Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

ISEmax CAM40/CAS40

Online measurement of nutrient parameters
Ion-selective electrode system for the continuous measurement of ammonium and nitrate

Application

The ion-selective electrode system works directly in the activated sludge basin of the sewage treatment plant without any sample conditioning or sample transportation.

The system consists of a sensor, electrodes and a transmitter with display and operating elements and is mounted on the basin rim.

Up to two ion-selective sensors simultaneously measure nitrate and ammonium in the activated sludge basin.

Your benefits

- Reliable and cost-saving:
  - Nitrate and ammonium measured directly without the need for expensive sample conditioning
  - Optional potassium and/or chloride measurement to compensate high concentrations of interference ions
  - Low operating costs since no reagent used
- Versatile and flexible:
  - Large measuring range 0.1-1000 mg/l NH_4-N or 0.1-1000 mg/l NO_3-N
  - 4 current outputs and 5 relays, some user-configurable
- Easy-to-use and safe:
  - Installed directly on the basin rim, no measuring container or sample-conveying pump required
  - Low maintenance thanks to compressed air cleaning
  - Membrane cap replacement every 6 months prolongs electrode service life

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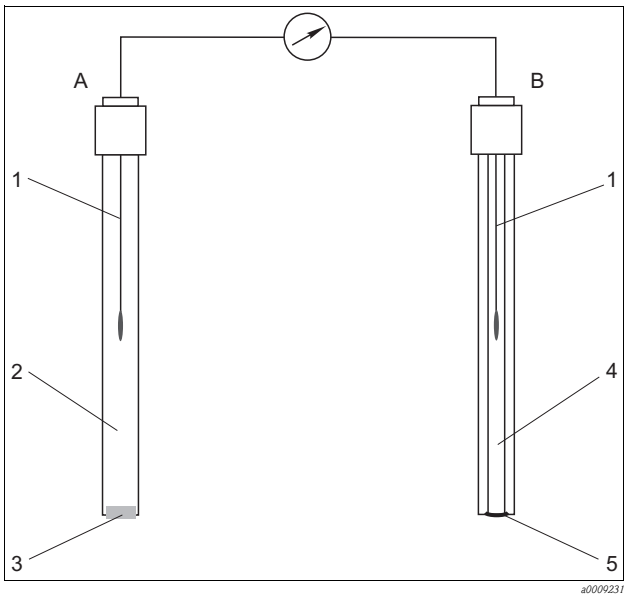
People for Process Automation

Measuring system

Measuring principle

At the heart of the ion-selective electrode (ISE) is a membrane that is selective for the ion to be measured. An ionophore is integrated into the membrane which facilitates the selective "migration" of a specific type of ion (e.g. ammonium or nitrate) to the electrode.
As a result of the ion migration, a change in the charge occurs, causing an electrochemical potential that is proportional to the ion concentration. The potential is measured against a reference electrode with a constant potential and converted to a substance-specific concentration using the Nernst equation.
With the potentiometric measuring principle, the color and turbidity do not affect the measurement result.



A Reference electrode
B Ion-selective electrode
1 Inner metal lead
2 Bridging electrolyte
3 Junction
4 Inner electrolyte
5 Ion-selective membrane

General measuring principle of an ion-selective electrode

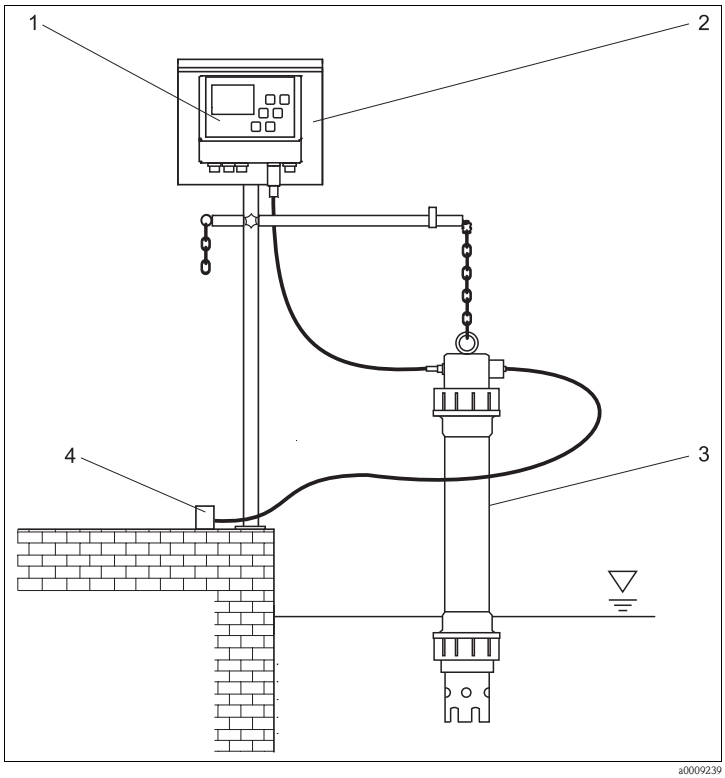
Interference

Depending on the selectivity of the ion-selective electrode vis-à-vis other ions (interference ions), and the concentration of these ions, such ions could also be interpreted as part of the measuring signal and thus cause measuring errors.
When measuring in wastewater, the potassium ion which is chemically similar to the ammonium ion can cause higher measured values.
The measured values for nitrate can be too high due to high concentrations of chloride.
To reduce measuring errors resulting from such cross-interference, the concentration of the potassium or chloride interference ion can be measured and compensated for with a suitable additional electrode.

Measuring system

A complete measuring system comprises:
- CAM40 transmitter
- CAS40 sensor
  - Ion-selective electrode(s) for ammonium and/or nitrate
  - Reference electrode
  - Ion-selective electrode for compensating cross-interference
  - pH glass electrode

Optional
- Upright post with boom
- Wall retainer
- Weather protection cover – absolutely essential if mounting the transmitter outdoors!
- Compressed air generator (if no compressed air is available on site)



Example: measuring system on basin rim

1	*CAM40 transmitter*	*3*	*CAS40 sensor*
2	*Upright post with weather protection cover*	*4*	*Compressed air supply (cleaning)*

Input

Measured variables

Depending on version:
- Ammonium
- Nitrate
- Potassium
- Chloride
- pH value

Measuring ranges

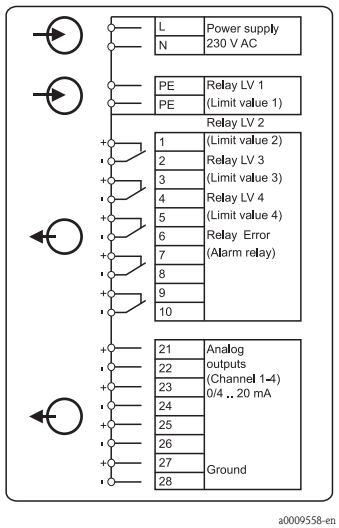
- Ammonium:
  0.1 to 1000 mg/l (NH_4-N)
- Nitrate:
  0.1 to 1000 mg/l (NO_3-N)
- Potassium:
  1 to 1000 mg/l
- Chloride:
  1 to 1000 mg/l

Output

Output signal	4 x 0/4 to 20 mA, galvanically isolated
Signal on alarm	Signal follows the measured value, fault can be freely programmed to a relay
Load	Max. 500 Ω
Relay output	5 relays: All user-configurable If the optional compressor is used, a relay output is used to control it.
Switch output	Relay switching capacity: 230 V DC / 5 A

Power supply

Electrical connection



CAM40 wiring diagram

Terminal	Assignment
L1, N	230 V AC power supply
1, 2	Relay 1, max. 230 V AC, 2 A
3, 4	Relay 2, max. 230 V AC, 2 A
5, 6	Relay 3, max. 230 V AC, 2 A
7, 8	Relay 4, max. 230 V AC, 2 A
9, 10	Relay 5, max. 230 V AC, 2 A
21, 22	Analog output 1
23, 24	Analog output 2
25, 26	Analog output 3
27, 28	Analog output 4
PE, PE	Protective earth

Note! A compressor can optionally be controlled to terminals 9 and 10. In such instances, relay 5 is no longer available.

Supply voltage	100 to 240 V AC **Caution!** The power supply must be connected via an all-pole mains switch.
Cable specification	3-wire, shielded cable, 10 m (33 ft) standard length **Caution!** Cable must have an outer diameter of 5 to 13 mm (0.2 to 0.5 inch) to guarantee the specified type of protection at the cable glands.
Electrode connection	GSA socket

Performance characteristics

Response time t_{90} [1)]

- Ammonium:
  < 2 min.
- Nitrate:
  < 2 min.
- Potassium:
  < 2 min.
- Chloride:
  < 2 min.

Measured value resolution

Ammonium, nitrate, potassium, chloride

- 0.1 to 99 mg/l:
  0.01 mg/l
- 99 to 999 mg/l:
  0.1 mg/l
- > 999 mg/l:
  1 mg/l

Maximum measured error

± 5 % of the measured value ± 0.2 mg/l

Repeatability

±3 % of the display value

Compensation

Sensor	Temperature	pH	Potassium[1)]	Chloride[1)]
Ammonium	2 to 40 °C (36 to 100 °F)	pH 8.3 to 10	1 to 1000 mg/l (ppm)	-
Nitrate		-	-	10 to 1000 mg/l (ppm)
Potassium		-	-	-
Chloride		-	-	-

1) The fluctuations in concentration, not the absolute value, are the determining factor

Max. operating life

Membrane and electrolyte

- Use:
  0.5 years
- Storage:
  2 years

Automatic cleaning

- Cleaning medium:
  Air
- Pressure:
  3 to 3.5 bar (30 to 50 psi)
- Volume of air required per cleaning cycle:
  3 to 4 l (0.8 to 1 US gal)
- Cleaning duration:
  4 to 15 s
- Cleaning intervals (at T > 10 °C (50 °F)):
  Sludge activation inlet: 15 s cleaning, 30 min pause
  Sludge activation: 15 s cleaning, 1 hour pause

1) For a change between 0.5 and 1 mmol/l in both directions, at 25 °C (77 °F)

Environment

Ambient temperature range

CAM40 transmitter:	–20 to 50 °C (–4 to 120 °F)
CAS40 sensor:	2 to 50 °C (36 to 120 °F)

Storage temperature

CAM40 + CAS40:	2 to 40 °C (36 to 100 °F)

Protection class

CAM40 transmitter:	IP 65
CAS40 sensor:	IP 68

Process

Process temperature range

2 to 40 °C (36 to 100 °F)

Process pressure

400 mbar (160 inH_2O) max. permitted overpressure

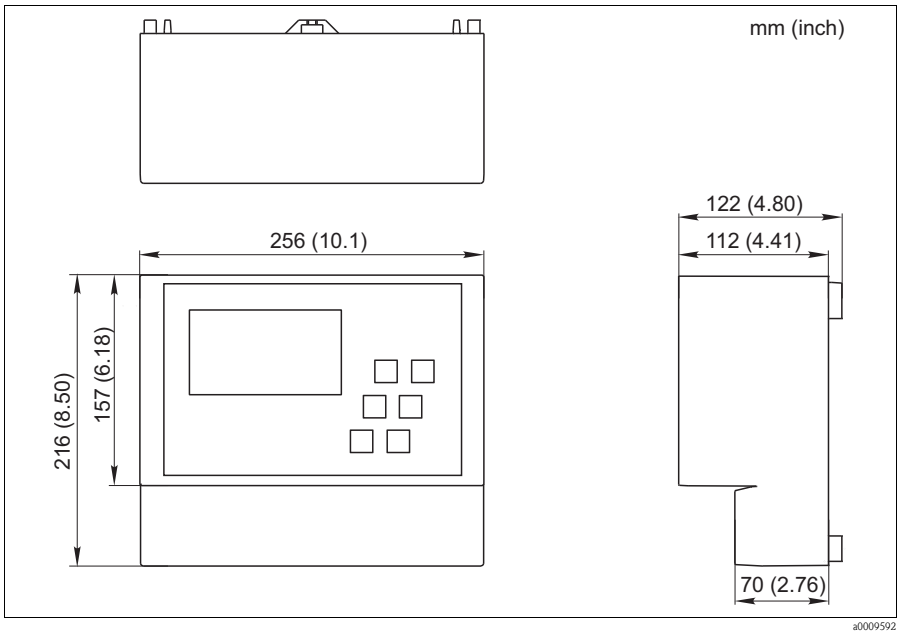
pH value of the medium

- Ammonium:
  pH 5 to 8.3 (without pH compensation)
  pH 5 to 10 (with pH compensation)
- Nitrate:
  pH 2 to 12
- Potassium:
  pH 2 to 12
- Chloride:
  pH 1 to 10

Mechanical construction

Dimensions

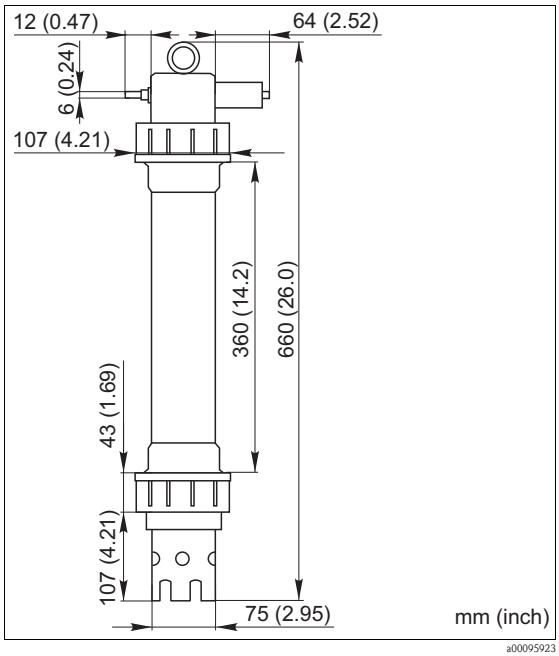
CAM40



CAM40 dimensions

Note!
Please refer to the original drawing of the housing for other dimensions, such as that of the rear housing panel with the suspension grooves (—> pdf file on the CD for the BA).

CAS40



CAS40 dimensions

Weight

CAM40 transmitter	Approx. 2.6 kg (5.7 lbs)
CAS40 sensor	Approx. 2.8 kg (6.2 lbs)

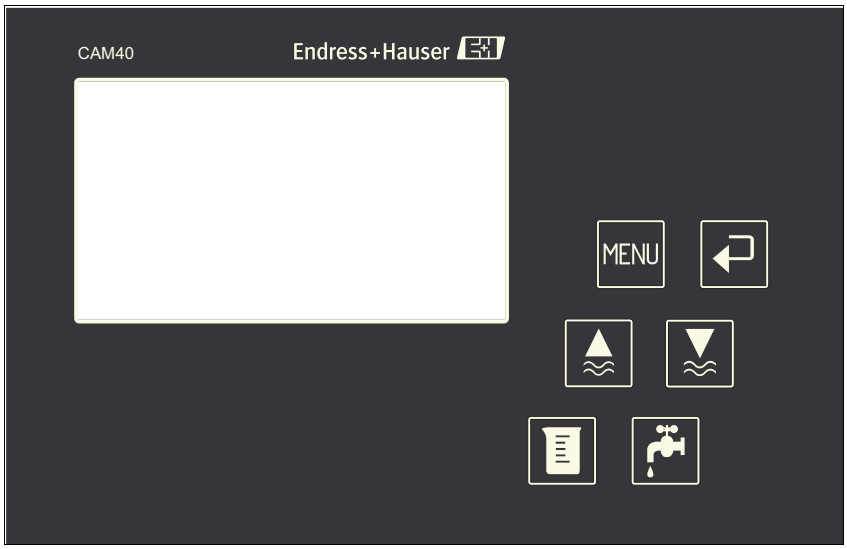
Material

CAM40 transmitter:	Polycarbonate
CAS40 sensor:	PVC, glass, polyethylene
Wetted parts	
- Ammonium, nitrate, potassium electrode:	PVC, plasticizer, silicone, nitrile
- Chloride electrode:	PVC, AgCl, AgS, silicone, nitrile
- Reference electrode:	Glass, PTFE, EPDM
- pH electrode:	Glass, EPDM

Electrode process connection Pg 13.5

Human interface

Display and operating elements



ISEmax CAM40 display

- *Call up the menu functions*
- *Confirm, switch, scroll*
- *"Freeze" (hold) the output signals*
- *Measure + release the output signals*
- *Call up calibration routines*
- *Trigger manual cleaning*

Certificates and approvals

CE approval

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.

Ordering information

CAM40 product structure

Power supply		
	A	100 - 240 VAC; 50/60 Hz
Signal output		
	1	4 x 0/4 - 20 mA
CAM40-		Complete order code

CAS40 product structure

Application					
	A				Aeration basin, nitrification, denitrification, with reference electrode
	B				Inlet aeration basin, with pH compensation (only ammonium)
		Ion-selective parameter			
		1			Ammonium + nitrate
		2			Ammonium
		3			Nitrate
			Compensation electrode		
			A		None
			B		Potassium (Ion-selective parameter="1" or "2" only)
			C		Chloride (Ion-selective parameter="1" or "3" only)
				Cable length	
				1	10 m (33 ft)
				9	Special version, to be specified
CAS40-					Complete order code

Scope of delivery

The scope of delivery comprises:

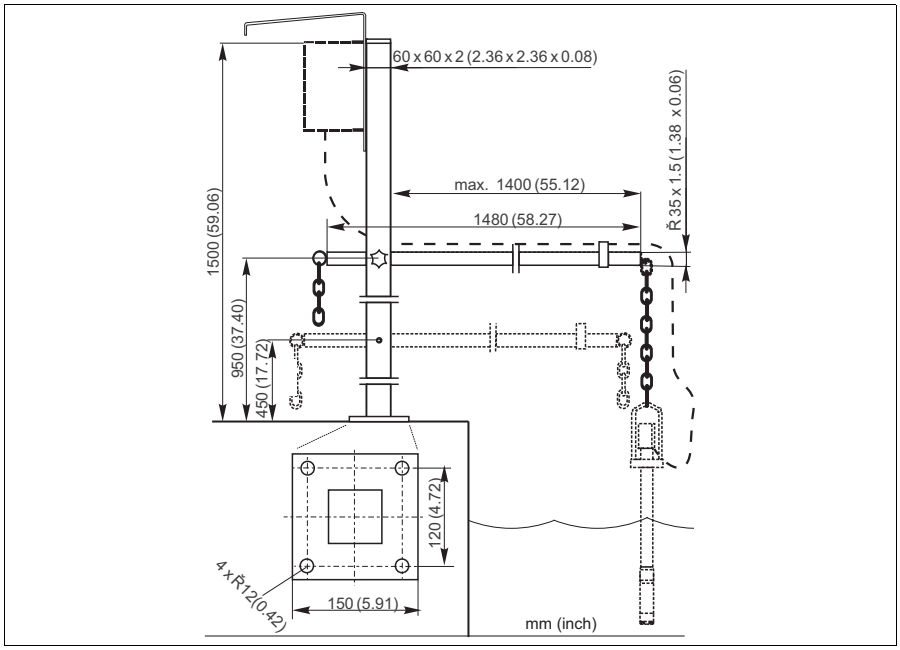
- 1 transmitter
- 1 sensor (version as per nameplate)
- 1 sensor cable
- 3 screws for fastening to the weather protection cover
- 1 set of Brief Operating Instructions
- 1 set of Operating Instructions on CD-ROM

Accessories

Note!
In the following sections, you find the accessories available at the time of issue of this documentation.
For information on accessories that are not listed here, please contact your local service.

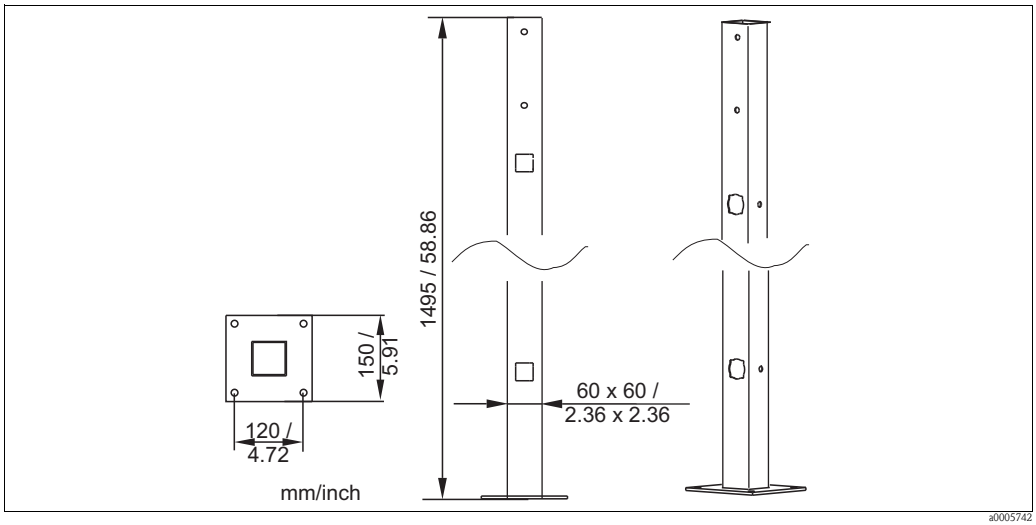
Installation accessories

Immersion assembly holder CYH101
- For pH, ORP, oxygen, conductivity assemblies, for oxygen and turbidity sensors and for ISEmax;
- With weather protection cover
- Ordering acc. to product structure (Technical Information TI092C/07/en)



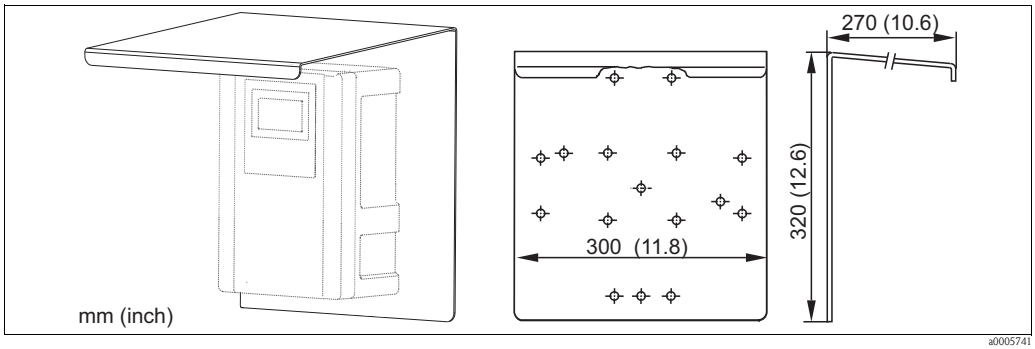
Immersion assembly holder CYH101

CYY102 universal post
- Square pipe for mounting transmitters
- Material: stainless steel 1.4301 (AISI 304)
- Order No. CYY102-A



Square post

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



Weather protection cover for field devices

Maintenance kits

Membrane kit
- 2 membrane caps
- Electrolyte
- Order numbers:
  - Ammonium: 71072574
  - Nitrate: 71072575
  - Potassium: 71072576

Maintenance kit for the chloride electrode
- Sandpaper
- Electrolyte
- Order number: 71085727

Electrodes

Ion-selective electrode
- Electrode, complete
- Order numbers:
  - Ammonium: 71072578
  - Nitrate: 71072580
  - Potassium: 71072581
  - Chloride: 71072582
  - pH: CPS64-1AA2GSA

Reference electrode
- Order number: CPS13-0TA2GSA

Standard solution

Ammonium, nitrate, potassium and chloride

	Standard solution					
	1	Ammonium nitrate, 1 molar				
	2	Potassium chloride, 1 molar				
		Container size				
		A	250 ml (8.45 fl.oz.)			
			Transport documents			
			1	Standard documents		
			2	Incl. dangerous goods sheets		
			3	Safety data sheet		
				Certificate		
				A	None	
				B	Manufacturer's certificate	
CAY40-						Complete order code

pH

High-quality buffer solutions of Endress+Hauser - CPY20

The secondary buffer solutions have been referenced to primary reference material of the PTB (German Federal Physico-technical Institute) and to standard reference material of NIST (National Institute of Standards and Technology) according to DIN 19266 by a DKD (German Calibration Service) accredited laboratory.

	pH value					
	A	pH 2.00 (accuracy ± 0.02 pH)				
	C	pH 4.00 (accuracy ± 0.02 pH)				
	E	pH 7.00 (accuracy ± 0.02 pH)				
	G	pH 9.00 (accuracy ± 0.02 pH)				
	I	pH 9.20 (accuracy ± 0.02 pH)				
	K	pH 10.00 (accuracy ± 0.05 pH)				
	M	pH 12.00 (accuracy ± 0.05 pH)				
		Quantity				
		01	20 x 18 ml (0.68 fl.oz) only buffer solutions pH 4.00 and 7.00			
		02	250 ml (8.45 fl.oz)			
		10	1000 ml (0.26 US gal)			
		50	5000 ml (1.32 US gal) canister for Topcal S			
			Certificates			
			A	Buffer analysis certificate		
				Version		
				1	Standard	
CPY20-						complete order code

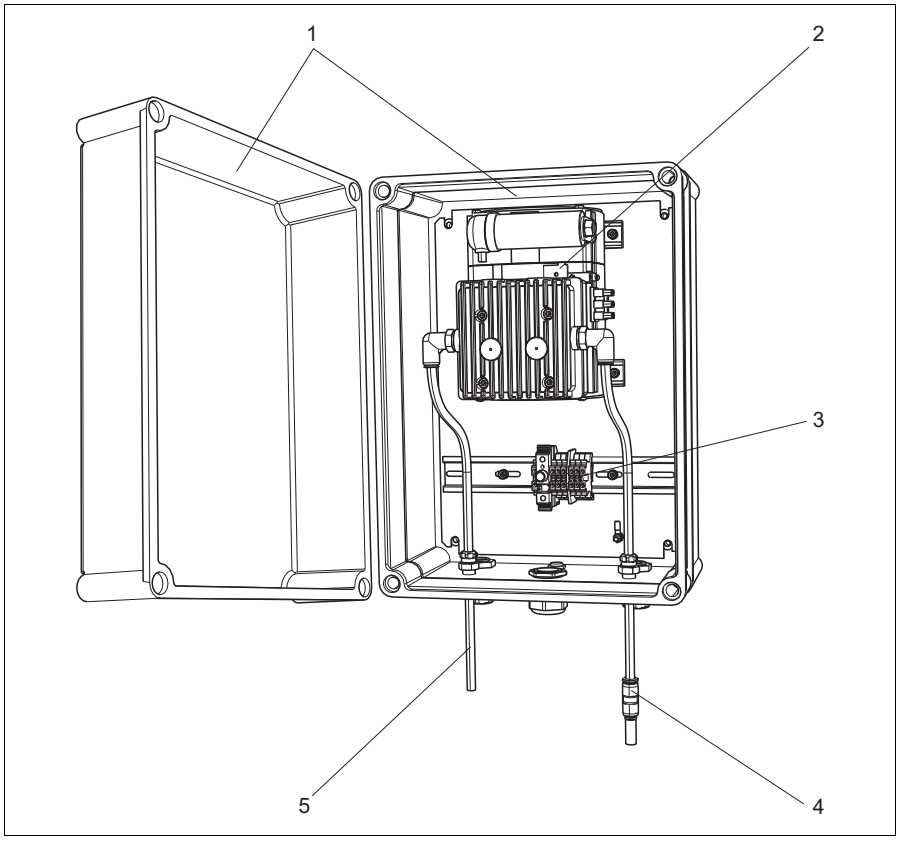
Cleaning unit

Caution!

- Not suitable for continuous operation!
  Operating interval: max. 3 minutes cleaning, break for at least six times the cleaning time.
- Avoid condensation in the pressurized hoses.

Cleaning unit in the housing

- 230 V, IP 65
- Conveying rate at atmospheric pressure: 50 l/min (13.2 gal/min)
- Power consumption: 240 W
- Current consumption: 1.3 A
- Overheating protection: Automatic switch off at T > 130 °C (266 °F)
- Order no.: 71072583



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Cleaning unit

1 Housing
2 Pump
3 Terminal strip with fuse
4 Suction side
5 Compressed air supply (to the sensor)

Instruments International

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