EMISSIONS MONITORING

IMR7500

Continuous Emission Monitoring System (CEMS)

THE BASICS

Flue gas analyzers with electrochemical sensors for emission control purposes are in use in many industrial applications. To increase the efficiency, the availability as well as the durability, gas conditioning systems are used to eliminate soot and dust particles in the flue gas sample and to avoid condensation of target substances. Measuring data are transferred online during the measurement, or from the analyzer memory via RS 232 or RS 485 interfaces. Processing of measuring data is today, even with standard software, a simple task.

It is not a secret anymore that analyzers using electrochemical sensors are as accurate and durable as systems based on physical measuring technology. More important than the measuring technology is the selection of the analyzer components. Flue gas extraction probes made of stainless steel, gas conditioning systems made of glass and the quality of the pump and the motor are the key components to guarantee high accurate measuring results. An exact definition of the application and the measuring ranges is essential. This provided, and an analyzer with electrochemical sensors performs well in a CEM application, but even more cost efficient in the overall cost.

THE APPLICATION

The IMR7500 is a system for continuous emission monitoring (CEM) of flue gases in industrial applications. Up to 6 gases can be measured simultaneously. Typical application for the IMR7500 are:

- Emission monitoring
- Furnace optimisation
- Environmental monitoring
- Combustion control

THE PERFORMANCE CRITERIA

Gentics is using electrochemical sensors for the gas components O_2, CO, NO, NO_2, SO_2 and H_2S . For the gases CO_2 and C_xH_y NDIR – (non dispersive infrared absorption) sensors are used.

The IMR7500 is a modular system and consisting of the components flue gas conditioning, flue gas pump and the analyzer. The components are built-in a 19" rack, and allow easy access for maintenance and service. All components that get in touch with the flue gas, such as pump, magnetic valve and the sensors are located after the flue gas conditioning system to avoid corrosion due to alcalic and/or basic condensate. A humidity sensor in the gas path way provides additional safety for the analyzer components in case of failure of the gas conditioning system. The integrated 5,5" TFT-Display allows easy check on the analyser readings and the operating condition. Status signals allow documentation of the analyser status such as service, instrument failure and online measurement.

The installation on site of a IMR7500 is conveniently made in real time from a personal computer. Same for the regular calibration of the analyzer with single standard gases. In pre-programmed intervals the analyzer is performing a 0 calibration with ambient air. The IMR7500 ensures an annual availability of over 99 %.

Additionally to the analysis of flue gases, the IMR7500 can also measure flue gas temperature, flue gas volume and flue gas velocity. Measuring data are available in digital form at the interfaces RS 232 or RS 485, or as analogue signal 4...20 mA. **Gentics** offers also a data visualisation software TabGraph+. The calibration software is included in the

IMR7500. It can be operated on any Microsoft compatible personal computer.

THE SOLUTION

Gentics offers also complete solutions for continuous emission monitoring systems such as the installation of analyzers in cabinets and containers for indoor as well as outdoor applications. The scope of delivery includes gas extraction probes and heated sampling lines. For complete systems, **Gentics** provides a questionnaire to generate all project related information.

IMR7500, the cost efficient CEM system from **Gentics**.

THE MEASURING PRINCIPLE

The major advantages of electrochemical sensors are fast response, high linearity and high reproducibility.

Electrochemical sensors are by definition micro fuel cells, designed to be maintenance free and stable for long periods. They have a direct response to volume concentration of gas rather than partial pressure. The simplest form of electrochemical toxic gas sensors comprises two electrodes, sensing and counter, separated by a thin layer of electrolyte. This is enclosed in a plastic housing that has a small capillary to allow gas entry to the sensing electrode and includes pins which are electrically attached to both electrodes and allow easy external interface.

Gas diffusing into the sensor is either oxidised or reduced at the sensing electrode and, coupled with a corresponding (but converse) counter reaction at the counter electrode, a current is generated through the external circuit. This signal is digitalised as gas concentration in ppm (parts per million). The indication of the measuring results is either in ppm or in mg with oxygen reference.

To eliminate the cross interference reaction of the various sensors, the IMR7500 uses additionally a mathematic correction with matrix calculation. Another advantage of this form of calibration is that the sensor performance over the lifetime of a sensor can be optimised. This eliminates also the possibility of incorrect measuring results due to unusual high sensor drift. The life span of electrochemical sensors is in average 2 years for oxygen sensors and 3 years for the toxic gas sensors.

For the measurement of CO_2 and Hydrocarbons **Gentics** features NDIR sensors.

THE FLUE GAS CONDITIONING

The most efficient way to condition gas for flue gas analysis is the refrigeration of the flue gas humidity in a way of controlled condensation. The advantage of this technology is that condensation of target substances can be avoided. This is achieved in the gas conditioning system included in the IMR7500. The condensed humidity of the flue gas is drained off with a peristaltic pump. To guarantee controlled condensation, the shape of the heat exchanger in the cooling block is very important. **Gentics** has adopted a system that enforces immediate contact of the entering flue gas with the refrigerated wall of the heat exchanger. The instant temperature reduction to approx. 5°C separates the condensate from the gas. The Peltier controlled gas preparation is the most efficient way of flue gas conditioning. The gas conditioning system in the IMR7500 is maintenance free.

THE DATA PROCESSING

Available for the IMR7500 is the data processing software TabGraph+ Measuring data transferred over the digital or analogue interfaces are displayed in real time in tabular or graphic form. TabGraph+ is programmed to store the incoming measuring data directly on the hard disc of the computer to avoid data loss due to computer malfunction or power shut-down. TabGraph+ can also be used to further process the measuring data into average readings to generate daily averages or annual averages. TabGraph+ is an application compatible with any Microsoft Windows system. Establishing an online connection for the PC, the IMR 7500 can also be factory controlled for diagnosis or online maintenance.

The IMR7500 is the complete system for continuous emission monitoring for almost every industrial application.

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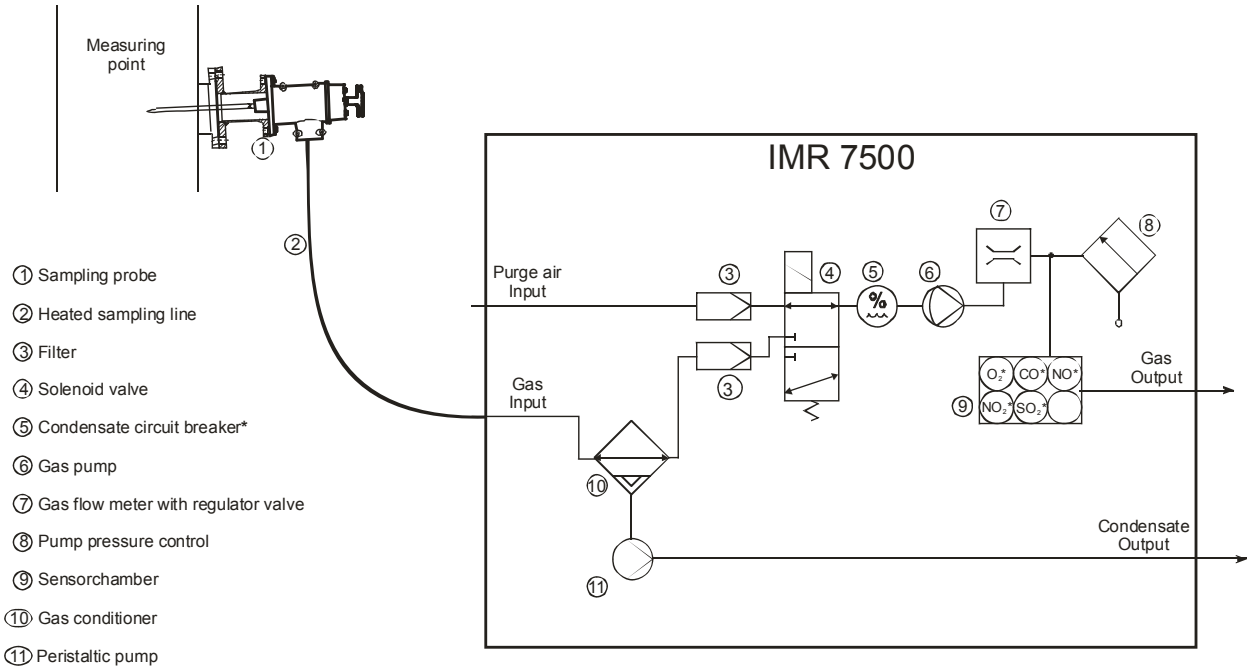

GENTICS®

TECHNICAL DATA

COMPONENT	METHOD	SMALLEST MEASURING RANGE	LARGEST MEASURING RANGE	RESOLUTION	ACCURACY
O_2 (Oxygen)	electrochem. sensor	0 ... 20,95 Vol.-%	0 ... 20,95 Vol.-%	0,01 Vol.-%	± 0,2%
CO (Carbon monoxide)*	electrochem. sensor	0 ... 75mg/m³ *	0 ... 5 Vol.-%	< 100 mg/m³: 0,1 mg > 100 mg/m³: 1,0 mg	max. ± 1,5% from end of measuring range
NO (Nitric oxide)*	electrochem. sensor	0 ... 200mg/m³ *	0 ... 5.000mg/m³	< 100 mg/m³: 0,1 mg > 100 mg/m³: 1,0 mg	max. ± 1,5% from end of measuring range
NO_2 (Nitric dioxide)*		0 ... 100mg/m³ *	0 ... 500mg/m³		
SO_2 (Sulfur dioxide)*		0 ... 75mg/m³ *	0 ... 5.000mg/m³		
H_2S (Hydrogen sulfide)**		0 ... 60mg/m³	0 ... 300mg/m³		
H_2 (Hydrogen)**	TCD	0 ... 20 Vol.-%	0 ... 100 Vol.-%	< 100 mg/m³: 0,1 mg > 100 mg/m³: 1,0 mg	± 3%
O_2 (Oxygen)**	paramagnetic sensor	0 ... 20,95 Vol.-%	0 ... 100 Vol.-%	0,01 Vol.-%	± 0,2%
CH_4 (Methane)**	Infrared sensor (NDIR)	0 ... 0,2 Vol.-%	0 ... 100 Vol.-%	0,1 Vol.-%/1 ppm	± 2%
CO_2 (Carbon dioxide)**		0 ... 20 Vol.-%	0 ... 100 Vol.-%		
CO (Carbon monoxide)**		0 ... 2.000 ppm	0 ... 100 Vol.-%		
NO (Nitric oxide)**		0 ... 2.000 ppm	0 ... 100 Vol.-%		
SO_2 (Sulfur dioxide)**		0 ... 2.000 ppm	0 ... 100 Vol.-%		
H_2O (Water)**	Laser Gas Detector (TDLS)[1]	0 ... 10 Vol.-%	0 ... 30 Vol.-%	0,1 Vol.-%/1 ppm	± 2%
NH_3 (Ammonia)**		0 ... 100 ppm	0 ... 500 ppm	0,1 ppm	
HCl (Hydrogen chloride)**		0 ... 20 ppm	0 ... 50 ppm	0,1 ppm	
°C (Sample Gas temperature)	Thermoelement NiCr-Ni	0 ... 500 °C	0 ... 1000 °C	1 K	± 1 K

The analyzer complies with DIN EN 14181, TÜV approved 936/21200089/A.

[1] Only in conjunction with IMR7600

FURTHER TECHNICAL DATA	
Weight	14 kg
Dimensions	19" rack system, 6RU – 430 mm deep
Power Supply	230 VAC, 50/60 Hz
Power consumption	approx. 200 W (plus up to 100 W/m of heated sampling line)
Operating temperature	+5°C to +40°C
Data signal parts	RS 232, 4 ... 20 mA per parameter and 2 ... 10 V
Capacity of gas conditioning system	≤ 150 l/h
Pump volume	≤ 3,0 l/min
max. draft	500 mbar abs.
Reproducibility	> 30
Response time/T90	< 115 sec
Annual availability	> 99%
Drift (electro chemical sensor):	< 5%/year
Linearity	< ± 2,0% of range
Zero- and referent point drift	< ± 3%
Detection limit of smallest range	< 1,4%
Cross interference	< 4%

* Measurements are approved according to TA - Luft, in particular according to the 13. BImSchV, 17. BImSchV, 27. BImSchV in accordance with the DIN EN 14181
**Other measuring ranges on request