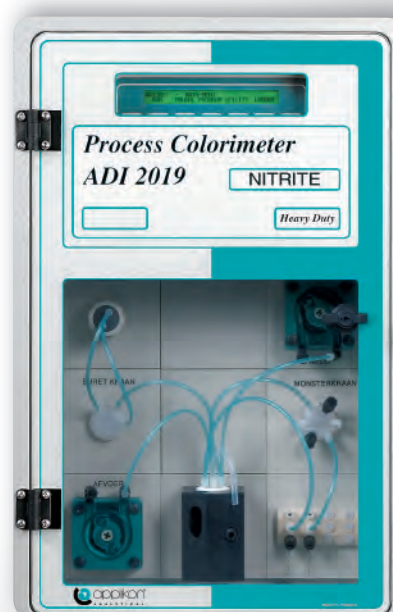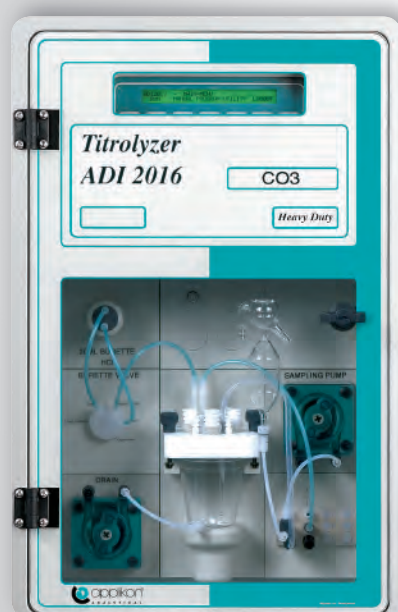# Single Method On-line Analyzers

ADI 2016 Titrolyzer
ADI 2018 Ion-Analyzer
ADI 2019 Process Colorimeter

Metrohm Applikon

Automatic and dependable on-line ion analysis

The single method process analyzers from Metrohm Applikon can be applied in many different industries to analyze and control their wet chemical processes.

The single method analyzers are available for:

Titrations
ADI 2016 Titrolyzer

Ion selective measurements
ADI 2018 Ion-Analyzer

Colorimetric analysis
ADI 2019 Process Colorimeter

- Many proven applications in the analysis of wet chemical processes are available for (petro)chemical-, mining-, semiconductor-, pulp & paper-, textile-, food-, and many other industries for process as well as effluent streams.
- A flexible wet part containing modules like valves, sampling devices, pumps, sensors, etc. and the flexibility in setting up program runs, measuring ranges, and result calculation allow a configuration for almost every application.
- Easy operation by use of programmable macros with dialog functions.
- Combination of corrosion resistant plastic and epoxy coated steel, or fully stainless steel cabinets.
- Electronics fully shielded from the so-called «wet part».
- Ingress protection according to IP66 and NEMA 4X.
- Smart design of hard- and software and application of special analytical methods allows automatic calibration and validation of the results.
- Batch-wise operation allows the analysis frequency to be defined, which leads to a significant reduction in reagent usage.
- A flexible design makes it possible to automate your laboratory method ensuring that the analyzer provides the same results as your laboratory.
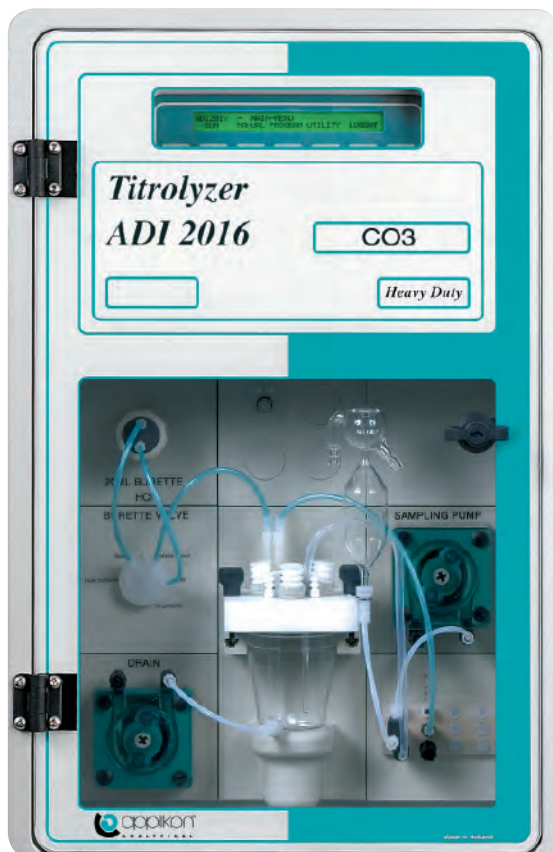
Automation

The analyzers can run three different programs, which can conveniently be adapted to the specific needs of the application.

- A clean program for periodic cleaning of sampling device, analysis vessel or cuvette and sample lines.
- A reference or calibration program for periodically performing a reference analysis on a standard. A titrant or electrode offset can automatically be adjusted.
- An analysis program for on-line sample analysis.

The programs are executed in a user definable sequence with a user selectable time interval. Conditional actions based on the result outcome are available to trigger alarms, increase/decrease analysis frequency, and perform cleaning and reference programs.

ADI 2016 Titrolyzer

Analysis techniques

The ADI 2016 Titrolyzer performs potentiometric titrations by means of a high precision burette system and high performance electrodes:

- Acid/base titrations
- Redox titrations
- Precipitation titrations
- Karl Fischer titrations

A self finding inflection point technique can be applied for most applications. This can be performed either with fixed time interval additions or with drift controlled additions, depending on the application. For some applications also a (temperature compensated) end-point technique is available. Karl Fischer titration is a special version of that.
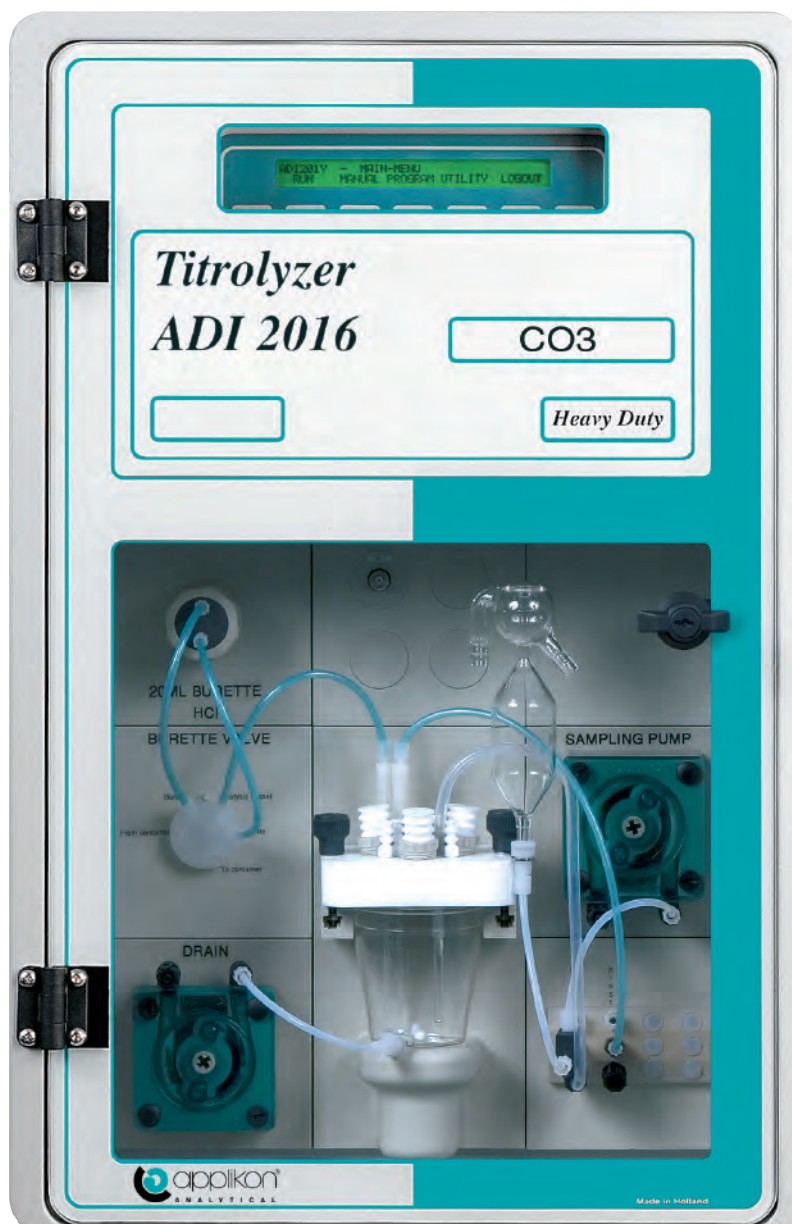
Titration

Titration is one of the most frequently applied and proven analysis techniques. This can be explained by the fact that it uses very straightforward instrumentation and yet delivers most accurate analysis results. This is also reflected in the following features brought by the ADI 2016 Titrolyzer:

- No need for calibration since titration is an absolute method.

- The applied electrode does not need calibration when the inflection point is derived from the measured potential differences, rather than the absolute potentials.

- Great selectivity through the use of dedicated titrants and electrodes.

- Several parameters can be obtained by multipoint titration, e.g., P and M value, or alkalinity and carbonate.
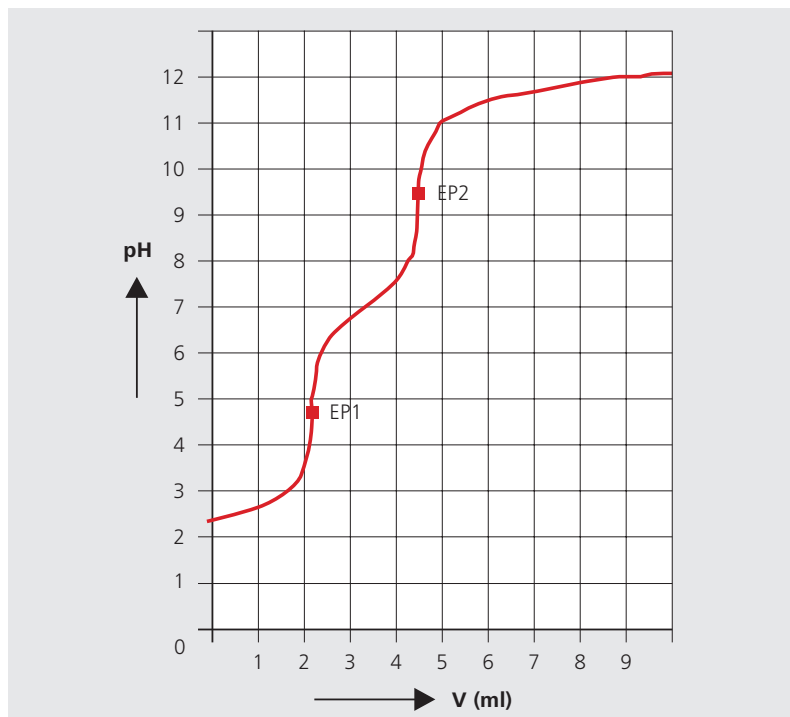
Titration curve with two inflection points

ADI 2018 Ion-Analyzer

Analysis techniques

The ADI 2018 Ion-Analyzer performs a dynamic standard addition method by means of a high precision burette and high performance Ion Selective Electrodes (ISE). These methods adapt the standard addition volume to the actual sample concentration by means of a dynamic differential approach. Moreover it takes into account ISE slope values over several ranges. This means that ISEs can be used to their ultimate low (or high) measuring range which is mostly non-linear. Finally an accompanying temperature measurement eliminates possible temperature effects on the analysis results.

Dynamic Standard Addition
The above described method brings important benefits, making ion selective measurements a robust on-line analysis approach with the following features:

- Intrinsic result validation.

- Elimination of sample matrix effects.

- Automatic ISE calibration.

- Wide measuring range of approx. 2.5 decades.

- Easy adaption of measuring range by choosing the standard concentration.

- Significant reduction of reagent use; only buffer and standard solutions are needed (typically 0.5 to 1 mL per analysis).

- Automatic temperature compensation.
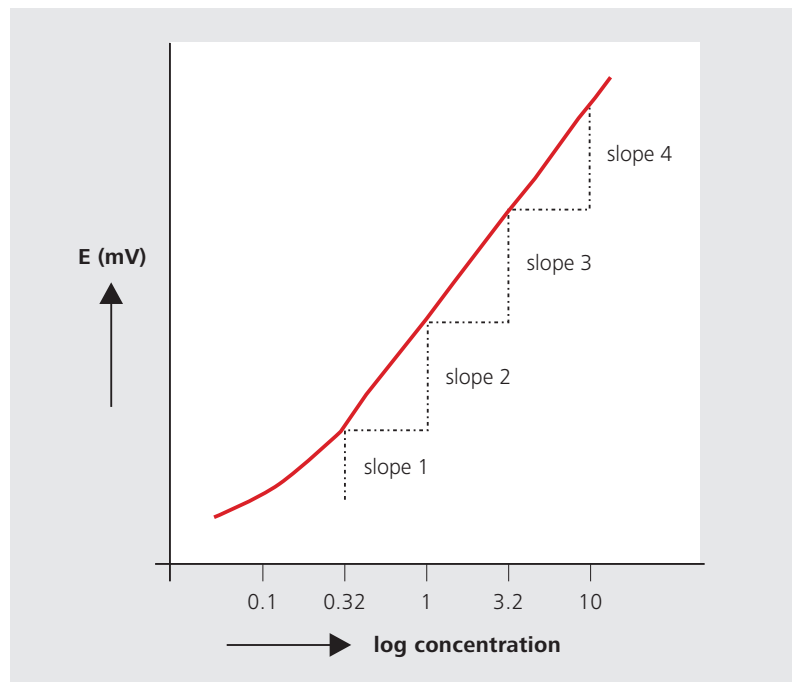
Calibration with multiple slopes

ADI 2019 Process Colorimeter

Analysis techniques

The ADI 2019 Process Colorimeter performs photometric absorption measurements in the visible light range. A high performance compact photometer module developed by Metrohm Applikon is used. It comprises a thermostated cuvette with 3 cm light path and LED technology. The color development stabilization is automatically detected by making use of differential absorbance measurements. The ADI 2019 will have no problem performing your colorimetric laboratory method; in most cases it can be directly implemented in a simple way.

Differential colorimetry

The differential measuring method as applied by Metrohm Applikon makes colorimetry a robust, accurate on-line analysis with the following features:

- Insensitive to cuvette fouling, background sample color or ageing of light source.

- High accuracy and repeatability.

- High sensitivity, typical in the low µg/L.

- Processes linear as well as curved calibration lines, in order to offer wide measuring ranges.

- Significant reduction of reagent use; only buffer and standard solutions are needed (typically 0.5 to 1 mL per analysis).

- Insensitive to sample temperature variations.
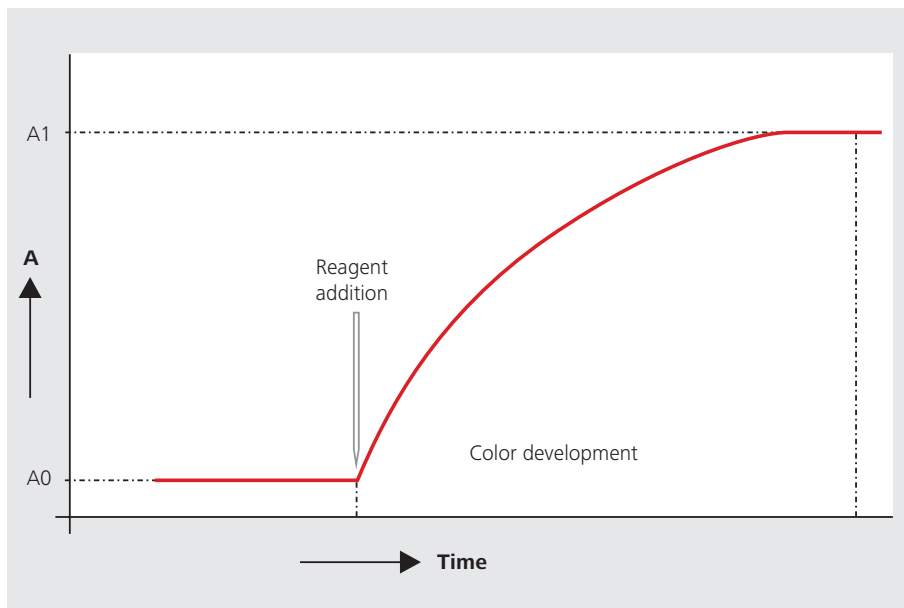
Drift-controlled measured value acceptance

Preconditioning and stream selector

Not only the chemical analysis, but also sample preparation or preconditioning is of utmost importance for the success of a process analyzer system. Furthermore, the analyzer location is an important part of the analysis. The sample needs to be as representative as possible, which means that the sampling point needs to be as close to the analyzer as possible.

Metrohm Applikon can engineer and supply virtually any «unit operation» for sample preconditioning:

- Pressure reduction
- Cooling
- Heating, heat tracing
- (Ultra) filtration
- Precipitation
- Dilution to avoid crystallisation
- Degassing
- Homogenising
- Flow metering
- Phase separation

With more than 35 years of experience in process analyzer systems Metrohm Applikon can provide a complete and exact solution for almost any application.

Projects range from one analyzer in combination with simple sample preparation to complete packages with shelters, piping, wiring, and interfacing.

On-site, only the necessary utilities and the sample stream need to be connected, saving a lot of time and energy in the start up phase of the instrument.

Food and Beverage
A Stainless Steel housing option of the anlayzers is available for all hygienic applications in the food and beverage processing industry. The watertight design withstands the daily stringent cleaning procedures without fear of rust and corrosion. It is also suitable for harsh chemical environments where corrosion is unavoidable.

Multi-stream analyzer
In some cases the analyzer can be equipped with a sample sequencer. This unit makes it possible to monitor multiple sample streams with one analyzer. Each individual sample stream is assigned to an analog output module (4–20 mA) that transfers the analysis result of the chosen sample stream to a process computer.

Typical applications

Industry > Component	Chemical Petro Chem	Semi conductor	Metal Mining	Metal Surface	Energy	Pulp, Paper, Textile	Food Beverage	Water Waste Water
Acidity	•	•	•	•		•	•	•
Alkalinity	•				•		•	•
Aluminium			•	•	•			•
Ammonia	•	•	•					•
Boric acid	•	•		•	•			•
Bromide	•					•		
Cadmium	•	•	•	•				•
Calcium	•				•	•	•	•
Caustic	•	•		•		•		
Carbonate	•		•		•	•	•	•
Chloride	•			•	•		•	•
Chlorine	•					•		•
Chromium	•		•	•				•
Citric acid							•	
Cobalt	•	•	•					•
COD	•					•		•
Copper	•	•	•	•				•
Cyanide	•		•	•				•
EDTA		•	•	•	•			
FFA	•						•	
Fluoride	•	•						•
Formaldehyde	•			•				
Glucose							•	
Hardness	•			•	•		•	•
Hydrazine				•				
Hydrochloric acid	•	•	•	•	•			
Hydrofluoric acid	•	•		•				•
Hypochlorite	•					•		•
Hypophosphite	•	•		•				•
Hydrogen Sulfide	•							
Iodide							•	
Iron	•	•	•	•	•			
Indigo Dye						•		
Lactic acid							•	
Magnesium	•				•			•
Manganese								•
Mercaptans	•							
Nickel	•	•	•	•				•
Nitrate	•				•	•		•
Nitric acid	•	•		•	•			
Nitrite	•						•	•
Nitrous acid			•					
PAA							•	
P & M					•			•
Peroxide	•	•		•		•		
Persulfate	•	•						
Phenol	•							•
Phosphate	•				•		•	•
Phosphoric acid	•	•		•				
Potassium	•						•	•
Silica	•	•			•			•
Silver			•	•				
Sodium		•			•		•	•
Sulfide	•					•		•
Sulfite	•						•	
Sulfonic acid	•	•		•				
Sulfuric acid	•	•	•	•				
Surfactant	•			•				
TMAH		•						
TP & TN	•							•
Urea	•							
Water	•	•					•	
Zinc	•	•	•					•

Specifications / general information

Applied analysis methods

ADI 2016	Titrations
ADI 2018	Dynamic Standard Addition with Ion Selective Electrodes
ADI 2019	Differential Absorbance Colorimetry

Measurement

Repeatability	typical 1–2%
Inaccuracy	typical 1–2% (95% confidence level)
Analysis time	typical approx. 10 minutes

Sampling and sample streams

Sampling	batch wise
Sample frequency	programmable
Sample streams	Titrolyzer: 1 stream + standard Ion Analyzer: 2 streams + blank Colorimeter: 1 stream + standard
Sample volume	0.2–50 mL
Sample temperature	5–90 °C / 41–194 °F
Sample pressure	0–4 bar / 0–7.2 PSI (without preconditioner)

Maintenance

Weekly	visual inspection
Monthly	visual inspection & reagent refill
Yearly	hardware inspection

Connectivity

Serial Communication	RS232, RS422
Analog Outputs	2 × 0/4–20 mA
Digital Input	remote start, remote stop, remote emergency stop
Digital Output	analyzer running system error result value low alarm result value high alarm no sample alarm out of reagent alarm 3 programmable relays

General

Power supply	100–120 / 200–240 V / 200 VA / 50...60 Hz
Accessibility	pass code protected
Housing material	**Standard system:** «Electronics» cabinet: Zinc plated steel, epoxy coated steel «Wet part» door: Polystyrene, epoxy coated **Special system:** Stainless Steel SS316
Ingress protection	IP66 and NEMA 4X
Ambient temperature	5–40 °C
Dimensions	H × W × D 700 × 460 × 352 mm
Weight	45 kg max

www.metrohm-applikon.com

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