Technical Information
TI373/e/09/02.05
51500279

Conductivity/Resistivity Measurement
OLM 223/253

Transmitter
for conductive and inductive sensors

Application

The modular design of the OLM223/253 allows easy adaption of the transmitter 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

- Ultrapure water
- Water treatment
- Ion exchanger, reverse osmosis
- Cooling water desalinisation
- Sewage

Your benefits

- Field or panel-mounted housing
- Universal application
- Simple handling
  - Logically arranged menu structure
  - Calibration via CAL key
- Safe operation
  - Excellent interference immunity
  - Direct access for manual contact control
  - User-defined alarm configuration

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:
  - User defined current output characteristics
  - Automatic cleaning trigger on alarm or limit violation
  - Ultrapure water monitoring acc. to USP (United States Pharmacopeia, conductive)
  - Polarisation detection (conductive)
  - Concentration measurement
  - Temperature compensation via coefficient table
  - Process Check System (PCS): live check of the sensor
  - Adaptive calibration with installation factor (inductive)
- 2nd current output for temperature, main measured value or controller output

Function and system design

Features of the basic version

Conductive or inductive

Two instrument versions for measurement with conductive (two electrode) sensors or inductive sensors are available. Mainly for high conductivities, for concentration measurement or for adhering media, the use of an inductive sensor is recommended.

Measuring of conductivity and resistivity (conductive)

This is selected via the menu. During measurement,the value measured can be displayed in the other measuring mode. The temperature is displayed at the same time or, if desired, not shown at all.

Temperature compensation

The following temperature compensation selections are available:

- Linear
- NaCl curve according to IEC 746
- Ultrapure water

The reference temperature is user defined, the standard value is 25 °C (77 °F).

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 (by passing 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.
The cell constant can be edited and even calibrated for demanding special applications.

Additional functions of the plus package

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.

Polarisation detection

Polarisation effects in the boundary layer between the sensor and the medium to be measured limit the measuring range of conductive conductivity sensors.
The transmitter can detect polarisation effects using an innovative, intelligent signal evaluation process.

Process Check System (PCS)

This function checks the measuring signal for deviations. If the measuring signal does not change for some time (several measured values), an alarm is triggered. Soiling, blockage or similar could be the cause of such behaviour.

Ultrapure water monitoring acc. to USP (United States Pharmacopeia)

Ultrapure water monitoring according to USP <645> means that the uncompensated conductivity and the temperature are measured and compared to a table. The transmitter (conductive) comes with this function. The user-adjustable pre-alarm indicates undesirable operating values in due time. Full compliance with USP requires the use of a precisely calibrated sensor, for example, the OLS15.

Concentration measuring

The conversion from conductivity to concentration is effected using four user-definable concentration curves . This permits concentrations to be displayed in %, ppm, mg/l or TDS (total dissolved solids).

Adaptive calibration for determination of the installation factor (inductive)

Inductive measuring sensors must normally be installed in pipes at a required minimum distance from the pipe wall. If this minimum distance is not observed, the measured value changes. The built-in adaptive calibration using the installation factor allows you to compensate for this once the sensor is installed.

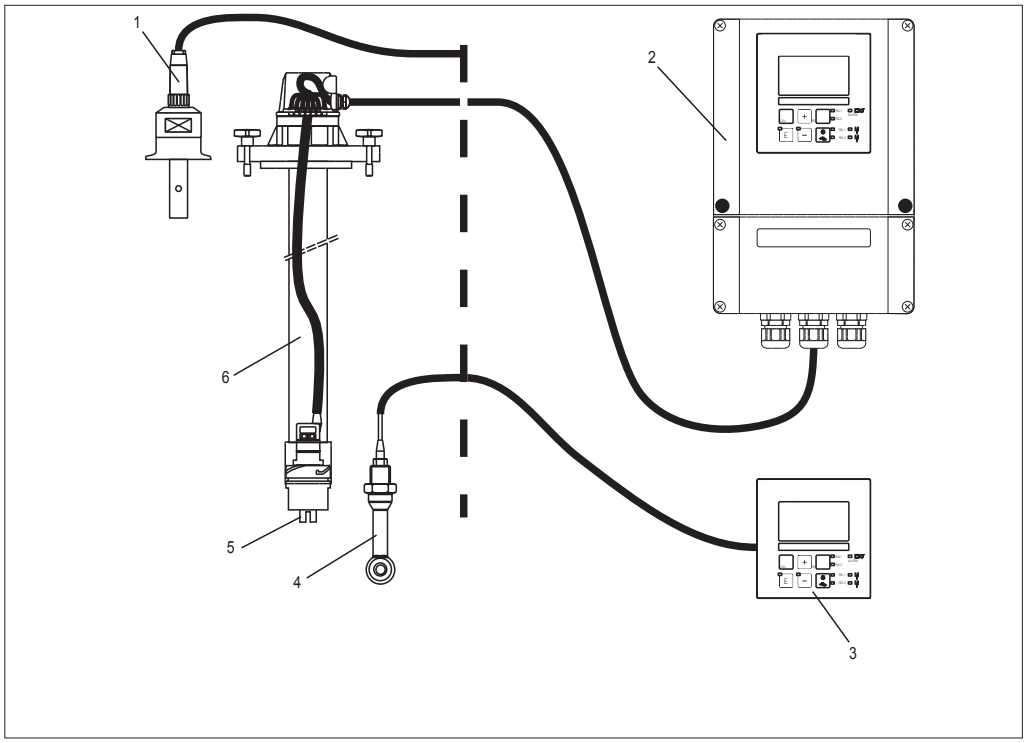
Second current output

The second current output can be configured for temperature, main measured value (conductivity, resistivity, concentration) or controller output.

Measuring system

A complete measuring systems comprises:
- The transmitter OLM223 or OLM253
- A sensor with or without an integrated temperature sensor
- A measuring cable OYK71 (conductive), or OLK5 (inductive)

Options: extension cable, junction box VBM



Complete measuring system OLM223/253

1 Conductive sensor OLS15
2 OLM253
3 OLM223
4 Inductive sensor OLS50
5 Conductive sensor OLS21
6 Immersion assembly OLA111

Input

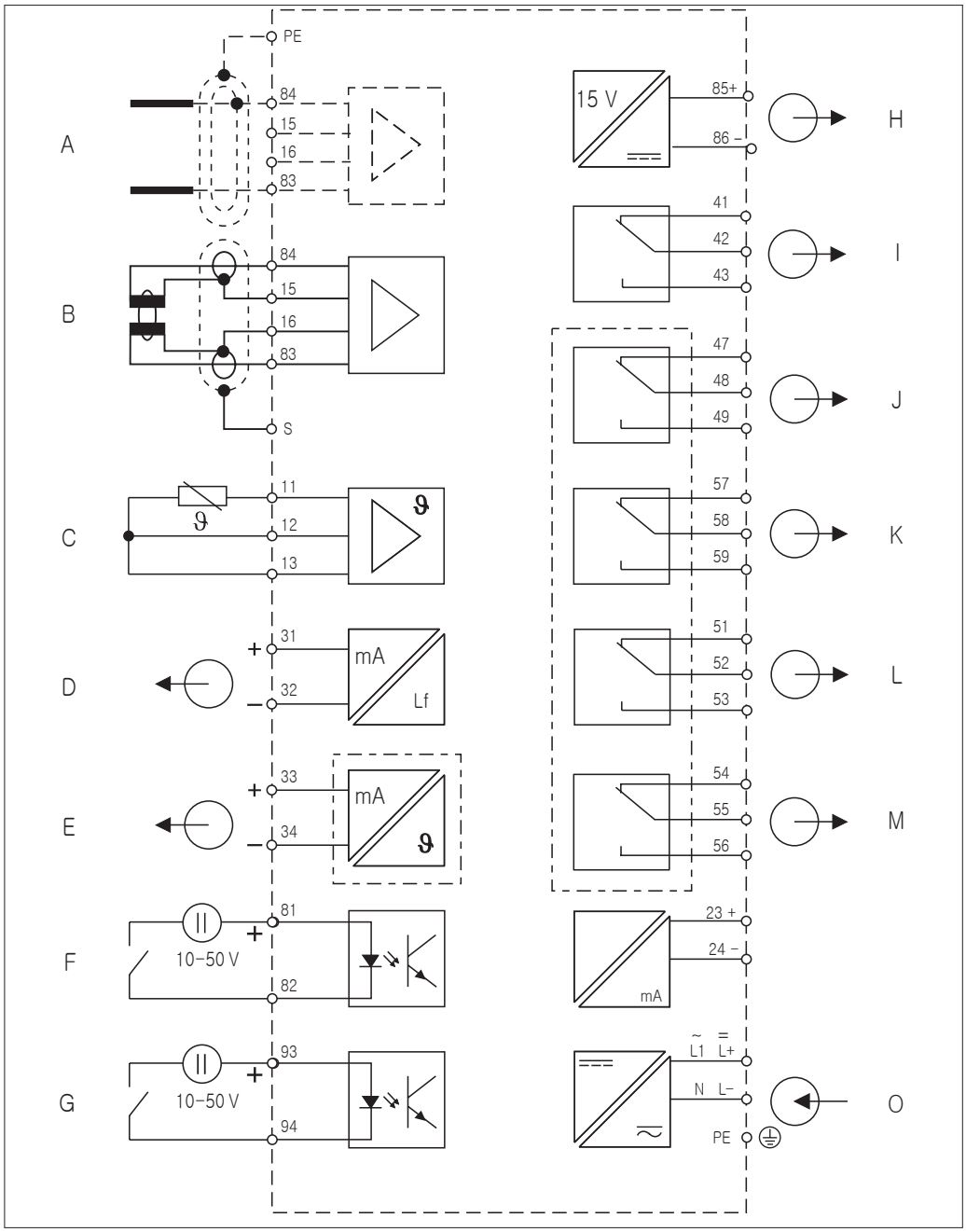
Measured variables	Conductivity, resistivity, temperature	
Measuring range	Conductivity (conductive):	0 ... 60 mS/cm (uncompensated)
	Conductivity (inductive):	0 ... 2000 mS/cm (uncompensated)
	Resistivity:	0 ... 200 M Ω· cm
	Concentration:	0 ... 9999 (%, ppm, mg/l, TDS)
	Temperature:	–35 ... +250 °C (–31 ... +482 °F)
Cable specification	Cable length (conductive):	conductivity: max. 100 m (328.1 ft) (OYK71) resistivity: max 15 m (49.22 ft) (OYK71)
	Cable length (inductive):	max 55 m (180.46 ft) (OLK5)
	Cable resistance OYK71:	165 Ω/km (conductivity measurement)
Cell constant	Adjustable cell constant:	k = 0.0025 ... 99.99 cm^{-1}
Temperature sensors	Pt 100, Pt 1000, NTC 30K	
Measuring frequency	Conductivity, resistivity (conductive):	170 Hz ... 2 kHz
	Conductivity (inductive):	2 kHz
Current input	4 ... 20 mA, galvanically separated Load: 260 Ω at 20 mA (voltage drop 5.2 V)	

Output

Current range	0/4 ... 20 mA, galvanically separated, active	
Error current	2.4 or 22 mA in case of an error	
Load	maximum 500 Ω	
Linearisation transmission behaviour	Conductivity:	adjustable
	Resistivity:	adjustable
	Concentration:	adjustable
	Actuating variable:	adjustable
	Temperature:	adjustable
Resolution	max 700 digits/mA	

Min. distance for 0 / 4 ... 20 mA signal	Conductivity:	
	Measured value 0 ... 1.999 µS/cm	0.2 µS/cm
	Measured value 0 ... 19.99 µS/cm	2 µS/cm
	Measured value 20 ... 199.9 µS/cm	20 µS/cm
	Measured value 200 ... 1999 µS/cm	200 µS/cm
	Measured value 2 ... 19.99 mS/cm	2 mS/cm
	Measured value 20 ... 2000 mS/cm	20 mS/cm
	Resistivity	
	Measured value 0 ... 199.9 kΩ· cm	20 k Ω· cm
	Measured value 200 ... 1999 kΩ· cm	200 k Ω· cm
	Measured value 2 ... 19.99 MΩ· cm	2.0 M Ω· cm
	Measured value 20 ... 200 MΩ· cm	20 M Ω· cm
	Concentration	no minimum distance
	Temperature	15 °C
Isolation voltage	max. 350 V_{RMS}/500V 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 ... 2000 s
Controller	Function (adjustable):	pulse length/pulse frequency controller/annalog controller
	Controller response:	P, PI, PD, PID, basic load dosage
	Control gain K_p:	0.01 ... 20.00
	Integral action time T_n:	0.0 ... 999.9 min
	Derivative action time T_v:	0.0 ... 999.9 min
	Period for pulse length controller:	0.5 ... 999.9 s
	Frequency for pulse frequency controller:	60 ... 180 min^{-1}
	Basic load:	0 ... 40% of max. set value
Alarm	Function (selectable):	Latching/momentary contact
	Alarm threshold adjustment range:	Conductivity, resistivity, concentration, temperature, USP: complete measuring range
	Alarm delay:	0 ... 2000 s (min)

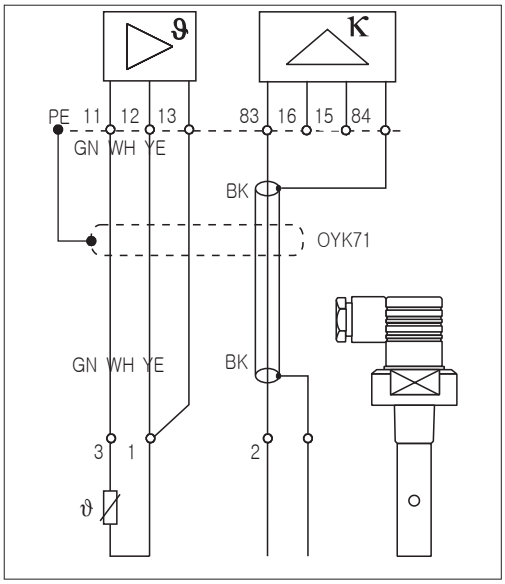
Electrical connection



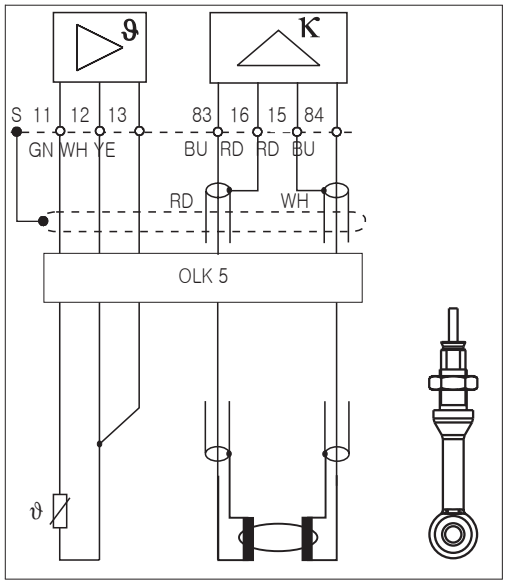
Electrical connetion of the transmitter

A	Sensor (conductive)	I	Alarm (current-free contact position)
B	Sensor (inductive)	J	Relay 1 (current-free contact position)
C	Temperature sensor	K	Relay 2 (current-free contact position)
D	Signal output 1 conductivity	L	Relay 3 (current-free contact position)
E	Signal output 2 variable	M	Relay 4 (current-free contact position)
F	Binary input 1 (Hold)	O	Power supply
G	Binary input 2 (Chemoclean)		
H	Aux. voltage output		

Connection of sensor	You require screened special measuring cables to connect conductivity sensors to the transmitter. To extend the measuring cable, use junction box and extension cable (see accessories).



Connection of conductive sensors



Connection of inductive sensors

Power supply	Depending on ordered version: 100/115/230 V AC +10/−15 %, 48 ... 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

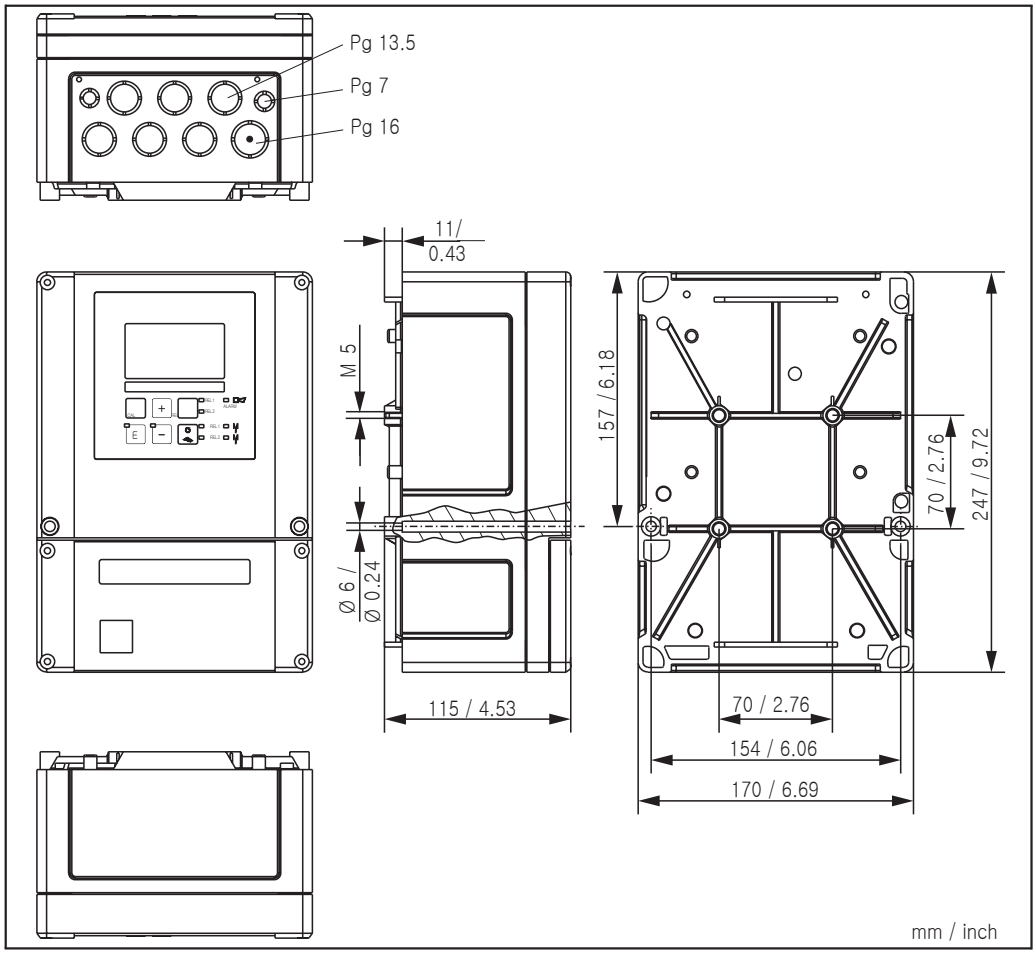
Performance characteristic

Reference temperature	25 °C (77 °F); adjustable for the compensation of the medium temperature	
Resolution	Conductivity:	depending on the measuring range: 0.001 µS/cm to a measured value of 1.999 µS/cm and k ≤ 0.5 cm^{-1}
	Temperature:	0.1 °C
Deviation of indication[a]	Conductivity:	
	Display:	max. 0.5 % of measured value ± 4 digits
	Conductivity signal output:	max. 0.75 % of current output range
	Resistivity:	
	Display:	max. 0.5 % of measured value ± 4 digits
	Resistivity signal output:	max. 0.75 % of current output range
	Temperature:	
	Display:	max. 1.0 % of measuring range
	Temperature signal output:	max. 1.25 % of current output range
Repeatability[a]	Conductivity:	max. 0.2 % of measured value ± 2 digits
	Resistivity:	max. 0.2 % of measured value ± 2 digits

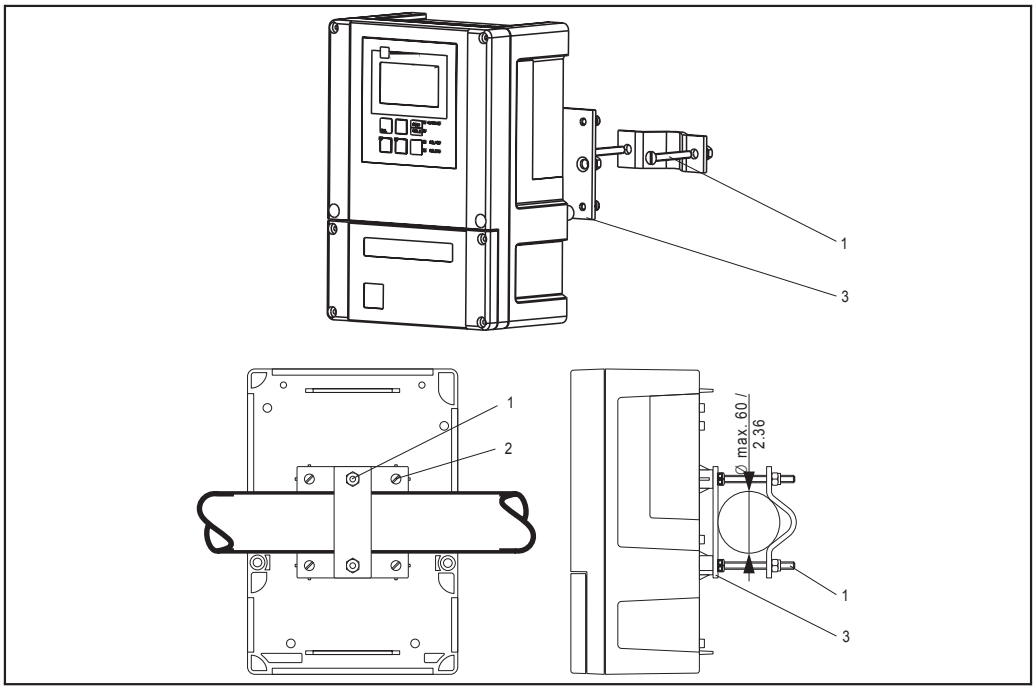
Temperature compensation	Range: Types of compensation:	−35 ... +250 °C (−31 ... +482 °F) uncompensated, linear, NaCl, table; conductive only: ultrapure water (NaCl)
Temperature offset	±5 °C; for the adjustment of the temperature display	

Installation conditions

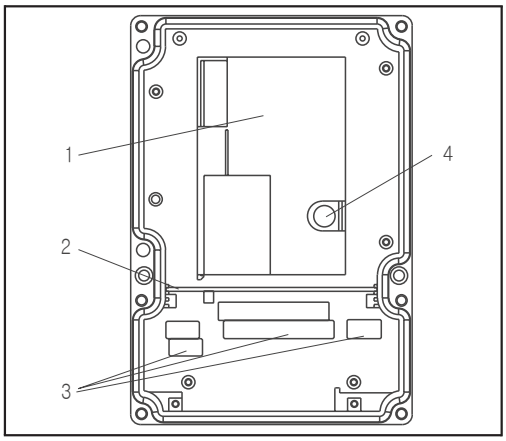
Installation instructions



Field instrument

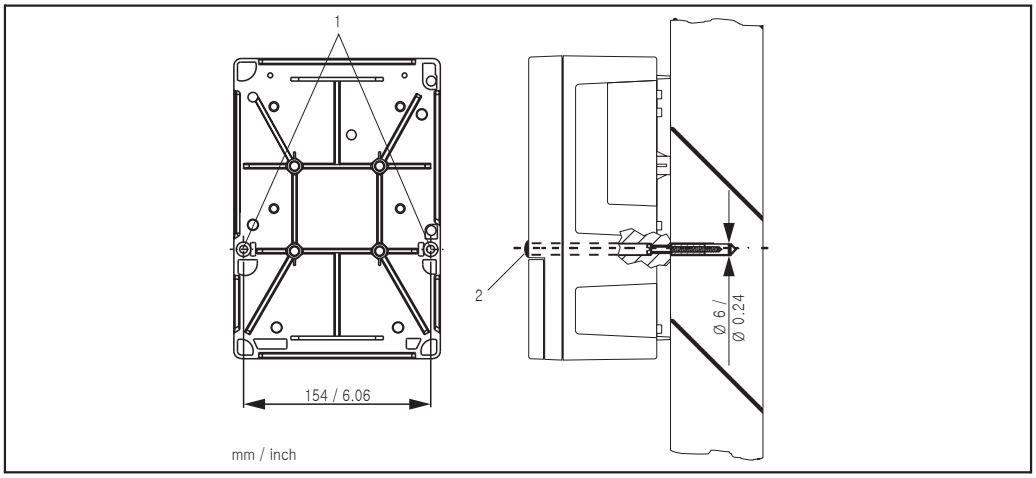


Mounting on pipes



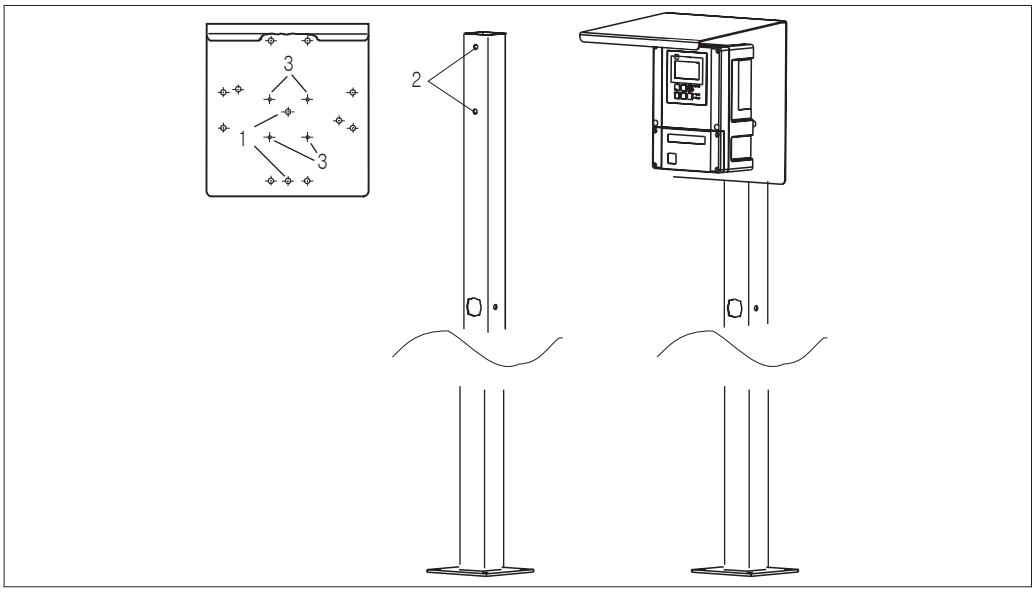
1 Removable electronics box
2 Partition plate
3 Terminal blocks
4 Fuse

Inside of field instrument



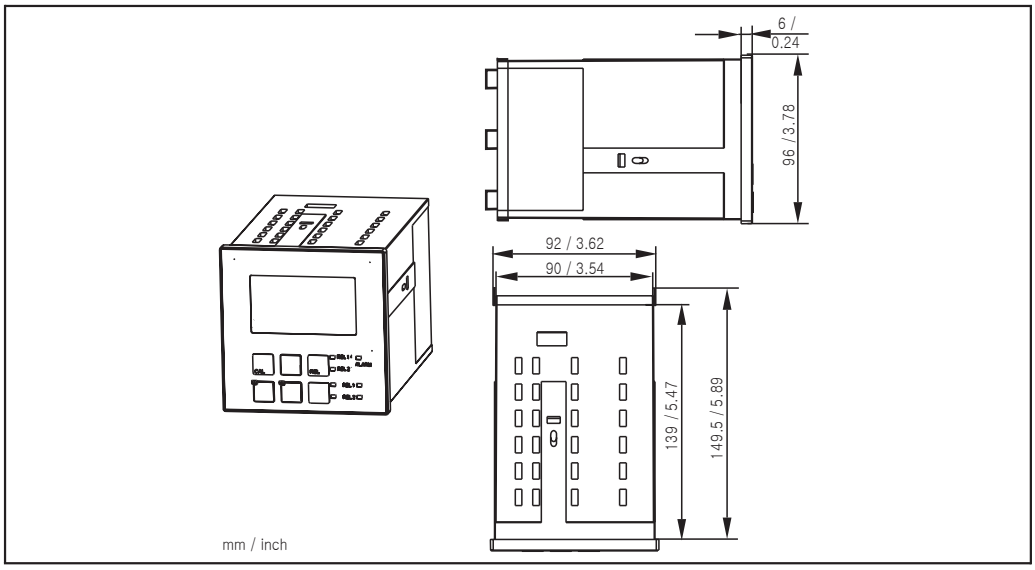
Wall mounting of the field instrument

1 Mounting holes
2 Protecting cap

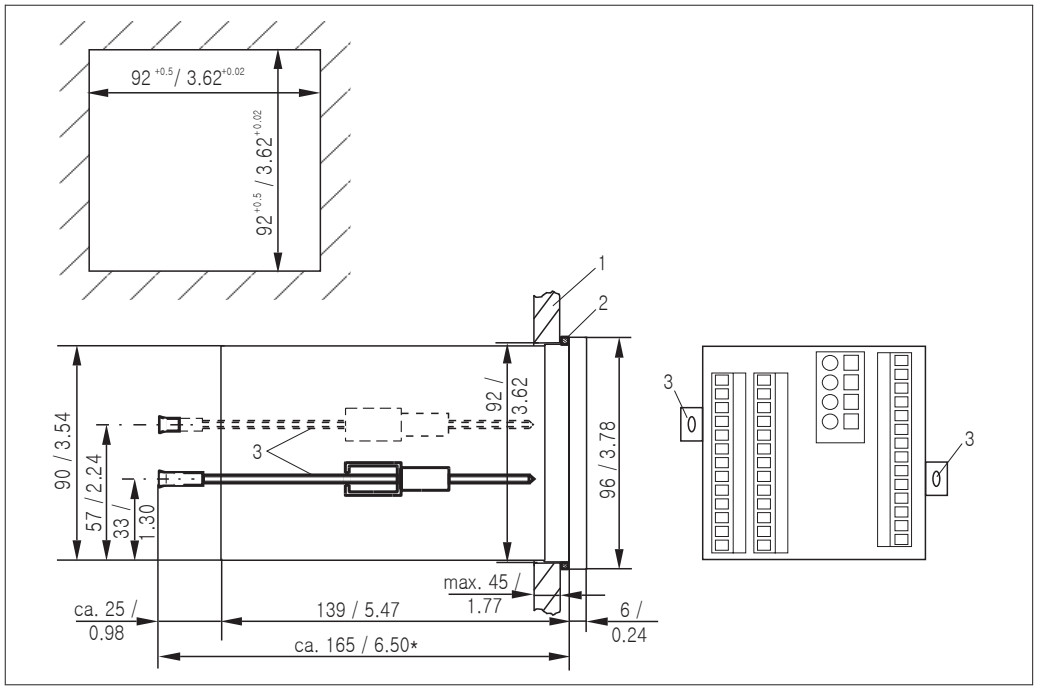


Mounting of the field instrument with mounting post and weather protection cover

1 -3 Mounting holes



Dimensions panel-mounted instrument



Installation of the panel mounted instrument

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

Environment

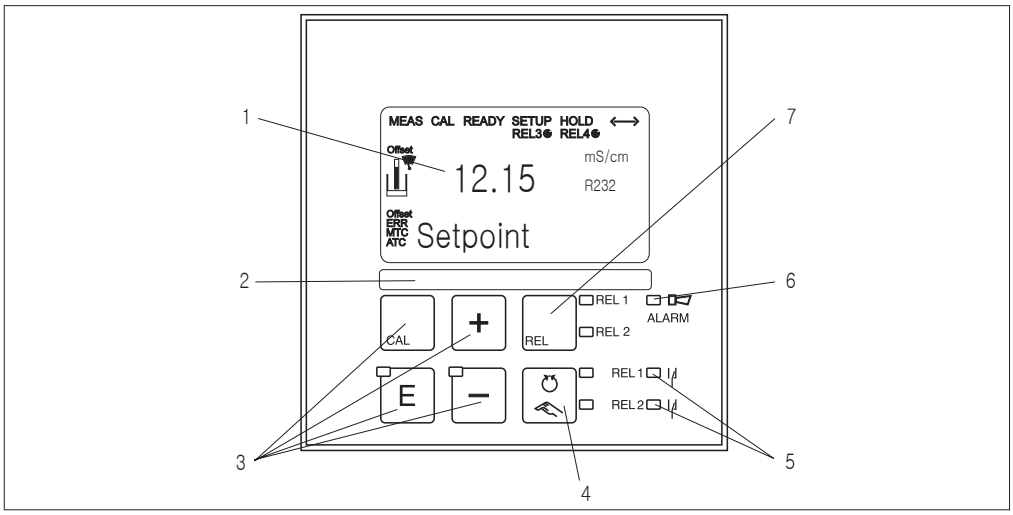
Ambient temperature	-10 ... +55 °C (+14 ... +131 °F)	
Ambient temperature limit	-20 ... +60 °C (-4 ... +140 °F)	
Storage and transport temperature	-25 ... +65 °C (-13 ... +149 °F)	
Electromagnetic compatibility	Interference emission and interference immunity acc. to EN 61326: 1997 / A1: 1998	
Ingress protection	Panel mounted instrument: Field instrument:	IP 54 (front), IP 30 (housing) IP 65
Relative humidity	10 ... 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	Wire cross section	max. 2.5 mm^2

Human interface

Display elements



Operating elements

1 LC display for display of measured values, configuration data and current menu field
2 Field for user labeling
3 4 main control keys for calibration and instrument configuration
4 Key for switching between automatic/manual operation of the relays
5 LED indicators for limit contactor relay (switch status)
6 LED indicator for alarm function
7 Display of active contact and key for relay switching in manual mode

The display simultaneously shows the current measured value and the temperature – the essential process data. Brief information texts in the configuration menu povide assistance with parameter configuration.

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 legal requirements of the harmonised European standards.
The manufacturer confirms compliance with the standards by affixing the CE symbol.

Ordering information

Product structure

	Version	
	CD	Conductivity/resistivity measurement (conductive two-electrode sensor)
	CS	Conductivity/resistivity measurement (conductive two-el ectrode sensor) with additional functions (Plus package)
	ID	Conductivity measurement (inductive sensor)
	IS	Conductivity measurement (inductive sensor) 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, conductivity/resistivity
			1	2 x 20 mA, conductivity/resistivity and temperature/main measured value/actuating variable

				Additional contacts; analogue input	
				05	Not selected
				10	2 x relay (limit/controller/timer)
				15	4 x relay (limit/contr oller/timer/Chemoclean)
				16	4 x relay (limit/controller/timer)

OLM253-					complete order code
OLM223-					

Additional functions of the Plus package

- Current output table to cover la rge areas with varying resolution
- Process Check System (PCS): live check of the sensor
- Ultrapure water monitoring acc. to USP with pre- alarm (conductive, additional contacts necessary)
- Polarisation detection (conductive)
- Concentration measurement
- Temperature compensation via coefficient table
- Adaptive calibration with installation factor (conductive)
- Automatic cleaning function start

Scope of delivery

The delivery of the field instrument includes:
- 1 transmitter OLM253
- 1 plug-in screw terminal, 3 pole
- 1 cable gland Pg 7
- 1 cable gland Pg 16 reduced
- 2 cable glands Pg 13.5
- 1 operating instructions

The delivery of the panel mounted instrument includes:
- 1 transmitter OLM223
- 1 set of plug-in screw terminals
- 2 tensioning screws
- 1 operating instructions

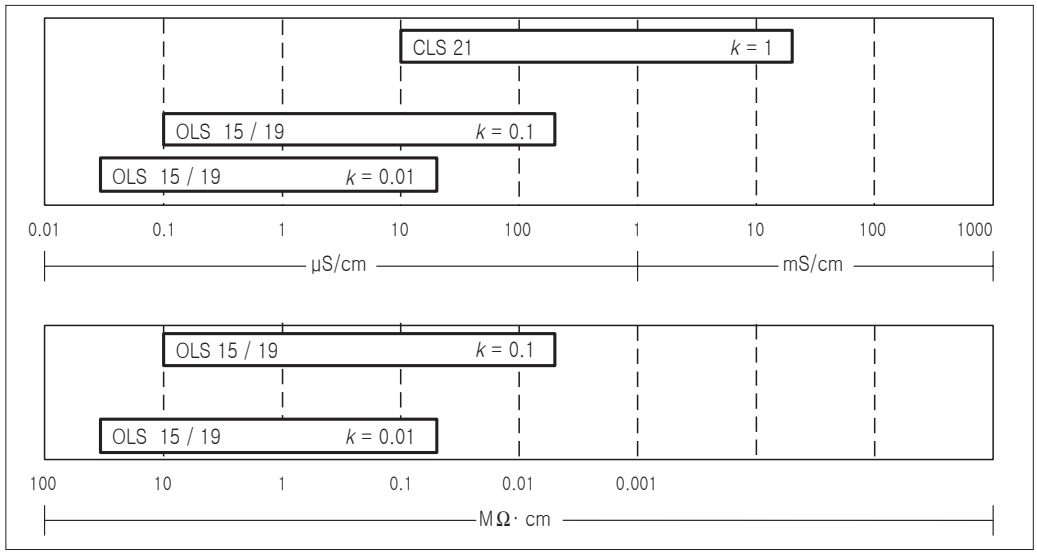
Accessories

Sensors

❑ OLS15
Conductive conductivity sensor for pure, ultra-pure water applications;
Ordering acc. to version, see Technical Information

❑ OLS19
Conductive conductivity sensor for pure and ultra-pure water applications;
Ordering acc. to version, see Technical Information

❑ OLS21
Conductive conductivity sensor for applications with middle to high conductivity
; Ordering acc. to version, see Technical Information



Application ranges of conductive conductivity sensors:

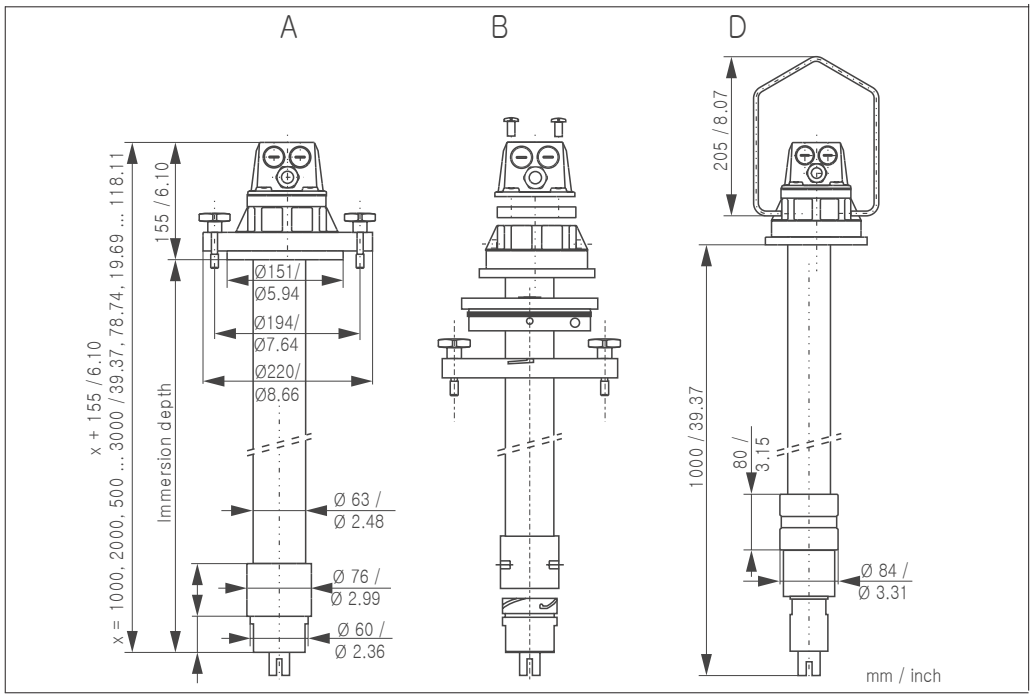
top = conductivity

bottom = resistivity

❑ OLS50
Inductive conductivity sensor for standard, and high temperature applications;
Ordering acc. to the sensor version, see Technical Information (order no. 50090385)

Assemblies

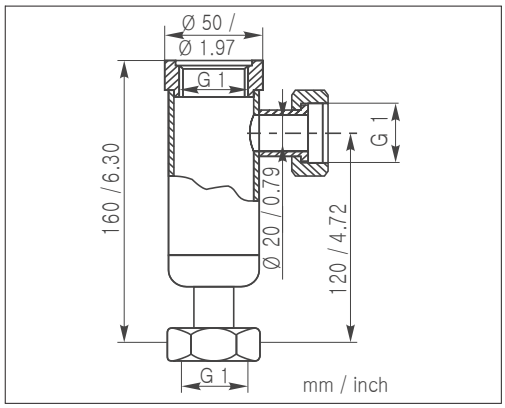
❑ OLA111 immersion and process assembly
For open and closed tanks with DN 100 flange,
for ordering information, see Technical Information OLA111



OLA111, DN 100 flange, mounting versions A, B und D

❑ OLA140
For the inductive sensor OLS50
Immersion assembly with flange connection for high duty processes;
Ordering acc. to the version, see Technical Information (order no. 51500081)

❑ OLA751 flow assembly



OLA751 flow assembly

For installation of conductivity sensors with G 1 thread.
Inlet (bottom) and outlet (lateral) DN 20 with union nuts G 1.
Stainless steel 1.4571 (AISI 316Ti)
Max. temperature: 160 °C / 320 °F
Max. pressure: 12 bar / 174 psi
Order no.: 50004201

Connection accessories

❑ Measuring cable OYK71
for use as extension cable between junction box VBM and transmitter, sold by the metre;
order no. 50085333

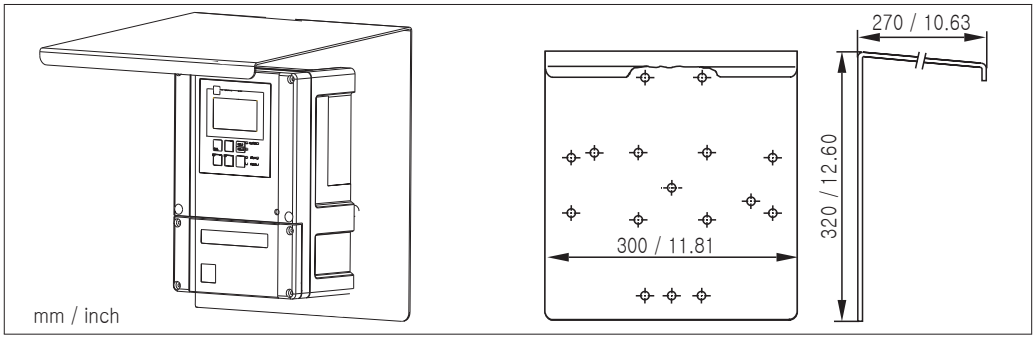
❑ Extension cable OLK5
for inductive conductivity sensors, for cable extension via junction box VBM;
(ordering per metre), order no. 50085473

❑ Junction box VBM
for cable extension, with 10 terminals, IP 65 / NEMA 4X

Cable entry Pg 13.5	Order no. 50003987
Cable entry NPT ½"	Order no. 51500177

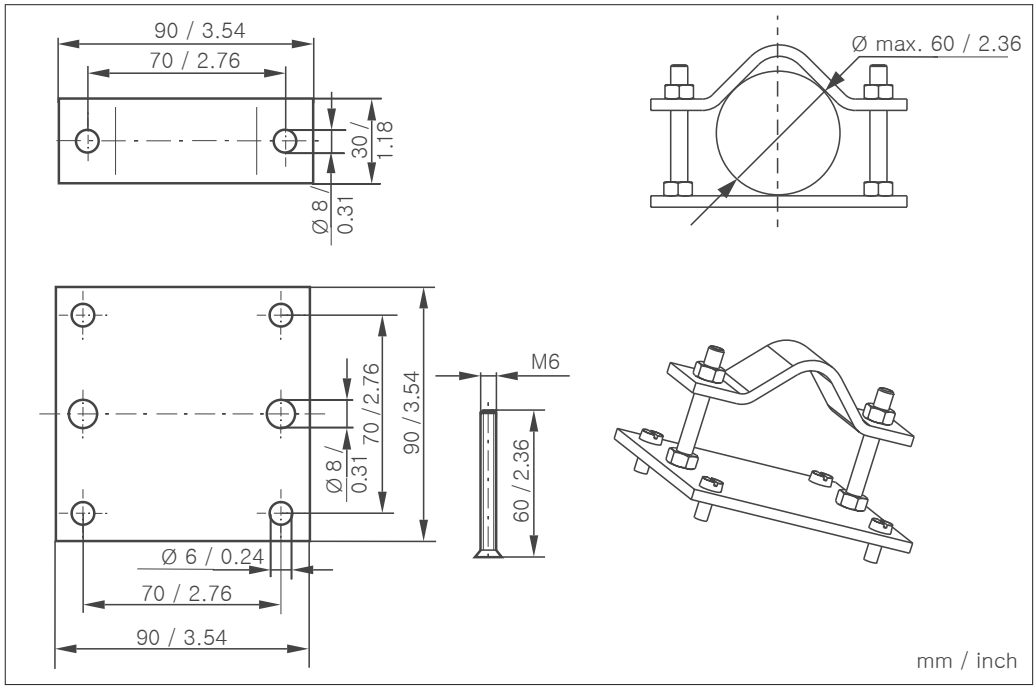
Mounting accessories

❑ Weather protection cover OYY101 for mounting of field housing, for outdoor installation
material: stainless steel 1.4031;
order no. OYY101-A



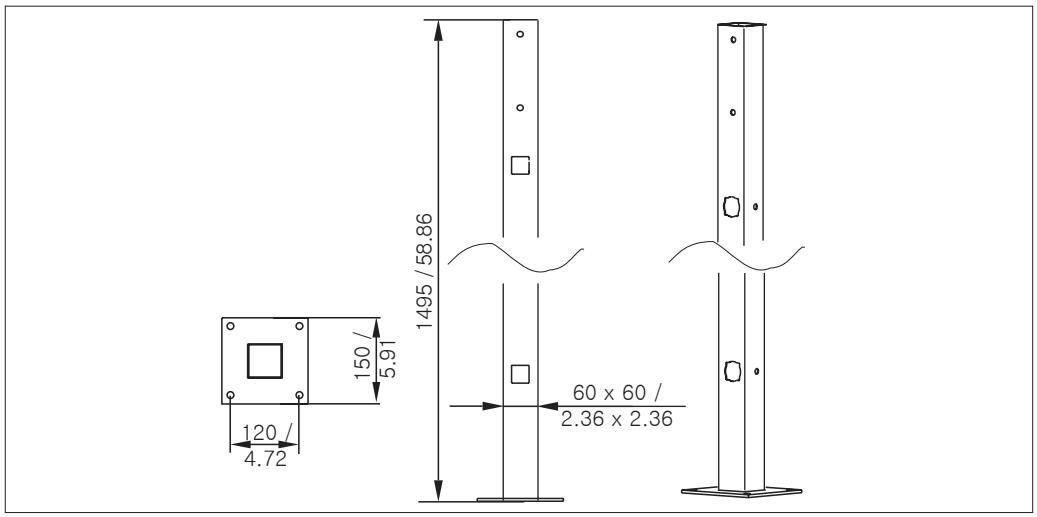
Weather protection cover for field instrument

❑ 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 OYY102
Square post for mounting of field housing, material: stainless steel 1.4301; order no. OYY102-A



Square post OYY102

Buffer solutions

Precision calibration solutions, acc. to SRM (Standard reference material) of NIST, reference temperature 25 °C (77 °F), with temperature table

- ❑ OLY11-A, 74.0 µS/cm, 500 ml (0.132 Us.gal);
- ❑ OLY11-B, 149.6 µS/cm, 500 ml (0.132 Us.gal);
- ❑ OLY11-C, 1.406 mS/cm, 500 ml (0.132 Us.gal);
- ❑ OLY11-D, 12.64 mS/cm, 500 ml (0.132 Us.gal);
- ❑ OLY11-E, 107.0 mS/cm, 500 ml (0.132 Us.gal);

Documentation

- ❑ Operating Instructions OLM223/253,