



Level



Pressure



Flow



Temperature



Liquid
Analysis



Registration



Systems
Components



Services



Solutions

Technical Information

SPECTRON TP CA72TP

Analyzer for total phosphorus

Spectrometric analysis system for the virtually continuous measurement of total phosphorus in sewage treatment plants, process water and surface water



Application

For monitoring:

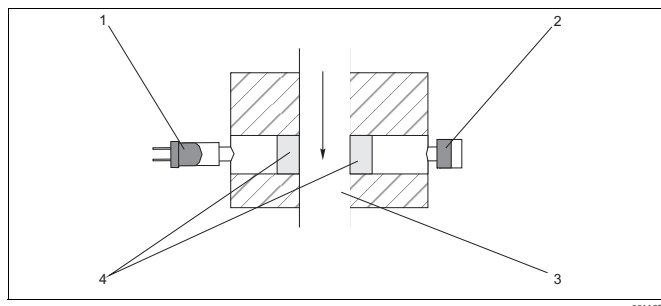
- The sewage treatment plant outlet
- Process water
- Surface water
- Cooling water

Your benefits

- User-friendly
 - No complex sample preparation
 - Automatic two-point calibration
 - Low-maintenance owing to large tube diameter
- Measurement accuracy
 - Diode array spectrometer, 3 nm separation accuracy
 - Blue method: highly accurate in lower measuring range
 - Yellow method: optimized for high measuring ranges
- Secure data
 - TP load curve and current value on LCD graphic monitor
 - Measured values from the last 14 days can be called up
- Variable
 - Exchangeable cells with different measuring ranges
 - Chemical and thermal digestion
 - Measuring cycles from 25 minutes

Function and system design

Measuring principle



Schematic measuring arrangement

- 1 Light source
- 2 Detector (diode array spectrometer)
- 3 Measuring cell with sample
- 4 Optical windows

A light source (1) transmits light through the sample (3). Some of the light is absorbed by the substances in the sample. The absorption at a certain wavelength is characteristic of a certain substance, and the intensity of the absorbed light is proportional to the concentration of the substance (Lambert Beer's Law).

The light passing through the medium is measured by the diode array spectrometer (2) between 380 nm and 780 nm. The concentration of the particular substance is determined in the analyzer from the amount of light the sample absorbs at a wavelength of 735 nm (molybdenum blue method), or at a wavelength between 380 and 480 nm (molybdate-vanadate method).

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 eutrophication¹⁾.

Orthophosphate and total phosphate

Phosphates are generally subcategorized into:

- Orthophosphates
- Condensed phosphates:
 - Metaphosphates
 - Pyrophosphates
 - Polyphosphates
- Organically bound phosphate

Orthophosphate is always determined if samples are not digested.

With CA72TP, the sample is digested prior to determining the phosphate. The result is the total phosphorus.

Digestion

Phosphoric compounds are digested in a boiling solution. Sodium peroxodisulfate is added to act as the oxidizing agent here. The digestion process produces orthophosphate ions.

Depending on the measuring range, we offer two different methods to determine the phosphorus:

- Molybdenum blue method (versions A+B)
- Molybdate vanadate method (versions C+D)

Photometric determination

Molybdenum blue method

Orthophosphate reacts with molybdate in an acidic solution to form a yellow phosphomolybdate complex. The subsequent reduction with ascorbic acid results in an intensely blue phosphomolybdenum blue.

The absorption is measured at a wavelength of 735 nm.

Molybdate vanadate method

Orthophosphate reacts with molybdate in an acidic solution to form a yellow phosphomolybdate complex. The vanadium in the reagent reacts with this complex to form an intensely yellow vanadomolybdophosphoric acid.

The absorption is measured at a wavelength between 380 and 480 nm.

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

Interferences

Primary amines and high concentrations of silicate are also determined and result in higher readings. High concentrations of organic matter or chloride can consume the oxidizing agent and result in lower readings.

The following do not affect the reading, provided the concentration does not exceed the value indicated in the table:

Concentration [mg/l (ppm)]	Ions or 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 increasing the amount of ascorbic acid added

Sample conditioning**Standard application in sewage treatment plant outlet:**

Use homogeneous, unfiltered samples.

Sewage treatment plant inlet:

Use homogeneous, filtered (500 µm) samples.

Industrial applications:

The application has to be examined in terms of the sample makeup and sample conditioning required. Please contact your local sales office.

Measuring system

A complete measuring system comprises:

- An analyzer
- A sample conditioning system PA-2 or PA-3 (optional)

Input

Measured variable

Total phosphorus (TP) [mg/l]

Measuring range

0.05 to 2 mg/l (CA72TP-A)
 0.1 to 5 mg/l (CA72TP-B)
 0.3 to 8 mg/l (CA72TP-C)
 0.5 to 25 mg/l (CA72TP-D)

Wavelengths

735 nm (CA72TP-A/B)
 380 to 480 nm (CA72TP-C/D)

Output

Output signal

0/4 to 20 mA, galvanically isolated

Signal on alarm

Limit value alarm, fault message and two optional floating contacts (max. 0.25 A / 50 V)

Load

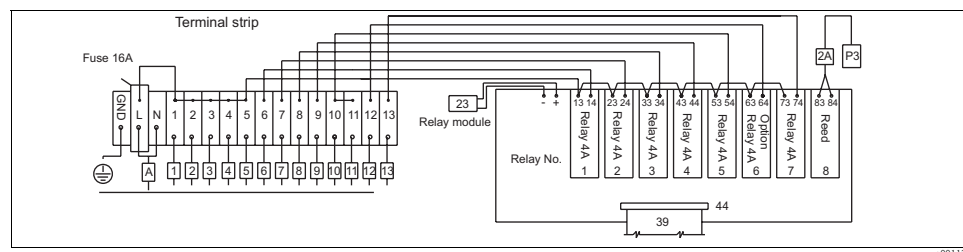
maximum 500 Ω

Loading capacity

230 V AC, max. 2 A

Power supply

Electrical connection



Power distribution terminal assignment

Cable	Function	Relay	Type	Function
A	Main switch power distribution	1	4 A	MV 1 sample to measuring cell
1	230 V - spectrometer electronics	2	4 A	MV 2 measuring cell seal
2	230 V - power supply, pump P3	3	4 A	MV 3 sample/standard switchover
3	230 V - power supply, pump P4	4	4 A	MV 4 standard 1 / standard 2 switchover
4	230 V - power supply, pump P5 (only A/B)	5	4 A	MV 5 screen rinsing (option)
5	Option	6	4 A	Option
6	MV 1 sample to measuring cell	7	4 A	Heater control
7	MV 2 measuring cell seal	8	Reed	Activation, P3, 2A
8	MV 3 sample/standard switchover	I	Reed	Fault message (floating contact)
9	MV 4 standard 1 / standard 2 switchover	II	Reed	Limit value alarm (floating contact)
10	MV 5 screen rinsing (option)	III	Reed	Activation, P4, P5, cable 3A
11	Option	IV	Reed	Option
12	Option			
13	Option 230 V - power supply, heater control			Relays I to IV at terminal box outputs

Supply voltage 230 V AC, 50/60 Hz

Power consumption 161 VA

Current consumption 0.7 A

Fuses 1 x 16 A FF (power distribution connection)
1 x 2 A T (electronics power unit)

Performance characteristics

Maximum measured error ± 5 % of end of measuring range

Measuring interval Approx. 2 measurements per hour (at a digestion time of 15 min.)

Time between two measurements

CA72TP-A/B
 t_{meas} = sample dosing (150 s) + oxidation time (960 s) + color reaction time (180 s) + measured value calculation (180 s) + discard sample + break in measuring (optional) + rinse time (210 s) = 28 min
 Only the oxidation time can be adjusted (0 to 3600 s)

CA72TP-C/D
 t_{meas} = sample dosing (90 s) + oxidation time (960 s) + color reaction time (180 s) + measured value calculation (180 s) + discard sample + break in measuring (optional) + rinse time (90 s) = 25 min
 Only the oxidation time can be adjusted (0 to 3600 s)

Sample requirement

CA72TP-A/B
40 ml (1.35 fl.oz.) / measuring cycle

CA72TP-C/D
5 ml (0.17 fl.oz.) / measuring cycle

Reagent requirement	CA72TP-A/B <ul style="list-style-type: none"> ■ Oxidizing agent R1: 370 ml (12.5 fl.oz.) / month with 30-minute measuring interval ■ R2 + R3: 500 ml (16.9 fl.oz.) / month with 30-minute measuring interval (With measuring ranges up to 5 mg/l, 30% less reagent (R1 to 3) is required) ■ Cleaner: 250 ml (8.45 fl.oz.) / month with 1 cleaning per day CA72TP-C/D <ul style="list-style-type: none"> ■ Oxidizing agent R1: 1000 ml (34 fl.oz.) / month with 25-minute measuring interval ■ R2: 2500 ml (85 fl.oz.) / month with 25-minute measuring interval
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Calibration interval	Selectable, 1–4 calibrations per day up to one calibration per week Standard: once per day at ambient temperatures < 30 °C (86 °F)
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Rinse interval	CA72TP-A/B <ul style="list-style-type: none"> ■ Alkaline rinsing: Selectable, 4 rinses per day up to one rinse per week ■ Screen rinsing (optional for CA72TP-**B/C): Selectable, from every hour to once a day CA72TP-C/D <ul style="list-style-type: none"> ■ Screen rinsing (optional for CA72TP-**B/C): Selectable, from every hour to once a day
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Rinse time	Screen rinsing: selectable, 15 to 1000 s, standard = 20 s
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Maintenance interval	6 months (typical)
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Servicing requirement	<ul style="list-style-type: none"> ■ Daily: visual inspection ■ Every 2 weeks: replace or top up reagents and standards ■ Every 6 weeks: clean sample conditioning system (if available) ■ Every 12 weeks: replace pump hoses and calibrate all pumps
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Environment

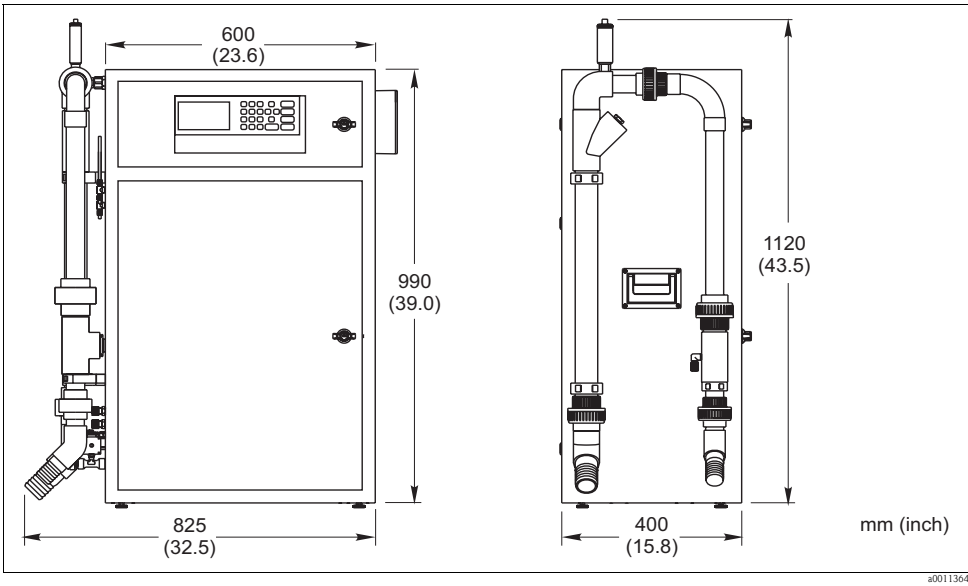
Ambient temperature range	0 to 40 °C (32 to 100 °F)
Humidity	10 to 90 %, non-condensating
Degree of protection	IP54 (corresponding to NEMA 3)

Process

Sample temperature	5 to 40 °C (41 to 104 °F)
Sample flow rate	5 to 12 ml/min (0.17 to 0.4 fl.oz./min) Pay attention to pump delivery rate
Consistency of sample	Low level of solids, particle size < 500 µm
Sample outlet	Unpressurized

Mechanical construction

Design, dimensions



Dimensions

Weight	CA72TP-A/B	Approx. 83 kg (183 lbs)
	CA72TP-C/D	Approx. 80 kg (176 lbs)
Materials	Housing	Aluminum, powder-coated
	Front window	Glass, conductive coating
	Valve seals	EPDM, PTFE
	Pump hoses	EPDM, Tygon®
	Pump and pump seals	PTFE
	Reagent and sample hoses	PTFE, PFA
	Hoses for exhaust air and ventilation	Norprene, PE
	Discharge hoses	PTFE, PE

Human Interface

Display and operating elements	Display
	LCD graphic display, 16 lines, 40 characters per line, backlit
	Keyboard
	21 operating keys, 13 x 13 mm with pressure point

Serial interface	RS232
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Ordering information

Product structure

Select one feature from each section in the following structure:

Measuring range	
A	0.05 – 2 mg total P/1 (blue)
B	0.1 – 5 mg total P/1 (blue)
C	0.3 – 8 mg total P/1 (yellow)
D	0.5 – 25 mg total P/1 (yellow)
Power supply	
0	230 VAC 50/60 Hz
1	115 VAC 50/60 Hz
Sample conditioning	
A	Not selected
B	1 x PA-2; PVC; 1 – 8 m ³ /h wastewater
C	1 x PA-3; PVC; 1 – 8 m ³ /h wastewater
Device language, documentation	
1	German
2	English
Data storage medium	
A	Not selected
B	Disk drive
C	SD card slot
CA72TP-	Order code

You can select more than one from the following options but these items do not have to be ordered:

Analyzer mounting (optional, select one option only)	
E1	Wall mounting
E2	Base
Communication (optional, select one option only)	
F1	RS 232 unidirectional
F2	PROFIBUS DP
Accessories, enclosed (optional, multiple selection possible)	
H1	Maintenance kit for measuring range A, B
H2	Maintenance kit for measuring range C, D
H3	Maintenance kit for sample conditioning PA-2
H4	Maintenance kit for sample conditioning PA-3

Note!

To complete your order code, simply add the optional features to the end of the order code. If you have any questions, please contact your local sales office.

Scope of delivery

The scope of delivery comprises:

- 1 analyzer with power plug
- 1 accessories pack
- 1 manufacturer's certificate
- 1 set of Operating Instructions in English
- 1 set of Operating Instructions for the heater control system

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.

Accessories

For all versions

Parent solution

- 1000 mg/l (1000 ppm) PO₄-P
- For preparing standards C1 and C2 (see Operating Instructions)
- Order numbers:
 - 1000 ml (33.8 fl.oz.): CAY248-V10C00AAE
 - 100 ml (3.38 fl.oz.): CAY248-V01C00AAE

Standard solutions ready for use, per 1 l (33.8 fl.oz.)

- Standard 1.0 mg/l (1 ppm) PO₄ - P; Order No. CAY242-V10C01AAE
- Standard 1.5 mg/l (1.5 ppm) PO₄ - P; Order No. CAY242-V10C03AAE
- Standard 2.0 mg/l (2 ppm) PO₄ - P; Order No. CAY242-V10C02AAE
- Standard 5 mg/l (5 ppm) PO₄ - P; Order No. CAY242-V10C05AAE
- Standard 10 mg/l (10 ppm) PO₄ - P; Order No. CAY242-V10C10AAE
- Standard 15 mg/l (15 ppm) PO₄ - P; Order No. CAY242-V10C15AAE
- Standard 20 mg/l (20 ppm) PO₄ - P; Order No. CAY242-V10C20AAE
- Standard 25 mg/l (25 ppm) PO₄ - P; Order No. CAY242-V10C25AAE
- Standard 30 mg/l (30 ppm) PO₄ - P; Order No. CAY242-V10C30AAE
- Standard 40 mg/l (40 ppm) PO₄ - P; Order No. CAY242-V10C40AAE
- Standard 50 mg/l (50 ppm) PO₄ - P; Order No. CAY242-V10C50AAE

Only for versions CA72TP-A/B

Reagent set, active

- Digestion agent sodium peroxodisulfate R1, 40 g (1.41 oz., powder)
- Ascorbic acid R2 + molybdate reagent R3
- Order No. CAY246-V10AAE

Reagent set, inactive

- Digestion agent sodium peroxodisulfate R1, 40 g (1.41 oz., powder)
- Per 1 l (33.8 fl.oz.), ascorbic acid R2 and molybdate reagent R3
- Order No. CAY246-V10AAH

Cleaner solution

- Alkaline cleaner
- Order No. CAY247-V10AAE

Only for versions CA72TP-C/D

Reagent set, active

- Digestion agent sodium peroxodisulfate R1, 40 g (powder)
- Color reagent R2, 2 l (67.6 fl.oz.)
- Order No. CAY249-V20AAE

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