

# pH/ORP Measurement OPM223/253

Transmitter for analogue sensors and for ISFET sensors



The modular design of the OPM223/253 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.

## Application

- Effluent treatment
- Neutralisation
- Detoxication (electroplating)
- Water treatment
- Water monitoring

## Your benefits

- Field or panel-mounted housing
- Universal application
- Simple handling
  - Logically arranged menu structure
  - Large two-line display
  - Ultrasimple two-point calibration
- Safe operation
  - Overvoltage (lightning) protection
  - Direct access for manual contact control
  - Calibration plausibility check
  - User-defined alarm configuration

The basic unit can be extended with:

- Additional 2 or 4 contacts for use as:
  - Limit contacts (also for temperature)
  - P(ID) controller
  - Timer for simple rinse processes
  - Complete cleaning with Chemoclean
  - Current input
- Plus package:
  - User defined current output characteristics
  - Automatic cleaning trigger on alarm or limit violation
  - Sensor Check System for pH glass and reference
  - Live check of sensor
  - Special neutralisation controller
- HART® or PROFIBUS-PA/-DP
- 2nd current output for temperature, pH/ORP or continuous controller

## Function and system design

### Features of the basic version

#### pH and ORP value measurement

This is selected via the menu. During measurement, the value measured can be displayed in the other measuring mode (e.g. pH - mV or ORP % - ORP mV). The temperature is displayed at the same time or, if desired, not shown at all.

#### Calibration

pH electrodes are normally calibrated with the same pH values. Therefore the transmitter presents the settings from the **previous** calibration as defaults for the next calibration. If the buffer solutions are interchanged by accident (e.g. pH 4 buffer first, then pH 7 buffer instead of pH 7 first and then pH 4) the **plausibility check** ensures that the calibration is accepted anyway.

#### 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.

### Additional functions of the plus package

#### Current output

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.

#### Sensor-Check-System (SCS)

The sensor check system alerts to deviations of the pH glass impedance or reference impedance from the normal range, thus indicating possible failure due to pH electrode blocking or damage.

#### 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.

#### Neutralisation controller

A special control response that cannot be handled adequately by a P(ID) controller is required to neutralise solutions. For this reason, the transmitter provides a special neutralisation controller function by combining two P(ID) controllers.

#### 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

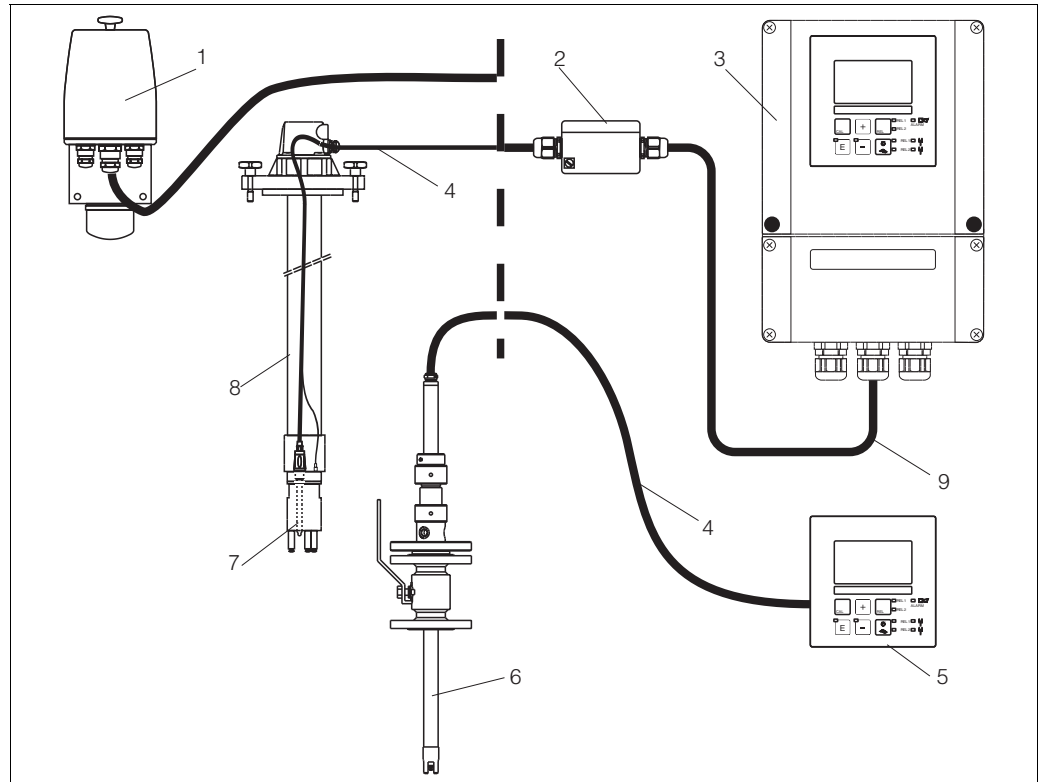
Field housing OPM253 with power supply 24 V	Application of transmitter and sensor in hazardous area zone 2
Field housing OPM253 with power supply 230 V	Application of transmitter as related electrical equipment in non-hazardous area or in simple pressurised apparatus; application of sensor in hazardous area zone 2
Panel mounted housing OPM223 with power supply 230 V or 24 V	Application of transmitter as related electrical equipment in non-hazardous area or in simple pressurised apparatus; application of sensor in hazardous area zone 2

**Measuring system**

A complete measuring systems comprises:

- The transmitter OPM223 or OPM253
- A pH/ORP electrode with or without an integrated temperature sensor
- An immersible, flow or retractable assembly
- A measuring cable(e.g. OPK9)

Options: extension cable, junction box VBA or VBM



C07-OPM2x3xx-14-06-00-xx-001.eps

**Complete measuring system OPM223/253**

- |   |                           |   |                             |
|---|---------------------------|---|-----------------------------|
| 1 | Flow assembly OPA250      | 6 | Retractable assembly OPA450 |
| 2 | Junction box VBA          | 7 | Electrode, e.g OPS11        |
| 3 | Transmitter OPM253        | 8 | Immersion assembly OPA111   |
| 4 | Measuring cable e.g. OPK9 | 9 | Extension cable             |
| 5 | Transmitter OPM223        |   |                             |

## Input

<b>Measured variables</b>	pH (analogue or digital sensors) ORP Temperature	
<b>Measuring range</b>	pH: ORP: Temperature: Pt 100, Pt 1000 NTC 30K	-2 ... 16 -1500 ... +1500 mV / 0 ... 100 % -50 ... +150 °C (-58 ... +302 °F) -20 ... +100 °C (-4 ... +212 °F)
<b>Input resistance</b>	> 10 <sup>12</sup> Ω (for nominal operating conditions) for standard sensors	
<b>Cable specification</b>	Length of cable (analogue): Length of cable (digital):	max. 50 m (164.05 ft) max. 100 m (328.10 ft)
<b>Binary inputs</b>	Voltage: Power consumption:	10 ... 50 V max. 10 mA
<b>Current input</b>	4 ... 20 mA, galvanically separated Load: 260 Ω at 20 mA (voltage drop 5.2 V)	

## Output

<b>Current range</b>	0 / 4 ... 20 mA, galvanically separated	
<b>Error current</b>	2.4 or 22 mA	
<b>Load</b>	max. 500 Ω (depending on operating voltage)	
<b>Output range</b>	pH: ORP: absolute: relative: Temperature:	adjustable, min. Δ 1 pH adjustable, min. Δ 50 mV fixed, 0 ... 100 % adjustable, Δ 10 ... Δ 100 % of upper range value
<b>Resolution</b>	max. 700 digits/mA	
<b>Min. distance for 0 / 4 ... 20 mA signal</b>	10 % of measuring range	
<b>Isolation voltage</b>	max. 350 V <sub>rms</sub> / 500 V DC	
<b>Overvoltage protection</b>	acc. to EN 61000-4-5:1995	
<b>Auxiliary voltage output</b>	Output voltage: Output current:	15 V ± 0.6 max. 10 mA
<b>Contact outputs</b>	Switching current with ohmic load (cos φ = 1): Switching current with inductive load (cos φ = 0.4): Switching voltage: Switching power with ohmic load (cos φ = 1): Switching power with inductive load (cos φ = 0.4):	max. 2 A max. 2 A max. 250 V AC, 30 V DC max. 1250 VA AC, 150 W DC max. 500 VA AC, 90 W DC

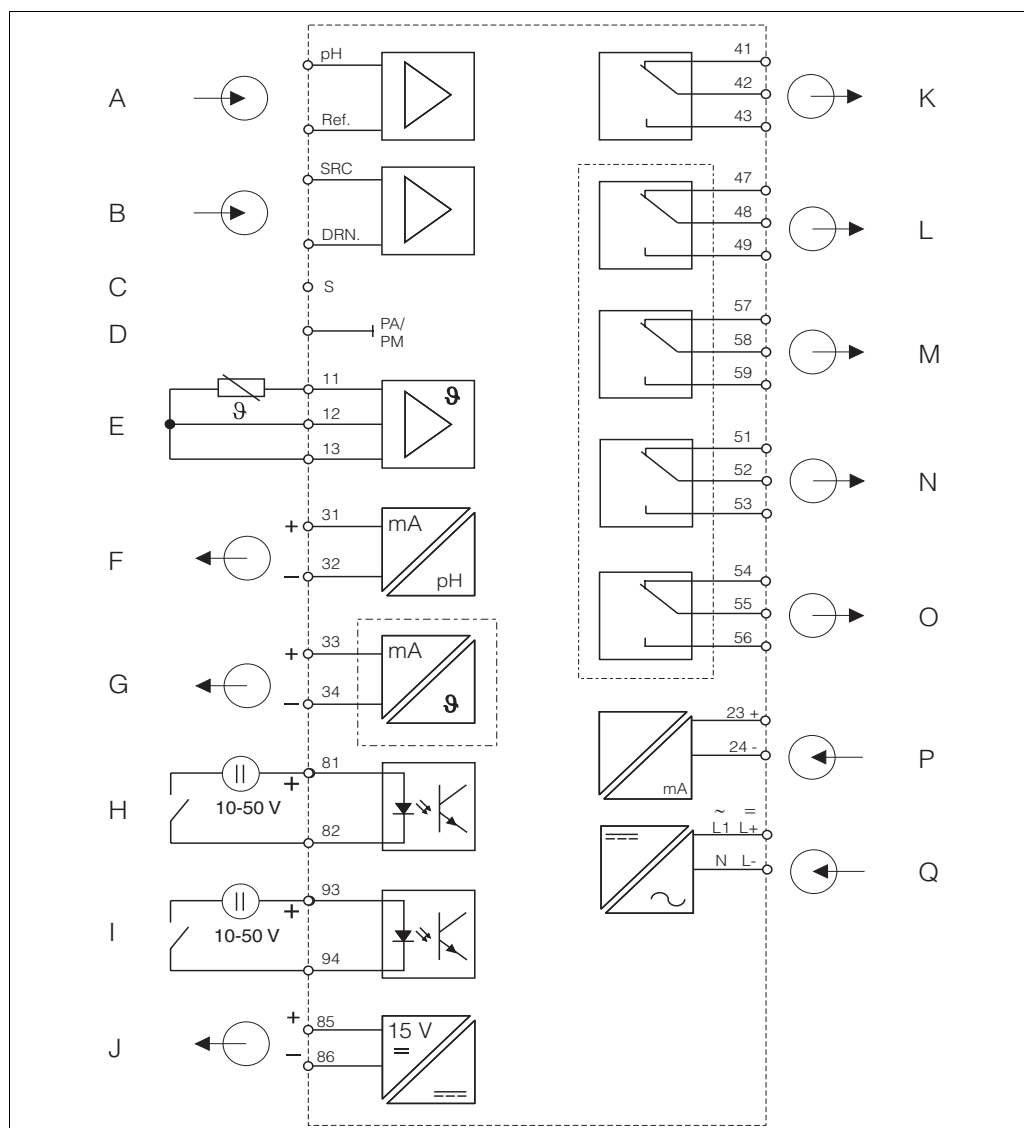
---

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

---

## Power supply

### Electrical connection of standard sensors and ISFET sensors



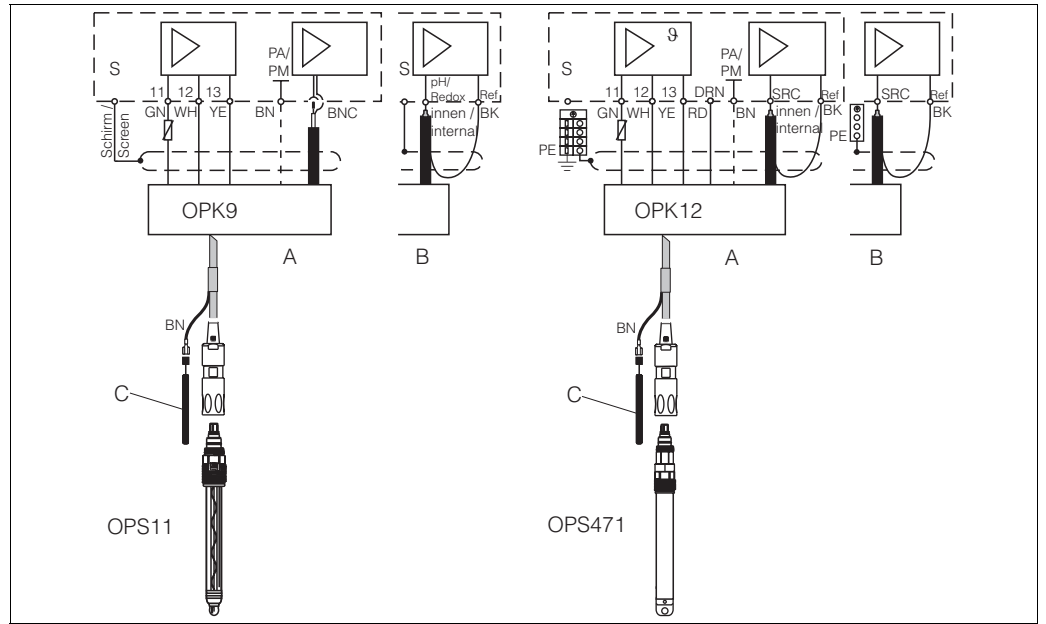
C07-OPM2x3xx-04-06-00-xx-001.EPS

#### Electrical connection of the transmitter

- |          |  |          |   |
|----------|--|----------|---|
| <b>A</b> | Standard sensor  | <b>J</b> | Aux. voltage output                     |
| <b>B</b> | ISFET sensor   | <b>K</b> | Alarm (current-free contact position)   |
| <b>C</b> | Shield for glass electrodes                                  | <b>L</b> | Relay 1 (current-free contact position) |
| <b>D</b> | Solution ground  | <b>M</b> | Relay 2 (current-free contact position) |
| <b>E</b> | Temperature sensor   | <b>N</b> | Relay 3 (current-free contact position) |
| <b>F</b> | Signal output 1 pH/ORP                                       | <b>O</b> | Relay 4 (current-free contact position) |
| <b>G</b> | Signal output 2 temperature, pH/ORP or continuous controller | <b>P</b> | Current input 4 ... 20 mA               |
| <b>H</b> | Binary input 1 (Hold)  | <b>Q</b> | Power supply                            |
| <b>I</b> | Binary input 2 (Chemoclean)                                  |          |   |

**Connection of sensor**

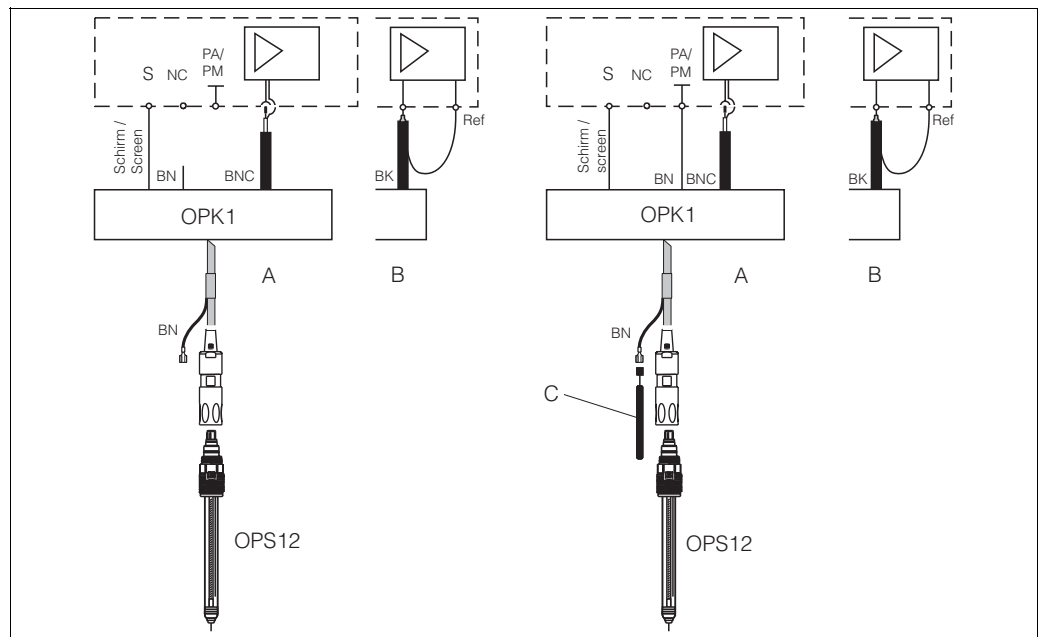
The pH and ORP electrodes are connected using special terminated and shielded multicore cables. The measuring cable can be extended with a junction box and an extension cable. Termination instructions are supplied with the measuring cable.



C07-OPM2x3xx-04-06-01-xx-010.eps

Connection OPS11 with OPK9 and OPS471 with OPK12 to the transmitter

- A Panel-mounted instrument
- B Field instrument
- C Potential matching PM for symmetrical connection



C07-OPM2x3xx-04-06-01-xx-011.eps

Unsymmetrical and symmetrical connection of ORP electrodes to the transmitter

- A Panel-mounted instrument
- B Field instrument
- C Potential matching PM for symmetrical connection

**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** microfuse, medium time-lag, 250 V/3.15 A

## Performance characteristic

**Reference temperature** 25 °C (77 °F)

**Resolution**

pH:	0.01 pH
ORP:	1 mV/0.1 %
Temperature:	0.1 °C

**Deviation of indication<sup>a</sup>**

Display	
pH:	max. 0.5 % of measuring range
ORP:	max. 0.5 % of measuring range
Temperature:	max. 1.0 % of measuring range
Signal output	
pH:	max. 0.75 % of measuring range
ORP:	max. 0.75 % of measuring range
Temperature:	max. 1.25 % of measuring range

**Repeatability<sup>a</sup>**

pH:	max. 0.2 % of measuring range
Redox:	max. 0.2 % of measuring range

**Zero point**

Glass:	pH 5.0 ... 9.0 (nominal pH 7.00)
Antimon:	pH -1.0 ... 3.0 (nominal pH 1.00)
ISFET:	-500 ... +500 mV

**Slope**

Glass:	38.00 ... 65.00 mV/pH (nominal 59.16 mV/pH)
Antimon:	25.00 ... 65.00 mV/pH (nominal 59.16 mV/pH)
ISFET:	38.00 ... 65.00 mV/pH (nominal 59.16 mV/pH)

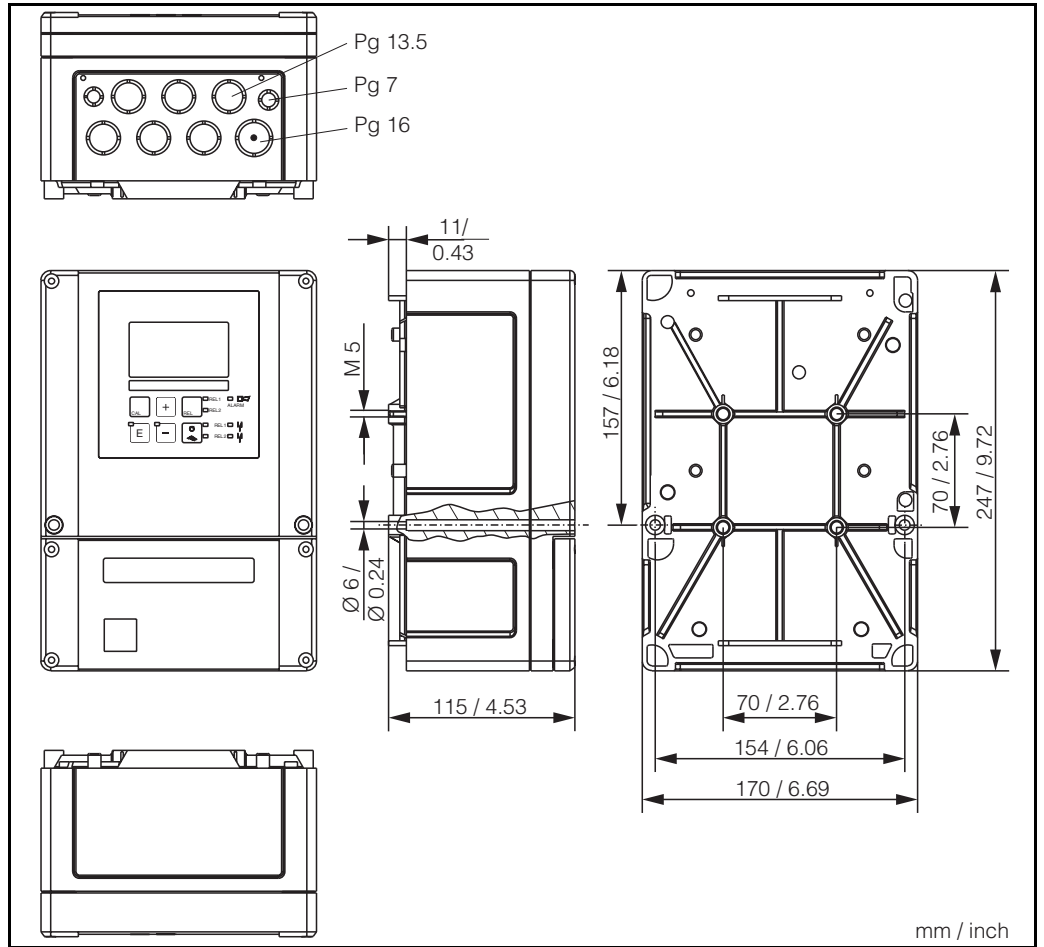
**Offset**

pH:	±2 pH
ORP:	±120 mV/±50 %
Temperature:	±5 °C

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

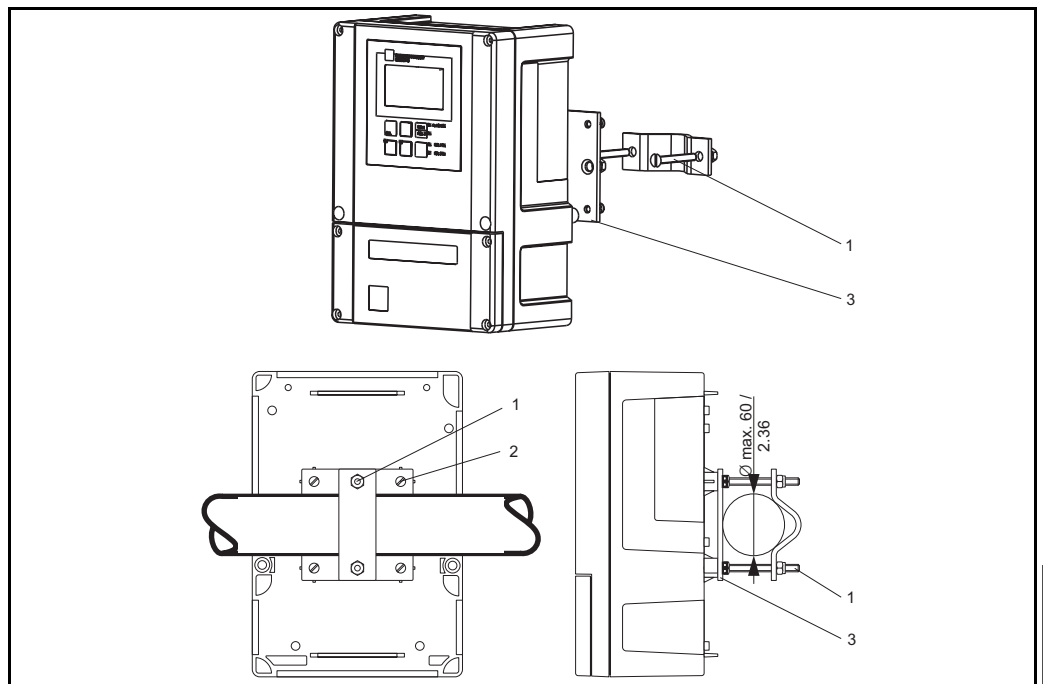
# Installation conditions

## Installation instructions



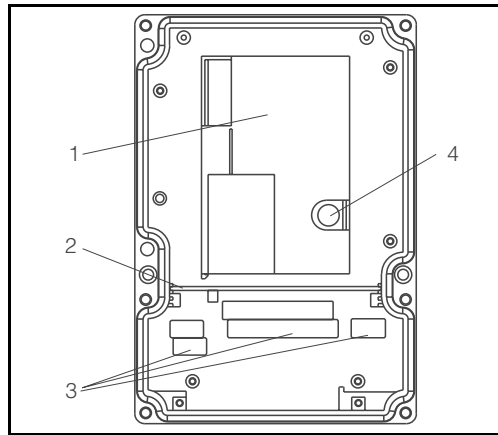
C07-OxM253xx-08-06-00-en-001.EPS

Field instrument



C07-OxM253xx-11-06-00-en-003.EPS

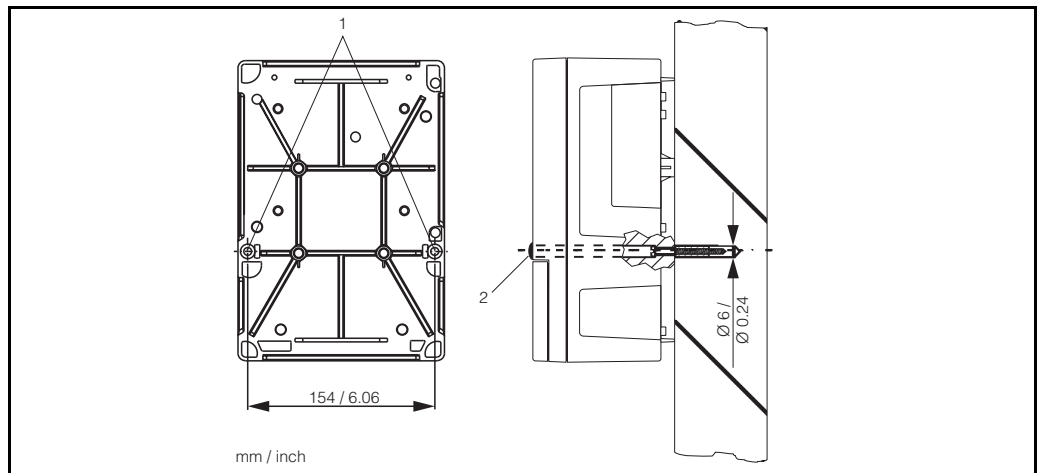
Mounting on cylindrical pipes



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

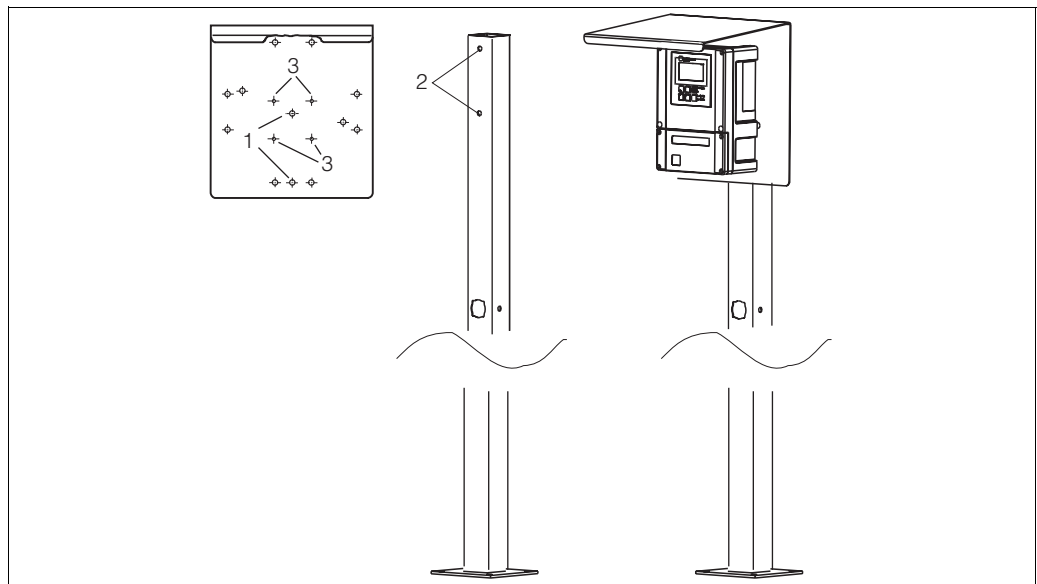
C07-OxM253xx-11-06-00-xx-001.EPS

Inside of field instrument



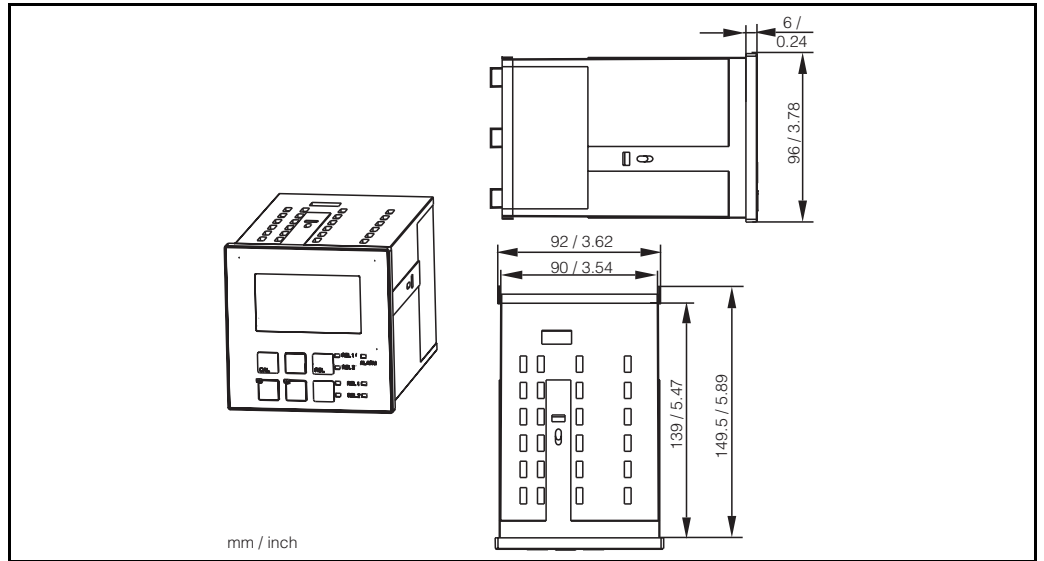
C07-OxM253xx-11-06-00-en-002.EPS

Wall mounting of the field instrument



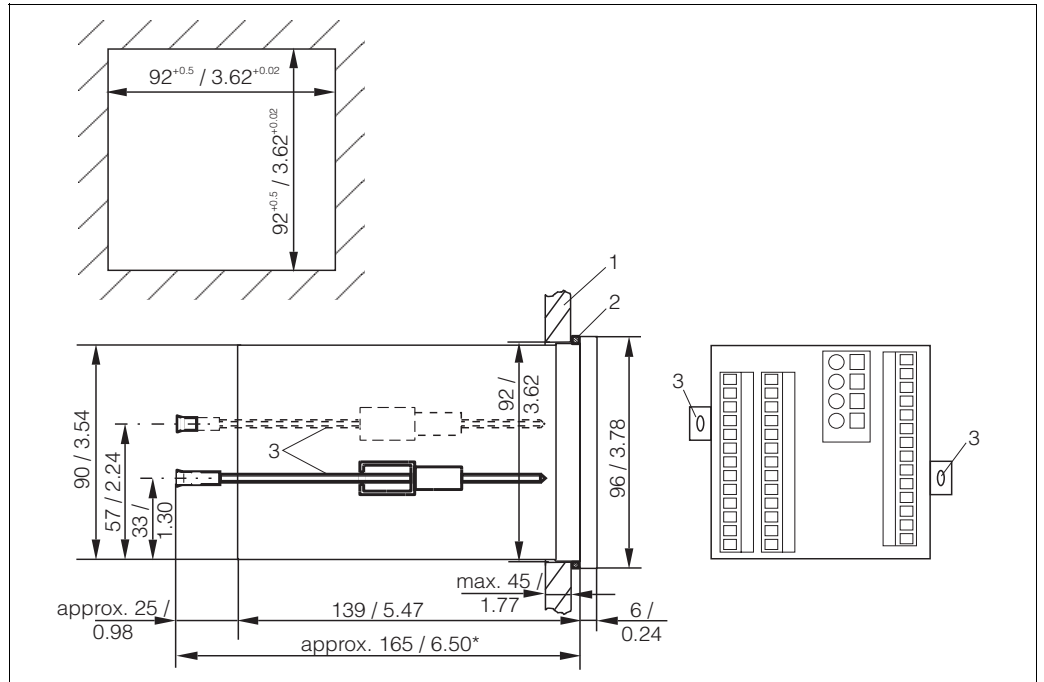
C07-OxM253xx-11-06-00-xx-004.EPS

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



C07-OxM223xx-08-08-00-en-001.EPS

Dimensions panel-mounted instrument



C07-OxM223xx-11-06-00-en-001.EPS

Installation of the panel mounted instrument

- 1 Wall of control cabinet
- 2 Gasket
- 3 Tensioning screws

## Environment

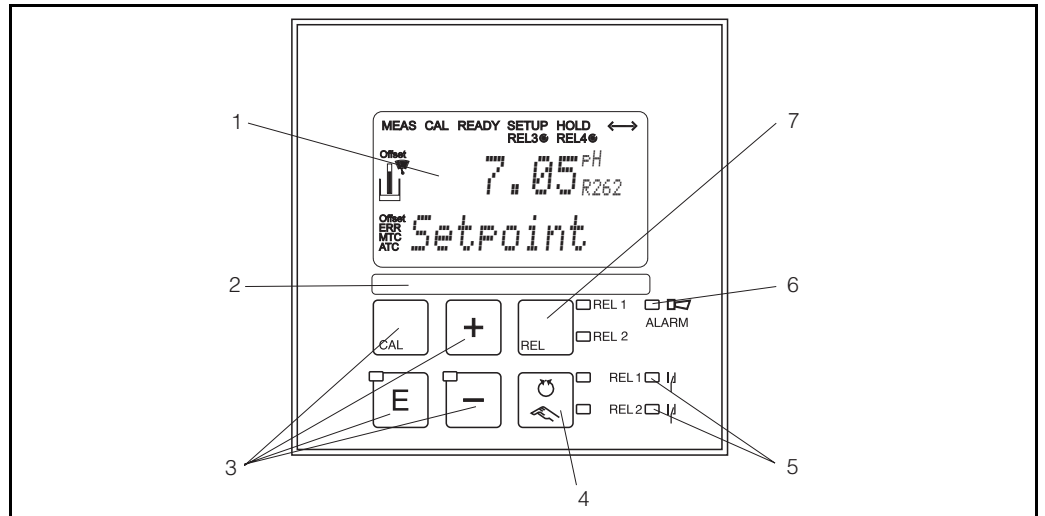
<b>Ambient temperature</b>	-10 ... +55 °C (+14 ... +131 °F)	
<b>Ambient temperature limit</b>	-20 ... +60 °C (-4 ... +140 °F)	
<b>Storage and transport temperature</b>	-25 ... +65 °C (-13 ... +149 °F)	
<b>Electromagnetic compatibility</b>	Interference emission and interference immunity acc. to EN 61326: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

## Mechanical construction

<b>Dimensions</b>	Panel mounted instrument:	96 x 96 x 145 mm (3.78 x 3.78 x 5.71 inches) Mounting 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	2.5 mm <sup>2</sup>

## Human interface

### Display elements



C07-OPM2x3xx-19-06-00-en-001.eps

### 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
- 5 LED indicators for switched limit outputs
- 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 provide 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 harmonized European standards. The manufacturer confirms compliance with the standards by affixing the CE symbol.

### Ex approval for zone 2

OPM253-..6...	ATEX II 3G EEx nA[L] IIC T4
OPM253-..4...	ATEX II 3G [EEx nAL] IIC
OPM223-..4...	
OPM223-..6...	

## Ordering information

### Product structure

		Sensor input; software	
IS		pH (glass/ISFET) / ORP; Plus package	
PR		pH (glass)/ORP; basic version	
PS		pH (glass)/ORP; 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 [EEx nAL] IIC	
	5	100 V AC	
	6	24 V AC/DC; ATEX II 3G [EEx nAL] IIC for OPM223, EEx nA[L] IIC T4 for OPM253	
	7	24 V AC; CSA Gen. Purp.	
	8	24 V AC/DC	
		Output	
	0	1 x 20 mA, pH/ORP	
	1	2 x 20 mA, pH/ORP + selectable	
	3	PROFIBUS PA	
	4	PROFIBUS DP	
	5	1 x 20 mA, pH/ORP HART	
	6	2 x 20 mA, pH/ORP HART + selectable	
		Additional contacts; analogue input	
	05	not selected	
	10	2 x relay (limit/P(ID)/timer)	
	15	4 x relay (limit/P(ID)/Chemoclean)	
	16	4 x relay (limit/P(ID)/timer)	
	20	2 x relay (limit/P(ID)/timer); 20 mA	
	25	4 x relay (limit/P(ID)/Chemoclean); 20 mA	
	26	4 x relay (limit/P(ID)/timer); 20 mA	
OPM253-			
			complete order code
OPM223-			

### Additional functions of the Plus package

- Current output table to cover large areas with varying resolution
- Monitoring of sensor and process for safe operation
- Neutralisation controller to keep pH value constant by dosing acid and alkali
- Automatic cleaning function start

### Scope of delivery

The delivery of the field instrument includes:

- 1 transmitter OPM253
- 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 BA194e00
- versions with HART communication:
  - 1 operating instructions Field Communication with HART, BA208e00
- versions with PROFIBUS communication:
  - 1 operating instructions Field Communication with PROFIBUS PA/DP, BA209e00
- versions with explosion protection for hazardous area zone II (ATEX II 3G):
  - Safety instructions for use in explosion-hazardous areas, XA194a300

The delivery of the panel mounted instrument includes:

- 1 transmitter OPM223
- 1 set of plug-in screw terminals
- 2 tensioning screws
- 1 BNC-plug (solder-free)
- 1 operating instructions BA194e00
- versions with HART communication:
  - 1 operating instructions Field Communication with HART, BA208e00

- versions with PROFIBUS communication:  
1 operating instructions Field Communication with PROFIBUS PA/DP, BA209e00
- versions with explosion protection for hazardous area zone II (ATEX II 3G):  
Safety instructions for use in explosion-hazardous areas, XA194a300

## Accessories

### Sensors

- OPS11  
pH electrode for process applications, with PTFE diaphragm;  
Ordering acc. to product structure, see Technical Information
- OPS12  
ORP electrode for process applications, with PTFE diaphragm;  
Ordering acc. to product structure, see Technical Information
- OPS41  
pH electrode with ceramics diaphragm and KCl liquid electrolyte;  
Ordering acc. to product structure, see Technical Information
- OPS42  
ORP electrode with ceramics diaphragm and KCl liquid electrolyte;  
Ordering acc. to product structure, see Technical Information
- OPS71  
pH electrode with double chamber reference system and integrated bridge electrolyte;  
Ordering acc. to product structure, see Technical Information
- OPS72  
ORP electrode with double chamber reference system and integrated bridge electrolyte;  
Ordering acc. to product structure, see Technical Information
- OPS91  
pH electrode with open aperture for media with high dirt load;  
Ordering acc. to product structure, see Technical Information
- OPS471  
Sterilisable and autoclavable ISFET sensor for food and pharmaceuticals, process technology,  
water treatment and biotechnology;  
Ordering acc. to product structure, see Technical Information
- OPS441  
Sterilisable ISFET sensor for media with low conductivity, with liquid KCl electrolyte;  
Ordering acc. to product structure, see Technical Information
- OPS491  
ISFET sensor with open aperture for media with high dirt load;  
Ordering acc. to product structure, see Technical Information

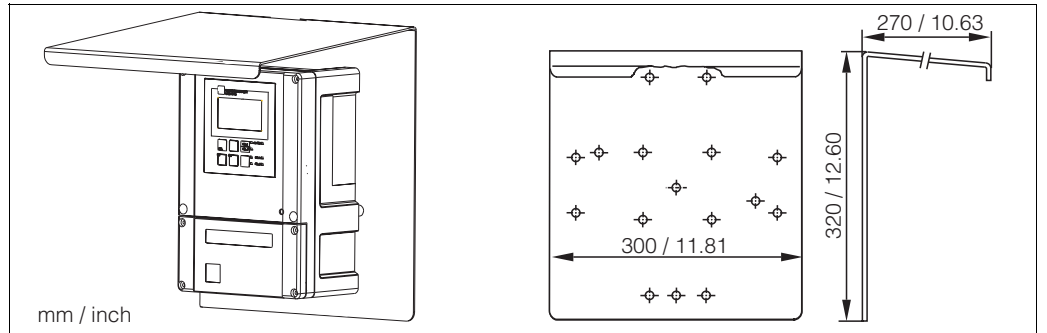
### Assemblies

- OPA450  
Manually operated retractable assembly for pH electrodes, for the installation of 120 mm  
electrodes in tanks and pipes,  
Ordering acc. to product structure, see Technical Information
- OPA471  
Compact retractable stainless steel assembly, for the installation in tanks and pipes, manual or  
pneumatic operation;  
Ordering acc. to product structure, see Technical Information
- OPA472  
Compact retractable plastic assembly, for the installation in tanks and pipes, manual or  
pneumatic operation;  
Ordering acc. to product structure, see Technical Information
- OPA473  
Retractable stainless steel process assembly, with ball valve for a particularly safe and reliable  
separation of the medium from the environment;  
Ordering acc. to product structure, see Technical Information
- OPA474  
Retractable plastic process assembly, with ball valve for a particularly safe and reliable  
separation of the medium from the environment;  
Ordering acc. to product structure, see Technical Information



**Mounting accessories**

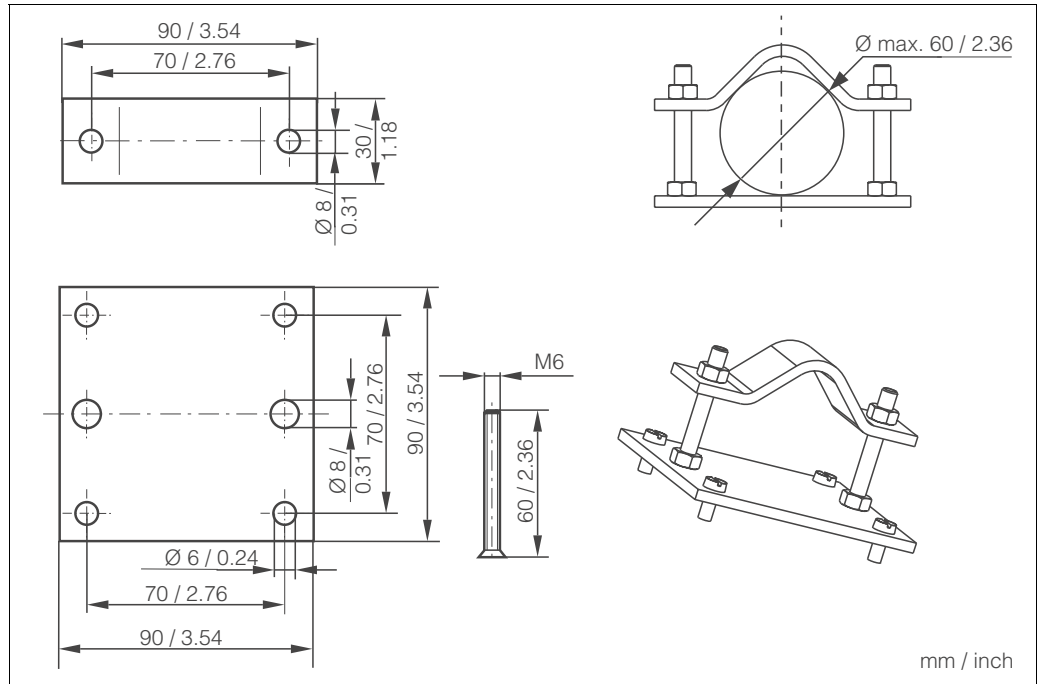
- Weather protection cover OYY101 for mounting of field housing, for outdoor installation material: stainless steel 1.4031; order no. OYY101-A



C07-OYY101xx-00-06-00-en-001.eps

*Weather protection cover for field instrument*

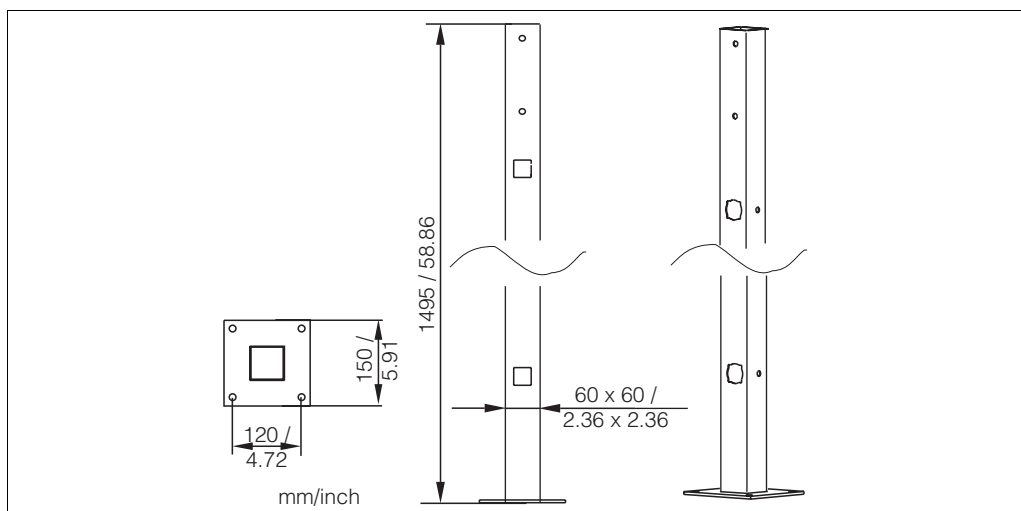
- Kit for mounting of field housing on horizontal or vertical pipes (Ø max. 60 mm (2.36")) order no. 50086842



C07-OxM2x3xx-00-06-00-en-001.eps

*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

Technical buffer solutions, accuracy 0.02 pH, acc. to NIST/DIN

- pH 4.0 red, 100 ml (3.4 fl.oz.), order no. OPY2-0
- pH 4.0 red, 1000 ml (34 fl.oz.), order no. OPY2-1
- pH 7.0 green, 100 ml (3.4 fl.oz.), order no. OPY2-2
- pH 7.0 green, 1000 ml (34 fl.oz.), order no. OPY2-3

Technical buffer solutions for single use, accuracy 0.02 pH, acc. to NIST/DIN

- pH 4.0 20 x 20 ml (0.68 fl.oz.), order no. OPY2-D
- pH 7.0 20 x 20 ml (0.68 fl.oz.), order no. OPY2-E

Technical buffer solutions for ORP electrodes

- +220 mV, pH 7.0, 100 ml (0.026 US gal.); order no. OPY3-0
- +468 mV, pH 0.1, 100 ml (0.026 US gal.); order no. OPY3-1

KCl-electrolyte solutions for liquid filled electrodes

- 3.0 mol, T = -10 ... 100 °C (14 ... 212 °F), 100 ml (3 oz), order no. OPY4-1
- 3.0 mol, T = -10 ... 100 °C (14 ... 212 °F), 1000 ml (30 oz), order no. OPY4-2
- 1.5 mol, T = -30 ... 100 °C (-22 ... 266 °F), 100 ml (3 oz), order no. OPY4-3
- 1.5 mol, T = -30 ... 100 °C (-22 ... 266 °F), 1000 ml (30 oz), order no. OPY4-4

## 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



