



Level



Pressure



Flow



Temperature

Liquid  
Analysis

Registration

Systems  
Components

Services



Solutions

## 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.

- 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

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## Function and system design

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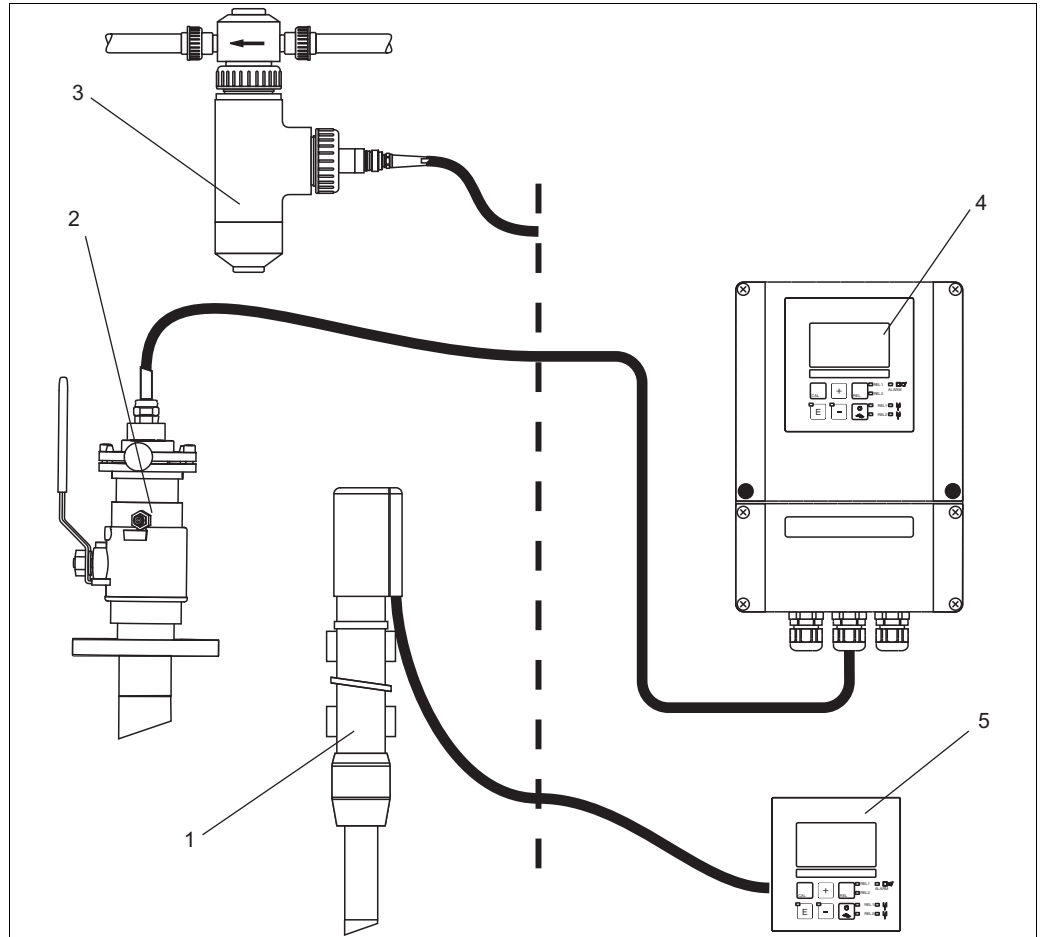
<b>Features of the basic version</b>	<p><b>Measurement of turbidity and suspended solids</b></p> <p>The sensor is selected from the menu. During measurement, the value measured can be displayed in the other measuring mode. The <b>temperature</b> is displayed at the same time if desired.</p> <p><b>Configuration</b></p> <p>Different alarms are required depending on application and operator. Therefore the transmitter permits independent <b>configuration of the alarm contact and error current</b> for each individual error. Unnecessary or undesirable alarms can be suppressed in this manner. <b>Up to four contacts</b> can be used as limit contacts (also for temperature), to implement a P(ID) controller or for cleaning functions. Direct <b>manual operation of the contacts</b> (bypassing the menu) provides quick access to limit, control or cleaning contacts, permitting speedy correction of deviations. The <b>serial numbers</b> of the instrument and modules and the order code can be called up on the display.</p>
<b>Additional functions of the Plus package TS</b>	<p><b>Current output configuration</b></p> <p>In order to output wide measuring ranges while still achieving a high resolution in specific ranges, the <b>current output</b> can be configured as required via a table. This permits <b>bilinear</b> or <b>quasi-logarithmic</b> curves, etc.</p> <p><b>Process Check System (PCS)</b></p> <p>It comprises two independent safety functions:</p> <ul style="list-style-type: none"> <li>■ Errors in applications <b>without</b> control are detected by monitoring the limit between plausible and implausible measured values, i.e. <b>the alarm threshold</b>.</li> <li>■ Errors in applications <b>with</b> control are detected by the <b>controller monitor</b> which monitors freely adjustable, maximum permissible time intervals and reference value overshoot or undershoot.</li> </ul> <p><b>Live check</b></p> <p>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.</p>
<b>Additional functions of version TS</b>	<p><b>Display of various measurement units</b></p> <p>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 %).</p>
<b>Second current output</b>	<p>The second current output can be configured for temperature, main measured value (turbidity, suspended solids) or actuating variable.</p>
<b>Current input</b>	<p>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.</p>

**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



- 1 Immersion assembly CYA611
- 2 Retractable assembly CUA451
- 3 Assembly with gas bubble trap

- 4 Liquisys CUM253
- 5 Liquisys CUM223

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## Input

<b>Measured variables</b>	Turbidity, suspended solids, temperature	
<b>Measuring range</b>	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)
<b>Cable specification</b>	Cable length:	max. 200 m (656 ft.)
<b>Signal input</b>	Digital communication	
<b>Temperature measurement</b>	NTC 30 k $\Omega$ at 25 °C (77 °F)	
<b>Binary inputs</b>	Voltage:	10 to 50 V
	Power consumption:	max. 10 mA
<b>Current input</b>	4 to 20 mA, galvanically separated Load: 260 $\Omega$ at 20 mA (voltage drop 5.2 V)	

## Output

<b>Output signal</b>	0/4 to 20 mA, galvanically separated, active									
	<table border="1"> <thead> <tr> <th colspan="2">HART</th> </tr> </thead> <tbody> <tr> <td>Signal coding</td> <td>Frequency Shift Keying (FSK) + 0.5 mA via current output signal</td> </tr> <tr> <td>Data transfer rate</td> <td>1200 Baud</td> </tr> <tr> <td>Galvanic isolation</td> <td>yes</td> </tr> </tbody> </table>		HART		Signal coding	Frequency Shift Keying (FSK) + 0.5 mA via current output signal	Data transfer rate	1200 Baud	Galvanic isolation	yes
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<b>Signal on alarm</b>	2.4 or 22 mA in case of an error									
<b>Load</b>	maximum 500 $\Omega$									

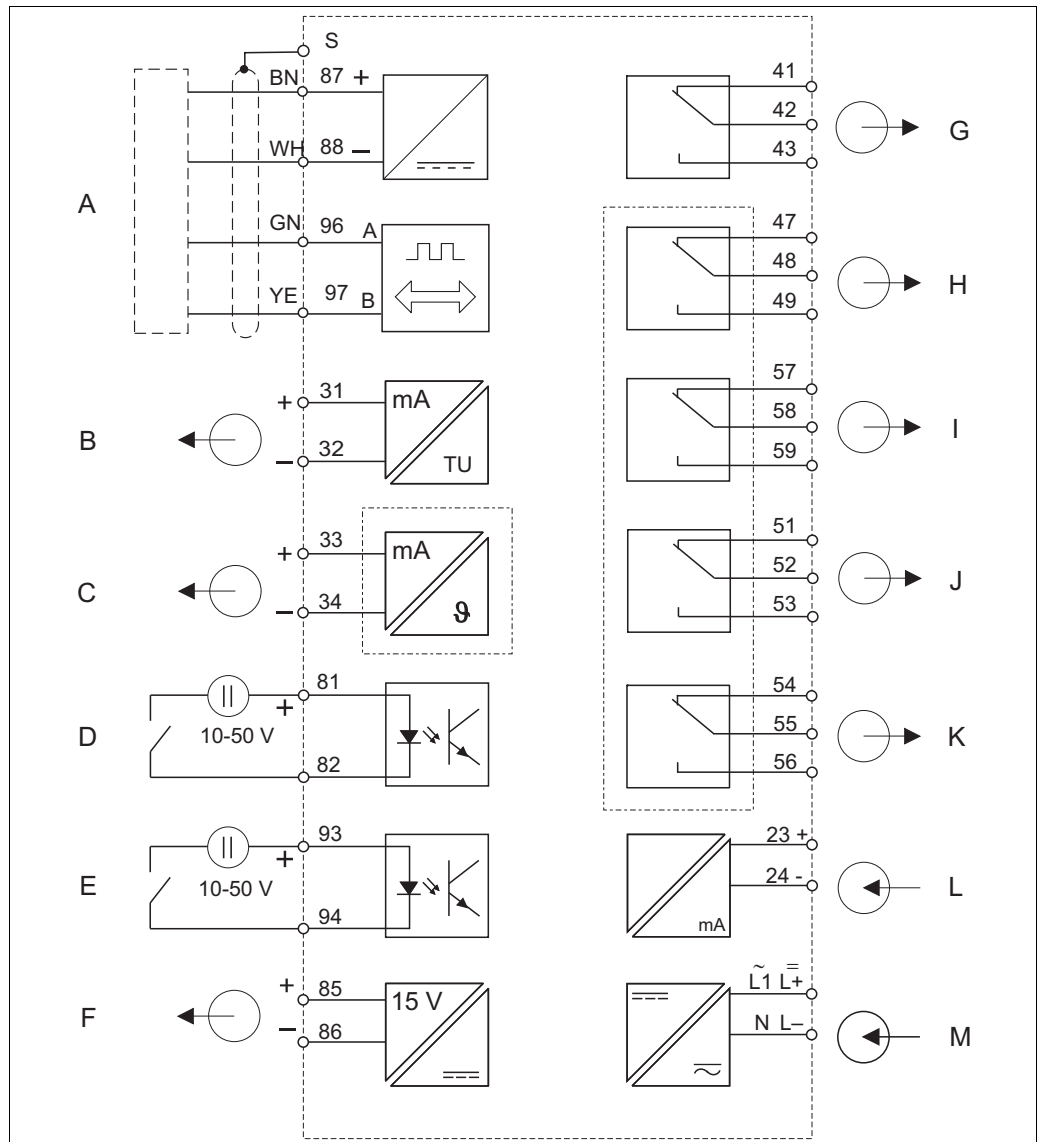
<b>Transmission range</b>	CUS31/CUS41: Temperature:	adjustable, min. $\Delta$ 0.1 FNU, $\Delta$ 0.1 ppm, $\Delta$ 0.1 g/l, $\Delta$ 0.1 % adjustable, $\Delta$ 10 to $\Delta$ 100 % of measuring range																																
<b>Resolution</b>	max. 700 digits/mA																																	
<b>Isolation voltage</b>	max. 350 V <sub>RMS</sub> /500 V DC																																	
<b>Overvoltage protection</b>	according to EN 61000-4-5																																	
<b>Auxiliary voltage output</b>	Output voltage: Output current:	15 V $\pm$ 0.6 max. 10 mA																																
<b>Contact outputs</b>	Switching current with ohmic load (cos $\varphi$ = 1): Switching current with inductive load (cos $\varphi$ = 0.4): Switching voltage: Switching power with ohmic load (cos $\varphi$ = 1): Switching power with inductive load (cos $\varphi$ = 0.4):	max. 2 A max. 2 A max. 250 V AC, 30 V DC max. 500 VA AC, 60 W DC max. 500 VA AC, 60 W DC																																
<b>Limit contactor</b>	Pickup/dropout delay:	0 to 2000 s																																
<b>Controller</b>	Function (adjustable): Controller response: Control gain K <sub>p</sub> : Integral action time T <sub>i</sub> : Derivative action time T <sub>v</sub> : 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 <sup>-1</sup> 0 to 40% of max. set value																																
<b>Alarm</b>	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																																
<b>Protocol specific data</b>	<table border="1"> <thead> <tr> <th colspan="2">HART</th> </tr> </thead> <tbody> <tr> <td>Manufacturer ID</td> <td>11<sub>h</sub></td> </tr> <tr> <td>Device type code</td> <td>0095<sub>h</sub></td> </tr> <tr> <td>Transmitter specific revision</td> <td>0001<sub>h</sub></td> </tr> <tr> <td>HART specification</td> <td>5.0</td> </tr> <tr> <td>DD files</td> <td><a href="http://www.products.endress.com/profibus">www.products.endress.com/profibus</a></td> </tr> <tr> <td>Load HART</td> <td>250 <math>\Omega</math></td> </tr> <tr> <td>Device variables</td> <td>None (dynamic variables PV, SV, only)</td> </tr> <tr> <td>Features supported</td> <td>-</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th colspan="2">PROFIBUS PA</th> </tr> </thead> <tbody> <tr> <td>Manufacturer ID</td> <td>11<sub>h</sub></td> </tr> <tr> <td>Ident number</td> <td>1517<sub>h</sub></td> </tr> <tr> <td>Device revision</td> <td>11<sub>h</sub></td> </tr> <tr> <td>Profile version</td> <td>2.0</td> </tr> <tr> <td>GSD files</td> <td><a href="http://www.products.endress.com/profibus">www.products.endress.com/profibus</a></td> </tr> <tr> <td>GSD file version</td> <td></td> </tr> </tbody> </table>		HART		Manufacturer ID	11 <sub>h</sub>	Device type code	0095 <sub>h</sub>	Transmitter specific revision	0001 <sub>h</sub>	HART specification	5.0	DD files	<a href="http://www.products.endress.com/profibus">www.products.endress.com/profibus</a>	Load HART	250 $\Omega$	Device variables	None (dynamic variables PV, SV, only)	Features supported	-	PROFIBUS PA		Manufacturer ID	11 <sub>h</sub>	Ident number	1517 <sub>h</sub>	Device revision	11 <sub>h</sub>	Profile version	2.0	GSD files	<a href="http://www.products.endress.com/profibus">www.products.endress.com/profibus</a>	GSD file version	
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<b>PROFIBUS PA</b>	
Output values	Main value, temperature value
Input values	Display value of PLC
Features supported	Device locking: The device can be locked by hardware or software.

<b>PROFIBUS DP</b>	
Manufacturer ID	11 <sub>h</sub>
Ident number	151F <sub>h</sub>
Profile version	2.0
GSD files	www.products.endress.com/profibus
GSD file version	
Output values	Main value, temperature value
Input values	Display value of PLC
Features supported	Device locking: The device can be locked by hardware or software.

## Power supply

### Electrical connection



Electrical connection of the transmitter

- A Sensor
- B Signal output 1 turbidity/solids content
- C Signal output 2 temperature
- D Binary input 1 (Hold)
- E Binary input 2 (Chemoclean)
- F Aux. voltage output
- G Alarm (current-free contact position)

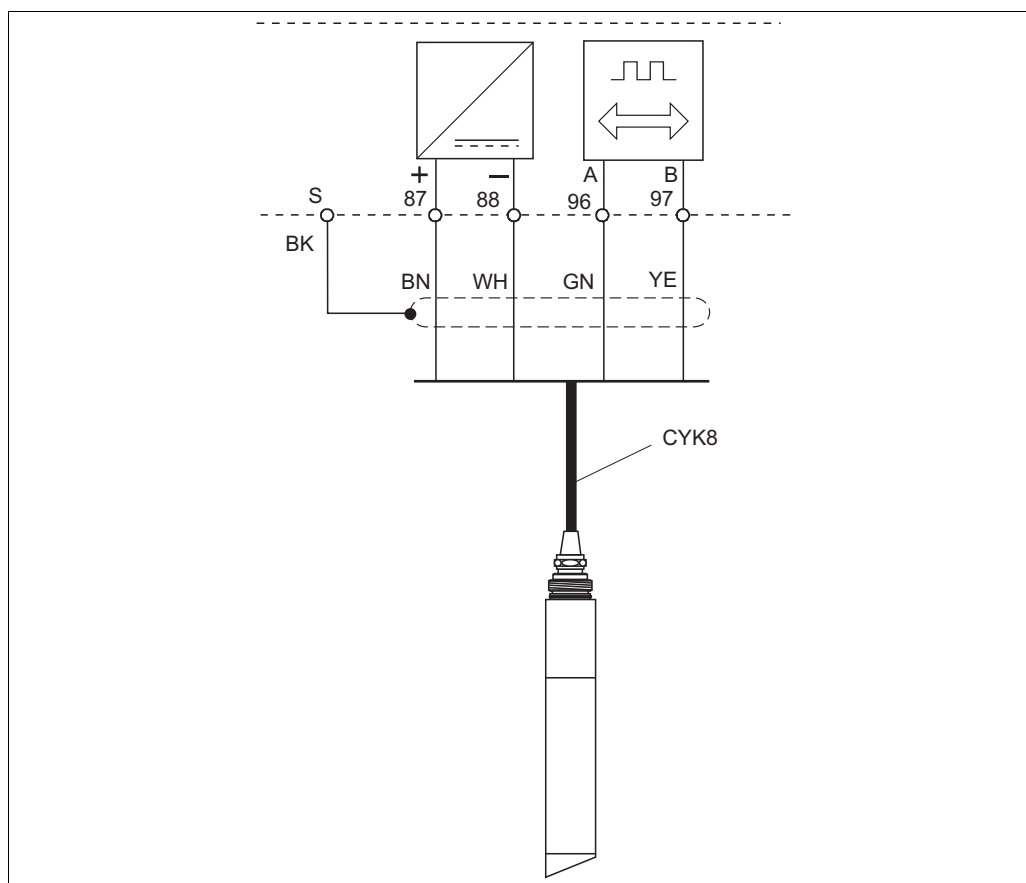
- H Relay 1 (current-free contact position)
- I Relay 2 (current-free contact position)
- J Relay 3 (current-free contact position)
- K Relay 4 (current-free contact position)
- L Current input 4 to 20 mA
- M Power supply

#### 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.

#### Sensor cable

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

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<b>Supply voltage</b>	Depending on ordered version: 100/115/230 V AC +10/-15 %, 48 to 62 Hz 24 V AC/DC +20/-15 %
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#### Fieldbus connection

HART	
Supply voltage	n/a, active current outputs
Integrated reverse voltage protection	n/a, active current outputs

PROFIBUS PA	
Supply voltage	9 V to 32 V, max. 35 V
Polarity sensitive	no
FISCO/FNICO compliant acc. to IEC 60079-27	no

PROFIBUS DP	
Supply voltage	9 V to 32 V, max. 35 V
Polarity sensitive	n/a
FISCO/FNICO compliant acc. to IEC 60079-27	no

<b>Power consumption</b>	max. 7.5 VA
<b>Mains protection</b>	Fine-wire fuse, medium-slow blow 250 V/3.15 A

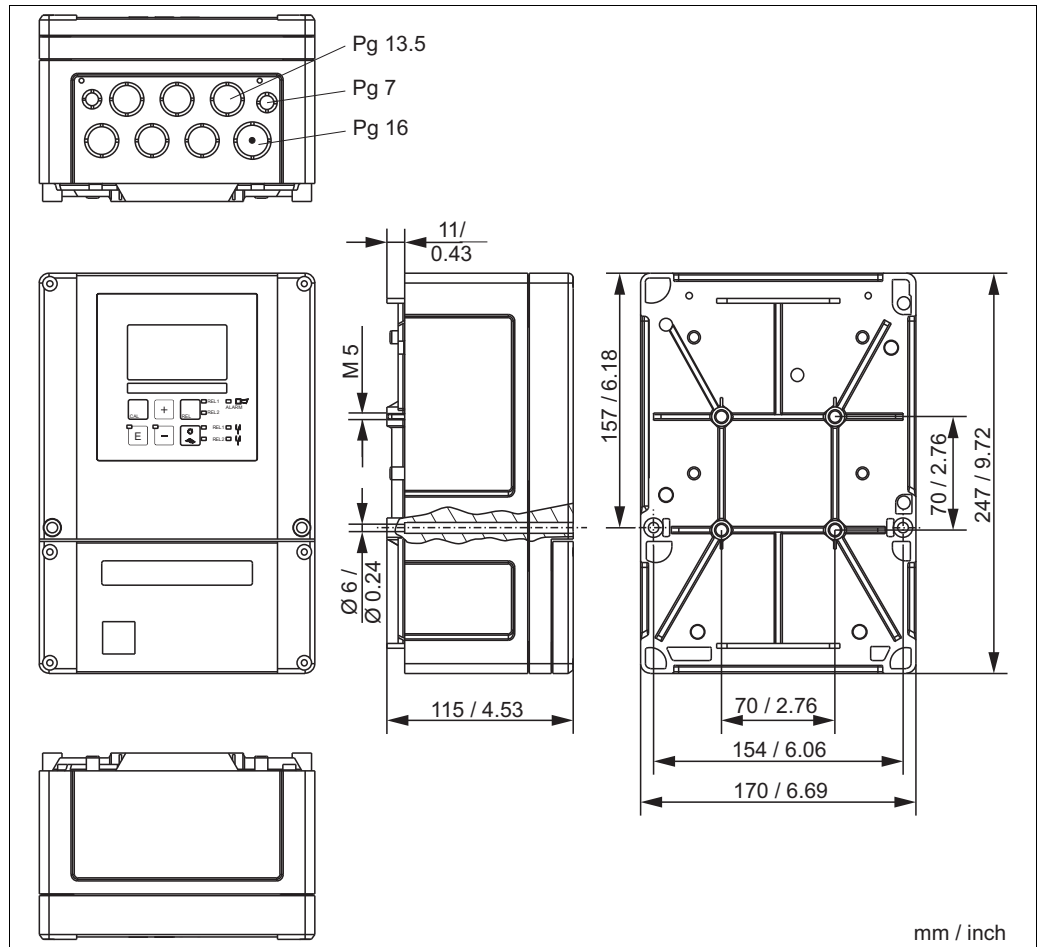


## Performance characteristics

<b>Measured value resolution</b>	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
<b>Maximum measured error</b>	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	
<b>Repeatability<sup>1)</sup></b>	± 1 % of measured value (min. 0.01 FNU)	

## Installation

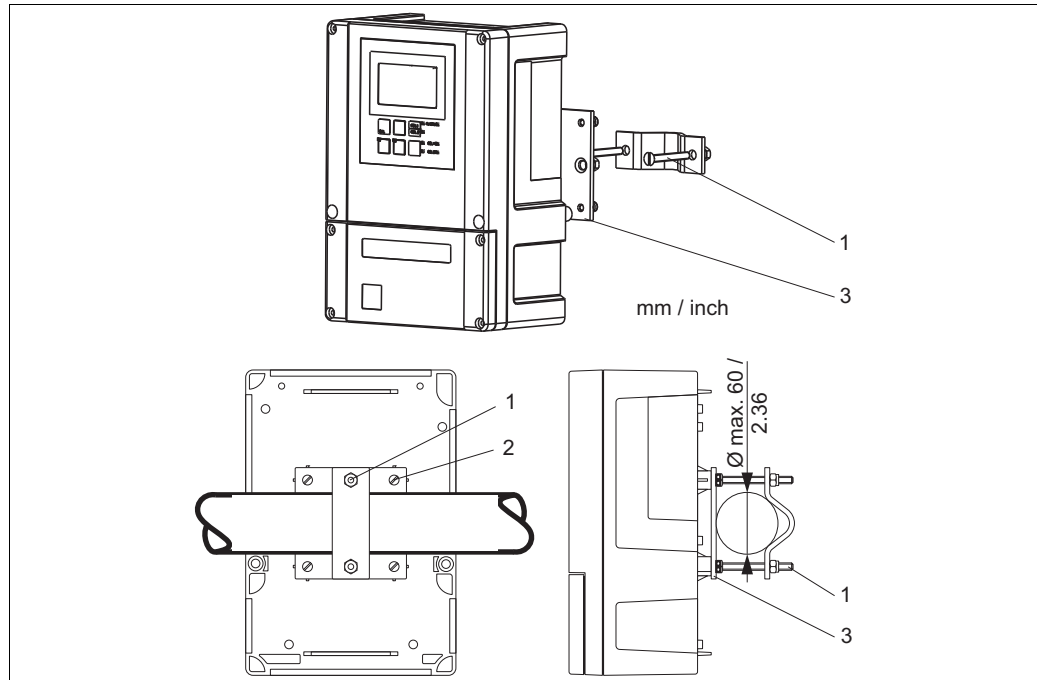
### Installation instructions



Field instrument

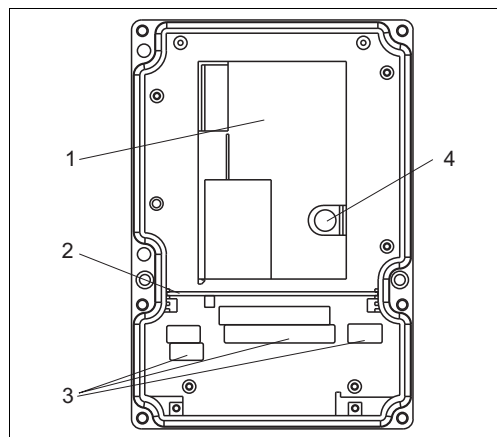
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1) acc. to IEC 746-1, for nominal operating conditions



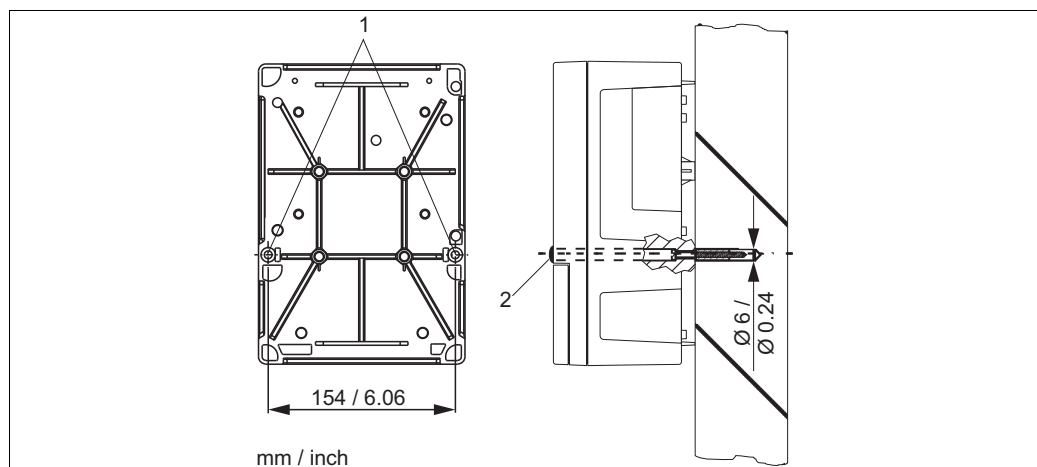
Mounting on pipes

1 - 3 Mounting screws and mounting plate



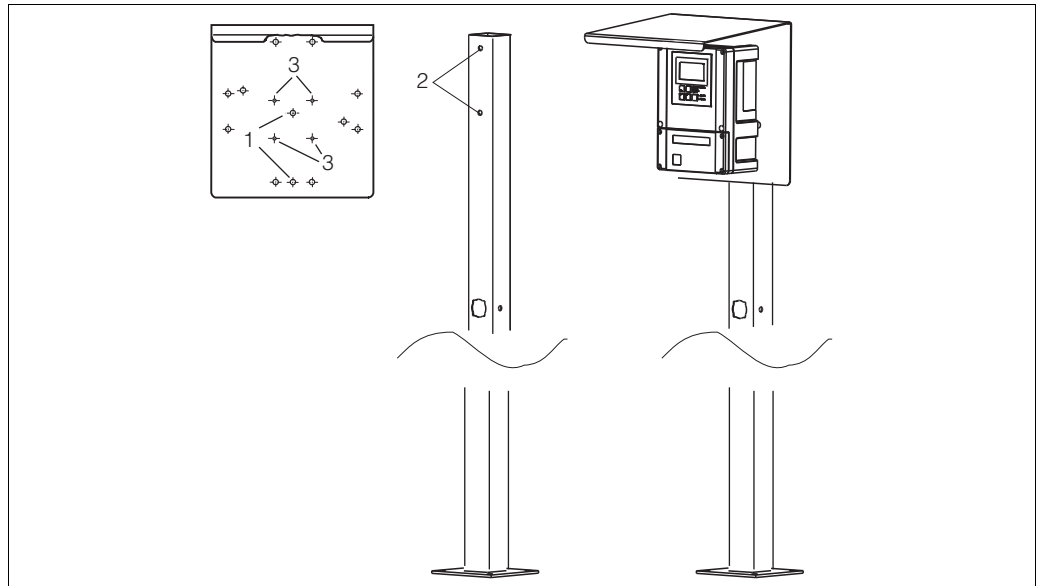
- 1 Removable electronics box
- 2 Partition plate
- 3 Terminal blocks
- 4 Fuse

View into the field instrument



Wall mounting of the field instrument

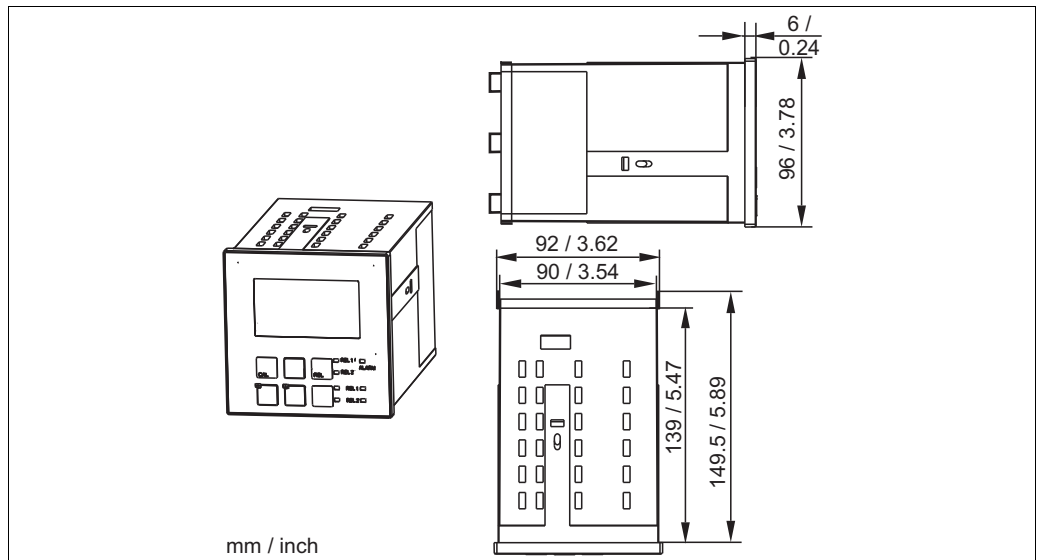
- 1 Mounting holes
- 2 Protecting cap



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

1 - 3 Mounting holes

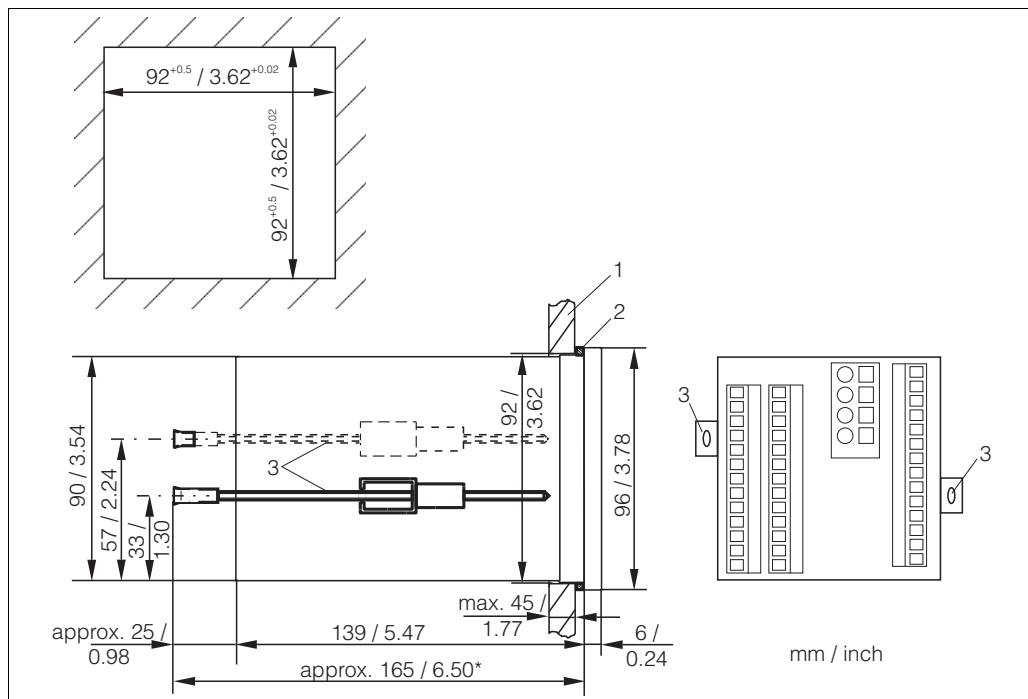
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mm / inch

Dimensions panel-mounted instrument

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Installation of the panel-mounted instrument

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

## Environment

<b>Ambient temperature</b>	-10 to +55 °C (+14 to +131 °F)	
<b>Storage temperature</b>	-25 to +65 °C (-13 to +149 °F)	
<b>Electromagnetic compatibility</b>	Interference emission and interference immunity as per EN 61326-1:2006, EN 61326-2-3:2006	
<b>Ingress protection</b>	Panel mounted instrument: Field instrument:	IP 54 (front), IP 30 (housing) IP 65 / tightness acc. to NEMA 4X
<b>Electrical safety</b>	according EN/IEC 61010-1:2001, Installation Category II, for use up to 2000 m above sea level	
<b>CSA</b>	Apparatus with CSA General Purpose Approval are certified for indoor use.	
<b>Relative humidity</b>	10 to 95%, non-condensing	
<b>Pollution degree</b>	The product is suitable for pollution degree 2.	

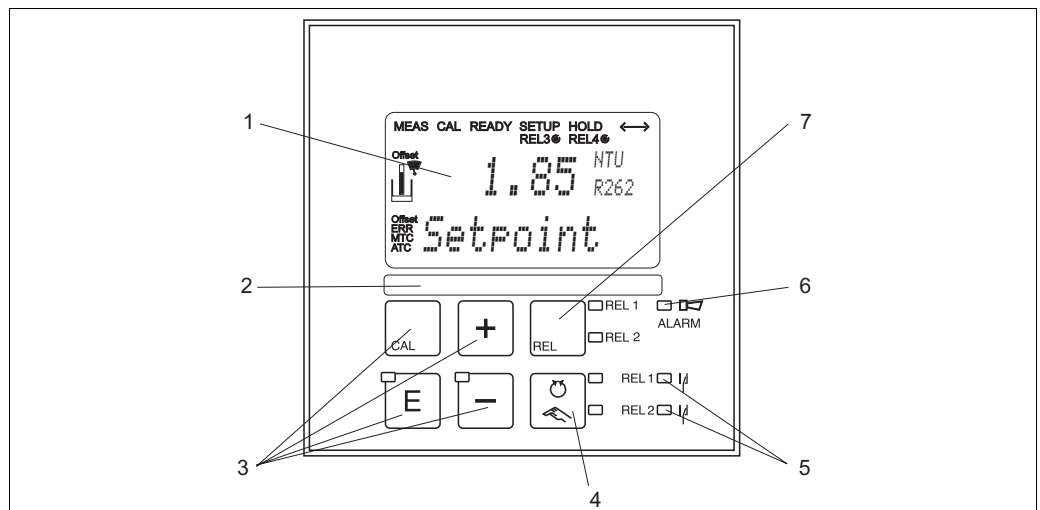
## Mechanical construction

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

## Operability

**Operating concept** 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.

### 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

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## 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.

### CSA General Purpose

C.M2.3-..2...

C.M2.3-..3...

C.M2.3-..7...

## Ordering information

### Product structure

Input, software 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.
5	100 V AC
7	24 V AC/DC; CSA Gen. Purp.
8	24 V AC/DC
Output	
0	1 x 20 mA, primary value
1	2 x 20 mA, primary value + secondary value
3	PROFIBUS PA
4	PROFIBUS DP
5	1 x 20 mA, primary value, HART
6	2 x 20 mA, primary value, HART + secondary value
Additional contacts	
05	not selected
10	2 relays (limit/P(ID)/timer)
15	4 relays (limit/P(ID)/Chemoclean) <b>(not with PROFIBUS DP)</b>
16	4 relays (limit/P(ID)/timer) <b>(not with PROFIBUS DP)</b>
20	1 x 4 ... 20 mA input + 2 relays (limit/P(ID)/timer)
25	1 x 4 ... 20 mA input + 4 relays (limit/P(ID)/Chemoclean) <b>(not with PROFIBUS DP)</b>
26	1 x 4 ... 20 mA input + 4 relays (limit/P(ID)/timer) <b>(not with PROFIBUS DP)</b>
Marking	
1	Tagging (Tag), see additional spec.
CUM253-	
CUM223-	
complete order code	

### 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

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

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## Accessories

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### 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)
- 

### Connection accessories

CYK81 measuring cable

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

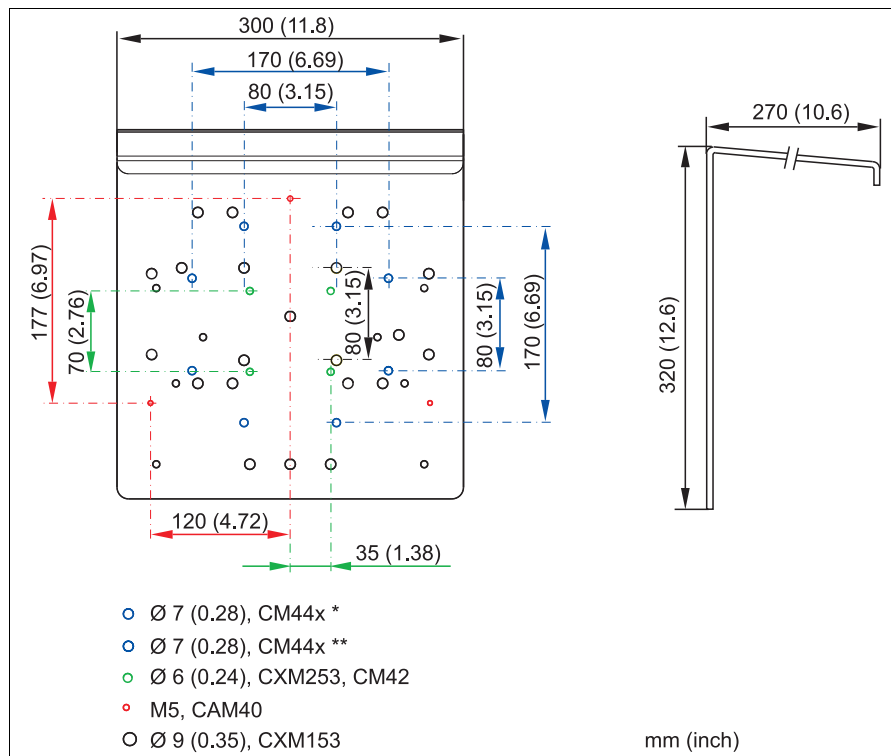
Junction box RM

- For cable extension (e.g. for Memosens sensors)
- 5 terminals
- Cable entries: 2 x Pg 13.5
- Material: PC
- Ingress protection: IP 65
- Order no.: 51500832

### Mounting accessories

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



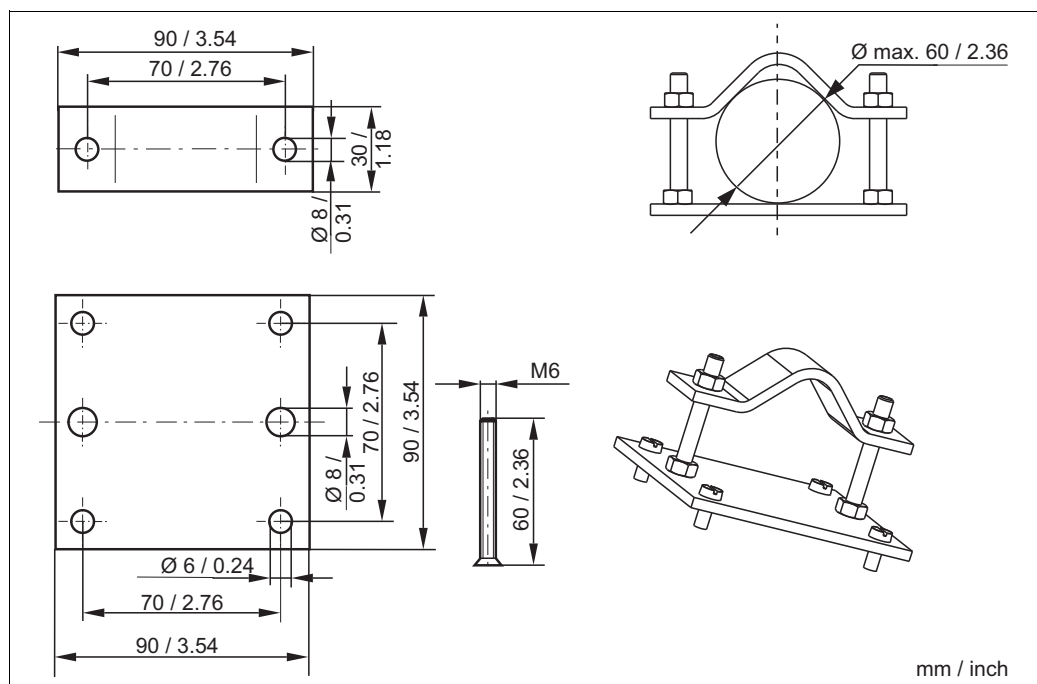
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Weather protection cover for field devices

- \* Wall and post mounting
- \*\* Rail mounting

Post mounting kit

- For mounting of field housing on horizontal or vertical pipes (Ø max. 60 mm (2.36"))
- Material: stainless steel 1.4301
- order no. 50086842



a0005676

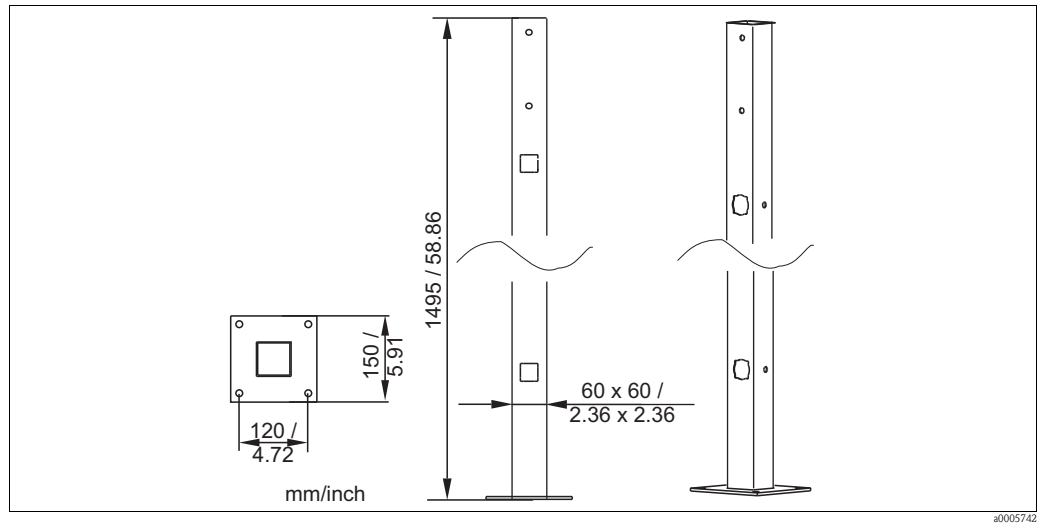
Post mounting kit

CYY102 universal post

- Square pipe for mounting transmitters



- Material: stainless steel 1.4301 (AISI 304)
- Order No. CYY102-A



Universal post

#0005742

### 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

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## Instruments International

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