

Mercury Ultratracer UT-3000

AMBIENT

Measuring of Total Gaseous Mercury (TGM)
in Air and other gases at Ultra Trace Levels



- Air quality studies
- Monitoring of indoor air pollution
- Environmental pollution source tracking
- Plume profiling
- Studies of mercury dispersion in the atmosphere
- Studies of interaction between atmosphere and surfaces
- Pollution prevention
- Natural gas, hydrogen and other gases
- According to EN15852 standard

Measurement of total gaseous mercury in air or other gases at ultratrace levels



The **UT-3000 Mercury Ultratracer** provides a compact and reliable tool for measuring mercury in gases at ultra trace levels. Utilizing the high performance GoldTrap amalgamation module and an optimized state-of-the-art AA-mercury vapor detector the **UT-3000 Ultratracer** offers detection limits at sub-ng/m³ (ppq-parts per quadrillion) levels.

Measuring principle

The sample gas is fed into an optical cell by a maintenance-free membrane pump. A beam of UV light passes through the optical cell, a part of it is absorbed by the mercury atoms present in the sample. This method is called „atomic absorption spectroscopy“ or shortly AAS. It is extremely selective and sensitive. For mercury determination the AAS method has maintained its importance even if other methods have been worked out since the early beginnings. The AAS method is low in interference and does not require expensive carrier gases.

Automatic operation

The **UT-3000** operates automatically. All functions are controlled by an embedded microprocessor. Once the analysis has been started, measurements are performed and data are collected by the built-in datalogger. The datalogger has a recording capacity of more than 5 000 measurements.

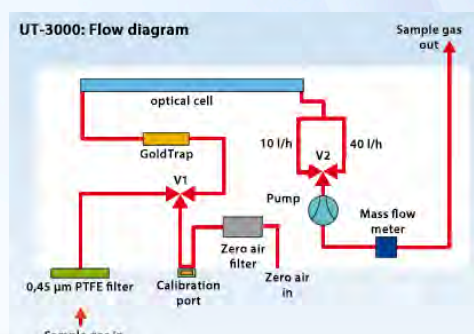
The GoldTrap, the “Heart of Gold“

The Mercury GoldTrap is a new Mercury concentration system that was developed for the **UT-3000**. It is a key component of the measuring system and has significantly improved properties compared to previous gold amalgamation methods. The GoldTrap consists of a wafer-thin ceramic tube with minimum thermal inertia located inside a protective cylinder. Ultra pure, solid gold is used as the collecting medium.



How does the GoldTrap in the UT-3000 work?

The ENVEA GmbH GoldTrap captures the total gaseous mercury (TGM) directly from the gas phase. The mercury is retained by the gold surface and removed from the sample gas in this way (gold amalgamation). After this accumulation phase the GoldTrap is heated up quickly. The bound mercury is released suddenly (thermal desorption). The mercury now exists in gaseous form as mercury vapour, it is swept by an air stream into the optical cell of the detector. Here, the mercury content is measured using atomic absorption spectrometry.



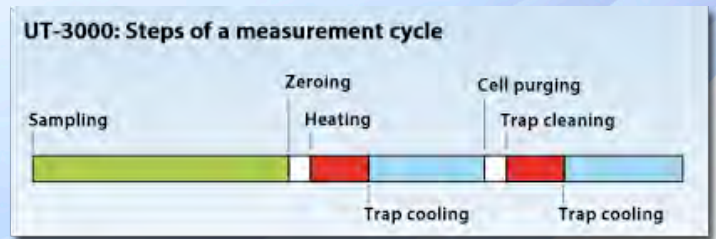
Measuring cycle sequence with the GoldTrap accumulation system

The GoldTrap is heated by an electric coil which is in direct contact with the ceramic surface. During the heating phase, the GoldTrap releases the captured mercury in sharp, high peaks.

A measurement cycle takes around 90 seconds. The GoldTrap is characterised by excellent long-term stability.

The use of air as a carrier gas is also advantageous during thermal Hg desorption as substances that could contaminate the system are oxidised and flushed out. This prevents any passivation of the gold surface.

For measurements in the trace range, it is particularly important that the gold is absolutely clean before measuring. To ensure this, a cleaning step is automatically performed before each measurement cycle. A PTFE-fine filter on the measurement gas inlet keeps particulate or aerosol droplets away from the measurement system. This means there is negligible interaction with the mercury to be determined.

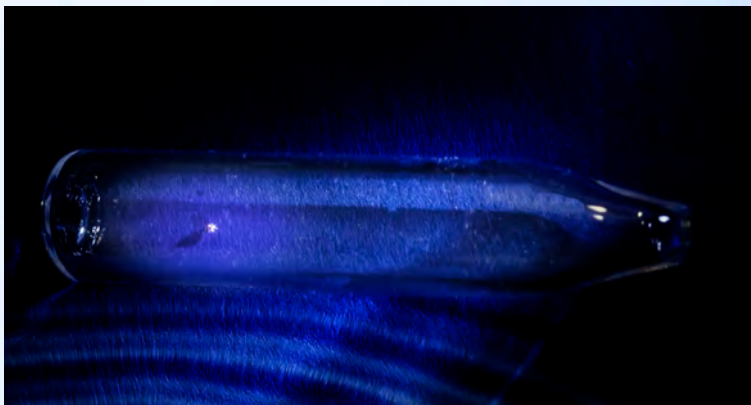


Sample flow control

The sample flow is measured with a high precision electronic mass flow meter. The flow rate integrated over time gives the total sample volume. The flow is automatically changed to a lower value during the desorption step to achieve maximum sensitivity.

Atomic absorption detector

The detector used in the UT-3000 provides a maximum of sensitivity, precision and stability. A high frequency driven electrodeless mercury low pressure lamp is used as UV light source.



It generates a 253.7 nm emission line of an extremely narrow bandwidth which is congruent with the absorption line of the Hg atoms measured. The reference beam method is applied to get an exceedingly high stability of the UV source. The mercury concentration is measured in an optical cell which is made entirely of fused silica (Suprasil).

Thanks to the sensitivity enhancement provided by the GoldTrap there is no need for a long path cell which always has a greater surface effect. Solid state UV detectors are used for absorption measurement.

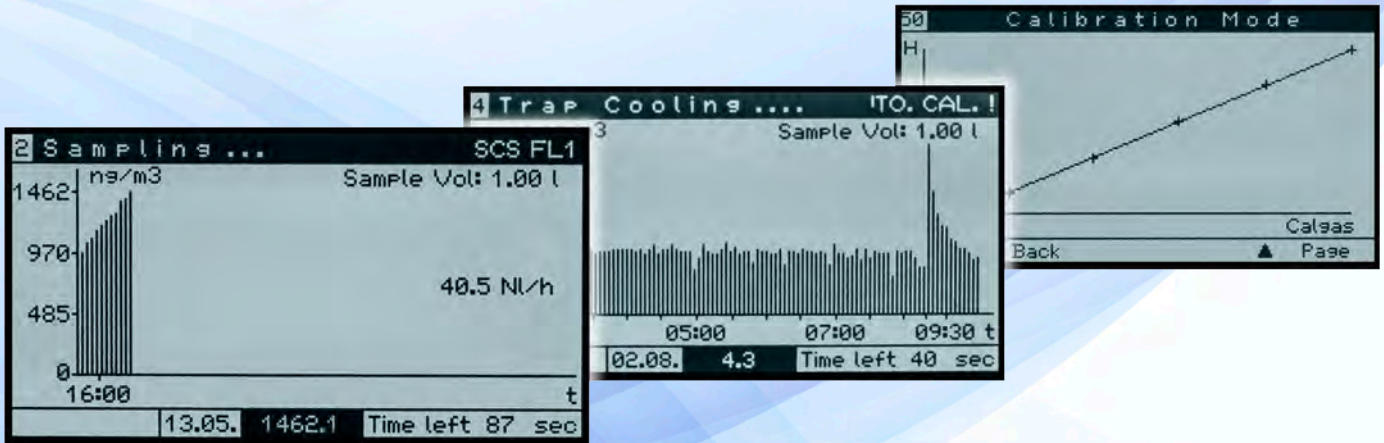
Calibration

For checking and calibrating the analyzer ENVEA GmbH offers a **manual** as well as an **automatic** calibrator as optional accessories. With both calibrators a defined volume of mercury saturated air is injected in the built-in calibration port of the UT-3000 and sampled in the GoldTrap. This method of static calibration is quick, safe and precise.

When calibrating manually a specially designed gas-tight syringe is used for injection of the calibration gas.



Display and output of measurements



The results of the measurements are displayed on a graphic LCD as a graph and numerically. It is possible to view past readings with a paging function. Calibrations are stored in a non-volatile memory.

The UT-3000 has a serial interface (RS232 / USB) for data transfer to a PC and an analogue 4-20 mA output.

AutoRange function

For on-line operation (e. g.: Natural Gas Systems) the UT-3000 can be equipped with an AutoRange function. If activated the sample volume will be automatically be adjusted according to the mercury concentration of the sample. After starting the measurement the smallest possible sample volume will be selected automatically. If the absorbance signal is too low, the sample volume will be increased until the absorbance is within the optimum range.

Advantages of the AAS detection method

The latest AA detection technique used in the UT-3000 offers some clear advantages over other methods. Mercury trace detection by fluorescence must use a carrier and sometimes a sheath gas and suffers from the quenching effect which can never be completely eliminated.

The UT-3000 requires no expensive gases for operation and there are no negative interferences caused by the quenching effect. Sensitivity and detection limits are far superior to those instruments based on measurement of electrical resistivity of a thin gold film.



Mercury monitoring in natural gas and LNG

Mercury is a frequent constituent of natural gas. It can be found in concentrations ranging from a few $\mu\text{g}/\text{m}^3$ to more than $10000 \mu\text{g}/\text{m}^3$. An important application for the UT-3000 is the measurement of mercury in natural gas and liquefied natural gas (LNG). A special version of the UT-3000 analyser is dedicated for measurement of mercury in natural gas.

Both a manual system, the Tedlar® Bag Technique, (punctual measurements) as well as automatic systems for on-line installations are available.

For continuous monitoring of Hg concentrations in natural gas ENVEA GmbH offers the explosion-proof MMS-NG (Mercury Monitoring System for Natural Gas) in single channel or multi channel versions. Also available is the UT-3000 NG mobile, which can be used at varying measuring sites should need occur.

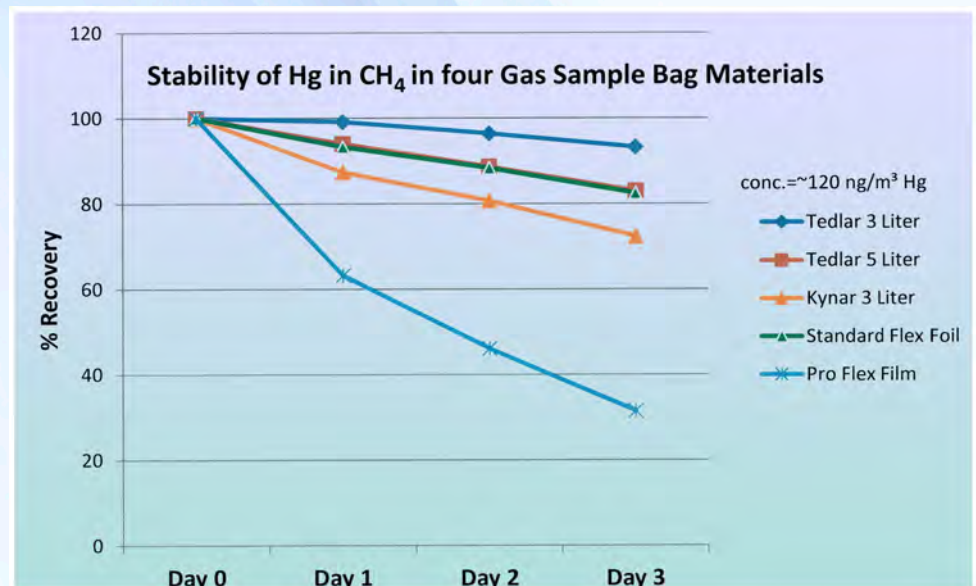


The superiority of Tedlar® Bags over other bag materials

The Tedlar® Bag allows to take samples hazard free in potentially explosive atmospheres. By using a special fitting Tedlar® Bags can hold 3 to 10 l of sample gas which can be injected into the UT-3000 for later measurement.

No need to hurry!

A comparative study by ENVEA GmbH in Karlsfeld, Germany shows that within one day practically no Hg recovery occurs (sample gas matrix: Methane).



Technical Specifications Mercury Ultratracer UT-3000

Measuring principle:	Amalgamation on gold (MI GoldTrap), UV absorption (CVAAS), Wavelength = 253,7 nm
Measuring component:	Total Gaseous Mercury (TGM)
UV source:	Electrodeless low-pressure mercury lamp (EDL)
Stabilization method:	Reference beam method
Optical cell:	Fused silica (Suprasil), Length approx. 230 mm, heated, approx. 45°
Sample volume:	0,1 l ... 10 l
Sampling duration:	9 seconds ... 15 minutes
Measurement cycle time:	3 ... 17 minutes
Detection limit:	0,1 ng/m ³ corresponding to 0,5 pg Hg absolutely
Measuring ranges:	<ul style="list-style-type: none"> at 10 l sample volume: 0,1 ng/m³ to 1000 ng/m³ at 1 l sample volume: 1 ng/m³ to 10 000 ng/m³
Sample volume determination:	Electronic massflow meter (calibrated to 0 °C; 1013 mbar)
Sample gas pump:	Rotary vane pump
Sample gas filter (at inlet):	Membrane filter PTFE 0,45 µm, exchangeable
Carrier gas:	not required
Data display:	Display of real-time signal reading during gold trap heating period, display of measurement results in a bar graph diagram
Data logger function:	Built-in data logger for up to 5 000 measurements
Signal output:	<ul style="list-style-type: none"> analogue: 4 - 20 mA serial: RS232 / USB
Calibration:	<ul style="list-style-type: none"> manually: by injecting calibration gas from CalSet (option) into the calibration port automatically: with calibration gas unit AutoCal (option)
Power supply:	<ul style="list-style-type: none"> 110 - 230 V / 50 - 60 Hz 12 V DC (option)
Power consumption:	250 VA max (heating peak)
Dimensions:	45 x 15 x 35 cm (W x H x D)
Weight:	approx. 9 kg
Permissible ambient temperature:	0°C to 40°
Accessories	<ul style="list-style-type: none"> Carrying case with handle and wheels Battery power supply module



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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