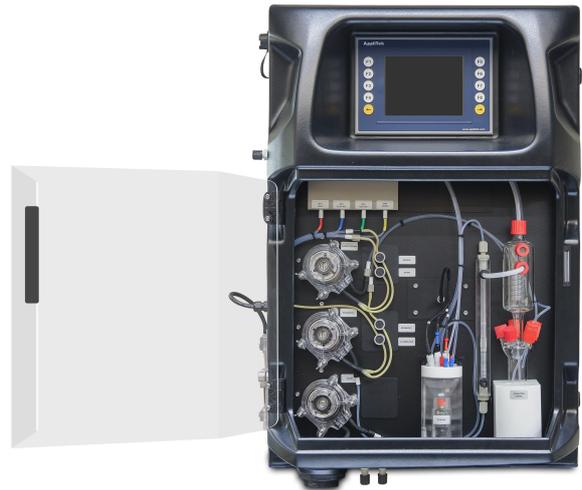


Single and multi-parameter determination of trace metals in water by on-line voltammetry



Advanced features

- Flexibility in analytical mainframe: single or double ASV cell
- Built-in sample digestion for complexed metals or higher organic content
- Easy operation and simple maintenance
- **New:** remote access and data communication through secure virtual private network (VPN)
- 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

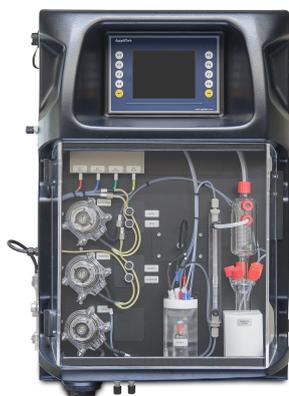
Application fields

Determination of trace metals/heavy metals in clean waters:

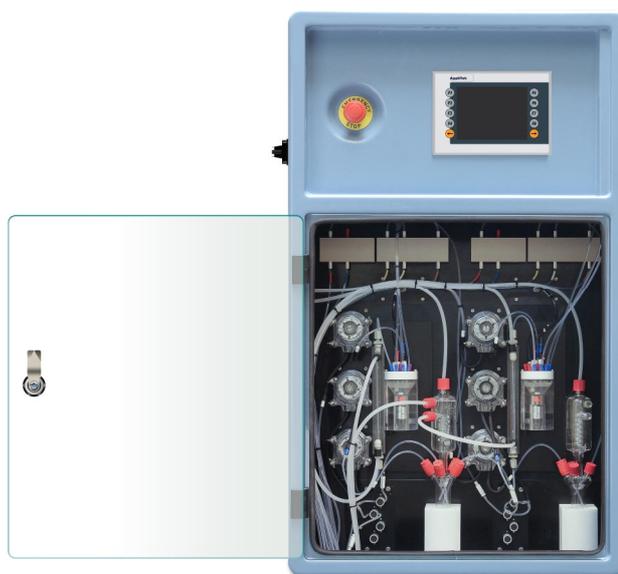
- Surface water
- Drinking water
- Mineral water
- Waste water effluent

High analytical performance

- Low sample and reagent consumption
- Excellent correlation with standard laboratory methods
- Smart features: automatic calibration and automatic cleaning
- Factory configured, tested and calibrated



AppliTrace®, standard mainframe



AppliTrace® Duo, with double ASV cell

Introduction

Trace metals are any metallic chemical element with high density, being toxic to humans and animals even at low concentrations. Typical examples of these elements include cadmium, mercury, chromium, arsenic and lead. Several analytical techniques have been established to meet today's challenges in environmental monitoring of trace metals. Many of these require complex sample preparation and expensive, time-consuming instrumentation. In contrast, Anodic Stripping Voltammetry (ASV) is considered to be one of the most sensitive analytical techniques incorporated in automatic, on-line analyzers for the determination of trace levels of metals.

The **AppliTrace®** Series of Trace Metal Analyzers have been developed to meet the requirements of companies and authorities wishing a cost-effective solution to environmental pollution and/or compliance. For many metals the analyzer boasts limits of detection (LOD) in the low ppb to high ppt range, comparing the ASV technique favorably with AAS or ICP analysis. ASV is also insensitive to the typical interference from which colorimetric measurements can suffer.

Last but not least, the **AppliTrace®** Series are available in two distinct mainframes: one standard with a single ASV flowcell and single working electrode for determination of 1 up to 4 metals. A more expensive alternative, the larger **Duo** mainframe integrates the equivalent of two analyzers each with an ASV cell, and the preferred choice when a compact installation is deemed necessary.

Determination of total metal levels

AppliTek's newly developed **AppliTrace®** Series build upon the voltammetry technology of the tried and tested multi-parameter **VPA®** for automatic determination of trace metals at sub-ppm levels. The **AppliTrace®** can be equipped with the add-on sample digestion unit or combined with any of our external filtration systems, allowing detection and measurement of trace metals in a wide range of water matrices. The exact configuration depends on the choice of working electrode and the priority metals for your application. Examples of typical metal combinations include:

CADMIUM + LEAD

CADMIUM + LEAD + COPPER + ZINC

ARSENIC + MERCURY

ARSENIC (TOTAL) + ARSENIC (FREE)

→ Please contact us to discuss your specific configuration.

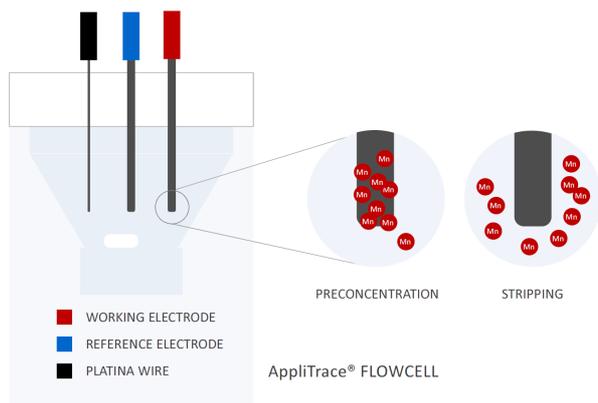


Hot acid digestion The **AppliTrace®** add-on digestion unit has been designed specifically for samples with higher organic contents, suspended particles and changing composition. Dissociation of organic metal complexes constitute a traditional problem in ASV where fouling of the electrode surface is not uncommon. Metals exist in various chemical states and forms in natural water or wastewater, which turns correct measurement in a challenging task. Examples of this are mercury and arsenic, the latter sometimes present in two oxidation states. The built-in new pretreatment digestion unit, consisting of a compact oxidation vessel with a reflux-cooler mounted on top, adds to analytical performance and trouble-free operation of the on-line analyzer, allowing you to shift your focus from analytical chemistry to environmental compliance.

Image, middle: the built-in pretreatment digestion unit processes samples with concentrated acids and oxidizing agents at high temperature.

Analysis principle

The analytical technology behind the **AppliTrace®** Series is Anodic Stripping Voltammetry (ASV), an established and sensitive electrochemical technique in which the current-potential behavior at an electrode surface is measured. Basically it involves a preconcentration of the analyte of interest, the metal, to the surface of an electrode, followed by an selective oxidation from the same electrode during the stripping phase. All steps of the analysis procedure, including sampling, sample transfer, cleaning and data exchange are controlled by the industrial panel PC.



Step 1: sample digestion

The sample is mixed with concentrated acid and heated in a compact, built-in oven during a fixed time of 20 minutes. The oxidation/digestion process turns all dissolved, complexed and adsorbed metal forms to free ions. The hot complex is cooled and transferred to the flowcell.

Step 2: preparation of the electrode

Inside the ASV cell, a buffer solution is added. Depending on type of working electrode, a thin film (mercury or gold) is plated on the electrode surface.

Step 3: analysis by ASV

The first step involves preconcentration of the analytes in the sample. The metals of interest are electrodeposited by reduction and form an amalgam with the thin film. In the equilibration phase the deposition potential is held but stirring inside the cell is stopped, allowing time for the amalgam to stabilize. Following equilibration, both thin film and metal(s) are stripped from the electrode by raising the electrode's potential during a linear potential sweep. The metals are oxidized and release electrons which are measured as a current. The potential that is needed to strip the metal is characteristic to each single metal. Final results are calculated, recorded and displayed on the human interface.

Step 4: cleaning cycle

Sample lines, oxidation oven and analysis vessel are cleaned with demineralized water in order to eliminate cross interference.

Smart features such as automatic cleaning, calibration and/or validation are embedded in the controller software of the **AppliTrace®** and contribute to enhanced analytical performance, minimized down-time and less human intervention.

Data exchange and supervision

The **AppliTrace®** mainframe incorporates a high performance industrial panel PC running AppliTek's proprietary controller-database software **UPAMATIC®** to control all analysis steps, actions and logs. This fully integrated software platform not only acts as the human interface but also features a host of functions specifically designed for industrial monitoring needs. If necessary, the optional **AnaComDa®** Analyzer Communication and Data Transfer Tool can be installed in order to create a secure VPN (Virtual Private Network) connection between the client (the analyzer) and the host (PC, mobile device).

Solid state data logger recording a history of the last 1,000 analysis results

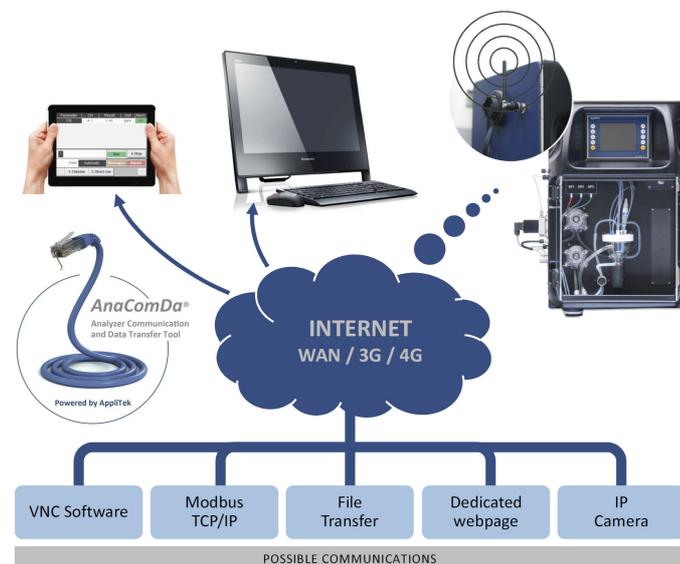
These can be visualized in a chronological data table and equally be exported as Microsoft Excel files through the sealed USB port outside the analyzer cabinet.

Full integration and communication within industrial production sites and corporate networks

AppliTek on-line analyzers come with industrial standard 4-20 mA outputs. Ethernet communication by means of the TCP/IP protocol enables easy and reliable integration into existing corporate networks. MODBUS interfacing is possible to assure full integration and communication with DCS systems.

Remote access to the panel PC minimizing physical operator intervention (through VPN)

The analyzer screen 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.



The **AnaComDa®** tool allows to create a secure VPN connection to mobile networks (3G, 4G) or Wide Area Networks, giving authorized users the possibility to use e.g. Modbus TCP/IP control through a dedicated webpage or via VNC software. The tool also allows extended data logging in the cloud and visualization (connection of an IP camera). With the VPN created, FTP protocols can be used directly from a PC or a mobile device.

Technical specifications

Analytical data

Analysis method

Anodic Stripping Voltammetry after hot acid digestion

Parameters

Antimony (Sb), arsenic (As), cadmium (Cd), cobalt (Co), copper (Cu), iron (Fe), lead (Pb), manganese (Mn), mercury (Hg), molybdenum (Mo), nickel (Ni), platinum (Pt), selenium (Se), silver (Ag), tin (Sn), zinc (Zn)

Remark: analysis of cyanide, chromium - see EnviroLyzer® Series

Working electrode

Glassy carbon, gold or bismuth

Standard measuring ranges

Please check the respective datasheets for each parameter.

Cycle time

40 minutes (including digestion)

Calibration

Factory calibrated (1-point)

Cleaning

Automatic, free adjustable sequence

Detection limit

Better than 1 µg/l

Precision / Repeatability

Better than 5% full scale for standard solutions

Mechanical data

Protection class

Analyzer cabinet: IP55

Touch screen/Industrial PC: IP65

Cabinet and materials, hinged part

Thermoform ABS

Bottom: leak detection

Door: antistatic plexiglass

Cabinet and materials, wall section

Galvanized steel, powder coated

Dimensions

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

(H X W X D)

Total weight

25 kg (55 lbs.)

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

10 - 30 ml per minute

Sample particulates

Maximum size 200 µm, < 0.1 g/l
Turbidity < 50 NTU

Reagents

Reagent containers (included)

Outside cabinet: 4 - 5

Containers come with torqueless screw caps.

Reagent solutions

Acid solution ≤ 1.5 L* / 28 days

Buffer solution ≤ 1.1 L* / 28 days

Plating solution ≤ 100 mL** / 28 days

* Based on 1 analysis result/60 min

** Depending on plating frequency

Calibration / validation solution

Consumption depends on pre-programmed sequence; ≤ 1 L / 28 days

Cleaning solution (recommended)

Deminerlized water

Utilities

Power

220 - 240 VAC, 2 A, 50 Hz

Max. power consumption: 150 VA

Other voltages available on request

Instrument air

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

Deminerlized water

For rinsing, calibration and/or dilution

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 mm²

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)

Secure VPN connection

AnaComDa® remote access and data transfer

Certification

CE approval

Certified to CE approval

Factory Acceptance Test (FAT)

At AppliTek NV, Belgium.