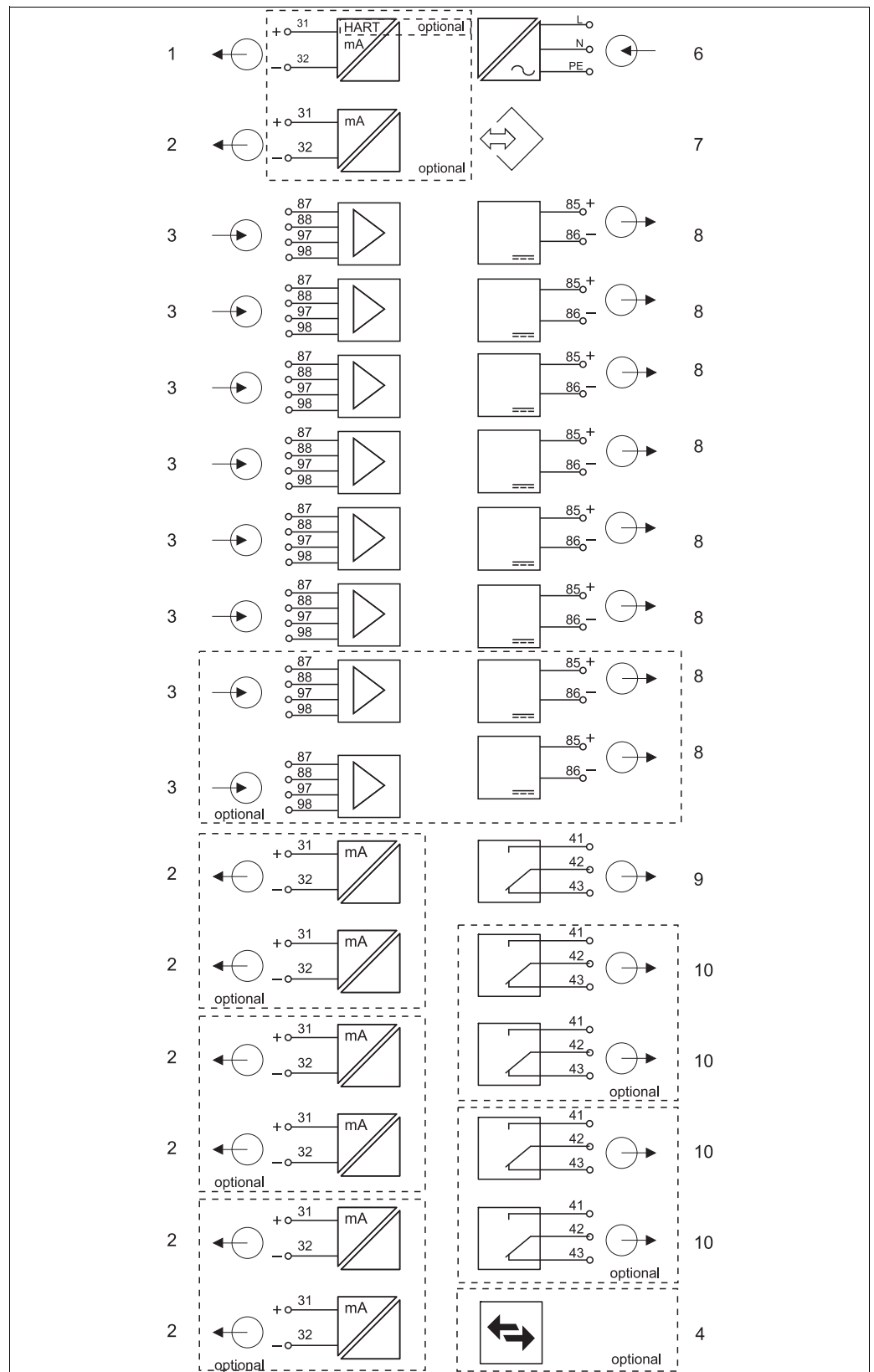
Block diagram CM448

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Block 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		

Communication and data processing

Types of communication:
- Fieldbuses
  - HART
  - PROFIBUS DP (Profile 3.02)
  - Modbus TCP or RS485
- Configuration via Ethernet

ℹ️ 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

Serviceability

Data logger function

- Adjustable scan time: 1 to 3600 s (6 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
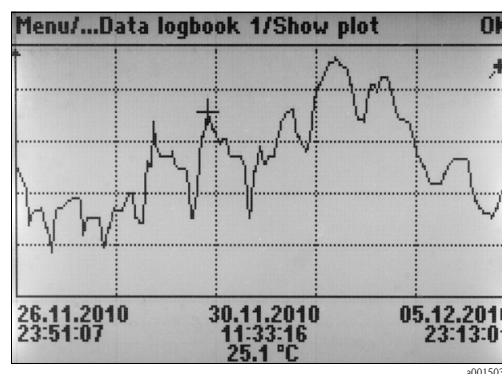
Data logbook: Graphic display

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

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)
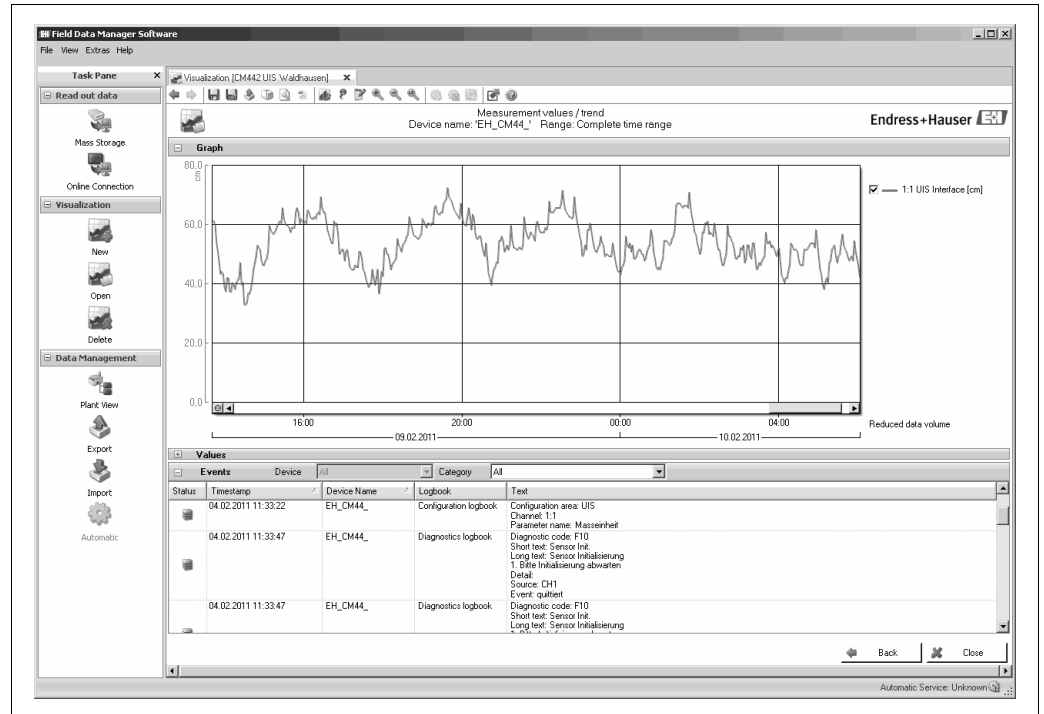
Endress+Hauser offers industry-approved SD cards as accessories. These memory cards provide maximum data security and integrity.
Other SD cards can also be used. However, Endress+Hauser does not accept any responsibility for the data security of such cards.

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

Reliability	**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.
	
	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.
	
	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)
	
	Self-monitoring functions
	
	Current inputs and outputs
	Current inputs are deactivated in the event of overcurrent and reactivated once the overcurrent stops. The current outputs are read to check if the value corresponds to the setpoint.
	
	Board monitoring
	Board voltages and board temperature are monitored.

Input

Measured variables	—> Documentation of the connected sensor
Measuring ranges	—> Documentation of the connected sensor
Input types	• Digital sensor inputs • Analog current inputs (optional)
Input signal	Depending on version • Max. 8 x binary sensor signal • 2 x 0/4 to 20 mA (optional), passive, potentially isolated from one another and from the sensor inputs
Current input, passive	**Span** > 0 to 20 mA **Signal characteristic** Linear **Internal resistance** Non-linear **Test voltage** 500 V

Cable specification	**Cable type**
	Memosens data cable CYK10 or sensor fixed cable, each with cable end sleeves or M12 round-pin connector

Cable length

Max. 100 m (330 ft)

Output

Output signal

Depending on version:
- 1 to 8 x 0/4 to 20 mA, active, potentially isolated from one another and from the sensor circuits
- Thereof one current output with optional HART communication (exclusively via current output 1:1)

HART

Signal coding	FSK ± 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

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): 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

Load	Max. 500 Ω

Linearization/transmission behavior	Linear

Current outputs, active

Span	0 to 23 mA
	2.4 to 23 mA for HART communication

Signal characteristic	Linear

Electrical specification	**Output voltage**
	Max. 24 V
	Test voltage
	500 V

Cable specification	**Cable type**
	Recommended: shielded cable
	Cross-section
	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)

Relay switching capacity

Basic 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

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 mm^2 (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 configured by the user and 16 pre-defined, dynamic variables PV, SV, TV, QV
Supported features	PDM DD, AMS DD, DTM, FieldXpert DD

PROFIBUS DP

Manufacturer ID	11_h
Device type	$155D_h$ (CM44x), $155C_h$ (CSFxx)
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	8 AO blocks, 4 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), 4 digital values (value, status), diagnostic information
Supported features	Address can be configured using switch or software

Modbus TCP

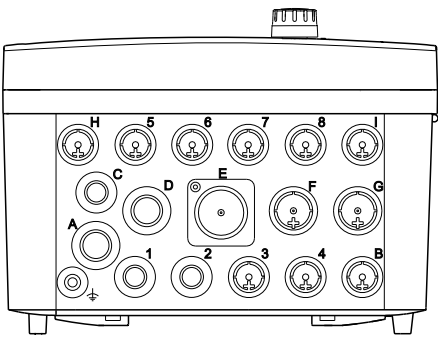| TCP port	502
TCP connections	3
Protocol	RTU
Function codes	03, 04, 06, 08, 16, 23
Broadcast support for function codes	06, 16, 23
Output data	16 measured values (value, unit, status), 8 digital values (value, status)
Input data	4 setpoints (value, unit, status), 6 digital values (value, status), diagnostic information
Supported features	Address can be configured using DHCP or software

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	■ Remote-controlled device configuration ■ Save/restore device configuration ■ Logbook export (file formats: CSV, FDM) ■ Access to web server via DTM or Internet Explorer

Power supply

|	
Supply voltage	**CM442** Depending on version: 100 to 230 V AC ± 15 %, 50/60 Hz 24 V AC/DC +20/-15 %, 50/60 Hz **CM444 and CM448** 100 to 230 V AC ± 15 %, 50/60 Hz **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
	Max. 73 VA

Fuse	**CM442** 5x20 mm, 250 V, 4.0 A, slow-blow (T4.0A) **CM444 and CM448** Fuse not exchangeable

Cable entry

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	Socket RJ45
⏚	M12x1.5 mm

Recommended assignment of cable entries

1-8   Sensors 1-8
A   Energy supply
B   RS485 Out
C   Ethernet 2
D,F,G   Current outputs and inputs, relays
H   Ethernet 1
I   RS485 In
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")

Electrical connection **Basic module**
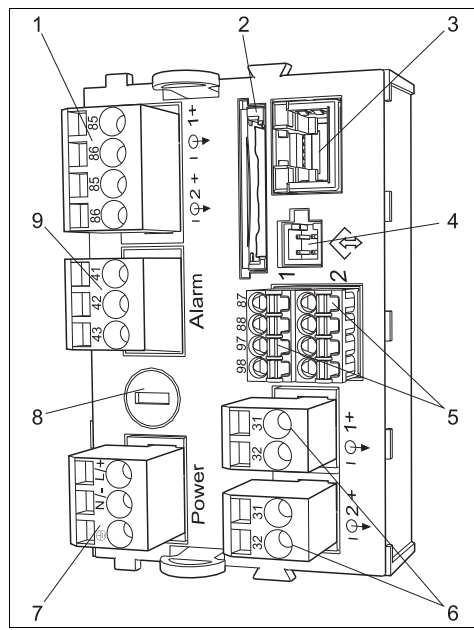
Basic module BASE-H or -L (CM442)

a0012405

1 Power supply for digital fixed cable sensors with Memosens protocol
2 SD card slot
3 Slot for display cable[1]
4 Service interface
5 Connections for 2 Memosens sensors
6 Current outputs
7 Power connection
8 Fuse
9 Alarm relay connection
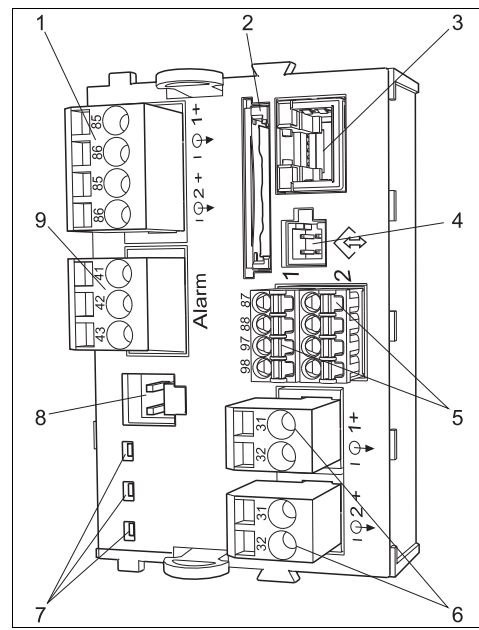
*Basic module BASE-E (CM444 and CM448)*

a0015871

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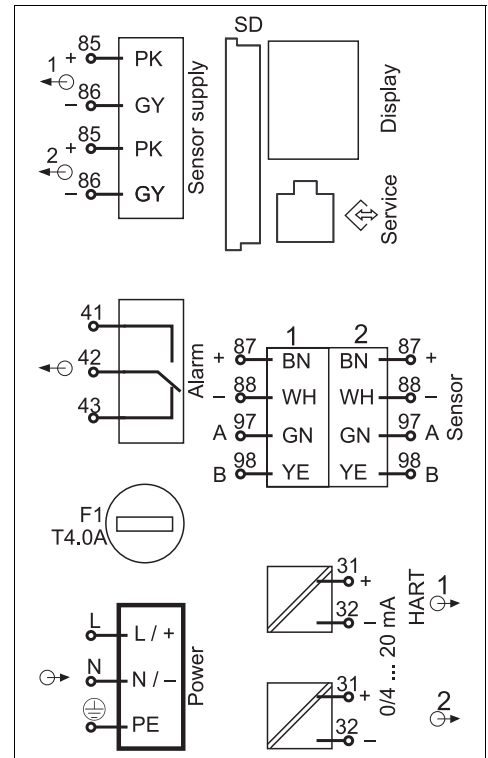8 Socket for internal supply cable
9 Alarm relay connection

1) Internal device connection. Do not disconnect the plug!
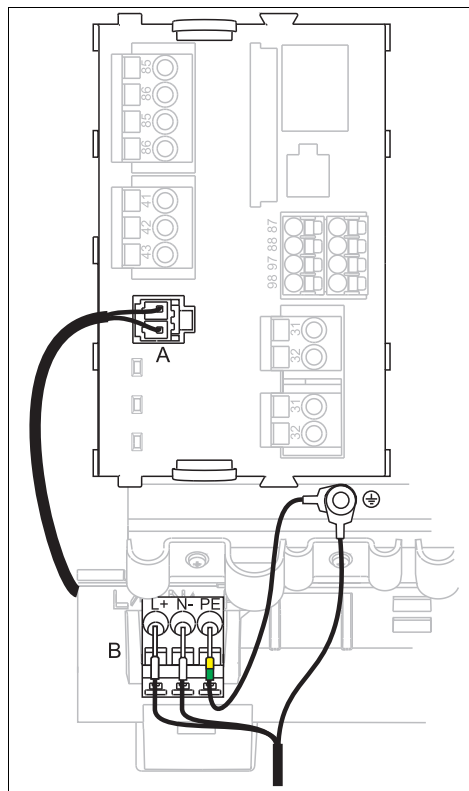
Connecting supply voltage for CM442
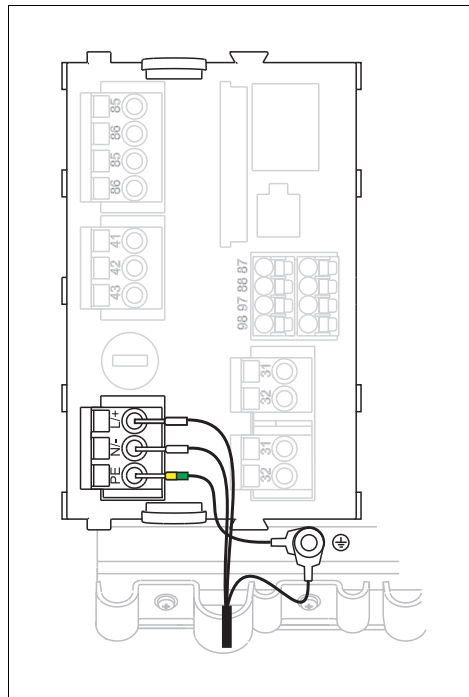
Connecting power supply on the BASE-H or -L

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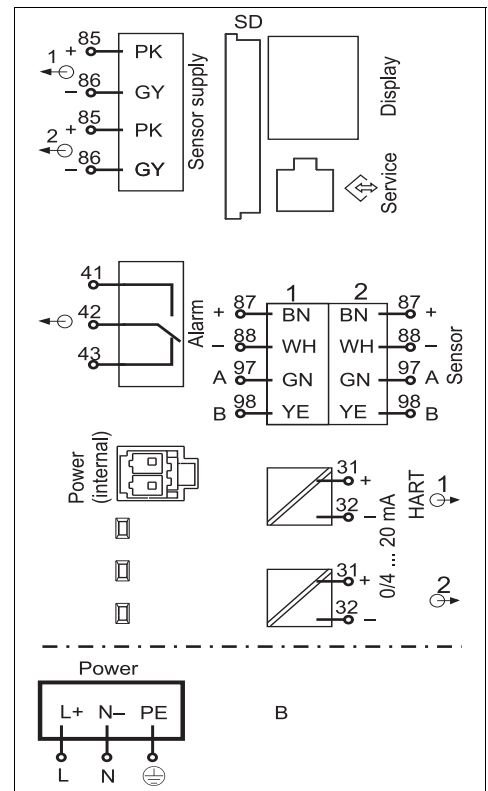L   Power unit 24 VAC or 24 VDC

a0015825

Overall wiring diagram for BASE-H or -L

a0012404

Connecting supply voltage for CM444 and CM448

Connecting power supply with BASE-E

A   Internal supply cable
B   Extension power supply unit

a0015872

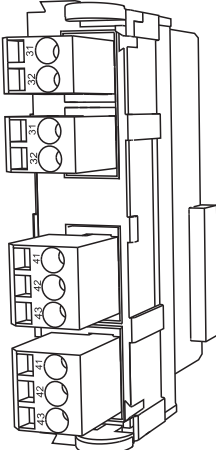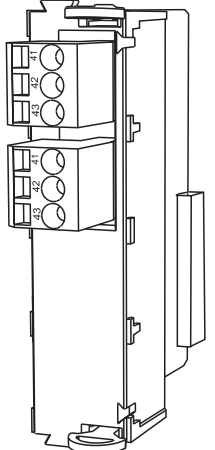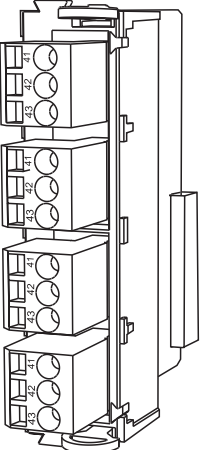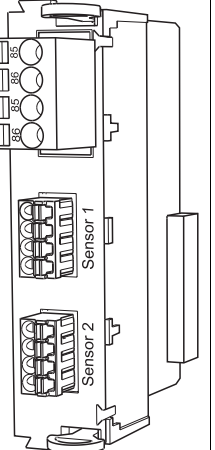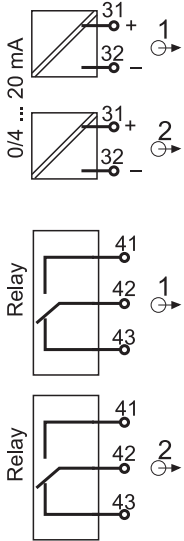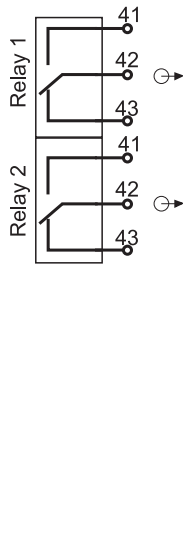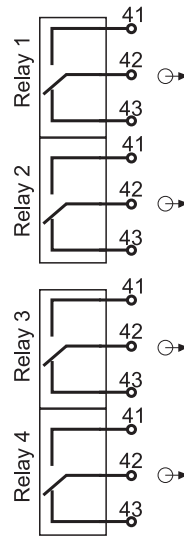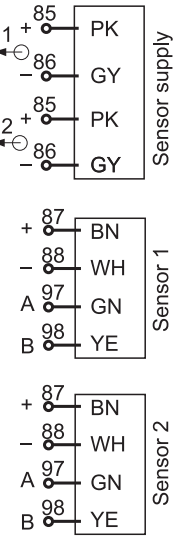*Overall wiring diagram for BASE-E and extension power supply unit*

a0015873

Connecting optional modules With extension modules you can purchase additional functions for your device.
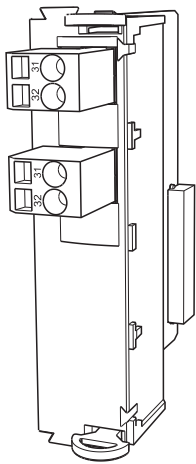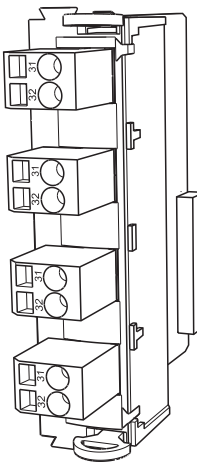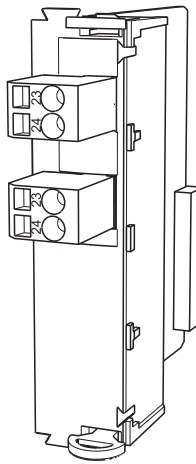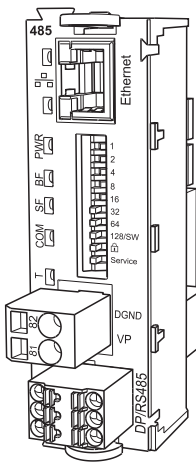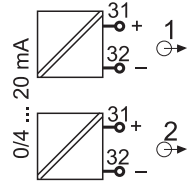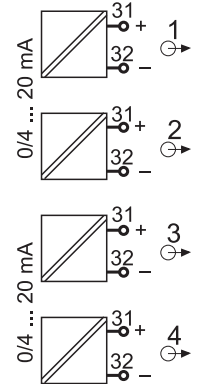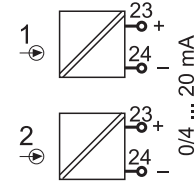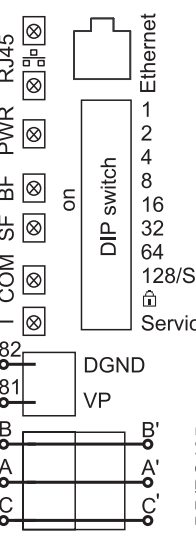
> **NOTICE**
>
> **Unacceptable hardware combinations (due to conflicts in power supply)**
> Incorrect measurements or total failure of the measuring point as a result of heat build-up or overloading
> ► If you are planning to extend your controller, make sure the resulting hardware combination is permitted (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.
> ► Please contact your Endress+Hauser sales center should you have any questions.

Module name			
AOR	**2R**	**4R**	**2DS**
a0015747	a0015748	a0015749	a0015754
• 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
a0015755	a0015758	a0015757	a0015756

Module name			
2AO	**4AO**	**2AI**	**485**
a0015750
a0015751
a0015752
a0015753
▪ 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 20 mA analog inputs
▪ Order no. 71135639	▪ 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

a0012454

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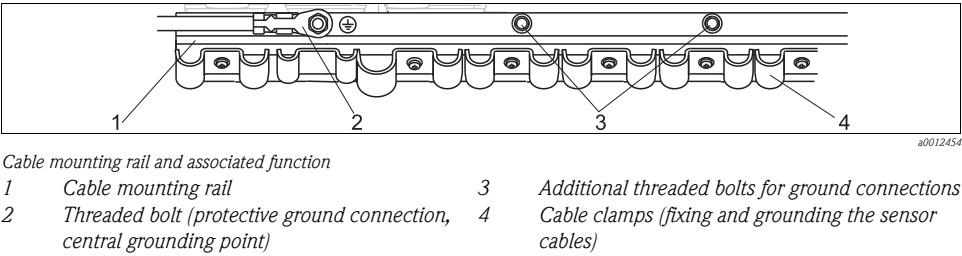
Sensor connection

Sensors with Memosens protocol

Sensor types	Sensor cables	Sensors
Digital sensors **without** additional power supply	CYK10 with plug-in connection and inductive signal transmission	■ pH sensors ■ ORP sensors ■ Combi sensors ■ Amperometric oxygen sensors ■ Conductive conductivity sensors ■ Chlorine sensors
	Fixed cable	Inductive conductivity sensors
Digital sensors **with** additional power supply	Fixed cable	■ Turbidity sensors ■ Sludge level sensors ■ Sensors for measuring the spectral absorption coefficient (SAC) ■ Nitrate sensors ■ Optical oxygen sensors ■ Ion-sensitive sensors

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
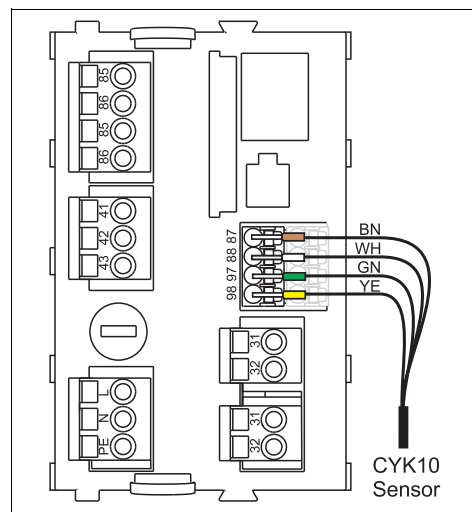
Sensors without additional supply voltage
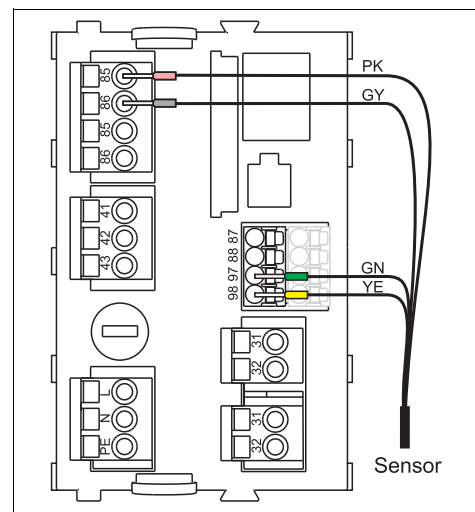
Sensors with additional supply voltage

a0016197
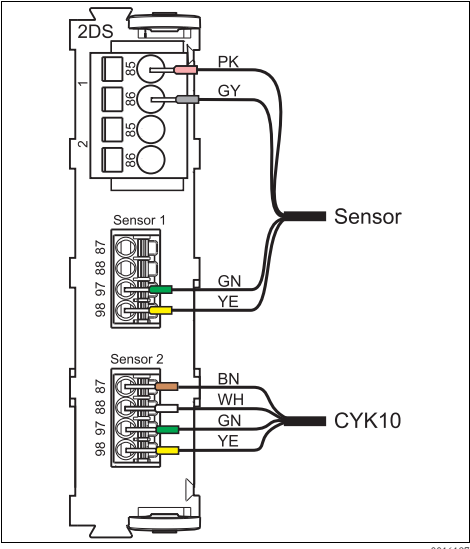
Sensors with and without additional supply voltage at sensor module 2DS

2. Connection via M12 plug-in connection

a0018019
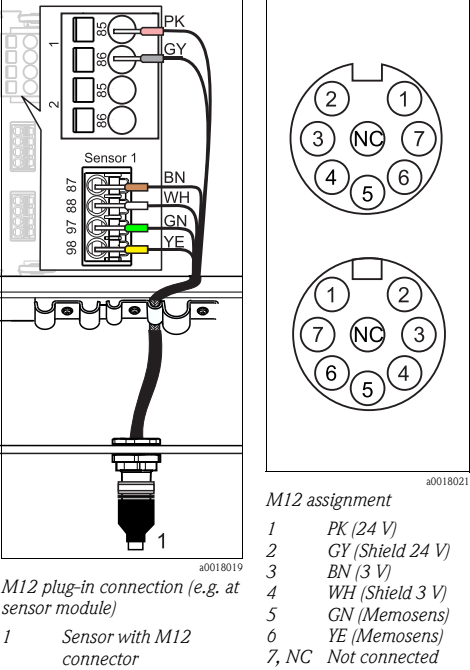
M12 plug-in connection (e.g. at sensor module)

1   Sensor with M12 connector

a0018021

M12 assignment

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

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	**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
Reference temperature	25 °C (77 °F)
Maximum measured error of sensor inputs	—> Documentation of the connected sensor
Maximum measured error of 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
Resolution of current inputs and outputs	< 5 µA
Repeatability	—> Documentation of the connected sensor

Installation

Mounting plate
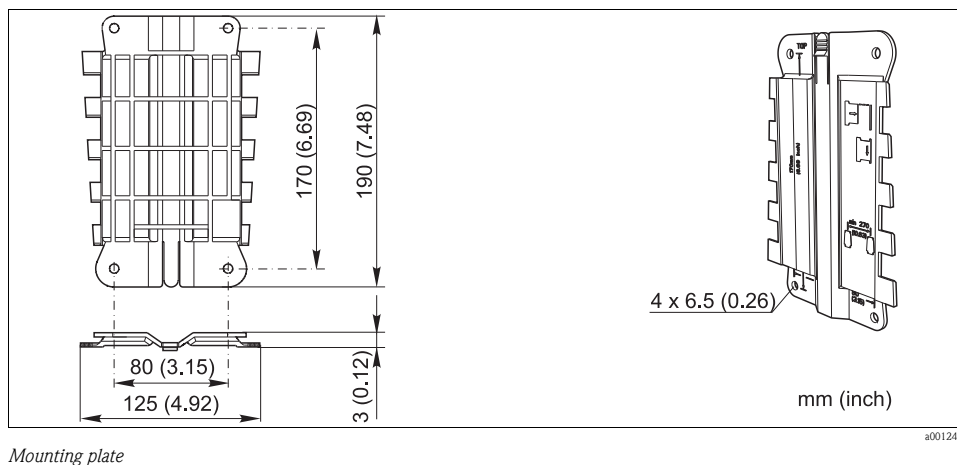
Mounting plate

Weather protection cover
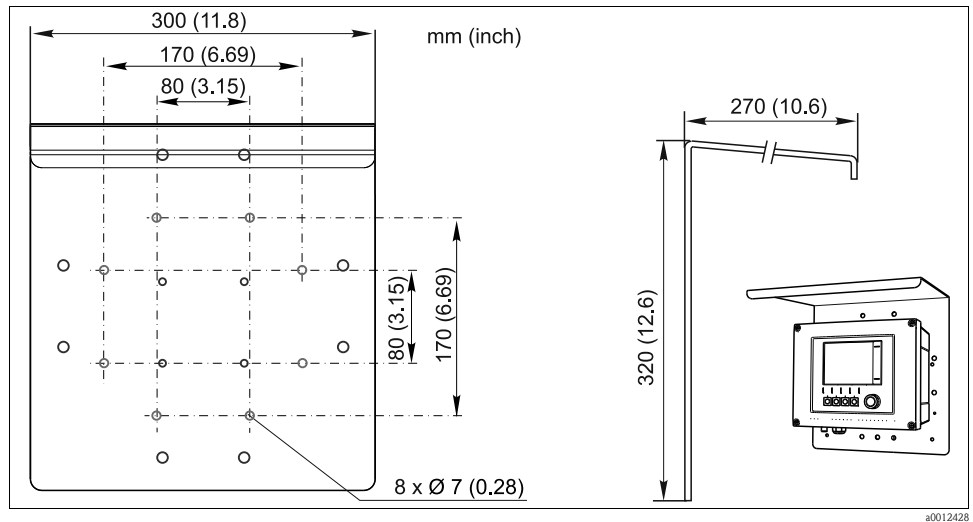
Weather protection cover for CM44x

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
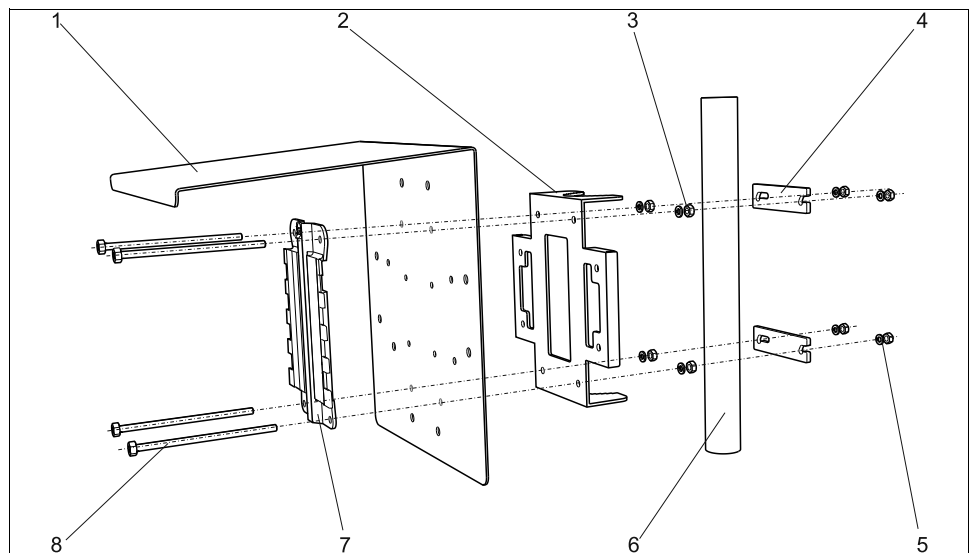
Post mounting (exploded view)

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
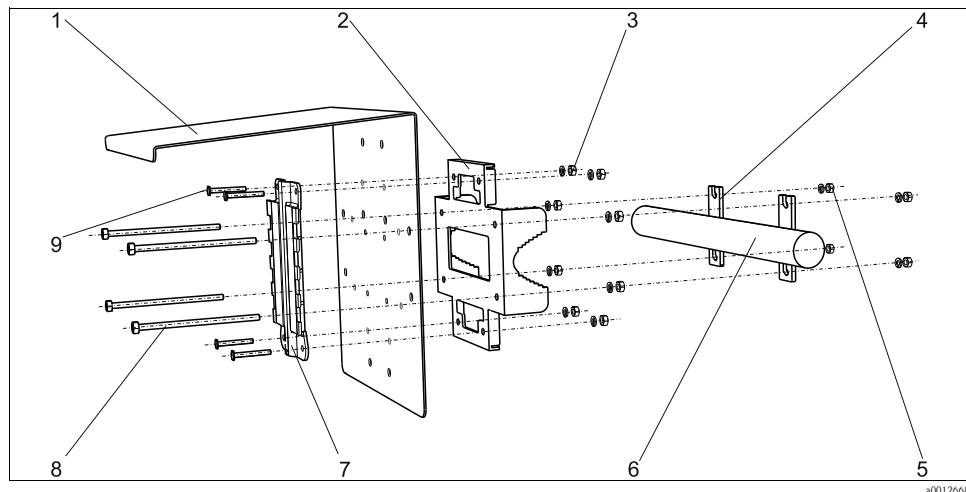
Rail mounting (exploded view)

1   Weather protection cover (optional)
2   Post mounting plate (post mounting kit)
3   Spring washers, nuts (post mounting kit)
4   Pipe clamps (post mounting kit)
5   Spring washers, nuts (post mounting kit)

6   Pipe or railing (circular/square)
7   Mounting plate
8   Threaded rods (post mounting kit)
9   Screws (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.
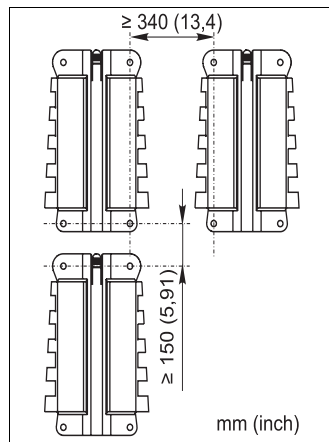
Minimum spacing required for mounting
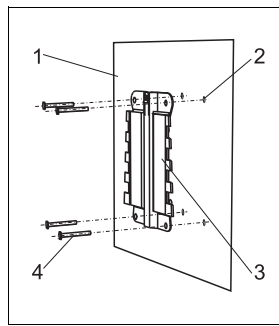
Wall mounting

1   Wall
2   4 drill holes[1]
3   Mounting plate
4   Screws Ø 6 mm (not part of scope of supply)

Attach the Liquiline and click it into place

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

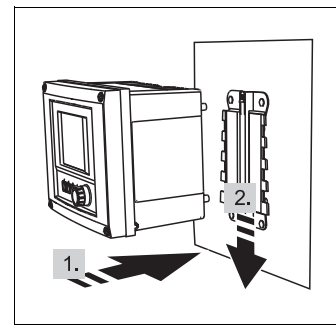|	

Ambient temperature range	**CM442**
	–20 to 60 ˚C (0 to 140 ˚F)
	
	CM444
	–20 to 55 ˚C (0 to 130 ˚F)
	
	CM448
	■ –20 to 55 ˚C (0 to 130 ˚F) in general, with the exception of the packages listed under the 2nd bullet point
	■ –20 to 50 ˚C (0 to 120 ˚F) for the following packages:
	  – CM448-***6AA******+...
	  – CM448-***8A4******+...
	  – CM448-***8A5******+...
	  – CM448-**28A3******+...
	  – CM448-**38A3******+...
	  – CM448-**48A3******+...
	  – CM448-**58A3******+...
	  – CM448-**68A3******+...

Storage temperature	–40 to 80 ˚C (–40 to 175 ˚F)
Relative humidity	10 to 95%, not condensing
Degree of protection	IP 66/67, leak-tightness 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** 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** 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 is approximately 9.81 m/s^2)
Electromagnetic compatibility	Interference emission and interference immunity as per EN 61326-1: 2006, class A for industry
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
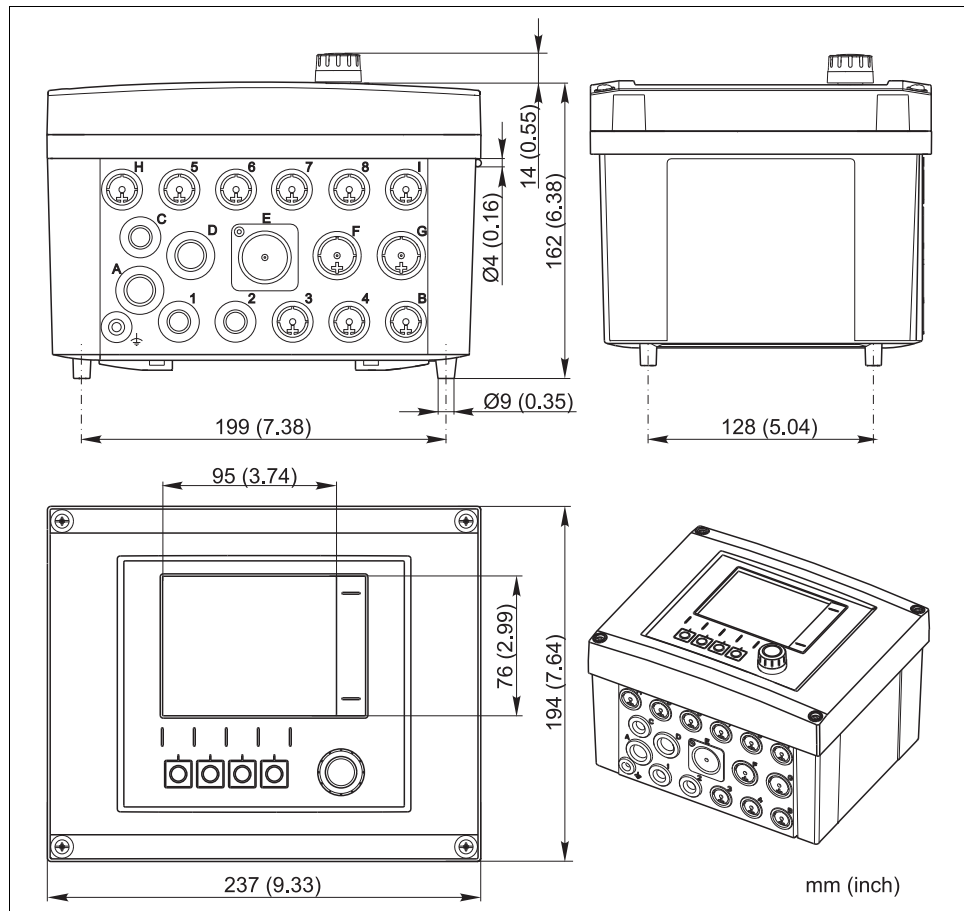
Dimensions of field housing

a0012396

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

Material

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)

Operability

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

Easy operation

Plain-text menu

Local operation

Human interface
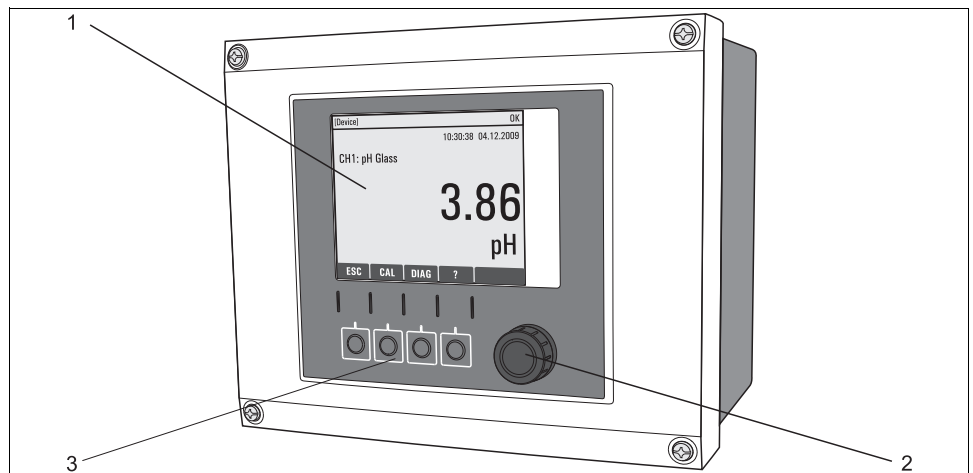
Overview of operation

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)
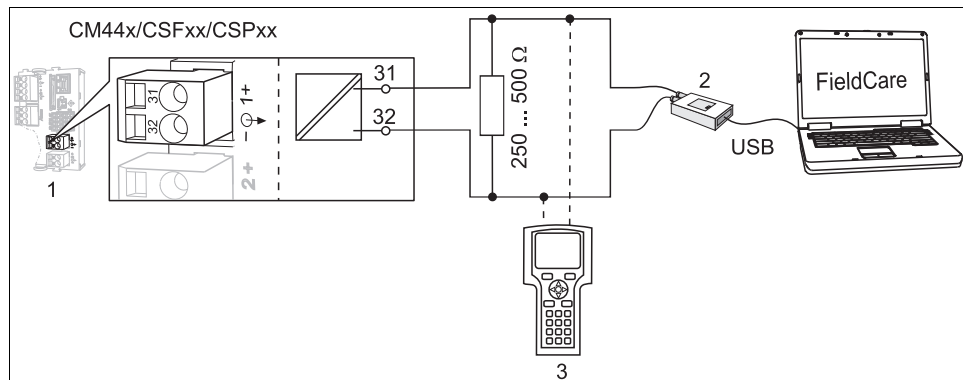
HART using modem

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

Via PROFIBUS DP
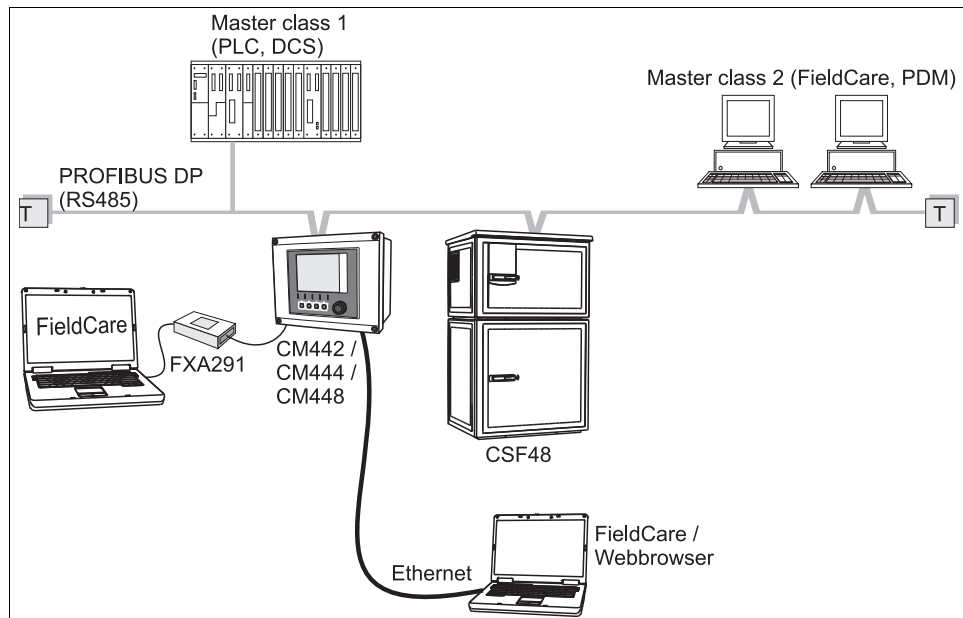
PROFIBUS DP

T   Terminating resistor

1)   Switch position "on" (replaces resistance)

Via Modbus RS485
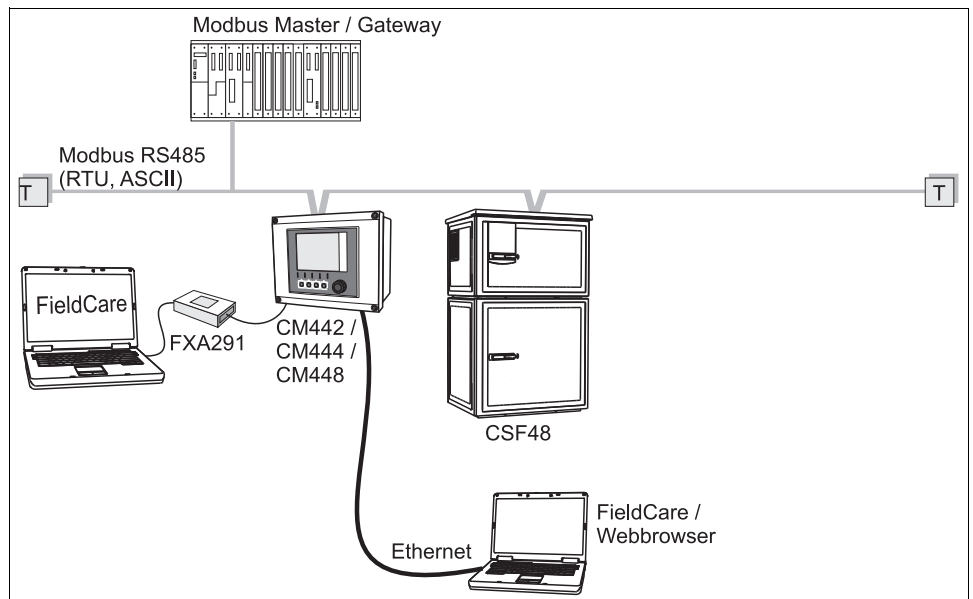
Modbus RS485
T   Terminating resistor

Via Ethernet/Web server/Modbus TCP
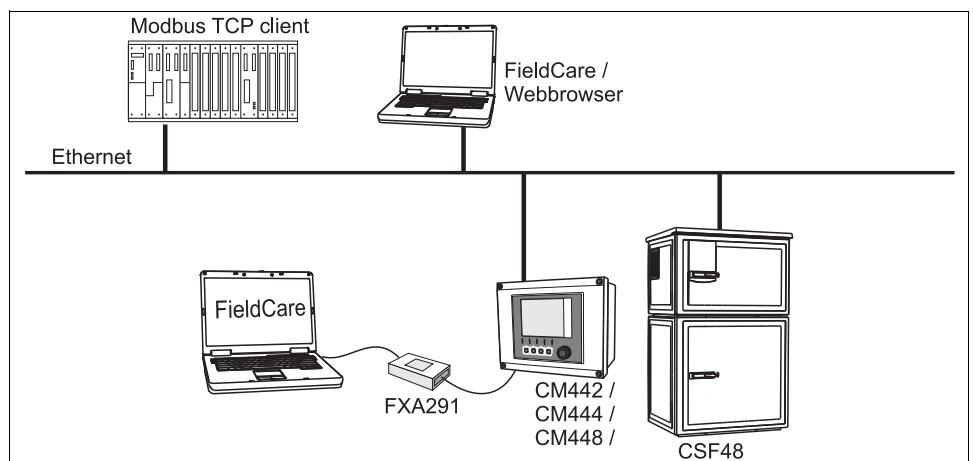
Modbus TCP and/or Ethernet

Language groups	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
- 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:

Product page function
:: Add to product list
:: Price & order information
:: Compare this product
:: Configure this product

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 "Commissioning" section of the 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. 1, Div. 2

MCERTS

Application made for CM442

Accessories

ℹ 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	CYY101 weather protection cover for field devices, absolutely essential if operating the unit outdoors • Material: stainless steel 1.4031 (AISI 304) • Order No. CYY101-A
Post mounting kit	Post mounting kit CM44x • For securing the field housing to horizontal and vertical posts and pipes • Order no. 71096920
Measuring cable	Memosens data cable CYK10 • 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) Memosens data cable CYK11 • Extension cable for digital sensors with Memosens protocol • Order as per product structure (—> online Configurator, www.products.endress.com/cyk11)
Sensors	**Glass electrodes** Orbisint CPS11D • pH sensor with Memosens technology • Dirt-repellent PTFE diaphragm • Order as per product structure (—> online Configurator, www.products.endress.com/cps11d) • Technical Information TI028C/07/EN Ceraliquid CPS41D • 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 TI079C/07/EN Ceragel CPS71D • pH sensor with Memosens technology • Double-chamber reference system and integrated bridge electrolyte • Order as per product structure (—> online Configurator, www.products.endress.com/cps71d) • Technical Information TI245C/07/EN Orbipore CPS91D • pH sensor with Memosens technology • Open aperture diaphragm for media with a high dirt load • Order as per product structure (—> online Configurator, www.products.endress.com/cps91d) • Technical Information TI375C/07/EN Orbipac CPF81D • 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 **Pfaudler 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 TI468C/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
- Double-chamber reference system and integrated bridge electrolyte;
- 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 a 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

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

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 TI109C/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 TI413C/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/CSF48: extension module AOR
- 2 x relay, 2 x 0/4 to 20 mA analog output
- Order no. 71111053

Kit CM442/CM444/CM448/CSF48: extension module 2R
- 2 x relay
- Order no. 71125375

Kit CM442/CM444/CM448/CSF48: extension module 4R
- 4 x relay
- Order no. 71125376

Kit CM442/CM444/CM448/CSF48: extension module 2AO
- 2 x 0/4 to 20 mA analog output
- Order no. 71135632

Kit CM444/CM448/CSF48: extension module 4AO
- 4 x analog output 0/4 to 20 mA
- Order no. 71135633

Kit CM444/CM448/CSF48: extension module 2DS
- 2 x digital sensor, Memosens
- Order no. 71135631

Kit CM442/CM444/CM448/CSF48: extension module 2AI
- 2 x 0/4 to 20 mA analog input
- Order no. 71135639

Kit CM442/CM444/CM448/CSF48: extension module 485
- Ethernet configuration
- Can be extended to PROFIBUS DP or Modbus RS485 or Modbus TCP using activation code
- Order no. 71135634

Upgrade kit CM442/CM444/CM448/CSF48
- Extension module 485
- PROFIBUS DP (+ Ethernet configuration)
- Order no. 71140888

Upgrade kit CM442/CM444/CM448/CSF48
- Extension module 485
- Modbus RS485 (+ Ethernet configuration)
- Order no. 71140889

Upgrade kit CM442/CM444/CM448/CSF48
- Extension module 485
- Modbus TCP (+ Ethernet configuration)
- Order no. 71140890

Kit CM442: upgrade kit to CM444/CM448
- Extension power supply unit and backplane
- Basic module BASE-E
- Order no. 71135644

Software 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

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

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 CM42/CM442/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

Kit CM442/CM444/CM448/CSF48: RJ45 socket for Ethernet
- Pre-terminated
- Order no. 71140895

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

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