



Wet gas extractive dust measurement for ATEX applications MARV 2Ex



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Description of the MARV 2EX extractive system

MARV 2EX = Extractive EX-proof Optical Particle Monitoring CEMS

Extractive, Isokinetic and Temperature controlled continuous particulate measurement for wet processes in explosive atmosphere

The system is designed to continuously measure concentration of the dust particles inside industrial stacks. It is an ideal solution for dust concentration monitoring in wet conditions, for example after wet scrubbers or in condensing environments.

MARV 2EX model is the only one, which can measure dust in applications with explosive atmosphere according to ATEX requirements (Zone 1/2).

In order to be used in explosive atmospheres, MARV 2EX dust monitor is using special configuration:

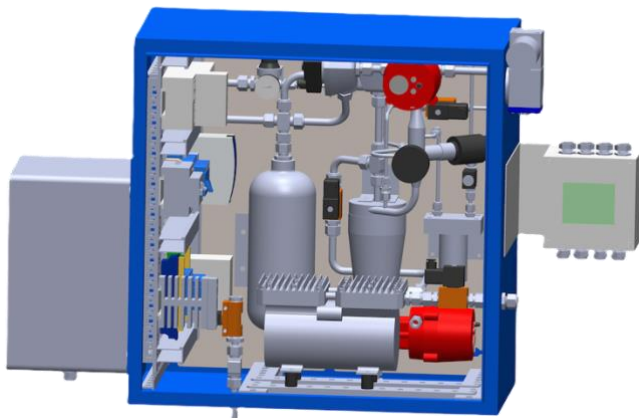
- a nitrogen (N₂) heated sampling probe,
- a N₂ purged optical sensor module,
- and an integrated PLC,

which are housed in a weather-proof powder coated steel enclosure, where a protective gas, N₂, maintained at a pressure above that of the external atmosphere is used to guard against the formation of an explosive gas atmosphere.

In a complete installation the probe is inserted inside a stack perpendicular to the process flow using a flange. An internal sample pump ejects at the end of the sampling line and draws flue gas through the internal piping of the device and ejects it back into the stack.

During operation, the probe continuously extracts a gas sample, which is heated by continuous heated N₂ flow through the probe to vaporize any moisture. The remaining dried particles are directed through the measurement chamber of the optical sensor module. Light from an LED is directed through the particle stream, which causes the light to scatter. A scattered light detector captures the scattered light and determines the particle concentration in the gas sample from the amount of scattered light. The underlying method is called "optical forward scattering".

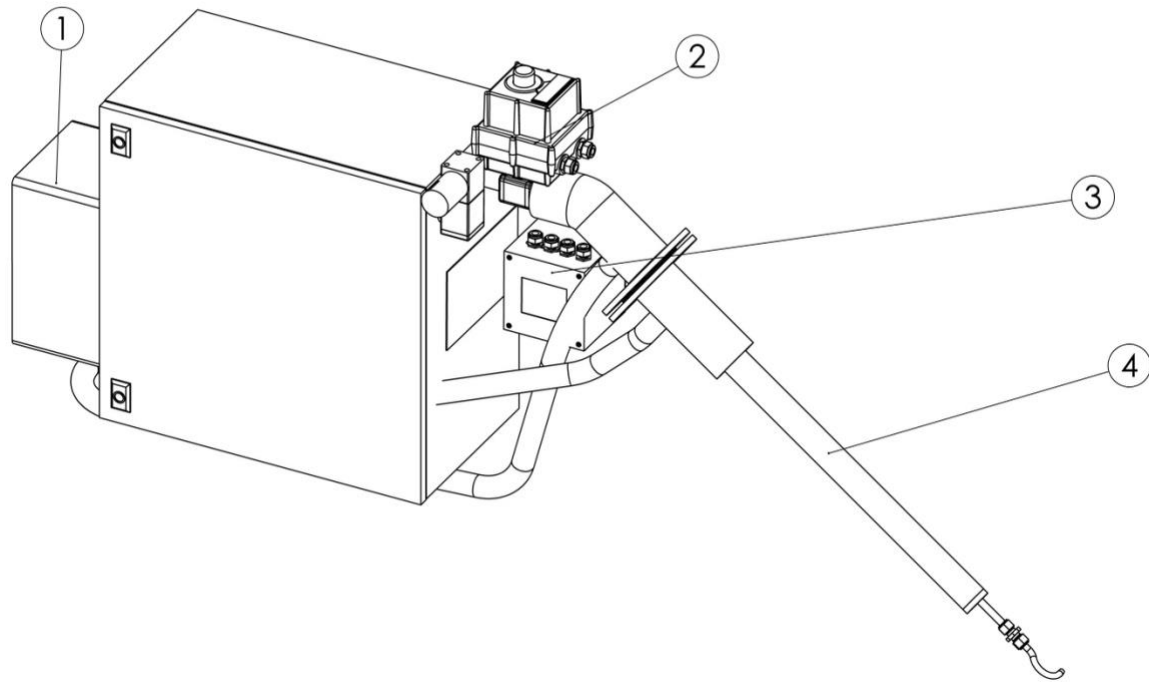
The device must be calibrated to the process conditions after installation using a standard reference method. The user interface displays the measurement results as mg/m³ or 4-20 mA values.



Features:

- Isokinetic sampling in variable flow conditions
- Continuous Dust levels as low as 0,1 mg/m³
- Sample stream isolated with N₂ curtain to keep the optics clean -> long maintenance interval
- Heated dust filter for pump protection with automatic back purge
- Accurate linear measurement for all kinds of dust
- PLC visualization software, local HMI (option) and WEB HMI for easy parametrization
- LED light source covers different particle size distributions and is less affected by particulate characteristic

System description



① Ex-proof electrical connection	③ N2 purge controller
② Cut off ball valve	④ Sample gas probe

Applications

BFG (Blast Furnace Gas)

Measurement of the dust and moisture concentrations before re-use in blast-furnace-gas (BFG) fired gas turbine.

Requirements to EEx based on high CO concentration (up to 20%) in the sample, which is sucked inside the cabinet.

Dust measurement in BFG after wet scrubber and before boiler.

The typical blast furnace gas composition in volume:

- CO = 20 to 30%,
- CO₂ = 12 to 20%,
- H₂ = 1 to 4%,
- CH₄ up to 0,5%
- balanced with N₂.

Gas temperature: 80 °C (in flue)
Relative humidity: 100% (in flue)

BOF (Basic Oxygen Furnace) and Linz-Donawitz process

Requirements to EEx based on high CO concentration (up to 60%) in the sample, which is sucked inside the cabinet.

Typical composition of the oxygen converter gas by volume:

- CO – 55 % to 60 %,
- CO₂ – 12 % to 18 %,
- O₂ – 0.1 % to 0.3 % and
- balanced with N₂.

Gas temperature: 70 °C (in flue)
Gas pressure: 0,95 – 1,023 Bar abs
Gas velocity: 5-30 m/s
Relative humidity: 100% (in flue)

Specification

General information:

Product name:	MARV 2Ex
Measured objects:	Total suspended particles (TSP)
Measurement principle:	Optical forward scattering
Measurement range:	Detection limit 0.1 mg/m ³ Maximum up to 0 - 300 mg/m ³
Power consumption:	230 V AC / 16 A, 50 Hz

Input/output signals:

Input signals (iso-kinetic option):	4 ... 20 mA input (process pressure, temperature, velocity, spare)
Output signals:	Digital output, 24 V DC / 0.5 A (common alarm) Isolated active 4 ... 20 mA output loop (dust concentration), max loop resistance 300 Ohm Ethernet TCP/IP for remote control USB for data logging

Physical properties:

Enclosure:	Powder coated steel, IP65
Probe length:	Approx. 1 m (3.28 ft) (depends on application)
Probe material:	Stainless steel (316L)

Process conditions:

Max. temperature:	200 °C
Flow speed:	5 ... 30 m/s
Pressure:	depends on application

Type of protection from explosive atmosphere:

According to requirements of IEC 60079-2:	II (1) 2G Ex px IIC T3 Gb II (2) 2G Ex pz IIC T3 Gc
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Ambient conditions

Ambient temperature:	-40 ... 60 °C
Humidity:	Up to 95 % RH



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