Level Pressure Flow Temperature Liquid Analysis Registration Systems Components Services Solutions

Technical Information

Stamolys CA71PH

Phosphate analyzer

Compact photometric analysis system for the phosphate measurement in sewage treatment plants and cooling water cycles

Application

- Monitoring and optimising the cleaning capacity of sewage treatment plants
- Controlling of precipitant addition
- Monitoring of activated sludge basins
- Monitoring of sewage treatment plant outlet
- Monitoring of cooling water cycles

Your benefits

- Stainless steel or glass-fibre reinforced carbon housing available
- Two channel version available
- Measured value storage using integrated data logger
- Automatic calibration and self-cleaning
- Free selectable measuring, cleaning and calibration intervals

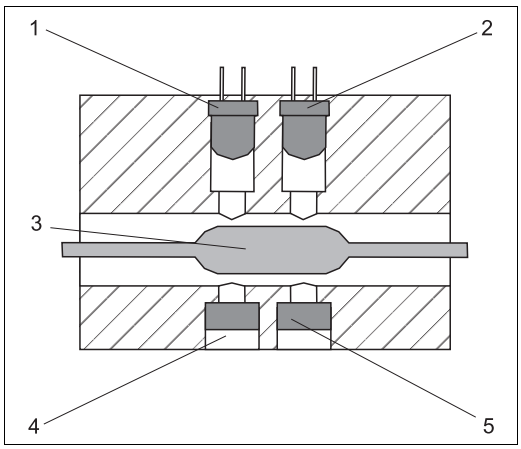
TI356C/07/en/05.09
71095964

Endress+Hauser
People for Process Automation

Function and system design

Measuring principle

After sample conditioning, the analyzer sample pump conveys a part of the filtrate to a mixing vessel. The reagent pump adds reagent at a specific ratio. As a result of the reaction, the sample turns a characteristic colour. The photometer determines the sample's absorption of an emitted light at a specific wavelength (s. Fig., Pos. 2). The wavelength is parameter specific. The absorbance is proportional to the concentration of the specified parameter in the sample (Pos. 3). Additionally, the absorption of a reference light is determined to receive a genuine measuring result. The reference signal is subtracted from the measuring signal to prevent any effects due to turbidity, contamination and ageing of the LEDs.
The temperature in the photometer is controlled thermostatically so that the reaction is reproducible and takes place within a short period of time.



Photometric principle

1 Reference LED
2 Emitter LED
3 Sample
4 Reference detector
5 Measuring detector

Phosphorus and Phosphates

Phosphorus is mainly present in natural bodies of water and in wastewater as phosphate.

The phosphate gets into water through:
- fertiliser washed out of the earth
- biological and industrial wastes and wastewater
- additives in water treatment systems (anticorrosion agents)

Phosphate is essential to life in specific proportions for animals and plants. Too much of it can, however, lead to eutrophication[1)].

Orthophosphate and total phosphate

Phosphate is generally subdivided into:
- orthophosphate
- condensed phosphate:
  - metaphosphate
  - pyrophosphate
  - polyphosphate
- organically bound phosphate

Only orthophosphate can be determined without disintegration of a sample since it can be detected directly photometrically. One speaks in this case of the determination of "reactive" phosphorus.

The measurement results can be indicated in various ways:
- PO_4, phosphate
- PO_4-P, phosphate-phosphorus
- P_2O_5, phosphorus pentoxide

E+H offers two methods for determining reactive phosphorus (depending on the measuring range):
- The Molybdenum Blue Method (2 reagents, specifications A+E)
- The Molybdate Vanadate Method (1 reagent, specifications B+D)

1) eutrophication = an increase in the amount of nutrients in bodies of water which can lead to undesirable usuriousness of certain plants.

Photometric orthophosphate determination

Molybdenum blue method in deviation to DIN EN 1189
(versions PH-A and PH-E)
In acid solutions molybdate ions and antimony ions form in conjunction with phosphate an antimonyl phosphoro molybdato complex. The complex is reduced to phosphoro molybdato blue by ascorbic acid. The absorption is determined at a wavelength of 880 nm (PH-A) resp. of 660 nm (PH-E). The absorption intensity is proportional to the orthophosphate concentration in the sample.
The reference wavelength is 565 nm.

Molybdate vanadate method
(versions PH-B and PH-D)
Vanadate ions and molybdate ions form in conjunction with phosphate a yellow vanadato molybdato phosphorous acid.
The absorption is determined at a wavelength of 430 nm. The absorption intensity is proportional to the orthophosphate concentration in the sample.
The reference wavelength is 565 nm.

Interferences

No interferences up to the given concentration:

Concentration [mg/l (ppm)]	Interference
10,000	SO_4^{2-}
1,000	Cl^-
500	Na^+, K^+, Ca^{2+}
50	CO_3^{2-}, NO_3^-, Fe^{2+}, Fe^{3+}, Zn^{2+}, Cu^{2+}, Ni^{2+}, Cr^{3+}, Co^{2+}, Hg^{2+}
25	Sn^{2+}
10	Pb^{2+}
5	Ag^+
0.5	Cr^{6+}, can be eliminated by higher ascorbic acid dosage
	Turbidity: sample has to be filtered before analysis

Sample conditioning

Micro/ultrafiltration (Stamoclean CAT430, optional)

A membrane filter element is suspended directly into the wastewater basin or channel. A hose pump is located in a pump box on the basin rim.The pump creates a vacuum between the membrane and the carrier plate of the filter element. This vacuum makes the filtrate pass through the filter membrane. Suspended materials, particles, algae and bacteria are collected on the surface of the membrane.
Due to alternating pumping and pause, intervals of more than one month are achieved between cleaning cycles. Parallel connection of two or four filter elements increases the sampling quantity up to approx. 1 l/h (0.26 gal/hr).
The hose pump pressure transports the sample to a collecting vessel near the analyzer over a distance of 20 m (66 ft). For distances up to 100 m (330 ft) the sample is transported to the collecting vessel by means of compressed air. The analyzers suck the needed sample volume from the collecting vessel.

Membrane filtration (Stamoclean CAT411, optional)

A sample flow of 0.8 to 1.8 m^3/h (3.5 to 8 gal/min) is continuously conducted through the micro filter via a pressure pipe. A part of the sample passes the filter membrane and is then conveyed to the measuring device as filtrate.
Sampling is based on the cross flow filtration principle. The PTFE filter membrane separates particles with sizes > 0.45 µm from the filtrate. These particles are collected in front of the membrane and are washed away with the sample flow.
The medium is conducted in a meander-like channel through the filter element. This results in a constantly high flow rate. The high flow rate generates the self cleaning effect. Therefore, mechanical drives for the generation of a flow at the filter surface are not necessary.

Backwash filter (Stamoclean CAT221, optional)

A sample flow of 1 to 2.5 m^3/h (4.4 to 11 gal/min) is permanently conveyed through the backwash filter by means of a sampling pump or compressed air or rinse water. The filtrate passes through the wedge wire sieve and is then transported to the measuring device.
Clogging is minimized by the flow at the wedge wire sieve. Automatic backwashing results in a filter operating time of several weeks.

The automatic backwashing and a small compressor or compressed air resp. rinse water supply guarantee low-maintenance and low-energy operation.

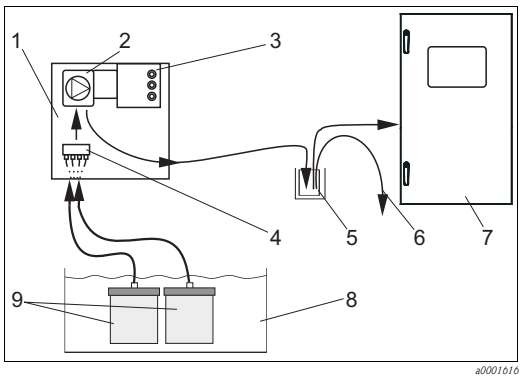
Customer specific solution

Before analysis, the sample has to be conditioned and to be transported to an external or to the delivered collecting vessel.

Measuring system

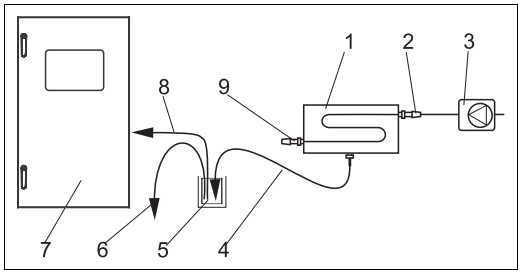
A complete measuring system comprises:
- An analyzer
- A sample conditioning system (optionally):
  - Micro filtration / ultra filtration Stamoclean CAT430 or Stamoclean CAT411
  - Backwash filter Stamoclean CAT221
  - Customer specific solution
- Collecting vessel (see product structure)

Micro / ultra filtration



Measuring system with Stamoclean CAT430

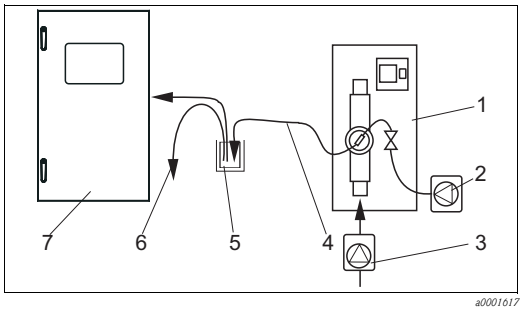
1 *Control box*
2 *Pump*
3 *Control unit*
4 *Collecting unit (optional)*
5 *Collecting vessel*
6 *Overflow*
7 *Analyzer*
8 *Aeration basin*
9 *Membrane filter*



Measuring system with Stamoclean CAT411

1 *Stamoclean CAT411*
2 *Inlet*
3 *Sample pump or hydraulic main*
4 *Filtrate line*
5 *Collecting vessel*
6 *Overflow*
7 *Analyzer*
8 *Analyzer sample line*
9 *Outlet*

Backwash filter



Measuring system with Stamoclean CAT221

1 *Stamoclean CAT221*
2 *Compressor or compressed air*
3 *Sample pump or hydraulic main*
4 *Sample outlet*
5 *Collecting vessel*
6 *Overflow*
7 *Analyzer*

Standard applications

Sewage treatment plant outlet monitoring

Sampling from hydraulic main and analyzer in measuring station:
- Backwash filter Stamoclean CAT221 (order no. CAT221-Axxx)
- Compressor for CAT221 (order no. 51511143)
- Analyzer with collecting vessel, Stamolys CA71PH-A1xB2A1

Sampling from open channel

Local filtration and analyzer in measuring station (up to 20 m (66 ft) distance):
- Ultra filtration Stamoclean CAT430, plate filter with hose heating for max. 20 m (66 ft) distance to the analyzer (order no. CAT 430-A1F0A3A)
- Filter element holder with horizontal slide (order no. 51511374)
- Analyzer with collecting vessel, Stamolys CA71PH-A1xB2A1

Precipitant addition monitoring in the biology

Local filtration and analyser in measuring station (up to 100 m (328 ft) distance):
- Ultra filtration Stamoclean CAT430, plate filter with hose heating over 18 m (59 ft) , remaining distance freeze free installed, sample transportation by compressed air up to 100 m (order no. CAT 430-A4F0A3A)
- Filter element holder with vertical slide (order no. 51511354)
- Analyzer with collecting vessel, Stamolys CA71PH-A1xB2A1 or CA71PH-B1xB2A1

Precipitant addition monitoring in the biology

Local filtration and analyser in measuring station (up to 20 m (66 ft) distance):
- Ultra filtration Stamoclean CAT430, plate filter with hose heating over max. 20 m (66 ft) distance to the analyzer (order no. CAT430-A1F0A3A)
- Filter element holder with vertical slide (order no. 51511354)
- Analyzer with collecting vessel, Stamolys CA71PH-A1xB2A1 or CA71PH-B1xB2A1

Input

Measured variable

PO_4-P [mg/l]

Measuring range

PH-A
0.05 to 2.5 mg/l (0.05 to 2.5 ppm)

PH-B
0.5 to 20 mg/l (0.5 to 20 ppm)

PH-D
0.5 to 50 mg/l (0.5 to 50 ppm)

PH-E
0.05 to 10 mg/l (0.05 to 10 ppm)

Wavelength

PH-A
880 nm

PH-B and PH-D
430 nm

PH-E
660 nm

Reference wavelength

565 nm

Output

Output signal

0/4 to 20 mA

Signal on alarm

Contacts: 2 limit contacts (per channel), 1 system alarm contact
optional: end of measurement (with two channel version display of channel no. available)

Load	max. 500 Ω
Data interface	RS 232 C
Data logger	1024 data pairs per channel with date, time and measured value 100 data pairs with date, time and measured value for calibration factor determination (diagnostic tool)
Load capacity	230 V / 115 V AC max. 2 A, 30 V DC max. 1 A

Power supply

Electrical connection

Caution!
The following figure (→ 1) shows the connection department sticker as an example. Terminal assignment and cable core colors can be different to the originals.
For connecting your analyzer only use the terminal assignment of the connection department sticker **in the device** (→ 2)!

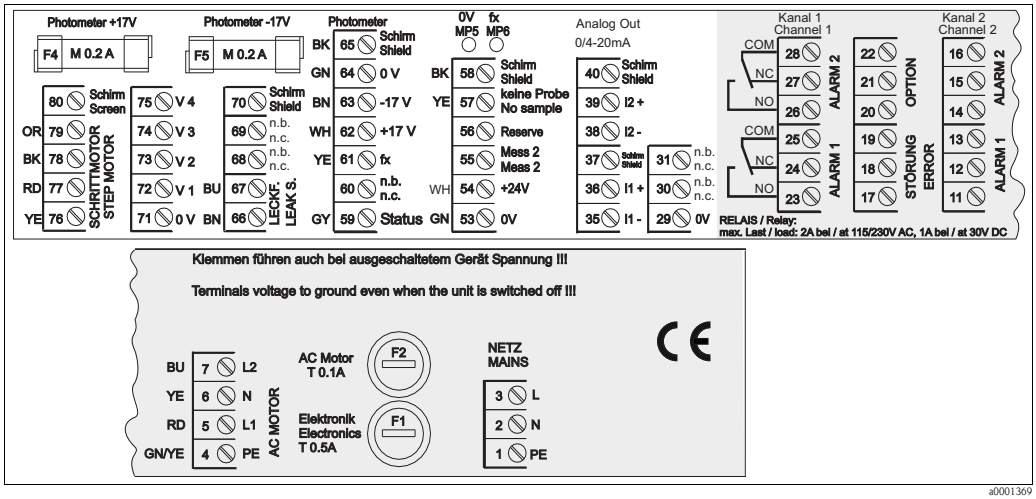


Fig. 1: Example of the connection sticker

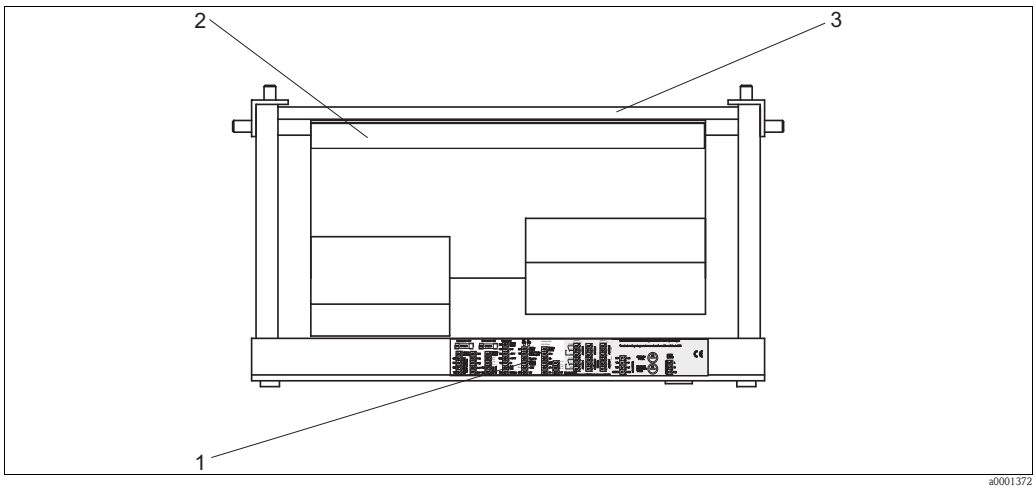


Fig. 2: Analyzer from top (open version resp. swung out)

1 Connection department sticker
2 Printed circuit board with terminal strip
3 Backside of the analyzer

Supply voltage	115 V AC / 230 V AC ±10%, 50/60 Hz

Power consumption	approx. 50 VA
Current consumption	approx. 0.2 A at 230 V approx. 0.5 A at 115 V
Fuses	1 x time-lag 0.5 A for electronics 2 x medium time-lag 0.2 A for photometer 1 x time-lag 0.5 A for motors

Performance characteristics

Time between two measurements	t_{mes} = reaction time + rinse time + waiting time + rinse again time + filling time + sampling time + reagent refusal time (min. waiting time = 0 min)
Maximum measured error	±2 % of measuring range end
Measuring interval	t_{mes} to 120 min
Reaction time	6 minutes
Sample requirement	15 ml (0.51 fl.oz.) per measurement
Reagent requirement	PH-A: 2 x 0.1 ml (0.0034 fl.oz.) PH-B: 1 x 0.1 ml (0.0034 fl.oz.) PH-D: 1 x 0.20 ml (0.0068 fl.oz.) PH-E: 2 x 0.20 ml (0.0068 fl.oz.) 0.43 l (0.11 US.gal) (PH-A/B) resp. 0.86 l (0.23 US.gal) (PH-D/E) per reagent per month with 10 minute measuring interval
Calibration interval	0 to 720 h
Rinse interval	0 to 720 h
Rinse time	selectable from 20 to 300 s (standard = 60 s)
Rinse again time	30 s
Filling time	25 s
Maintenance interval	6 months (typical)
Servicing requirement	15 minutes per week (typical)

Environment

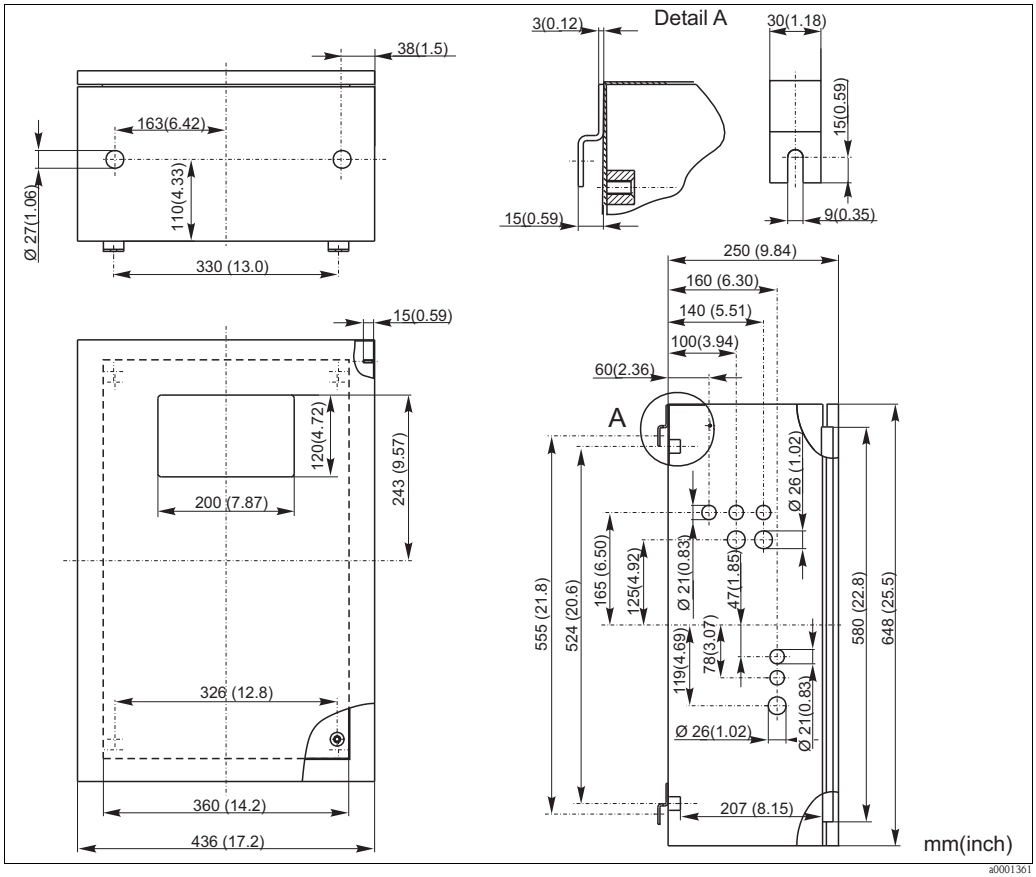
Ambient temperature	5 to 40 °C (40 to 100 °F), avoid strong fluctuations
Humidity	below the condensation limit, installation in usual, clean rooms outdoor installation only possible with protective devices (customer supplied)
Ingress protection	IP 43

Process

Sample temperature	5 to 40 °C (40 to 100 °F)
Sample flow rate	min. 5 ml (0.0013 US.gal.) per min
Consistence of the sample	low solid content (< 50 ppm)
Sample inlet	Unpressurized

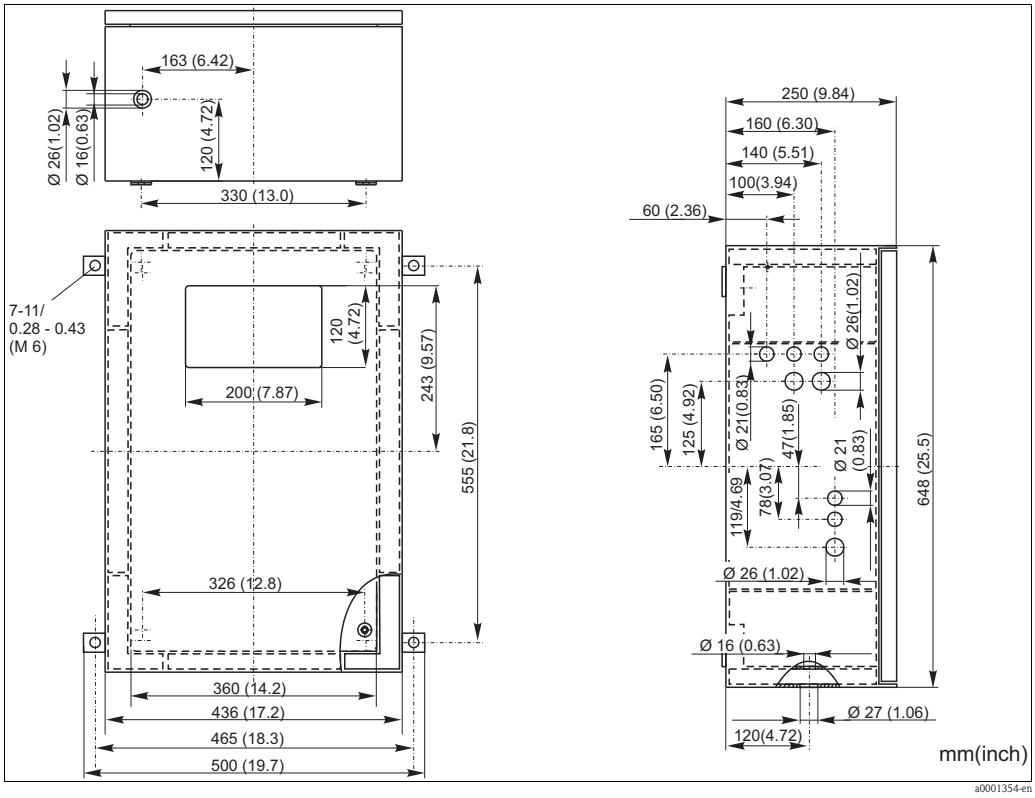
Mechanical construction

Design, dimensions **Stainless steel housing**



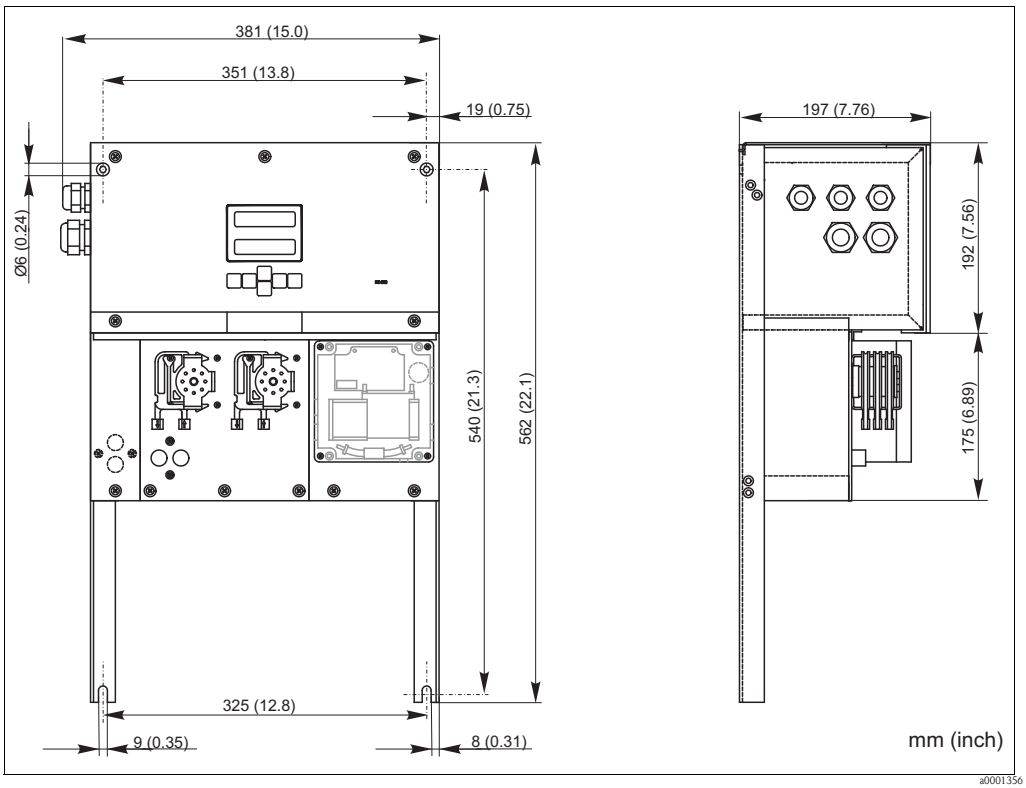
Stainless steel version

GFR housing



GFR version

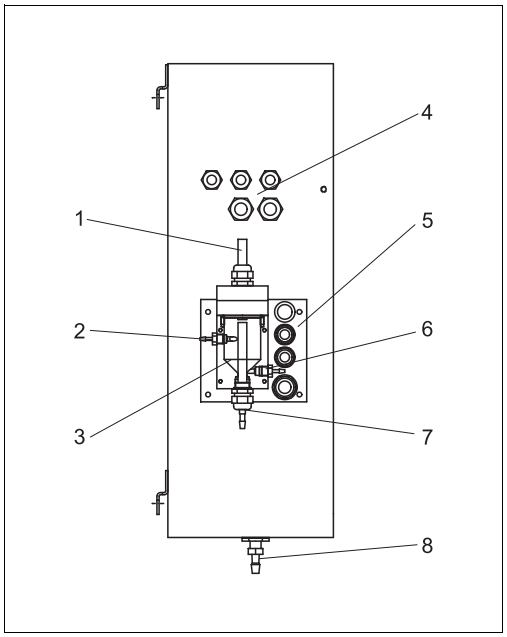
Open version



Open version (without housing)

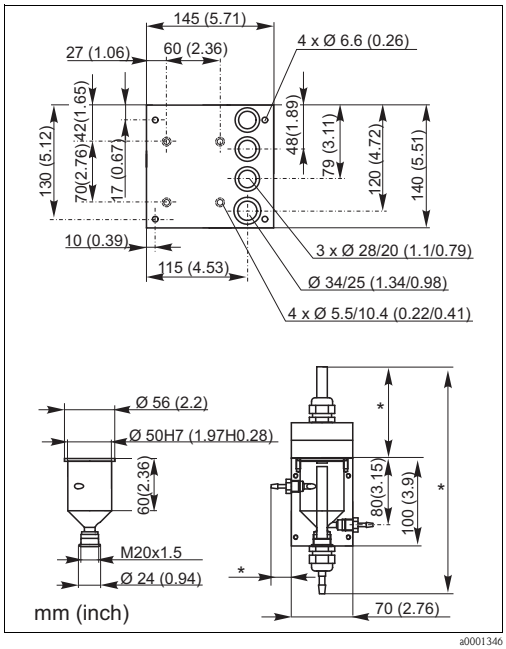
Note!
With the open version, you need an additional platform for the reagents. Mount this platform max. 35 cm (13.8 inch) below the pumps. The reagent bottels have the following dimensions: 90 x 90 x 215 mm (3.54 x 5.54 x 8.46 inch). The number of bottles varies from 2 to 5 depending on the analyzer version.
For these versions, the outlet pipe must be installed right of the analyzer. See the supplement to the Operating Instructions.
The outlet pipe must be mounted to a wall so that the sample outlet hoses from the photometer have a gradient of 5 to 10 %. If neccessary, extend the hoses.

Collecting vessel



Collecting vessel at analyzer (optional)

1 Ventilation
2 Sample inlet from sampling
3 Collecting vessel
4 Electrical connections
5 Analyzer sample inlet



Collecting vessel dimensions

** variable, freely adjustable dimensions*
6 Sampling for analyzer
7 Sample overflow
8 Analyzer outlet

Weight

GFR housing	approx. 28 kg (62 lbs)
Stainless steel housing	approx. 33 kg (73 lbs)
Without housing	approx. 25 kg (55 lbs)

Materials

Housing:	Stainless steel 1.4301 (AISI 304) or glass-fibre reinforced carbon(GFR)
Front windows:	Polycarbonate®
Endless hose:	C-Flex®, Norprene®
Pump hose:	Tygon®, Viton®
Valves:	Tygon®, silicone

Connecting the sample line

One channel version

Collecting vessel (at analyzer, with or without level measurement)

Connection	hose ID 3.2 mm (0.13 inch)

Customer collecting vessel

Connection	hose ID 1.6 mm (0.06 inch)
Max. distance from collecting vessel to analyzer	1 m (3.3 ft)
Max. height difference from collecting vessel to analyzer	0.5 m (1.6 ft)

Two channel version

- Depending on the ordered version, one or two collecting vessels (with or without level measurement) are included in the scope of delivery.
- Level measurement is only possible for one channel.

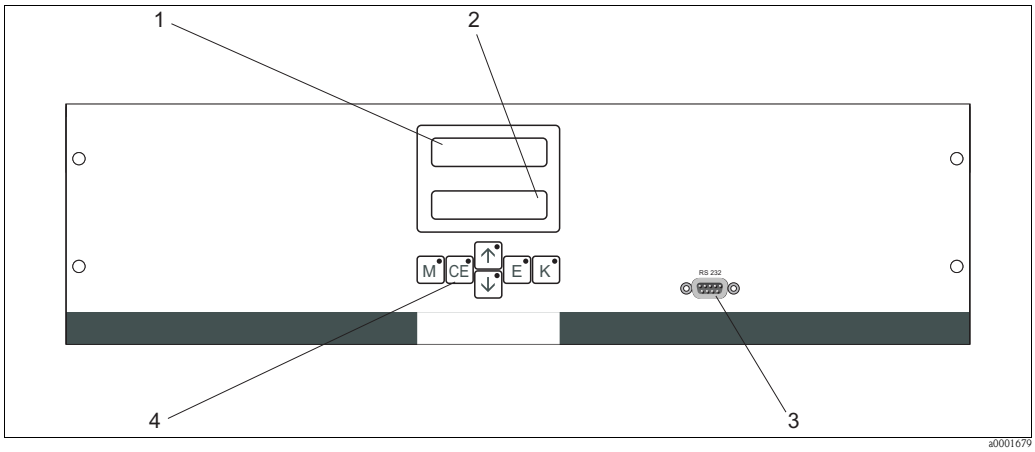
■ Only one collecting vessel can be mounted at the housing. The second is to be placed nearby the analyzer.

Sample outlet

Connection	Hose ID 6.4 mm (0.25 inch) – Max. length of closed loop: 1 m (3.28 ft) – Open outlet downgrade installed – No combination of several devices to a closed-loop system
Min. volume per measurement	20 ml (0.68 fl.oz.)

Human Interface

Display and operating elements



Display and operating elements

1 LED (measured value)
2 LC display (measured value and status)
3 Serial interface RS 232
4 Operating keys and control LEDs

Ordering information

Product structure

	Measuring range
A	Measuring range 0.05 to 2.5 mg/l PO_4-P (blue)
B	Measuring range 0.5 to 20 mg/l PO_4-P (yellow)
D	Measuring range 0.5 to 50 mg/l PO_4-P (yellow)
E	Measuring range 0.05 to 10 mg/l PO_4-P (blue)
Y	Special version acc. to customer's specification

	Sample transfer
1	Sample transfer from one measuring point (one-channel version)
2	Sample transfer from two measuring points (two-channel version)

	Power supply
0	230 V AC / 50 Hz
1	115 V AC / 60 Hz
2	115 V AC / 50 Hz
3	230 V AC / 60 Hz

	Collecting vessel for up to 3 analysers
A	Without collecting vessel
B	With collecting vessel without level measurement
C	With collecting vessel with level measurement (one-channel version only)
D	With two collecting vessels without level measurement (two-channel version)

	Housing version
1	Without housing
2	With GFK housing
3	With stainless steel 1.4301 (AISI 304) housing

	Communication
A	0/4 to 20 mA, RS 232

	Additional equipment
1	Quality certificate
2	Quality certificate + set of inactive reagents PH-A+E
3	Quality certificate + 3 sets of inactive reagents PH-A+E
4	Quality certificate + set of inactive reagents PH-B+D
5	Quality certificate + 3 sets of inactive reagents PH-B+D

CA71PH -	**complete order code**

Scope of delivery

The scope of delivery comprises:
- an analyzer with mains plug
- a cleaning injector
- a tin of silicone spray
- a Norprene hose, length 2.5 m (8.2 ft), ID 1.6 mm (0.06 inch)
- a C-flex hose, length 2.5 m (8.2 ft), ID 6.4 mm (0.25 inch)
- a C-flex hose, length 2.5 m (8.2 ft), ID 3.2 mm (0.13 inch)
- two hose fittings of each size:
  - 1.6 mm x 1.6 mm (0.06 inch x 0.06 inch)
  - 1.6 mm x 3.2 mm (0.06 inch x 0.13 inch)
  - 6.4 mm x 3.2 mm (0.25 inch x 0.13 inch)
- two T-hose fittings of each size:
  - 1.6 mm x 1.6 mm x 1.6 mm (0.06 inch x 0.06 inch x 0.06 inch)
  - 3.2 mm x 3.2 mm x 3.2 mm (0.13 inch x 0.13 inch x 0.13 inch)
- an interference suppressor for the current output
- 4 edge covers
- a quality certificate
- Operating Instructions (English).

Note!
Please, order reagents separately with analyzer version CA71XX-XXXXXX1.
With all other versions, inactive reagents are included in the scope of delivery. You have to mix the reagents before using them. Please, read the instructions attached to the reagents.

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.

Test reports

Quality certificate
Depending on the order code, you receive a quality certificate.
With the certificate the manufacturer confirms compliance with all technical regulations and the successful individual testing of your product.

Accessories

Reagents and standard solutions

- Reagent set active, 1 l of each reagent PH1+PH2 (blue); order no. CAY240-V10AAE
- Reagent set inactive, 1 l of each reagent PH1+PH2 (blue); order no. CAY240-V10AAH
- Reagent active PH1, 1 l (yellow); order no. CAY243-V10AAE
- Cleaning agent 1 l; order no. CAY241-V10AAE
- Standard solution 1.0 mg/l PO_4 - P; order no. CAY242-V10C01AAE
- Standard solution 1.5 mg/l PO_4 - P; order no. CAY242-V10C03AAE
- Standard solution 2.0 mg/l PO_4 - P; order no. CAY242-V10C02AAE
- Standard solution 5 mg/l PO_4 - P; order no. CAY242-V10C05AAE
- Standard solution 10 mg/l PO_4 - P; order no. CAY242-V10C10AAE
- Standard solution 15 mg/l PO_4 - P; order no. CAY242-V10C15AAE
- Standard solution 20 mg/l PO_4 - P; order no. CAY242-V10C20AAE
- Standard solution 25 mg/l PO_4 - P; order no. CAY242-V10C25AAE
- Standard solution 30 mg/l PO_4 - P; order no. CAY242-V10C30AAE
- Standard solution 40 mg/l PO_4 - P; order no. CAY242-V10C40AAE
- Standard solution 50 mg/l PO_4 - P; order no. CAY242-V10C50AAE

Cleaner for hoses

- Cleaning agent, alkaline, 100 ml (3.4 fl.oz.); order no. CAY746-V01AAE
- Cleaning agent, acidic, 100 ml (3.4 fl.oz.); order no. CAY747-V01AAE

Collecting vessel

– for sampling from pressurised systems
– results in an unpressurised continuous sample stream

- Collecting vessel without level measurement; order no. 51512088
- Collecting vessel with level measurement (conductive); order no. 51512089

Maintenance kit

- Maintenance kit CAV 740:
  – 1 set pump hoses yellow/blue
  – 1 set pump hoses black/black
  – 1 set hose connectors per hose set
  order no. CAV 740-1A

Additional accessories

- Interference suppressor for control, power and signal lines
  order no. 51512800
- Silicon spray
  order no. 51504155
- Valve set, 2 pieces, for two-channel version
  order no. 51512234
- Upgrade kit for upgrading from one-channel to two-channel version
  order no. 51512640

Documentation

- Technical Information Stamoclean CAT430, TI 338C/07/en
- Technical Information Stamoclean CAT411, TI 349C/07/en
- Technical Information Stamoclean CAT221, TI 384C/07/en

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