

Technical Information

Liquisys M CUM223/253

Turbidity and suspended solids transmitter



Application

The modular design of the transmitter allows easy adaption to a variety of customer requirements. Starting with the basic version for "measurement and alarm generation", the transmitter can be equipped with additional software and hardware modules for special applications. These modules can also be retrofitted as required.

Areas of application

- Sewage treatment plants, suspended solids measurement
- Wastewater treatment
- Water treatment and drinking water monitoring
- Surface water: rivers, lakes, ocean
- Service water

Your benefits

- Field or panel-mounted housing
- Universal application
 - One instrument for turbidity and suspended solids
 - Units: FNU (formazine standard), ppm, g/l, % or % SS
- Simple handling
 - Logically arranged menu structure
 - Ultrasimple calibration with user samples and alarm signalling for calibration errors
- Safe operation
 - Overvoltage (lightning) protection
 - Direct access for manual contact control
 - User-defined alarm configuration
 - Automatic sensor self-recognition with calibration data transfer

The basic unit can be extended with:

- 2 or 4 additional contacts for use as:
 - Limit contacts (also for temperature)
 - P(ID) controller
 - Timer for simple rinse processes
 - Complete cleaning with Chemoclean
- Plus package:
 - Any current output configuration via table
 - Automatic cleaning start
 - Display in customer units (e.g. density) via table assignment
 - Live check of sensor
- HART® or PROFIBUS® PA / DP
- 2nd current output for temperature, main measured value or actuating variable
- Current input for flow rate monitoring with controller shut off or for feedforward control

Function and system design

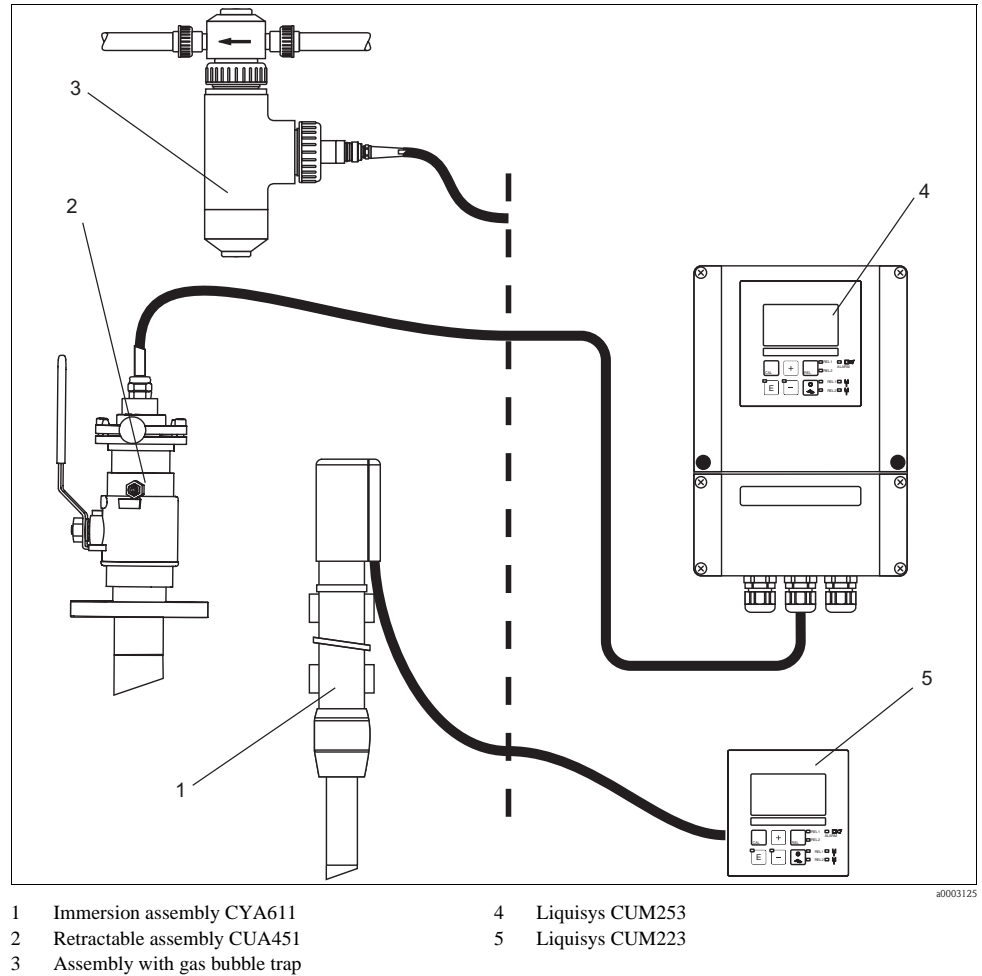
Features of the basic version	Measurement of turbidity and suspended solids	
	The sensor is selected from the menu. During measurement, the value measured can be displayed in the other measuring mode. The temperature is displayed at the same time if desired.	
	Configuration	
	Different alarms are required depending on application and operator. Therefore the transmitter permits independent configuration of the alarm contact and error current for each individual error. Unnecessary or undesirable alarms can be suppressed in this manner. Up to four contacts can be used as limit contacts (also for temperature), to implement a P(ID) controller or for cleaning functions.	
	Direct manual operation of the contacts (bypassing the menu) provides quick access to limit, control or cleaning contacts, permitting speedy correction of deviations.	
	The serial numbers of the instrument and modules and the order code can be called up on the display.	
Additional functions of the Plus package TS	Current output configuration	
	In order to output wide measuring ranges while still achieving a high resolution in specific ranges, the current output can be configured as required via a table. This permits bilinear or quasi-logarithmic curves, etc.	
	Process Check System (PCS)	
	It comprises two independent safety functions:	
	<ul style="list-style-type: none"> ■ Errors in applications without control are detected by monitoring the limit between plausible and implausible measured values, i.e. the alarm threshold. ■ Errors in applications with control are detected by the controller monitor which monitors freely adjustable, maximum permissible time intervals and reference value overshoot or undershoot. 	
	Live check	
	The live check issues an alarm when the sensor signal does not change over a defined period of time. This may be caused by blocking, passivation, separation from the process, etc.	
Additional functions of version TS	Display of various measurement units	
	In addition to turbidity (FNU, NTU) and concentration (ppm / % SS), the display can also show other units (e.g. density). A table is used for conversion (calibration in %).	
Second current output	The second current output can be configured for temperature, main measured value (turbidity, suspended solids) or actuating variable.	
Current input	The current input of the transmitter allows two different applications: controller shut-down in case of lower flow rate violation or total failure in the main flow as well as feedforward control. Both functions are also combinable.	
Explosion-proof versions for zone 2	Application of transmitter and sensor in hazardous area zone 2	Field housing CUM253 with power supply 24 V
	Application of transmitter as related electrical equipment in non-hazardous area or in simple pressurized apparatus; application of sensor in hazardous area zone 2	Field housing CUM253 with power supply 230 V or Panel-mounted housing CUM223 with power supply 230 V or 24 V

Measuring system

A complete measuring systems comprises:

- The transmitter Liquisys M CUM223 or CUM253
- A sensor with or without an integrated temperature sensor
- An immersion, flow or retractable assembly

Options: extension cable CYK81, junction box VBM or RM



Input

Measured variables	Turbidity, suspended solids, temperature	
Measuring range	CUS31:	0.000 to 9999 FNU/NTU 0.00 to 3000 ppm 0.0 to 3.0 g/l 0.0 to 200.0 %
	CUS41:	0.00 to 9999 FNU/NTU 0.00 to 9999 ppm 0.0 to 300.0 g/l 0.0 to 200.0 %
	Temperature:	-5.0 to +70.0°C (+23 to +158°F)
Cable specification	Cable length:	max. 200 m (656 ft.)
Signal input	Digital communication	
Temperature measurement	NTC 30 kΩ at 25°C (77°F)	
Binary inputs	Voltage:	10 to 50 V
	Power consumption:	max. 10 mA
Current input	4 to 20 mA, galvanically separated Load: 260 Ω at 20 mA (voltage drop 5.2 V)	

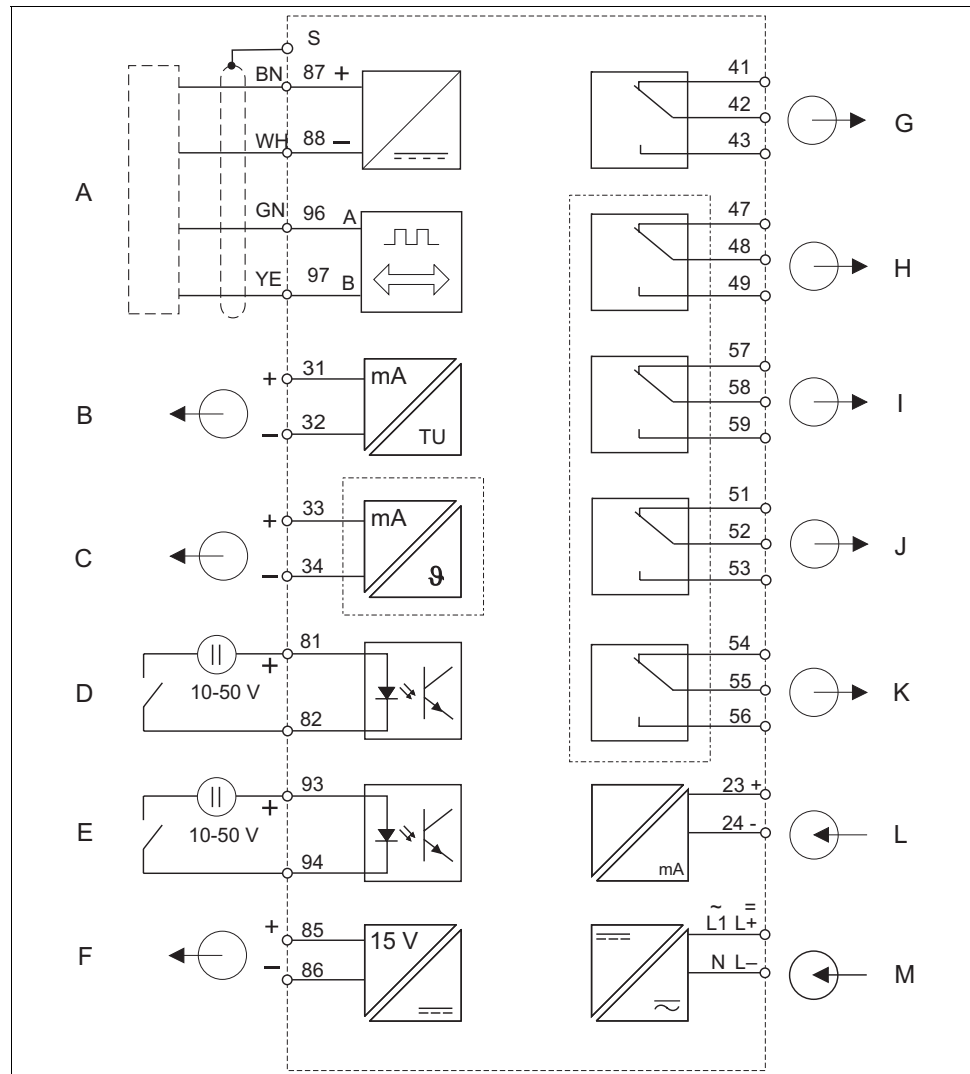
Output

Current range	0/4 to 20 mA, galvanically separated, active	
Error current	2.4 or 22 mA in case of an error	
Load	Maximum 500 Ω	
Transmission range	CUS31/CUS41:	adjustable, min. Δ 0.1 FNU, Δ 0.1 ppm, Δ 0.1 g/l, Δ 0.1 %
	Temperature:	adjustable, Δ 10 to Δ 100 % of measuring range
Resolution	Max. 700 digits/mA	
Isolation voltage	Max. 350 V _{RMS} /500 V DC	
Overvoltage protection	According to EN 61000-4-5	
Auxiliary voltage output	Output voltage:	15 V ± 0.6
	Output current:	max. 10 mA
Contact outputs	Switching current with ohmic load (cos φ = 1):	max. 2 A
	Switching current with inductive load (cos φ = 0.4):	max. 2 A
	Switching voltage:	max. 250 V AC, 30 V DC
	Switching power with ohmic load (cos φ = 1):	max. 500 VA AC, 60 W DC
	Switching power with inductive load (cos φ = 0.4):	max. 500 VA AC, 60 W DC

Limit contactor	Pickup/dropout delay:	0 to 2000 s
Controller	Function (adjustable): Controller response: Control gain K_p : Integral action time T_n : Derivative action time T_v : Period for pulse length controller: Frequency for pulse frequency controller: Basic load:	pulse length/pulse frequency controller PID 0.01 to 20.00 0.0 to 999.9 min 0.0 to 999.9 min 0.5 to 999.9 s 60 to 180 min ⁻¹ 0 to 40% of max. set value
Alarm	Function (selectable): Alarm threshold adjustment range: Alarm delay:	Latching / momentary contact Turbidity / suspended solids / temperature: complete measuring range 0 to 2000 s 0 to 2000 min

Power supply

Electrical connection



Electrical connection of the transmitter

A	Sensor	H	Relay 1 (current-free contact position)
B	Signal output 1 turbidity/solids content	I	Relay 2 (current-free contact position)
C	Signal output 2 temperature	J	Relay 3 (current-free contact position)
D	Binary input 1 (Hold)	K	Relay 4 (current-free contact position)
E	Binary input 2 (Chemoclean)	L	Current input 4 to 20 mA
F	Aux. voltage output	M	Power supply
G	Alarm (current-free contact position)		

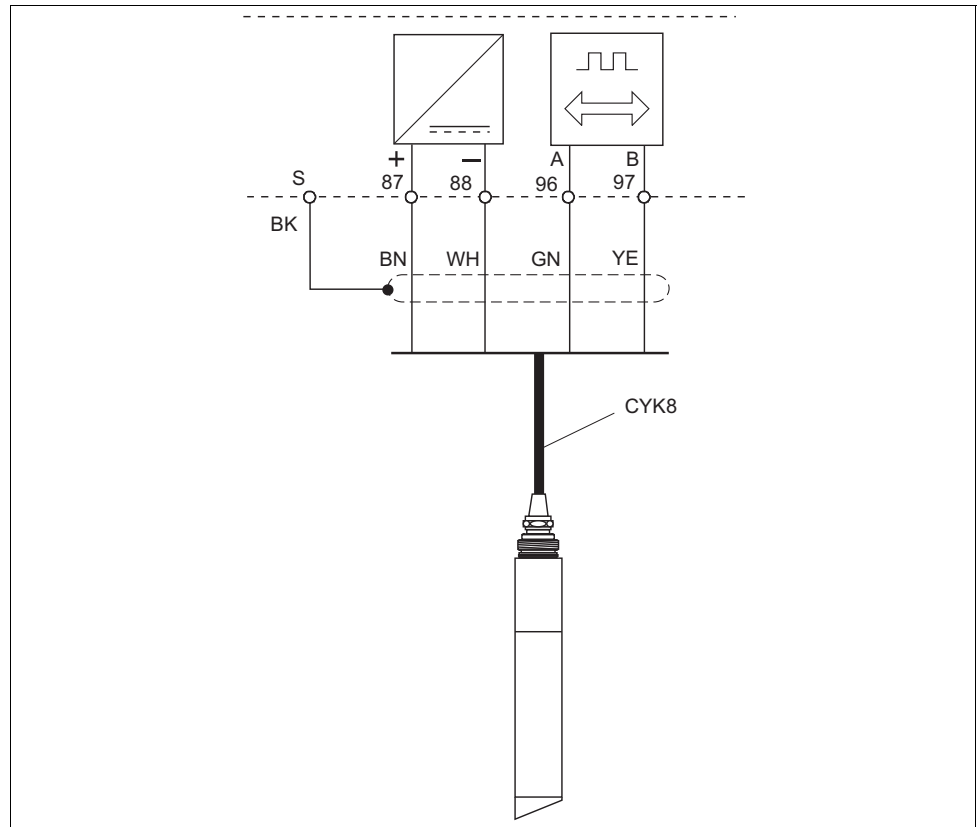


Note!

The device is approved for protection class II and is generally operated without a protective ground connection. The circuits "C" and "F" are not galvanically isolated from each other.

Connection of sensor

The sensors are delivered with measuring cables. Use a junction box and an extension cable to extend the measuring cable (see "Accessories")



Connection of the turbidity sensors CUS31 and CUS41

a0003129

Power supply

Depending on ordered version:
 100/115/230 V AC +10/-15 %, 48 to 62 Hz
 24 V AC/DC +20/-15 %

Power consumption

max. 7.5 VA

Mains protection

Fine-wire fuse, medium-slow blow 250 V/3.15 A

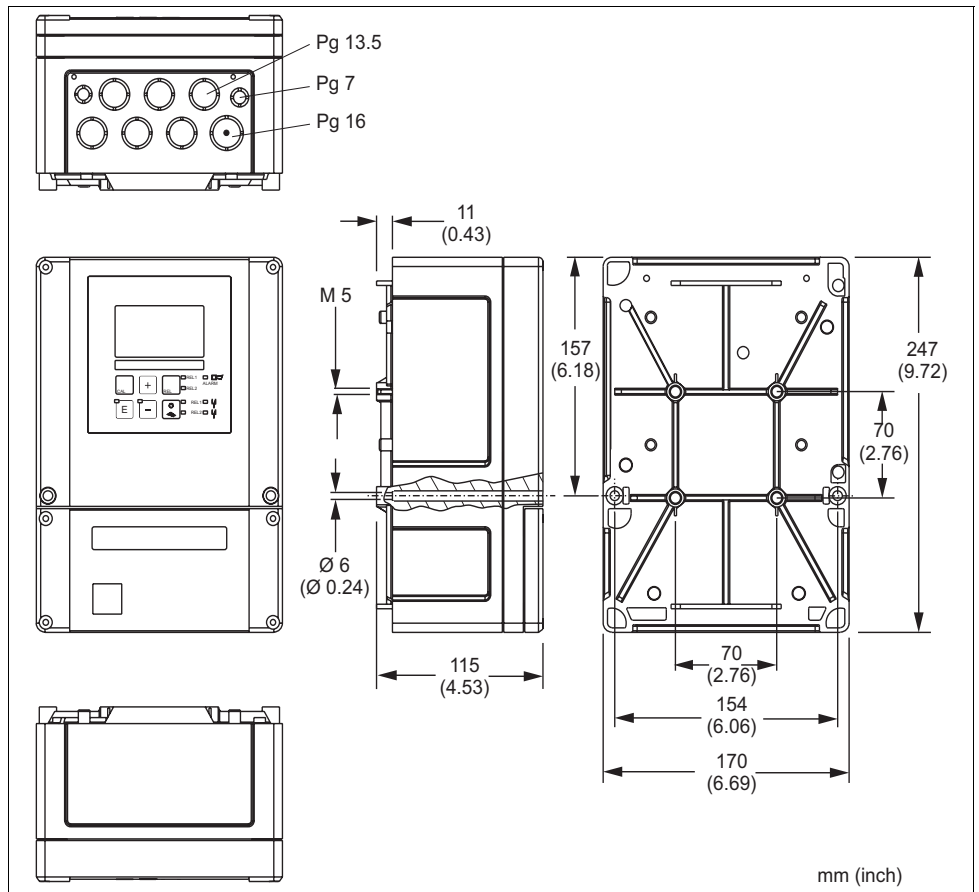
Performance characteristic

Measured value resolution	CUS31:	0.001 FNU/NTU, 0.01 ppm, 0.01 g/l, 0.01 %
	CUS41:	0.01 FNU/NTU, 0.01 ppm, 0.01 g/l, 0.01 %
	Temperature:	0.1 °C
Measurement deviation	Display	
	CUS31/CUS41:	± 2 % of measured value (min. 0.02 FNU)
	Temperature:	max. 1.0 % of measuring range
	Signal output	
CUS31/CUS41:	1 % of current output range (min. 0.02 FNU)	
Temperature:	max. 1.25 % of current output range	
Repeatability¹⁾	± 1 % of measured value (min. 0.01 FNU)	

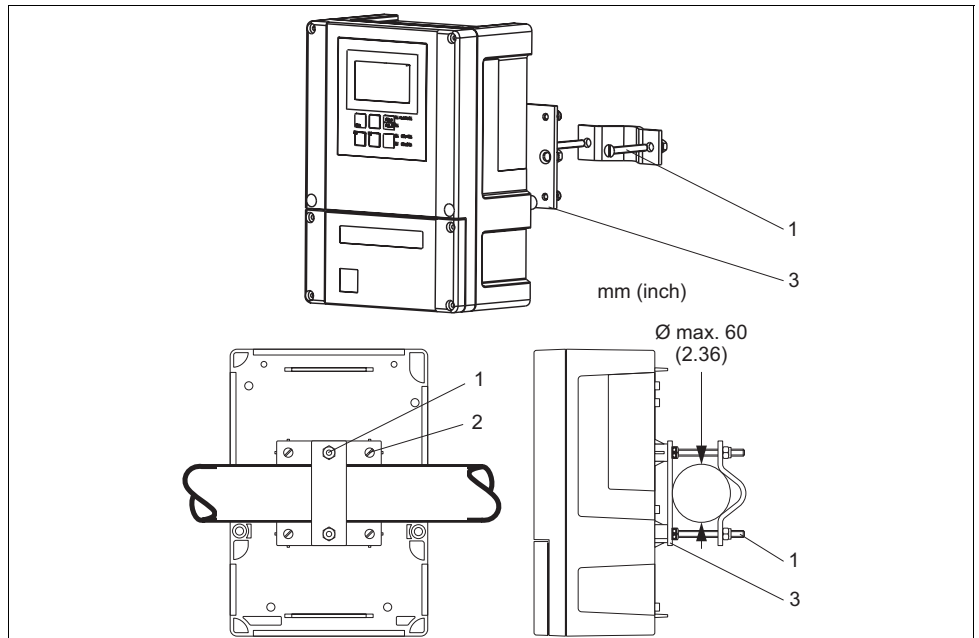
1) acc. to IEC 746-1, for nominal operating conditions

Installation conditions

Installation instructions

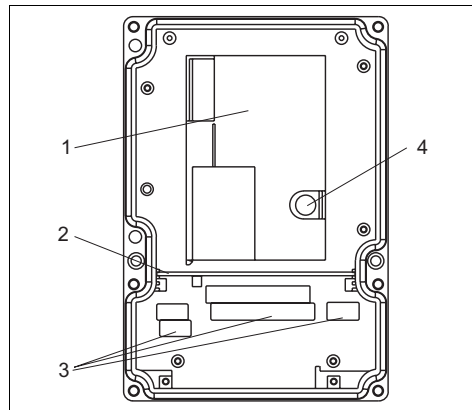


Field instrument



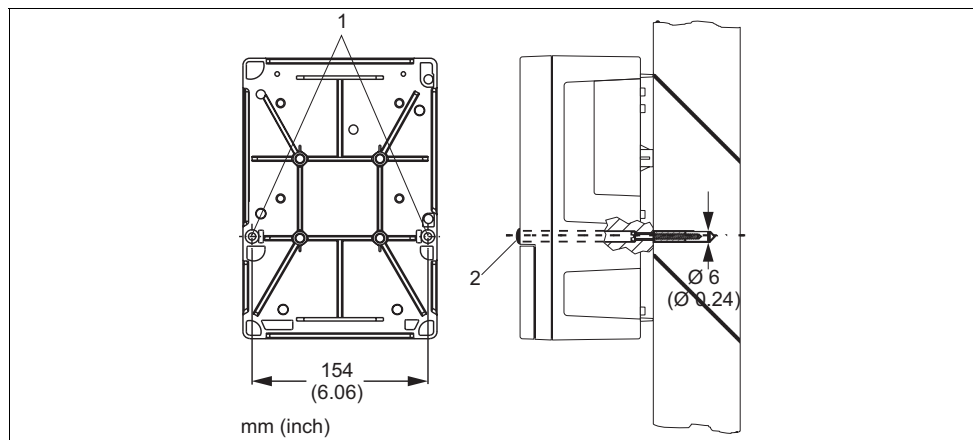
Mounting on pipes

1 - 3 Mounting screws and mounting plate



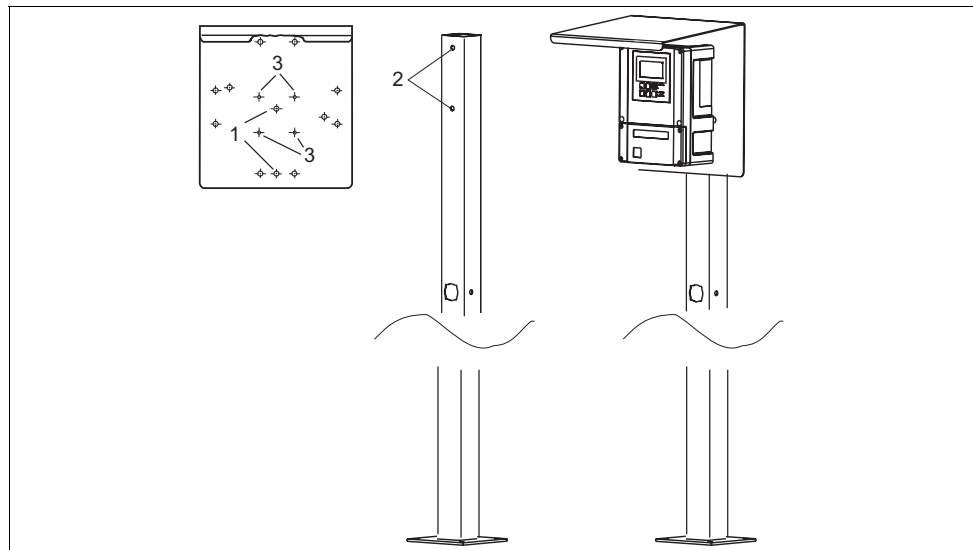
- 1 Removable electronics box
- 2 Partition plate
- 3 Terminal blocks
- 4 Fuse

View into the field instrument



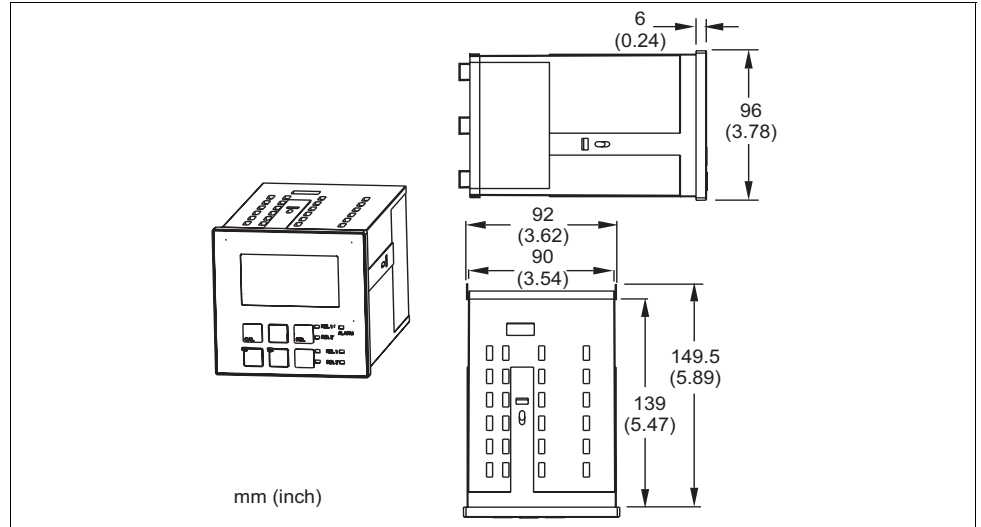
Wall mounting of the field instrument

- 1 Mounting holes
- 2 Protecting cap

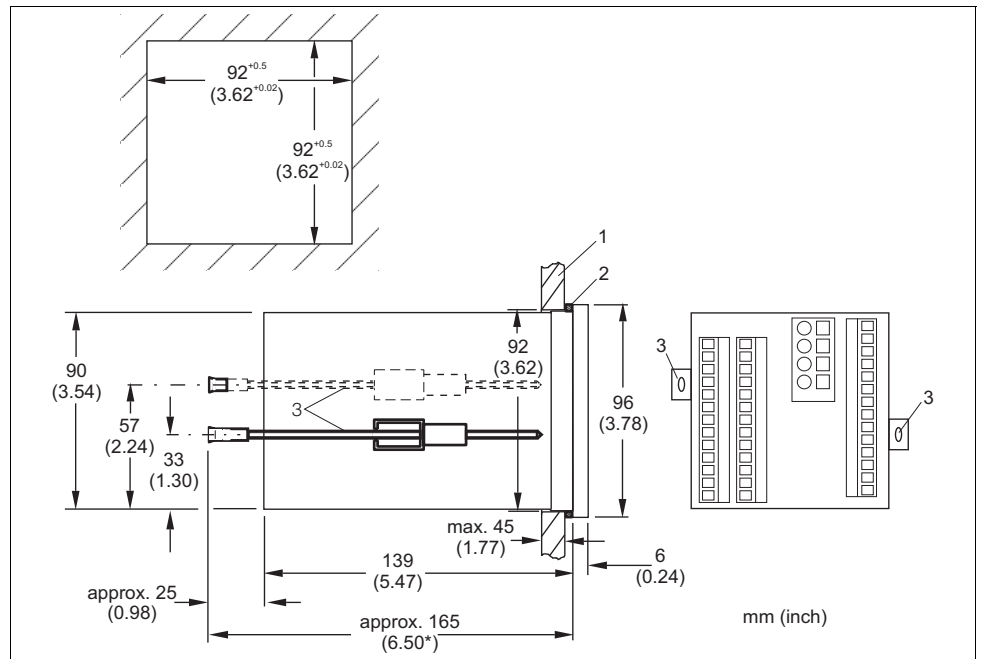


Mounting of the field instrument with mounting post and weather protection cover

- 1 - 3 Mounting holes



Dimensions of panel-mounted instrument



Installation of the panel-mounted instrument

- 1 Wall of control cabinet
- 2 Gasket
- 3 Tensioning screws
- * Required installation depth

Environment

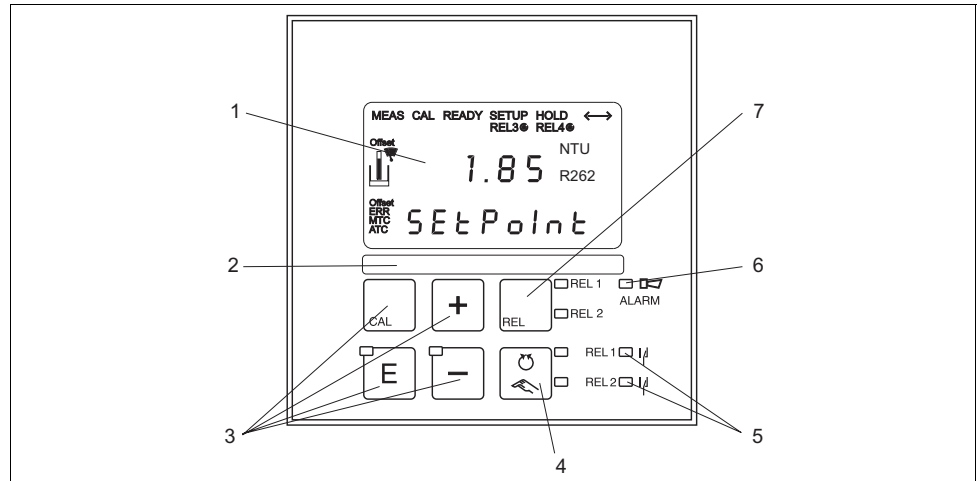
Ambient temperature	-10 to +55°C (+14 to +131°F)	
Ambient temperature limit	-20 to +60°C (-4 to +140°F)	
Storage and transport temperature	-25 to +65°C (-13 to +149°F)	
Electromagnetic compatibility	Interference emission and interference immunity acc. to EN 61326: 1997 / A1: 1998	
Ingress protection	Panel-mounted instrument: Field instrument:	IP 54 / NEMA 3S (front), IP 30 / NEMA 1 (housing) IP 65 (NEMA 4X)
Relative humidity	10 to 95%, non-condensing	

Mechanical construction

Dimensions	Panel-mounted instrument: Field instrument:	96 x 96 x 145 mm (3.78 x 3.78 x 5.71 inches) Installation depth: approx. 165 mm (6.50") 247 x 170 x 115 mm (9.72 x 6.69 x 4.53 inches)
Weight	Panel-mounted instrument: Field instrument:	max. 0.7 kg (1.5 lb) max. 2.3 kg (5.1 lb)
Materials	Housing of panel-mounted instrument: Field housing: Front membrane:	Polycarbonate ABS PC Fr Polyester, UV-resistant
Terminals	Cross section	max. 2.5 mm ² (14 AWG)

Human interface

Display elements



Operating elements

- 1 LC display for displaying the measured values and configuration data
- 2 Field for user labelling
- 3 4 main operating keys for calibration and device configuration
- 4 Changeover switch for automatic/manual mode of the relays
- 5 LEDs for limit contactor relay (switch status)
- 6 LED for alarm function
- 7 Display of the active contact and key for relay changeover in manual mode

Instrument control functions

All instrument control functions are arranged in a logical menu structure. Following access code entry, the individual parameters can be easily selected and modified as needed.

Certificates and approvals

CE symbol

Declaration of conformity

The product meets the requirements of the harmonized European standards. It thus complies with the legal requirements of the EC directives.

The manufacturer confirms successful testing of the product by affixing the CE symbol.

Ex approval for zone 2

Version	Approval
CUM253-..6...	ATEX II 3G EEx nA[L] IIC T4
CUM253-..4... CUM223-..4... CUM223-..6...	ATEX II 3G [EEx nAL] IIC

Ordering information

Product structure

		Version	
	TB	Suspended solids with factory setup > residual concrete water	
	TU	Turbidity and suspended solids measurement	
	TS	Turbidity and suspended solids measurement, with additional functions (Plus package)	
		Power supply; approval	
	0	230 V AC	
	1	115 V AC	
	2	230 V AC; CSA Gen. Purp.	
	3	115 V AC; CSA Gen. Purp.	
	4	230 V AC; ATEX II 3G [Ex nAL] IIC	
	5	100 V AC	
	6	24 V AC/DC; ATEX II 3G [Ex nAL] IIC for CUM223, Ex nAL IIC T4 for CUM253	
	7	24 V AC/DC; CSA Gen. Purp.	
	8	24 V AC/DC	
		Output	
	0	1 x 20 mA, turbidity/SS	
	1	2 x 20 mA, turbidity/SS and temperature/main measured value/actuating variable	
	3	PROFIBUS PA	
	4	PROFIBUS DP	
	5	1 x 20 mA, turbidity/SS with HART®	
	6	2 x 20 mA, turbidity/SS with HART® and temp./main measured value/actuating variable	
		Additional contacts; analog input	
	05	Not selected	
	10	2 x relay (limit/controller/timer)	
	15	4 x relay (limit/controller/Chemoclean)	
	16	4 x relay (limit/controller/timer)	
	20	2 x relay (limit/controller/timer); current input	
	25	4 x relay with cleaning (limit/controller/Chemoclean); current input	
	26	4 x relay with timer (limit/controller/timer); current input	
CUM253-			
			complete order code
CUM223-			

Additional functions of the Plus package

- Current output table to cover wide ranges with varying resolution, fields O33x
- Process Check System (PCS): live check of the sensor, function group P
- Concentration measurement, function group K
- Automatic cleaning function start, field F8

Scope of delivery

The delivery of the field instrument includes:

- 1 transmitter CUM253
- 1 plug-in screw terminal
- 1 cable gland Pg 7
- 1 cable gland Pg 16 reduced
- 2 cable glands Pg 13.5
- 1 Operating Instructions BA200C/07/en
- versions with HART communication:
 - 1 Operating Instructions Field Communication with HART, BA208C/07/en
- versions with PROFIBUS communication:
 - 1 Operating Instructions Field Communication with PROFIBUS PA/DP, BA209C/07/en
- versions with explosion protection for hazardous area zone II (ATEX II 3G):
 - Safety instructions for use in explosion-hazardous areas, XA194C/07/a3

The delivery of the panel-mounted instrument includes:

- 1 transmitter CUM223
- 1 set of plug-in screw terminals
- 2 tensioning screws
- 1 Operating Instructions BA200C/07/en
- versions with HART communication:
 - 1 Operating Instructions Field Communication with HART, BA208C/07/en
- versions with PROFIBUS communication:
 - 1 Operating Instructions Field Communication with PROFIBUS PA/DP, BA209C/07/en
- versions with explosion protection for hazardous area zone II (ATEX II 3G):
 - Safety instructions for use in explosion-hazardous areas, XA194C/07/a3

Accessories

Sensors

Turbimax W CUS31

- Turbidity sensor for drinking water and wastewater applications, 90 ° scattered light method
- Ordering acc. to product structure, see Technical Information (TI176C/07/en)

Turbimax W CUS41

- Turbidity sensor for wastewater and solid content measurements, 90 ° scattered light method
- Ordering acc. to product structure, see Technical Information (TI177C/07/en)

Assemblies

Retractable assembly Cleanfit CUA451

- retractable assembly with ball valve; for turbidity sensors; material: stainless steel
- ordering acc. to product structure (Technical Information TI369C/07/en)

Flow assembly Flowfit CUA250

- for CUS31/CUS41
- ordering acc. to product structure (Technical Information TI096C/07/en)

Immersion assembly Dipfit W CYA611

- for sensor immersion in basins, open channels and tanks, PVC;
- Ordering acc. to product structure (Technical Information TI166C/07/en)

Connection accessories

CYK81 measuring cable

- non-terminated measuring cable for extension of sensor cables of e.g. Memosens, CUS31/CUS41
- 2 wires, twisted pair with shield and PVC-sheath (2 x 2 x 0.5 mm² + shield)
- Sold by the meter, order no. 51502543

Junction box VBM

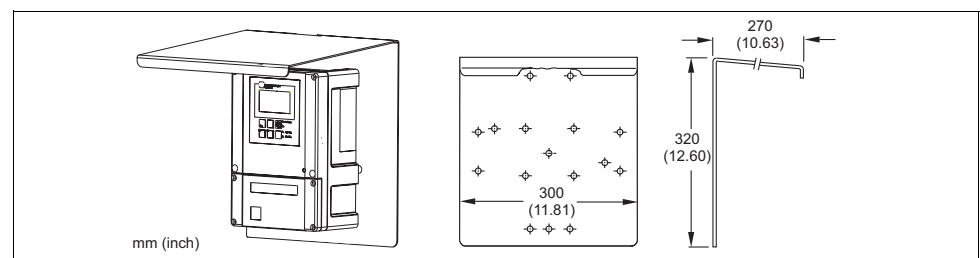
- For cable extension, with 10 terminals
- IP 65 (≅ NEMA 4X)
- Material: aluminum
- Order numbers:
 - cable entry Pg 13.5: 50003987
 - cable entry NPT ½": 51500177

Junction box RM

- To lengthen the cable for Memosens or CUS31/CUS41
- With 2 x Pg 13.5
- IP 65 (≅ NEMA 4X)
- Order no. 51500832

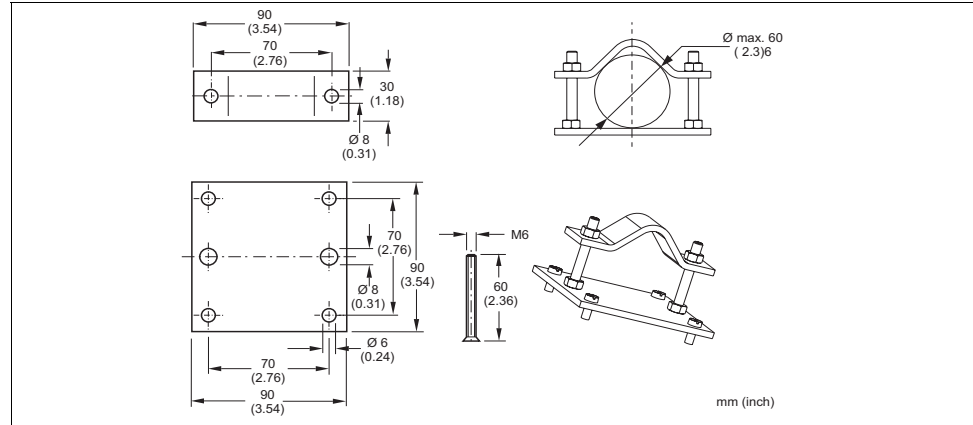
Mounting accessories

- Weather protection cover CYY101 for mounting of field housing, for outdoor installation material: stainless steel 1.4031 (AISI 304); order no. CYY101-A



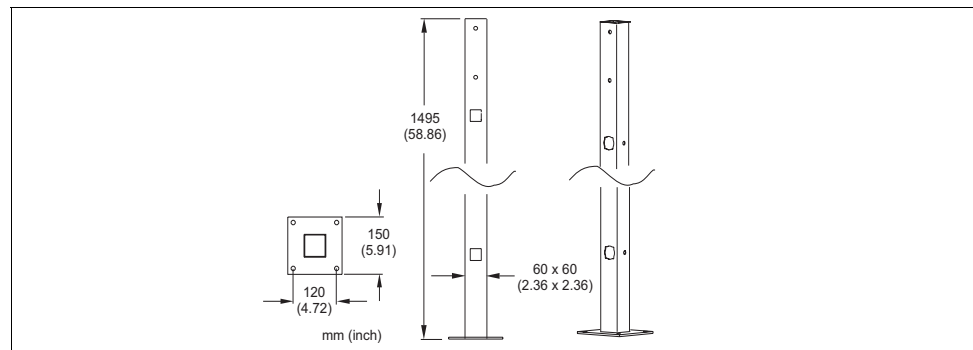
Weather protection cover for field instrument

- Kit for mounting of field housing on horizontal or vertical pipes (Ø max. 60 mm (2.36")) order no. 50086842



Pipe mounting kit

- Universal upright post CYY102
Square post for mounting of field housing, material: stainless steel 1.4301 (AISI 304);
order no. CYY102-A



Square post

Immersion assembly holder CYH101

- for pH, ORP, oxygen, conductivity assemblies and for oxygen and turbidity sensors;
- Ordering acc. to product structure (Technical Information TI092C/07/en)

Pendulum frame

- for pendulous suspension of CPA111, CLA111, CPA510 and CYA611 assemblies
- Order no. 50080196

Optoscope

- Optoscope
Interface between transmitter and PC / laptop for service purposes.
The Windows software "Scopeware" required for the PC or laptop is supplied with the Optoscope. The Optoscope is supplied in a sturdy plastic case with all the accessories required.
Order no. 51500650

United States

Endress+Hauser, Inc.
2350 Endress Place
Greenwood, IN 46143
Tel. 317-535-7138
Sales 888-ENDRESS
Service 800-642-8737
fax 317-535-8498
inquiry@us.endress.com
www.us.endress.com

Canada

Endress+Hauser Canada
1075 Sutton Drive
Burlington, ON L7L 5Z8
Tel. 905-681-9292
800-668-3199
Fax 905-681-9444
info@ca.endress.com
www.ca.endress.com

Mexico

Endress+Hauser, México, S.A. de C.V.
Fernando Montes de Oca 21 Edificio A Piso 3
Frac. Industrial San Nicolás
54030. Tlalnepantla de Baz
Estado de México
México
Tel: +52 55 5321 2080
Fax +52 55 5321 2099
eh.mexico@mx.endress.com
www.mx.endress.com