

AULA-254 Gold

AMBIENT

Automatic Mercury Analyzer for the Laboratory



- Fully automated flow analysis system
- High performance continuous flow analysis (CFA) technique
- Cold Vapor Atomic Absorption Spectrometry (CVAAS)
- Widest dynamic linear range
- Rugged construction
- Full feature software: AULAWIN
- Automatic protective system cleaning
- Integrated GoldTrap for maximum sensitivity of <math><1\text{ ng/l}</math>
- Extension: Automated Sample Digester module (ASD) for aqueous samples

Applications

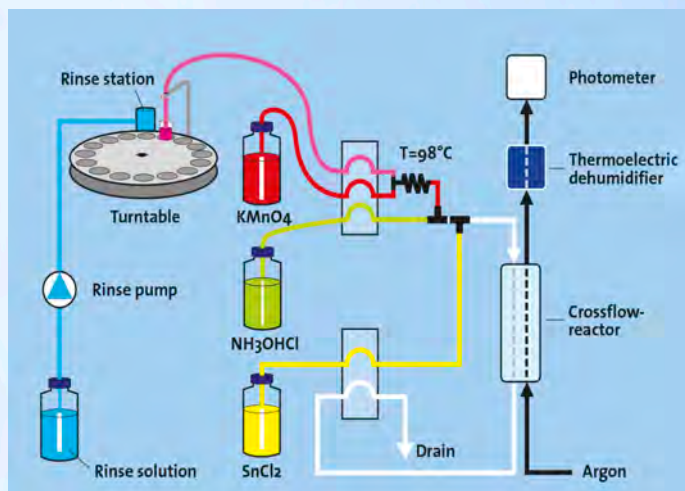
The **AULA-254 Gold** is a fully automatic analysis system for determining trace mercury levels in water samples and digested samples. The **AULA** system is designed to be the right tool for researchers and scientists. The instrument automates routine analysis: it treats each sample exactly according to a pre-specified routine. This increases efficiency and productivity in your lab.

Typical applications include:

- **Environmental monitoring:** Water, soils, sludge
- **Analysis of foodstuffs:** fish, innards, plants
- **Medicine:** urine, blood, saliva, hair
- **Geochemistry, mining**
- **Petrochemistry**
- **Metallurgy and material testing**
- **Chemical industry:** process monitoring, quality control
- **Applicable to EPA Methods:** 245.1, 245.7, 1631, 7470 and 7471A



Reliable and proven method: continuous flow analysis (CFA)



The system's working principle is the continuous flow analysis technique. The sample is continuously drawn from the sample vial and mixed with stannous chloride. This reduces mercury into the free atomic state. The solution then flows into a special crossflow reactor where an argon stream strips the elemental mercury and carries it into an optical cell, which is placed in the light path of a detector. The cell is entirely made of fused silica and is slightly heated to avoid water condensation.

Optimized mercury detection technique

The **AULA-254 Gold** uses an atomic absorption detector. The detection technique applied measures the resonance absorption at ambient temperature using a wavelength of 253.65 nm.

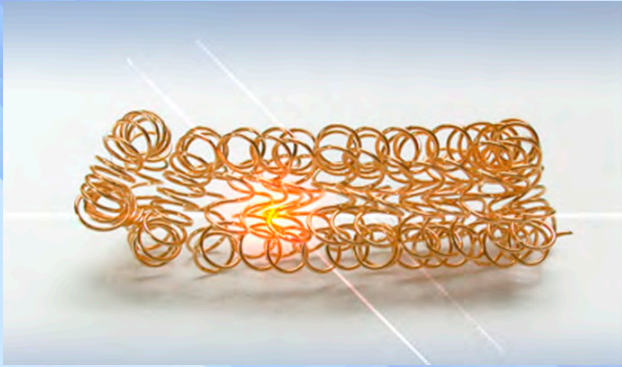
This analytical method is commonly known as cold vapor atomic absorption spectrometry (CVAAS), a preferred technique when analyzing mercury.

Unlike typical multi-element AA systems, the **AULA-254** is specially designed to detect and quantify mercury levels. This allows top performance in analytical applications.

The **AULA-254 Gold** uses an electro-optical stabilized electrodeless mercury discharge lamp (EDL) in connection with solid state UV detectors, resulting in excellent baseline stability and detection limits far lower than those of other AA spectrometers.



GoldTrap preconcentration



The integrated mercury preconcentration module (GoldTrap) drastically enhances detection sensitivity. Using ultra pure reagents and following the guidelines for mercury analysis at ultra trace levels, the **AULA-254 Gold** can achieve a measuring range from 1 ppt to 5000 ppt.

Small thermal inertia is an outstanding property of our latest GoldTrap design, achieved through the use of a wafer-thin ceramic substrate. Heating and cooling rates are very fast. Analysis duration is comparable to the direct method.

The GoldTrap is installed inside the photometer, thus not increasing bench space requirements. The **AULAWIN** software

enables the user to decide whether the GoldTrap preconcentration is activated or bypassed. This makes the **AULA-254** a most versatile instrument for almost any application.

High productivity

The typical duration of a full measurement cycle is 60 ... 180 seconds, depending on the set parameters. Measuring calibration standards, samples and QC standards is fully automatic. No long purging or rinsing procedure is needed, even when samples with high concentrations are analyzed.

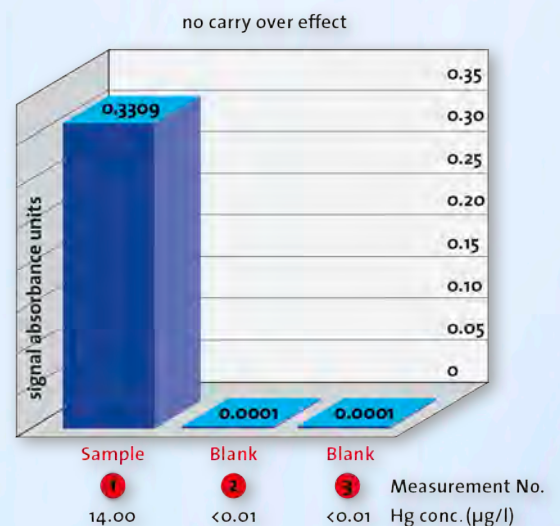
The **AULA-254 Gold** is simple to use. Samples are decanted into glass vials and positioned on the autosampler carousel. No weighing of the samples required! Reagent solution (tin-(II)-chloride) and rinse solution (water) are filled into the corresponding bottles. A keystroke starts the automatic measurement. The operator can suspend the automatic cycle at any time to select any sample for measurement or remeasurement. New samples can be added, even during a sample run.



Minimized memory effects

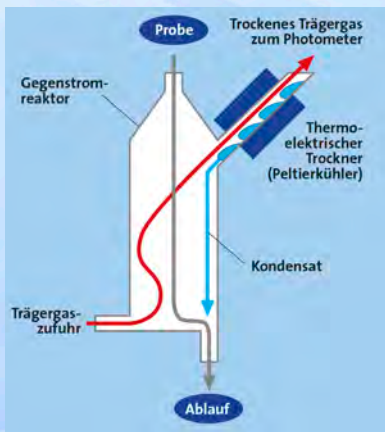
Mercury tends to cling to surfaces, causing a carry-over (memory effect) that can compromise results. **AULA systems** minimize memory effect by using selected materials for components touched by samples and by heating the optical bench. In addition, the autosampler probe and the sample tubing are rinsed after each sample run.

Even samples with concentrations in the upper measuring range do not cause carry-over.



Automatic baseline correction

The stability of the baseline is checked prior to each measurement and the zero point is adjusted automatically. Typical zero drift during a measurement is below 0.0001 absorbance units.



Thermoelectric dehumidifier

Conventional mercury analyzers use desiccant-filled dryer tubes or permeation tubes for removing water vapor from the mercury-loaded carrier gas, and these tubes add a maintenance burden. The **AULA-254 Gold** uses a maintenance-free thermoelectric dehumidifier. The gas is cooled below the dew point, excess water condenses on the wall of a small glass tube and flows back into the reactor. Absolutely no liquid carry-over! In contrast to other dryers this device has an extremely small surface, which prevents mercury adsorption.

Carrier gas flow stabilisation with electronic mass flow controller (MFC)

The stability of the carrier gas flow has a direct effect on the reproducibility of measurements. For this reason the **AULA-254 Gold** system uses a highly precise (1.5 % accuracy) electronic mass flow controller (MFC).

The system saves gas by automatically shutting off flow at the end of the job.

Automatic purging after exceedance of mercury concentration

The instrument automatically interrupts the measurement if samples with mercury concentrations exceeding the measuring range are detected.

In this case the system will clean itself immediately by purging. After being diluted, the rest of the sample can be analyzed.

User safety

The **AULA-254 Gold** collects mercury vapor in a sulfurized activated carbon filter, preventing mercury to escape into the working environment. A message appears on the screen when the filter needs replacement.

A fume hood is not required.



Full-feature software **AULAWIN**

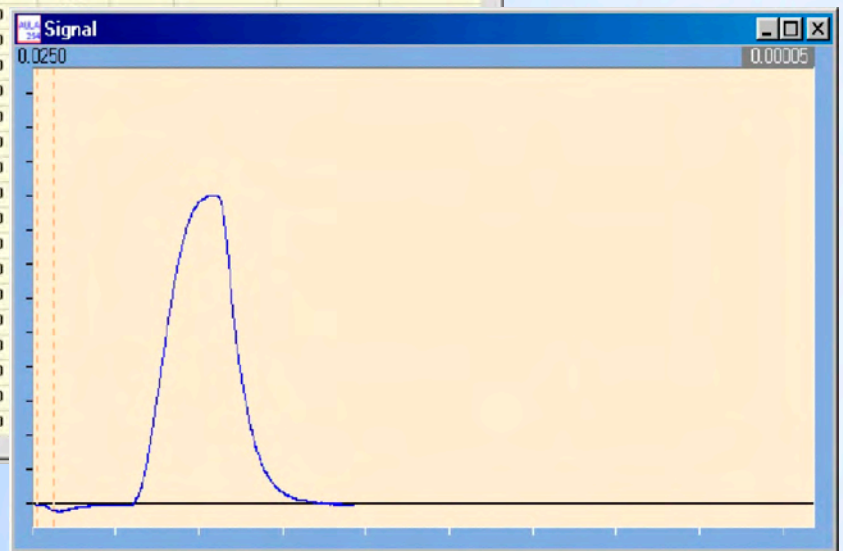
The **AULAWIN** software offers the complete feature set of modern analytical software. Developed with substantial input from our users, it is technically mature and easy to use. Samples, calibration standards and quality control standards (QCs) are selected by simple point-and-click. **AULAWIN** automatically creates a corresponding sample table, and the user can further specify sample dilution factors as well as sample weight and fill-up volumes for solid sample digestion.

The software makes it easy to measure a sample repeatedly. The result of each measurement is calculated automatically from the chosen calibration function and displayed in µg/l or µg/kg. The QC function assures a high level of reliability. A toolbar allows fast access to frequently used functions. The absorbance signal graph can be viewed in real time and may also be recalled later.

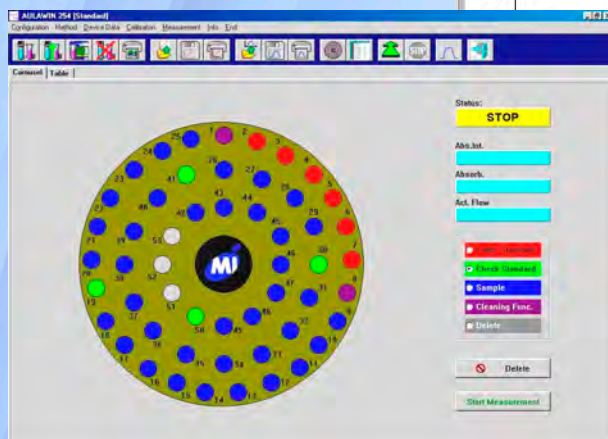
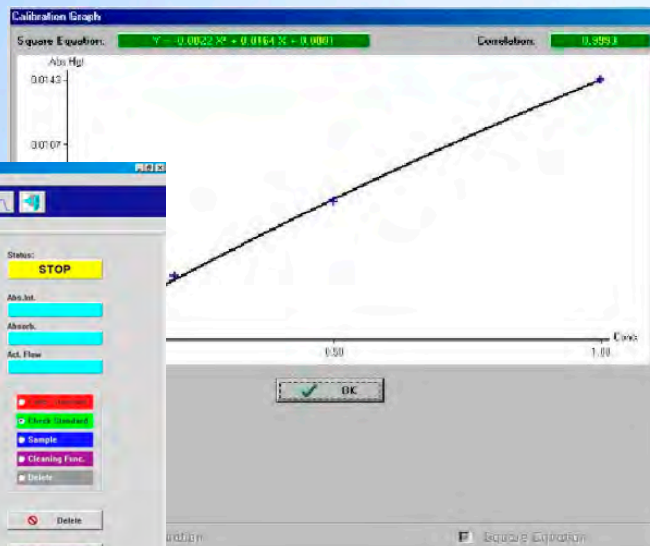
The analytical results are filed together with all data necessary for quality assurance (date, time, user ID, sample number, calibration data, method parameters, signal graph, etc). Worksheet templates can be created and stored to minimize set-up time for routine work. The user can format report sheets so that only the required data are printed.

PosNr	A	P	R	Type	Conc. [µg/L] / Sample	Weight [mg]	Volume [mL]	Dil. 1x	Absorb.	SD Absorb. [%]	Raw Data	Conc. Hg
1				Cleaning Func.		0.0	0.0	1.00				
2				Calib. Standard	10.000	0.0	0.0	1.00				
3				Calib. Standard	5.000	0.0	0.0					
4				Calib. Standard	2.000	0.0	0.0					
5				Calib. Standard	1.000	0.0	0.0					
6				Calib. Standard	0.500	0.0	0.0					
7				Calib. Standard	0.100	0.0	0.0					
8				Calib. Standard	0.010	0.0	0.0					
9				Cleaning Func.		0.0	0.0					
10		2		Sample	Water 12/04/04	0.0	0.0					
10a				Sample	Water 12/04/04	0.0	0.0					
10b				Sample	Water 12/04/04	0.0	0.0					
11		2		Sample	Water 10/04/04	0.0	0.0					
11a				Sample	Water 10/04/04	0.0	0.0					
11b				Sample	Water 10/04/04	0.0	0.0					
12				Sample	Water 08/04/04	0.0	0.0					
13				Sample	Sewage sludge 1375	0.0	0.0					
14				Sample	Test 0.5	0.0	0.0					
15				Check Standard		0.0	0.0					

AULAWIN sample table and display of measuring signal

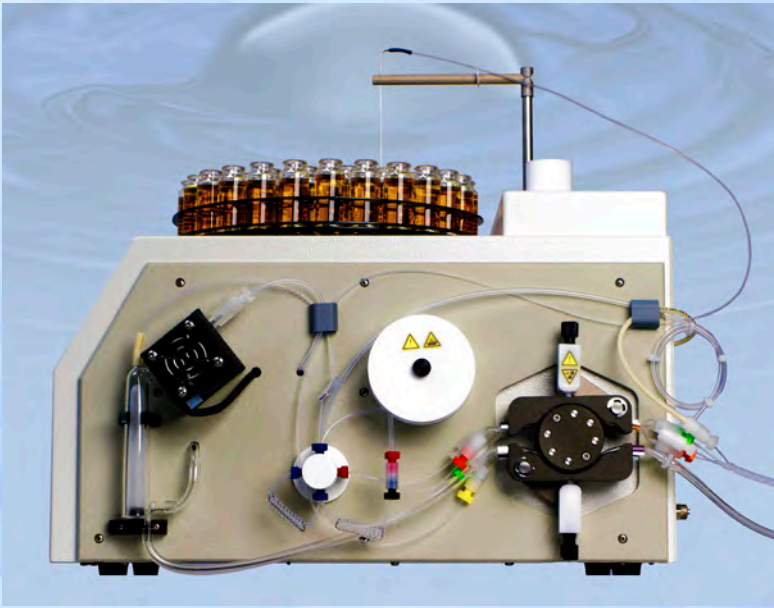


AULAWIN calibration graph and turntable screen



Extension:

Automated sample digestion (ASD) module



Samples frequently contain mercury in a complex form and require sample treatment prior to measurement. Wet chemical sample digestion turns out to be superior to thermal sample decomposition when water-based sample material is analyzed.

The **AULA-254 Gold** system is ready to be equipped with a sample preparation system for aqueous samples and digested samples. The ASD module carries out a digestion procedure derived from standard laboratory methods.

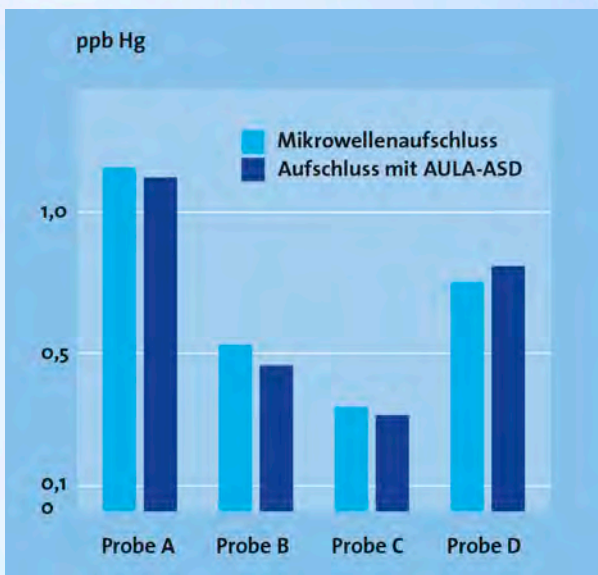
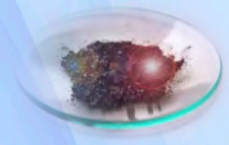
The sample flow is continuously mixed with an oxidizing reagent (e.g. potassium permanganate, potassium dichromate). The sample/oxidant mixture is then heated to approx. 98°C in a reaction coil. As a result mercury is oxidised to Hg^{2+} and the sample matrix is destroyed by oxidative reactions. After the oxidation step hydroxylamine hydrochloride and tin(II)-chloride are added

to reduce the mercury to the elemental state which is then extracted by a stream of carrier gas (Argon or nitrogen).

Water samples measured directly with the **AULA-ASD** module (8 ml of sample + 2 ml HNO_3 + 2 ml H_2O_2) yield results that closely match the same water samples that were microwave digested. Automatic sample digestion is fast: cycle time for a complete analysis is less than 4 minutes.

The **AULA-ASD module** is economical. Average reagent consumption for 100 analyses is:

- 3 g hydroxylamine-hydrochloride,
- 1-5 g potassium permanganate
- 6 g tin(II)-chloride,
- 5 l water (deionized)



The **AULA-ASD** module is suited to any application where aqueous solutions require a sample treatment prior to analysis: surface water, ground water, seepage water, effluents, process water, etc.

Standards for the **AULA-System**

The **AULA-254 Gold** system meets current regulations, with capacity in reserve to meet more stringent standards.

Compliant with:

- ISO 6637 (fruit, vegetables and derived products)
- ISO 11212-2 (starch and derived products)
- ISO 16772 (soil quality)
- ISO 17733 (workplace air)

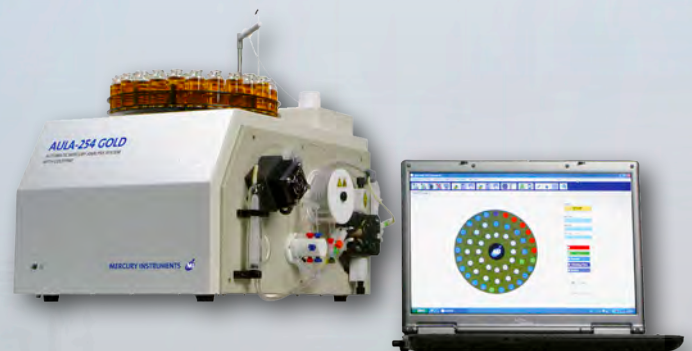
- European methods:
 - EN 1483 (water quality)
 - EN 12497 (paper and board-paper in contact with foodstuffs)
 - EN 13806 (foodstuffs)
 - EN ISO 12846 (water quality)

- EPA methods:
 - 7470A (liquid waste)
 - 7471A (solid or semisolid waste)
 - 245.1 (drinking, surface, and saline waters, domestic and industrial wastes)
 - 245.5 (soils, sediments, bottom deposits, and sludge type materials)
 - 245.6 (tissues)

- ASTM E538 (caustic soda and potash)

- FSIS USDA Food Safety and Inspection Service Method for Mercury Determination in Food

- The Ontario Hydro Method (stack gas)



The Response to an Analytical Challenge: ENVEA GmbH

Even nowadays quantitative trace analysis of mercury is still a challenging task for the analyst. ENVEA GmbH is at all times striving to develop leading edge products for mercury analysis at the highest technical level. The range of applications for our mercury analyzers is unique world-wide.



Technical specifications **AULA-254 Gold**

Measuring principle:	Amalgamation on gold (MI GoldTrap) UV-Absorption (CVAAS), Wavelength = 253.7 nm
UV source:	Electrodeless low-pressure mercury lamp (EDL)
Stabilization method:	Reference beam method
Optical cell:	Fused silica (Suprasil), heated, approx. 45°
Measuring range:	<ul style="list-style-type: none">• 10 ng/l to 50 µg/l (GoldTrap deactivated)• 1 ng/l to 5 µg/l (GoldTrap activated)
Detection limit:	<ul style="list-style-type: none">• < 50 pg Hg (GoldTrap deactivated)• < 5 pg Hg (GoldTrap activated)
Carrier gas:	argon (optional nitrogen), 4-6 l/h, stabilized with electronic mass flow controller
Autosampler:	53 place random access, turntable type
Sample vials:	10 ml, glass, aluminium foil disc covers
Sample consumption:	approx. 1 ml
Heating coil temperature:	approx. 98 °C (AULA-ASD only)
Zero drift:	none, Auto zero before each measurement
Measuring duration:	typ. 60 - 180 seconds
Software:	AULA-WIN, Windows™ compatible
El. power supply:	<ul style="list-style-type: none">• 115 VAC / 60 Hz• 230 VAC / 50 Hz
El. power consumption:	approx. 100 VA, (AULA 254-ASD: 120 VA)
Dimensions:	approx. 37 x 38x 44 cm (W x H x D)
Bench space requirements:	approx. 50 x 70 cm (W x D) (PC not included)
Weight:	approx. 14 kg (PC not included)



As a leading supplier of high precision analytical equipment, we strive at all times to offer top quality solutions. Our products are manufactured according to the ISO 9001 quality regulations.



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