PRODUCT INFORMATION

MERCEM
Mercury Analysis System

Continuous Monitoring of Mercury in Flue Gases

SICK
Sensor Intelligence.

Reliable Analysis Technology for Measurements 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 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 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 of 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 MCS100E HW multi-component analysis system, made by SICK, the need for separate sampling equipment is unnecessary and thereby reduces cost of acquisition and servicing.

Mercury Analysis in Detail

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 MCS100E HW multicomponent analysis system.

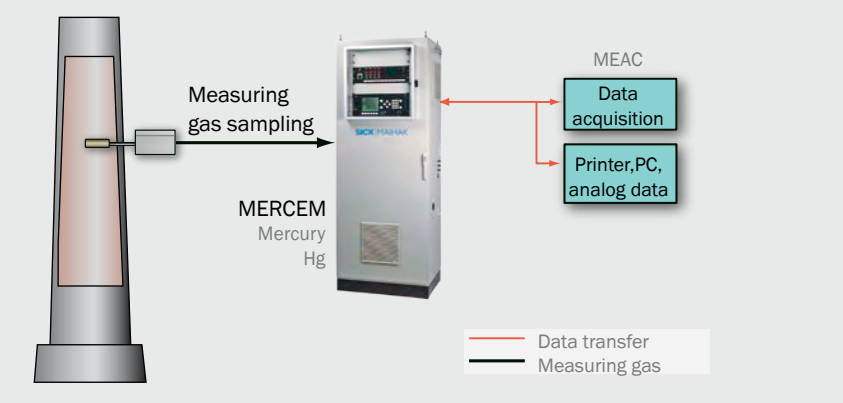
Easy accessibility and handling

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.

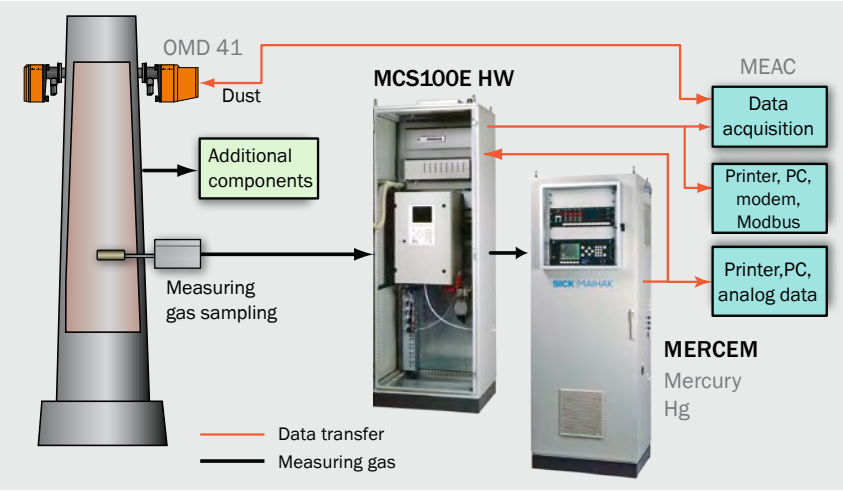
Automatic operation with self-monitoring

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.

MERCEM stand-alone system



MERCEM in combination with the MS100E 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 (355 °F) to avoid condensation and corrosion. Inside the gas sampling probe dust is separated from the stack gas though its gaseous composition is not hanged. Memory effects are minimized by the high sample gas flow rate and high temperature. A 2nd pump extracts a partial stream and feeds it to the reduction step and the analyzer unit.

Reduction

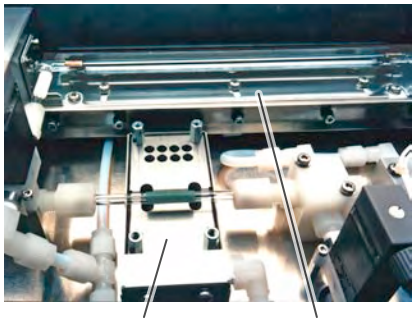
The reduction of mercury compound to elemental (metallic) mercury in the reactor happens by means of $SnCl_2$ reaction solution. Peristaltic pumps remove excess condensation and add fresh reduction solution. The gas dries in a cooler unit, the remaining condensation is removed. The processed gas sample has a const. temp. of appr. 5 °C/41 °F (dew point) and is led into the analyzer.

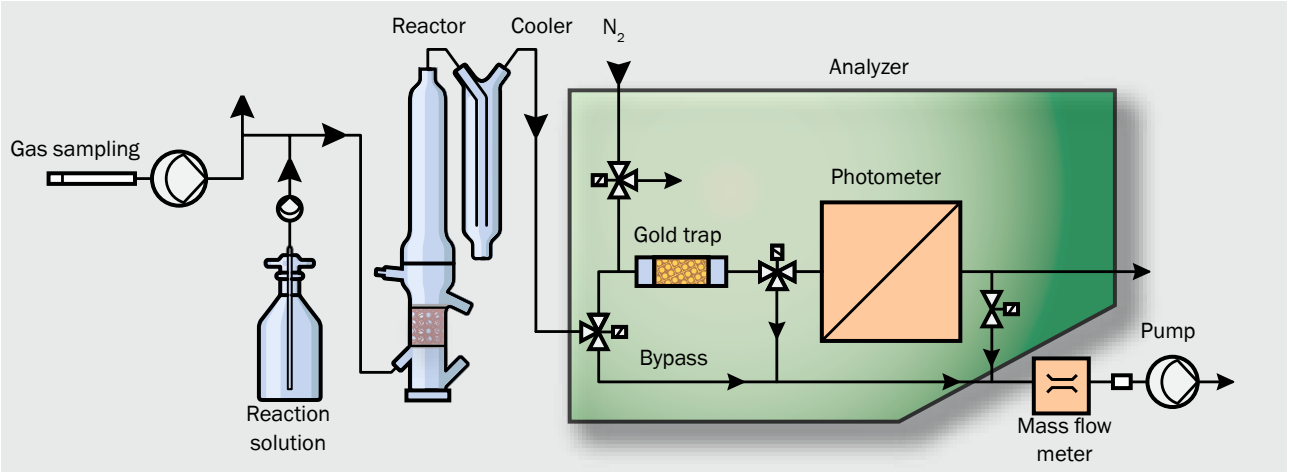
Amalgamation

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.

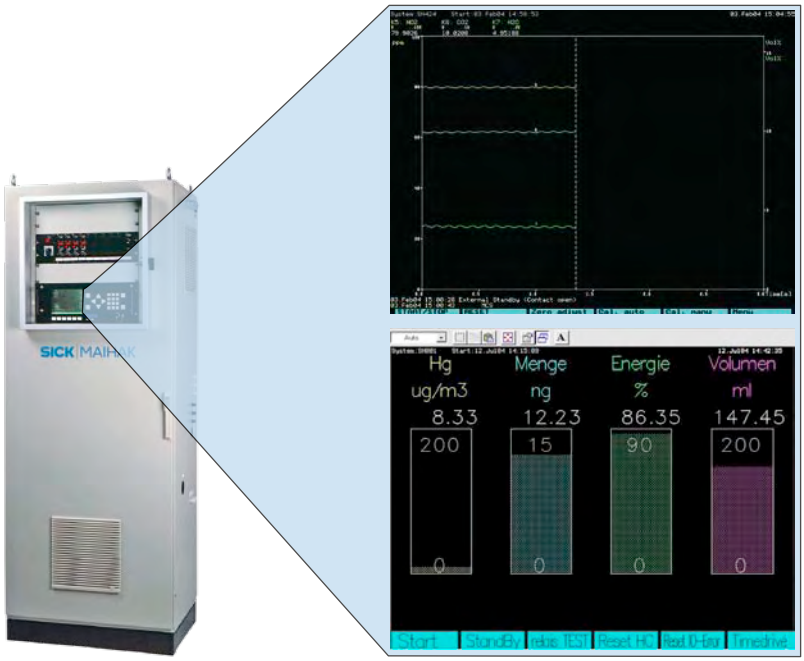




Specifications

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 decoupled 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

Technical Data	MERCEM	
Analyzer	**General information**	
Measuring principle	Photometry, cold vapor-atomic absorption	
Measuring range (acc. to 17th BImSchV)	0 ... 45 µg/m³ (smaller range on request) measuring range switching freely programmable (option)	
Cycle time of measurement	180 s (sec)	
Response time T_{90}	380 s (sec)	
Detection limit	< 5 % of daily limit value (17th BImSchV: < 1,5 µg/m³)	
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) N_2: 5 l/h (1.3 gal/hr); $SnCl_2$ 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	• 4 analog outputs , 0/4 –20 mA; max. load Ω max. • 5 relay outputs, freely assignable (bias reducing potential max. 250 V AC; current max. 6 A)	
Signal inputs	• 2 analog inputs, 0/4 – 20mA; freely assignable • 11 relay inputs, freely assig. (bias reducing pot. 11...40 V AC; small-signal input resist. 2.2 kΩ)	
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: user and servicing (password protected) freely programm. sequence program	
Maintenance interval	4 weeks	
Authorization/Conformity	17th BImSCHV, TÜV report no 936/80005/A from 01/29/2001 GMBl circular letter of the BMU IG13-51134/2 from the 04/17/2001	
Standards	EN 61010-1; EN 61326	
System cabinet		
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 % 115 V/60 Hz; +10, –15 %; other voltage on request	
Power consumption	• Cabinet: max. 1900 VA • Heated sampling probe: max. 450 VA	• Gas sampling filter: max. 450 VA • Heated gas sampling line: max. 100 VA/m
Ambient conditions	Temperature: +5 ... +40 °C (+41 ... + 104 °F) Humidity: up to 80% (not condensing)	
Protection class	• IP 43	

AT HOME IN THE INDUSTRIAL SECTOR

We can build on years of experience in the field of Analyzers and Process Instrumentation. That is why we are at home in the world of cement and power plants as well as in the chemical and petrochemical sector. Be it emission control at the waste treatment or process optimization for steel manufacturing, SICK MAIHAK offers tailor-made solutions.

WE OFFER YOU A CHOICE

SICK MAIHAK offers a number of sensor-based techniques for analysis, ranging from the continuous gas and dust measurement to specialized applications for water and liquid analysis. Within the process measurement technology SICK MAIHAK products play a central role in determining volume flow of gases and level of bulk materials.

AROUND THE WORLD TO YOUR SERVICE

Where ever you are, our global network of subsidiaries and representatives is able to supply qualified support when you need it. We deliver the equipment for your measuring tasks, provide documentation and training. Our highly skilled service staff offers support during installation, commissioning and maintenance of the appliances.

SICK GROUP

SICK MAIHAK represents the process automation segment of the SICK group, one of the worlds leading manufacturer of intelligent sensors and sensor solutions. With its 4,000 employees, SICK is able to offer an extensive portfolio of products and services on the market of factory automation.
www.sick.com

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