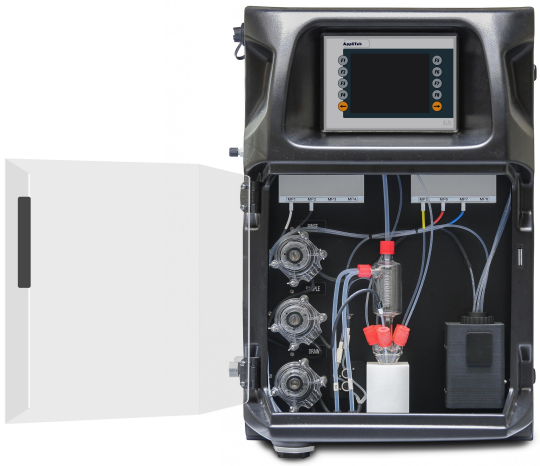
Technical Datasheet

TOPHO®

On-line Total Phosphorous Analyzer

Part of the On-line Analyzers Suite
www.applitek.com

On-line, automatic monitoring of Total Phosphorous (TP) in water and waste water



Advanced features

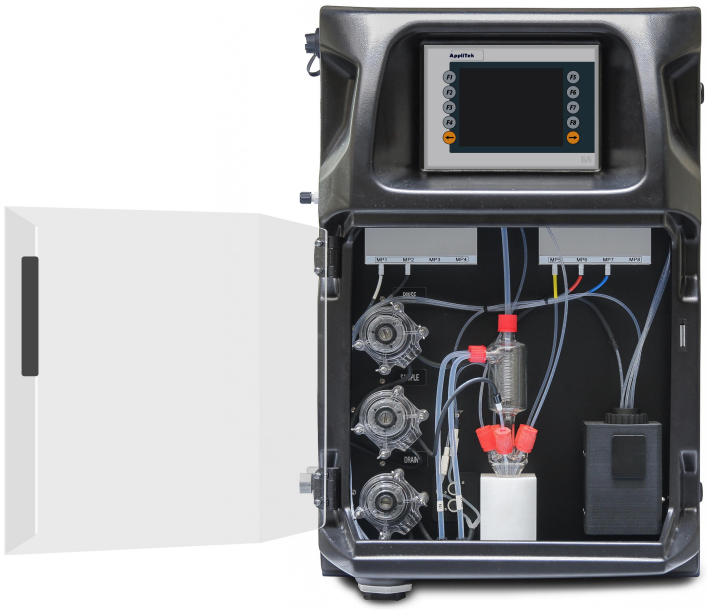
- On-line, automatic colorimetric measurements conform standard method 4500-P
- Low temperature wet-chemical oxidation
- Second generation design with small footprint, shorter liquid pathways and simple maintenance
- Complete separation between electronics and wet part
- Multiplexing up to eight (8) sampling points possible
- Incorporated industrial PC with AppliTek controller software
- Extended data communication and exchange features

Application fields

- Industrial waste water
- Municipal waste water
- Surface water

High analytical performance

- Full oxidation of all phosphorous components
- Smart features: automatic calibration, automatic validation and automatic cleaning
- Factory configured, tested and calibrated



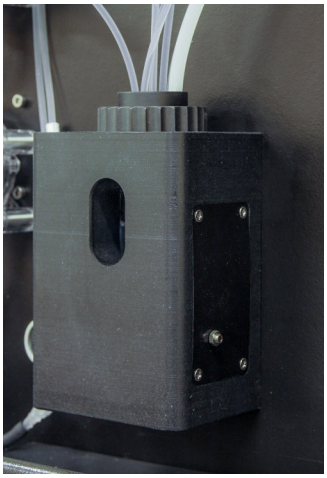
TOPHO®

On-line Total Phosphorus Analyzer

Introduction

Nitrogen, phosphorous and carbon are essential nutrients for growth of plants and organisms, yet in excessive quantities they will saturate a water body leading to eutrophication. Phosphorous is often synonymous with "phosphate" but can be present in different forms: orthophosphate (O-phosphate), condensed phosphate (polyphosphate) or organically bonded. O-phosphate is often the only form that is measured with traditional test kits or even in laboratory, yet the organic form of phosphate can be an important constituent of industrial discharges, often deriving from corrosion control programs or use of fertilizers.

The unique character of the **TOPHO®** On-line Total Phosphorous Analyzer allows operators of industrial and municipal water works to monitor and control in a convenient way the total portion of phosphorous. The analyzer shares similar wet-chemical oxidation techniques that are used for the **TONI®** On-line Total Nitrogen Analyzer, developed for fast and reliable monitoring of **regulatory sum parameters** in natural and treated water.



Second generation design

AppliTek is proud to launch the second generation **TOPHO®** On-line Total Phosphorous Analyzer, which has marked a dramatic difference with the older model, not only in appearance but also in mainframe and general architecture. The new model still houses the typical high quality components such as our robust precision micro pumps, used for addition of reagent solutions, and the long-life peristaltic pumps. The 5.7" industrial panel PC was introduced on the last series of the older **TOPHO®** and boasts all functionality of the bigger panel PC that ran the controller software for many years.

Down-scaling the wet-chemical analytical unit was essential in the framework of a global upgrade of the analyzer. Where necessary, wet-chemical components were redesigned for seamless operation:

- Built-in smart automatic functions
- Shorter liquid pathways: reagents, cooling, drain
- Pinch valves outside the cabinet for distribution of cleaning, validation and/or calibration solutions
- Water-cooled reflux condenser for increased stability
- Transparent door allows instant 180° visual inspection
- Reduced environmental footprint (60% weight reduction)

As with all of AppliTek's colorimeters, the compact proprietary photometer assembly with magnetic stirrer is at the heart of the on-line analyzer. Consumption of reagents is reduced by low volume analysis, while a long optical path length assures high sensitivity. There is no direct contact between the optical parts and the sample (or reagents added), to avoid fouling or corrosion of the optics. A narrow-band optical filter avoids all influence from ambient light.

AppliTek

On-line Analysis of Total Phosphorous

The conventional method for the determination of total phosphorous is a lengthy process prone to human errors. Heating acidified solutions to high temperatures in order to convert the P-components into orthophosphate may be of concern in terms of speed, user safety and convenience.

The completely automated analyzer mainframe of the **TOPHO®** On-line Total Phosphorous Analyzer bridges the gap between tradition and technology. It runs a chemical analysis based on standard method 4500-P with ascorbic acid reduction and molybdate color solution after persulphate destruction. Sampling, sample transfer, addition of reagents and reporting of the results are all controlled by the industrial panel PC.

Step 1: oxidation

The sample is mixed with oxidation reagents **SuperOxi A®** and **SuperOxi C®** and heated at 110° C in a compact, built-in oven during 10 minutes (standard). During this oxidation/digestion process organic and inorganic phosphorous is oxidized and converted to phosphate.

P-compounds + SuperOxi A + SuperOxi C $\rightarrow$ PO_4

Step 2: detection

Detection takes place in the photometer assembly where also the color complex is formed. The orthophosphate reacts with the color reagent to phosphomolybdic acid. This acid is reduced to an intensely colored molybdenum blue complex by means of a reducing reagent (ascorbic acid). The absorption at 630 nm is measured with a photometer and is proportional to the concentration of phosphorus in the sample (based on Lambert-beer law).

PO_4 + color reagent $\rightarrow$ $H_3PMo_{12}O_{40}$

$H_3PMo_{12}O_{40}$ + reducing agent $\rightarrow$ molybdenum blue

Smart functions

Auto-cleaning, auto-calibration, auto-validation

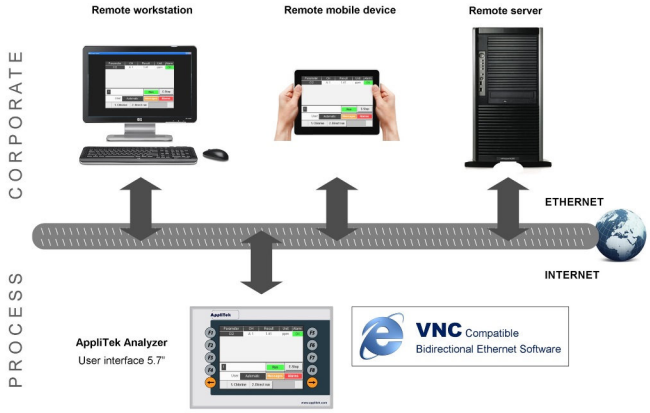
Enhanced analytical performance, minimized down-time and negligible operator intervention are essential when it comes to reliable and trouble-free on-line analysis. The **TOPHO®** On-line Total Phosphorous Analyzer comes standard with several possibilities, beginning with a cleaning cycle of the sample lines, oven and photometer, in order to eliminate cross interference. Instead of tap water, a separate alkali or acid solution can be used to clean the whole pathway.

Automatic calibration and validation cycles with standard solutions can be programmed in order to check the analysis program and analyzer functionality. AppliTek's controller software allows to program the sequence and interval of validation and cleaning, as well as the analysis cycle. The software can be set to generate alarms when calibration fails, results are out of range or when reagent containers are close to empty.

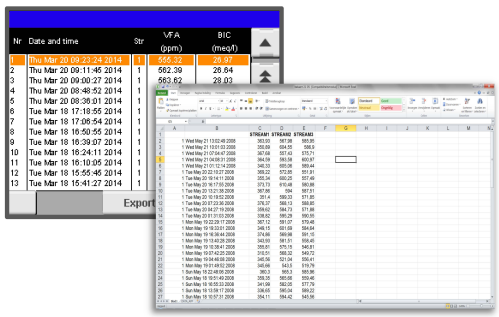
Data exchange and supervision

AppliTek on-line analyzers come with industrial 4-20 mA outputs, the most common analogue transmission standard available. Ethernet communication by means of the industry-standard TCP/IP protocol enables easy and reliable integration into existing corporate networks. MODBUS interfacing is possible to assure full integration and communication with distributed control systems (DCS).

All actions and logs of the **TOPHO®** On-line Total Phosphorous Analyzer are controlled by the incorporated high quality industrial panel PC. The flexibility of the controller software makes it easy to gain access to the analyzer system and minimizes physical operator intervention. The analyzer screen (the client) can remotely be taken over by means of LAN Ethernet software (such as VNC software). Authorized users can carry out all manual operations and settings from a remote PC, such as trouble-shooting before doing any physical intervention and capturing cross-platform screenshots for reports.



The solid state data logger of the panel PC allows to record a history of the records of the last 1,000 analysis results can be visualized in a chronological data table and equally be exported as Microsoft Excel files through the sealed USB port outside the analyzer cabinet.



Technical specifications

Analytical data

Analysis method

Standard method 4500-P

Colorimetric measurement using ascorbic acid reduction and molybdate color solution after persulphate destruction in acidic medium

Parameter

Total phosphorous

= Org P + Cond P + PO_4-P

Standard measuring ranges

One single range, factory set:

0 - 1 mg/L P

0 - 5 mg/L P

0 - 20 mg/L P

Note: higher ranges available by sample dilution

Cycle time

30 minutes including oxidation of 10 minutes

Note: oxidation time can be set to 60 minutes for difficult samples

Calibration

Factory calibrated

Cleaning

Automatic, free adjustable sequence

Detection limit

Better than 5 µg/l (range 0 - 1 mg/L)

Precision / Repeatability

Better than 2% full scale for standard solutions

Utilities

Power

220 - 240 VAC, 2 A, 50 Hz

Max. power consumption: 120 VA

Other voltages available on request

Instrument air (purging)

Dry and oil free according to ISA-S7.0.01-1996 quality standard for instrument air

Tap water

- Cleaning and/or dilution
- Cooling of the condenser

Drain

Atmospheric pressure, vented, min. Ø 64 mm

Earth connection

Dry and clean earth pole with low impedance (< 1 ohm) using an earth cable of > 2.5 mm^2

Environmental data

Ambient operating conditions

10 °C – 30 °C +/- 4 °C deviation at 5 - 95% relative humidity non-condensing

(50 °F – 86 °F +/- 7.2 °F deviation)

Reagent temperature

Keep between 10 °C - 30 °C (50 °F - 86°F)

Sample pressure

By external overflow vessel

Sample flow rate

Fast loop sample supply required - minimal flow rate depends on application

Sample particulates

Maximum size 40 µm, < 0.1 g/l

Reagents

Reagent containers (included)

Outside cabinet: 5 (7 with calibration/validation)

Containers come with torqueless screw caps.

Oxidizing solutions

SuperOxi A® ≤ 10 L / 30 days *

SuperOxi C® ≤ 5 L / 30 days *

Other solutions

Reducing reagent ≤ 7 L / 30 days *

Color reagent ≤ 3 L / 30 days *

* *Based on 1 analysis result/120 min*

Cleaning solution (recommended)

Tap water or specific chemical solution

Mechanical data

Protection class

Analyzer cabinet: IP55

Touch screen/Industrial PC: IP65

Cabinet and materials, hinged part

Thermoform ABS / Door: plexiglass

Cabinet and materials, wall section

Galvanized steel, powder coated

Wetted materials

PE / PTFE / PP / PFA

Dimensions (H X W X D)

69 cm (27.2") x 46.5 cm (18.3") x 33 cm (13")

Total weight

25 kg (55 lbs.)

Control and communication

User interface / controller

Industrial PC with 5.7" TFT colour user interface, compact flash memory

Backlit touchscreen, brightness adjustable

Data handling, logging and security

- Standard Ethernet 10 M (RJ45) NE 2000
- Communication ports supporting Ethernet connectivity to MODBUS TCP/IP
- Log files with 1,000 values/results are stored
- Easy export to spreadsheet files
- Sealed USB port for data or result graph download and program upload
- User interface with administrator access and menu keys activated/inactivated
- Data retention in case of power failure, initialization program for safe status after restart

Analogue outputs

Maximum 8, active 4 –20 mA

Max. 500 Ohm load

Alarms (digital outputs)

- Malfunctioning alarm (potential free contact)
- Result alarm (potential free contact)

MODBUS TCP/IP, MODBUS-RS232 -RS485

Optional

Options / add-on units

Sample preconditioning I

EZ-Size® self-cleaning filtration unit, various pore sizes available, requiring fast loop

Sample preconditioning II

MicroSize® self-cleaning microfiltration unit, various pore sizes available

Reagent level detection

Installed on reagent containers; alarms are generated by controller software

Multiple streams

ModuPlex® 2 or 3 streams (8 on demand)

Certification

CE approval

Certified to CE approval

Factory Acceptance Test (FAT)

At AppliTek NV, Belgium.

Siam Pollutek Co., Ltd.
40/25 Soi Wachiratham-satit 8, Sukmvit 101/1 , Bangna , Bangkok 10260
Tel 02- 7478234 Fax 02-7477566

E-mail : info@siampollutek.com
Web : www.siampollutek.com