



Product Information

## MERCEM

Continuous Monitoring of Mercury  
in Flue Gases

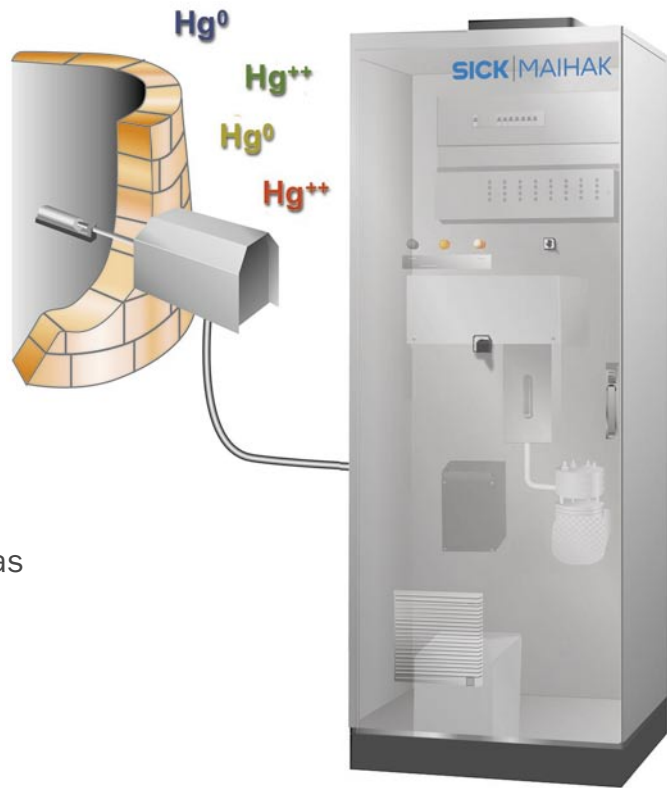


**SICK** | MAIHAK



## Analysis of mercury in flue gases

Modern legislation defines a very low limit value in the lower ppb-range of pollutants that are emitted into the atmosphere. This leads to higher or even new standard requirements in the measuring technology industry. SICK MAIHAK is able to face this challenge. MERCEM is a highly successful system that monitors mercury in flue gas on a continuous basis.



### The requirements of today and tomorrow

Mercem unites the advantages of an proven sampling technique developed by Sick MAIHAK with a standardized analyzing procedure. This enables complex analyzing methods to access industrial, continuous measuring technology.

### Field of application

- Waste incineration
- Sewage sludge incineration
- Hazardous waste incineration
- Cement production
- Biomass incineration
- Coal-fired power plant
- Ore processing
- Metal winning
- Specialized applications

### Key features

- Continuous measuring of total mercury in flue gas
- Comfortable handling
- Reliable and robust technology
- Auto-check of the zero-drift-point
- Internal test plant (optional)



## Established analyzing technique

In the field of harmful emission, special attention is being paid to heavy metals due to their high toxicity. This is especially true for the highly volatile mercury and its compounds. During combustion processes, such as take place in waste incineration plants, mercury is released as compound and as elemental mercury. To get a comprehensive record off the total mercury content in flue gas all Hg components need to be measured. However, dust-bound mercury plays a minor role in the total emission of the majority of incineration plants.

### Reliable reduction method

To determine the total sum of mercury content in stack gases it is essential to convert Hg-compounds to elemental mercury. The MERCEM system applies the tin(II)-chloride reduction technique, also well established in manual measurements.

### Detection Limits

The detection of very low concentrations are achieved by coupling a enrichment process (amalgamation) to the reduction procedure. By adjusting the duration of enrichment the measurement range as well as the detection limit can be varied and adjusted to meet individual requirements.

### No Spectral Cross Sensitivity

Another advantage of the amalgamation procedure is that the mercury analyzer is not in direct contact with the flue gas. Thus interference by concomitant flue gas components are eliminated.

### Minimizing Of Memory Effects

Specific to mercury salts are the strong memory effect during gas sampling. MERCEM is capable of minimizing the memory effect by utilizing very high sample gas flow rates and providing continuous heating to all system components that come into contact with the gas sample.

### Integrated reference standard

The use of external calibration gas can be avoided by opting for an automatic plausibility check function. For this purpose an exact defined amount of mercury is injected into the MERCEM analyzer during a cyclical or manual upstart. This generates a reproducible measuring value as reference standard.

### Economic Efficiency And Adaptability

The deployment of the reduction procedure allows longer servicing intervals due to loading optimization. By attaching the MERCEM to the multi component measuring system MCS 100 E HW multi-component analysis system, made by SICK MAIHAK, the need for separate sampling equipment is unnecessary and thereby reduces cost of acquisition and servicing.



# Overview Of The system

The Mercem is a system cabinet that contains a sample gas pump, a flow meter and an analyzer unit with a sample gas treatment unit. The system can be operated as a stand-alone unit or in combination with the MCS 100 E HW multi-component analysis system.

### Easy Accessibility and Handling

The front door at the system cabinet, containing a large window, allows optimal access to all components for operating and servicing purposes. The ACE control unit and the MFU heating controller are integrated as 19" slide-ins into the door of the system cabinet and can be accessed via a separate transparent door. Consequently, the system can be operated without opening the system cabinet.

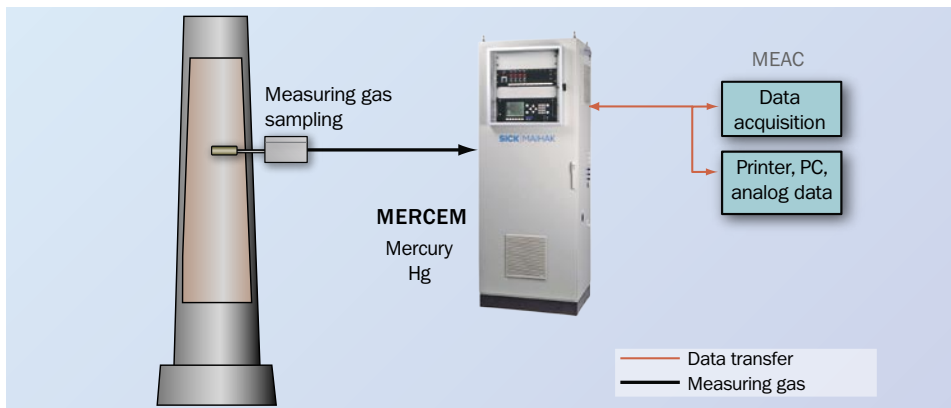
All components inside the cabinet can be easily accessed for servicing. The reservoir for reaction solution is placed just behind the front door for effortless replacement.



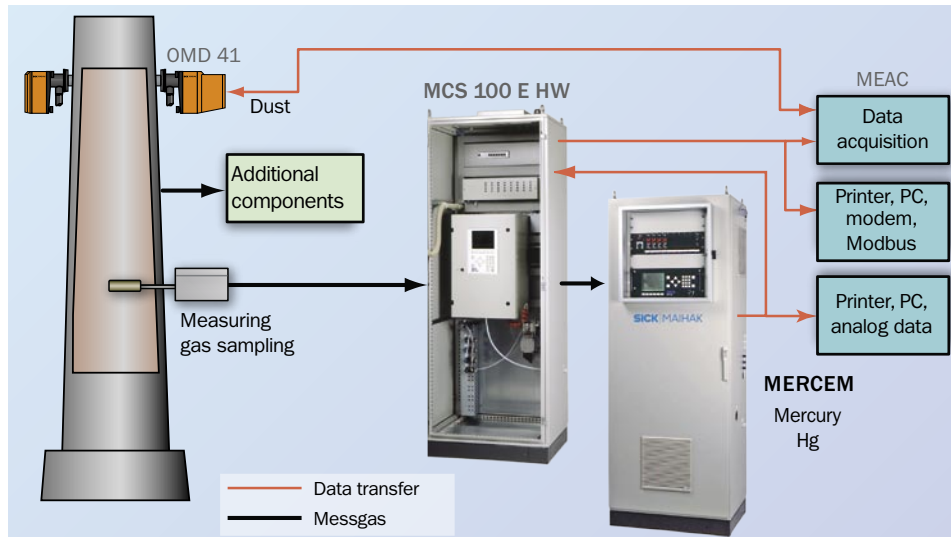
### Automatic Operation With Self-monitoring

Mercem contains all automatic control functions necessary for a system capable of continuous operation and little servicing requirements. In case of a dysfunction the measuring system switches automatically into "stand-by" modus and is flushed with an inert gas stream. For trouble-free operation of all system components, such as the reactor, the flow meter and the analyzer are checked automatically.

### MERCER standalone system



### MERCER in combination with the MS 100 E System



# Sample Preparation And Analysis

## Sample extraction

The sampling pump draws the stack gas via a gas sampling probe and sample gas tube into the system cabinet. All components that are in contact with the stack gas are heated to 180 °C to avoid condensation and corrosion. Inside the gas sampling probe dust is separated from the stack gas though its gaseous composition is not changed.

Memory effects are minimized by the high sample gas flow rate and high temperature. A second pump extracts a partial stream and feeds it to the reduction step and the analyzer unit.

## Reduction

The reduction of mercury compound to elemental (metallic) mercury in the reactor happens by means of the  $\text{SnCl}_2$  reaction solution. Peristaltic pumps remove excess condensation and add fresh reduction solution. The gas dries in a cooler unit and the remaining condensation is removed. The processed gas sample has a constant temperature of approx. 5 °C (dew point) and is led into the analyzer.

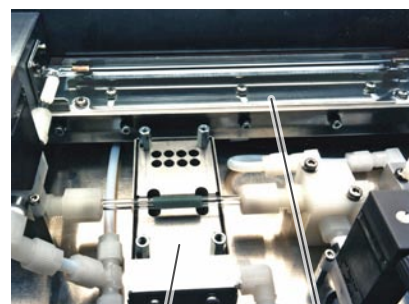
## Amalgamation

The first step in the analyzer is the amalgamation procedure. A precisely defined volume of the sample gas is transported through a gold trap whereby the metallic mercury forms an amalgam with the gold. As soon as the collecting phase has elapsed the gold trap is heated electrically to purge the mercury from the gold. The released mercury is carried by an inert carrier gas stream through the cell of a photometer where the concentration is determined. The analyzer is ready for the next measuring cycle after a cooling period.

The two main advantages of the amalgamation technique are that first the sensitivity of the analyzer is determined by the length of the collection phase and can be adjusted according to the required measuring range. Second, it prevents a spectral interference to the measurement by other stack gas components as it does not come in contact with the photometer.

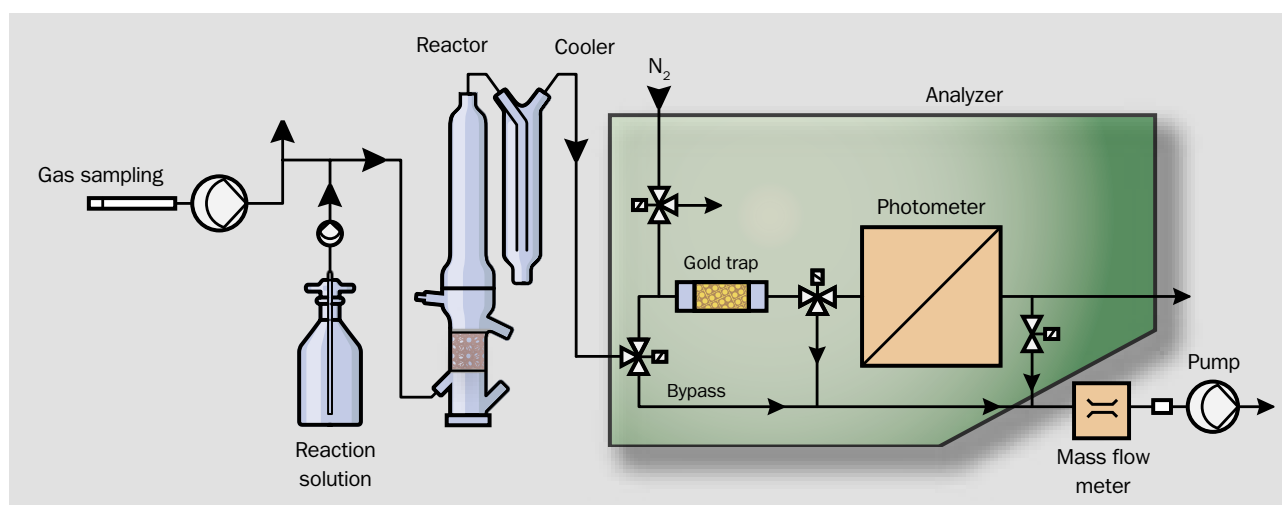
## Photometric measurement

The measurement of mercury happens by use of cold vapor- atomic absorption spectrometry (CVAAS). The single-beam photometer consists of a low pressure Hg- discharge lamp with high stability, a sample gas cell and a photodiode detector. Due to the automatic baseline correction before each measuring cycle safeguards the reliability of the measuring method.



Gold trap

Meas. gas cell



## System Control And Interfaces

ACE 100, the system control unit, is specific to the demands of industrial measurement technique. It contains a practice-oriented operating surface and fail-safe interfaces.



### Integrated Data Acquisition System

ACE 100 is an IBM-compatible computer in a 19" drawer with an illuminated LCD and a membrane keypad. A silicon disk offers mass storage capacity. The ACE 100 control the measurement sequence, calculates measured values, monitors limit values and provides results, warnings and alarms for the internal display and the opto-decoupled interfaces. Easy access to keypad and monitor are provided by being mounted directly behind the lockable transparent front door. An external keyboard can be easily connected if required, for e.g. servicing purpose.

### Easy-to-use Software

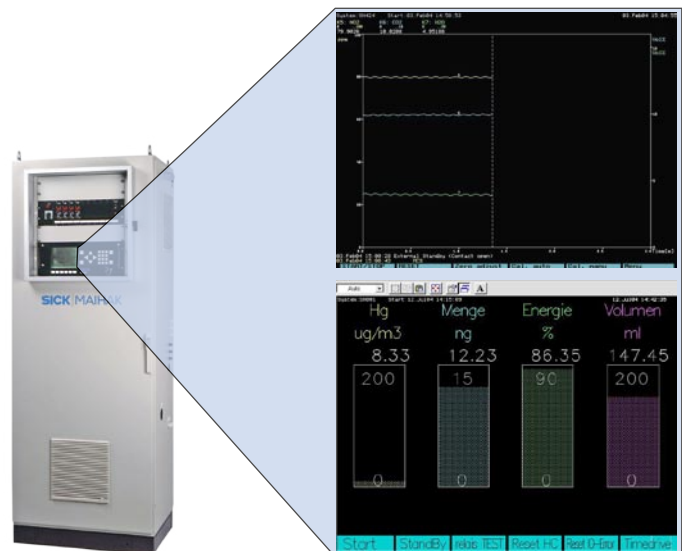
The appliance of the MERCEM meets the standard for modern measuring systems. The software is easy to use, entries are menu-controlled via cursor and function keys. There are two operating levels available, one is for measuring and one for servicing (password protected).

### Display Of Measured Values And Data Backup

All measuring and status data are displayed numerically, graphically or as a concentration curve on the LC-Display. Tracing the history of this data is possible due to the integrated mass storage disk.

### Interference-proof Interfaces, Automatic Change Of Measurement Range

Data in- and output occurs via de-coupled fiber-optic interfaces. Analog outputs (0/4-20 mA), with optional automatic switch-over mode for measuring ranges, and status signals are generated here. It is also possible to read in external digital and analog data and process them.



# Technical Data – Overview

| Technical Data  | MERCEM   |
|---|--|
| <b>Analyzer</b>                                       | <b>General information</b>   |
| Measuring principle                                   | Photometry, cold vapor-atomic absorption   |
| Measuring range<br>(acc. to 17 <sup>th</sup> BImSchV) | 0 ... 45 µg/m <sup>3</sup> (smaller range on request)<br>measuring range switching freely programmable (option)  |
| Cycle time of measurement                             | 180 s (sec)  |
| Response time T <sub>90</sub>                         | 380 s (sec)  |
| Detection limit                                       | < 5 % of daily limit value (17 <sup>th</sup> BImSchV: < 1,5 µg/m <sup>3</sup> )  |
| Limit values  | 2 limits functioning as change-over contact  |
| Zero drift  | < 3 % of the measuring range final value/servicing interval  |
| Span drift  | < 3 % of the measuring range final value/servicing interval  |
| Influence of temperature                              | < 5 % of the measuring range final value/ΔT = 35 °K)   |
| Sensitivity control                                   | Optional with internal testing standard (MGG)  |
| Flow  | Sampling: 1000 l/h (264 gal/hr), analyzer: 35 l/h (9 gal/hr)   |
| Auxiliary substances                                  | Instrument air: peak value 2000 l/h (528 gal/hr), average value: 350 l/h (90 gal/hr)<br>N <sub>2</sub> : 5 l/h (1.3 gal/hr); SnCl <sub>2</sub> solution, consumption 0.08 l (0.02 gal) per day, reservoir 10 l (2.6 gal) |
| Interfaces  | Optical, serial interfaces (V.24); optional opt./elect. converter  |
| Signal outputs  | <ul style="list-style-type: none"> <li>■ 4 analog outputs, 0/4 – 20 mA; max. load Ω max.</li> <li>■ 5 relay outputs, freely assignable (bias reducing potential max. 250 V AC; current max. 6 A)</li> </ul>              |
| Signal inputs   | <ul style="list-style-type: none"> <li>■ 2 analog inputs, 0/4 – 20mA; freely assignable</li> <li>■ 11 relay inputs, freely assign. (bias reducing pot. 11 to 40 V AC; small-signal input resist. 2,2 kΩ)</li> </ul>      |
| Display   | 7.4" monochrome LC monitor with 640 x 480 pixel  |
| Keypad  | Numeric membrane keypad with cursor and function keys, external keyboard may be connected  |
| BedienOperationung                                    | 2 operation levels, one for user, one for servicing purpose (password protected) freely programmable sequence program  |
| Maintenance interval                                  | 4 weeks  |
| Authorization/Conformity                              | 17 <sup>th</sup> BImSCHV, TÜV report no 936/80005/A from 01/29/2001<br>GMBI circular letter of the BMU IG13-51134/2 from the 04/17/2001  |
| Standards   | EN 61010-1; EN 61326   |
| <b>System cabinet</b>                                 |  |
| Dimensions (H x W x D)                                | 2100 mm (incl. 100 mm socket) x 800 mm x 600 mm (83 in (incl. 4 in socket) x 31.5 in x 24 in)  |
| Weight  | 340 kg (750 lb)  |
| Material  | Steel sheet, RAL 7035 (light gray)   |
| Power supply  | 3-ph: 230 V/50 Hz; +10, –15 %<br>115 V/60 Hz; +10, –15 %; other voltage on request   |
| Power consumption                                     | <ul style="list-style-type: none"> <li>■ Cabinet: max. 1900 VA</li> <li>■ Heated sampling probe: max. 450 VA</li> <li>■ Gas sampling filter: max. 450 VA</li> <li>■ Heated gas sampling line: max. 100 VA/m</li> </ul>   |
| Ambient conditions                                    | Temperature: +5 ... +40 °C (+41 ... + 104 °F)<br>Humidity: up to 80% (not condensing)  |
| Degree of protection                                  | <ul style="list-style-type: none"> <li>■ IP 43</li> </ul>  |
| Interference resistance                               | EMV, tested in accord. with NAMUR (commendation for advanced interference resistance)  |

# Der Dialog geht weiter.

Kopieren, ausfüllen und faxen an +49 7641 469 11 49

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|---------------------------|----------------------|
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| Name                      | <input type="text"/> |
| Funktion/Abt.             | <input type="text"/> |
| Straße, Nr.               | <input type="text"/> |
| PLZ, Ort                  | <input type="text"/> |
| Telefon/Fax               | <input type="text"/> |
| Branche/<br>Einsatzgebiet | <input type="text"/> |

Ja, ich möchte mehr wissen über  
den Bereich:

- |   |   |
|---|---|
| <input type="checkbox"/> Gasanalyse im Prozess            | <input type="checkbox"/> Ich bin an einer ausführlichen Beratung durch<br>einen Ihrer Projektberater interessiert.<br>Bitte vereinbaren Sie einen Termin mit mir. |
| <input type="checkbox"/> Rauchgasüberwachung              |   |
| <input type="checkbox"/> Emissionsüberwachung             |   |
| <input type="checkbox"/> Staubmessung                     |   |
| <input type="checkbox"/> Volumenstrommessung              |   |
| <input type="checkbox"/> Messwerterfassung und Auswertung |   |
| <input type="checkbox"/> Wasseranalyse                    |   |
| <input type="checkbox"/> Flüssigkeitsanalyse              |   |
| <input type="checkbox"/> Füllstandmessung                 |   |
| <input type="checkbox"/> Verkehrssensorik                 |   |
| <input type="checkbox"/> Spezialmesstechnik               |   |

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