

PA-2 Process Analyzer for Aqueous Solutions

On-line Mercury Determination



- Fully automatic system
- Easy menu-driven operation
- Proven and reliable detection method: UV absorption
- Measuring ranges from 0.1 ppb to 10 ppm (PA-2 standard); 0.01 ppb to 10ppb (PA-2-Gold)
- Right for complex sample compositions
- Low reagent consumption
- Corrosion-protected construction
- Automatic self diagnosis system for reliable operation

On-line Process Control of Mercury with the PA-2 / PA-2-GOLD

The mercury process analyzer PA-2 is used for continuous monitoring of mercury concentrations in industrial processes and in the environment. Applications include effluent and quality control in chlorine-alkali plants, monitoring of scrubber water of waste incinerators and power plants, control of industrial sewage and purification plants, quality control of sulphuric acid and caustic solutions, drinking water, surface water etc.

Flexibility in Sample Digestion

In practice mercury analysis sample matrices very often show different and variable compositions. Depending on the chemical process the forms of mercury differ: elementary, ionic, as an organic compound or as insoluble sulfide. The PA-2 offers a variety of sample pretreatment procedures to allow highly precise determination of total mercury in all these samples, with the results from the PA-2 showing very good correlations with standard laboratory analyses. High flexibility is achieved by the modular structure of the sample pretreatment. This allows the user to choose from the following digestion methods:

- Sample digestion with hydrochloric acid + potassium permanganate
- Sample digestion with sulphuric acid + potassium permanganate
- Sample digestion with hydrochloric acid + sodiumchlorate
- Sample digestion with Fenton's reagent
- Sample digestion with bromide/bromate

The integrated heated reaction module allows accelerated sample digestion at higher temperatures.

Proven Measurement Principle

The detection of mercury contained in the sample occurs in an optical cell made of fused silica (Suprasil). In a first step mercury is reduced to the elementary state by means of tin(II)chloride or NaBH₄. Subsequently mercury is stripped from the aqueous phase with an air stream and carried into the optical cell. Here the UV absorption measurement is conducted at a wavelength of 253,7 nm. This analytical technique called „cold vapor method“ shows extreme sensitivity and selectivity. It has been reliable and proven for many years. In contrast to the occasionally recommended atomic fluorescence method the analytical technique utilized by the PA-2 is extremely low in interference and does not require expensive noble gas as a carrier.

Continuous and Interval Operation

The PA-2 analyzer is controlled by a built-in computer and operates fully automatic. The continuous measuring mode can be switched over to a periodic measuring mode (for example 10 minutes of measurement every hour).

Auto-Cal. Check: periodically the instrument switches from the sample stream to a calibration solution to check any deviation from the reference value. A status signal is generated if the value measured is out of range.

Auto-Zero: the zero line of the analyzer is adjusted automatically after a preset period of time.

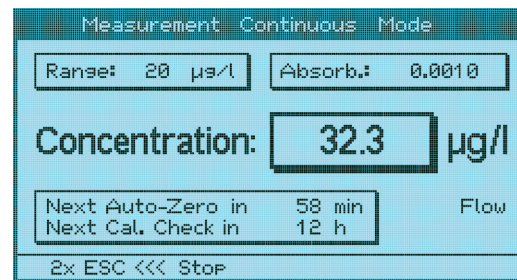
Self-Cleaning: Precipitations like manganese dioxide are dissolved by an automatic rinse step which makes manual cleaning superfluous.

Easy to Operate

The PA-2 is operated via a waterproof membrane keypad. All inputs required are selected in a readily understandable menu shown on the graphical display. It is also possible to initiate some functions like Auto Zero from an external computer via the RS 232 interface.

Display and Output of Measurements

The analytical results are continuously displayed on an LCD in micrograms per litre and as absorption units. A linear electrical signal (4 ... 20 mA) is also output and can be connected to a recorder or to the analog input of a data acquisition system.



Displayed data during continuous measurement mode

Automatic Self Diagnosis System

The PA-2 is equipped with sensors to detect malfunctions of the system and triggers an alarm for the operator. The following functions/malfunctions are checked and indicated:

Reagent pump, Sample pump, Stripping air flow, Leakage of fluids, Photometer lamp, Calibration.

These features permit reliable unattended operation. Malfunctions are reported to the user both optically and via a status signal.

Minimum Maintenance Work and Maximum Service Life

The PA-2 is not a laboratory analyzer simply converted for process applications but has especially been designed for operation under harsh industrial conditions. The number of parts subject to wear has been minimized and particularly durable components have been chosen for use in critical locations. This results in extended maintenance intervals. The stripping unit is based on an aerosol-free principle and the need for cleaning the optical cell is particularly low.

Industrial Grade Design

To provide optimum protection against corrosive environments all parts of the PA-2 Mercury Analyzer are enclosed in an industrial-grade cabinet made of fibreglass-reinforced polyester (protection class IP 66; NEMA 4X; etc.). The electronic circuitry is shielded from the wet chemical section by a chemically resistant wall.



For use in harsh industrial environments:
Mercury Process Analyzer PA-2

Communication with External Computers

The following data is available at the serial RS 232 interface:

- **Actual mercury concentration**
- **Status** (Calibration - Zeroing - Maintenance - Malfunction)

Options

- **Dilution Unit:** based for samples with high concentrations of salt or for caustic soda, dilution ratio up to 1:50, automatic online control
- **Multiplexer:** for measuring alternatively two different sample points with different mercury concentrations
- **PA-2-Gold Module:** for measuring of very low mercury concentrations by means of preconcentration at a GoldTrap (UT-3000)

PA-2 Mercury Process Analyzer

Technical Specifications

Measuring principle:	UV-Absorption
Wavelength:	254 nm
UV source:	Electrodeless low-pressure mercury lamp
Stabilization method:	Double beam (reference beam) method
Optical cell:	Fused silica (Suprasil)
Optical cell heating:	approx. 70°C
Measuring range:	continuously adjustable 0.1...10 µg/l and 0.05...5 mg/l (standard); up to 100 mg/l (with dilution unit); 0.01...10 µg/l (PA-2-Gold)
Sensitivity:	0,01 µg (for 0...1 µg measuring range)
Response time (99% signal):	approx. 1 minute
Carrier gas:	Air, approx. 30 l/h, 1–2 bar
Pump for liquids:	Multichannel peristaltic pump
Reduction reagent:	Tin-II-chloride or alternatively sodiumhydroborate
Reagent consumption:	approx. 3 l / week for each reagent
Sample digestion:	HCl, H2SO4, KMnO4, H2O2, Fenton's reagent, Na-chlorate (depending on sample composition)
Liquid-gas separation:	Aerosol-free principle
Input device:	Waterproof membrane keypad
Display of readings:	Graphical LC display with background illumination
Output for concentration:	4...20 mA; RS 232 bidirectional
Output for status:	Operational - Service - Malfunction, according to NAMUR 64 recommendations
Housing:	Fibreglass-reinforced polyester, for use in highly corrosive environment
Dimensions:	775 x 612 x 329 mm (WxHxD)
Weight:	approx. 50 kg



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