

LOW-MAINTENANCE, AFFORDABLE EMISSION MEASUREMENT

CONTINUOUSLY MONITOR UP TO 4 GASES WITH A SINGLE ROBUST ULTRAMAT 23 UNIT

To monitor exhaust gas emissions from combustion according to regulations or gases used in industrial processing, measurement and instrument maintenance should be straightforward, reliable and cost-efficient. This is why Siemens designed the robust ULTRAMAT 23 multi-component gas analyzer. This all-rounder can be configured to measure up to four gases simultaneously and around the clock, with a choice of detection methods and sensors to suit a wide range of applications. Its IR detector can determine up to three infrared-sensitive gases, and a UV photometer even smaller concentrations of SO₂ and NO₂. In addition, electrochemical or paramagnetic oxygen sensors can measure O₂, and an electrochemical H₂S measuring cell permits use in biogas applications. With its low measuring ranges, the economical ULTRAMAT 23 offers value for money that otherwise only high-end solutions do. Despite its versatility, the instrument is easy to use and low in maintenance – for example, daily autocalibration is performed with ambient air, so there is no need for calibration gases.

The need to monitor exhaust gases



Legal requirements to monitor industrial emissions vary around the globe. The EU's 2010 Industrial Emissions Directive 2010/75/EU aims to control and reduce the impact of industrial emissions on the environment by obliging a wide spectrum of industries to observe limits based on best available techniques (BAT). All EU member states had to pass its stipulations into national law by 2013 which in Germany, for example, led to changes of the Federal Emissions Control Act ("Bundes-Immissionsschutzgesetz") as well as to implementing regulations ("Bundes-Immissions-schutzverordnungen") for many industrial sectors, including power plants, waste incineration, cement, gas engines and crematories. As a consequence, companies in many industries have to monitor their emissions of certain gases using automated continuous emission monitoring systems (CEMS).

EN 14181, however, which is applicable in many European countries, states that CEMS must be certified to have passed a QAL 1 qualification test that covers the complete system including its gas paths and conditioning devices to adjust the temperature and humidity of the air sample, and to remove



airborne particles that could impair measurements. Testing is performed according to EN 15267 by an independent accredited authority.

For waste incineration and large coal-fired combustion plant applications the ULTRAMAT 23 has received this certification to determine CO, NO_x, NO, NO₂, SO₂, CO₂ and, either paramagnetically or electrochemically, O₂. The certification is for specified measuring ranges when equipped with the necessary upstream conditioning units. Operators wanting to use upstream equipment other than that in the certified CEMS have to have their own combination approved, but as its setup is typically similar to the already certified combination this process is usually straightforward.

The right configuration for each application

Different applications need different configurations of measuring cells. The ULTRAMAT 23 can determine up to three infrared-sensitive gases based on the NDIR principle (Table 1). The UV photometer, on the other hand, can detect and quantify UV-active gases – NO₂ for example, but also SO₂ at far lower concentrations than the IR detector. Legal limits for emission gases are generally getting stricter across the globe, so with its sensitive technologies, the ULTRAMAT 23 is facing up to the future: for SO₂ its smallest measuring range is a certified 0 to 70 mg/m³, but it can actually achieve 0 to 50 mg/m³, a lower range than many higher-end instruments. The detectors are very selective thanks to their multi-layer architecture, ensuring low water vapor interference. For oxygen measurements, the paramagnetic sensor is particularly robust and selective, and can measure low concentrations.

Countless configurations are possible with the ULTRAMAT 23 for the four gases that can be measured simultaneously. A typical setup to monitor exhaust gas emissions from firing systems would be CO, NO and SO₂ by NDIR, in addition to a paramagnetic "dumbbell" oxygen cell. For strictly regulated waste incineration plants, the configuration could be CO by NDIR, NO₂ and SO₂ by UV photometer, and O₂ electrochemically. To a large degree, the configuration for an application will depend on the locally applicable legal requirements. In principle, the ULTRAMAT 23 can also monitor CO and CH₄ to detect dangerous smoldering fires at an early stage.

For asphalt mixing plants, Siemens offers CEMS Asphalt, a complete solution from gas sampling and analysis to computerized measurement and data evaluation. The core is an analyzer cabinet that includes the ULTRAMAT 23 for determining CO and O₂, a FIDAMAT 6 gas analyzer for total hydrocarbons, and an LDS 6 laser diode gas analyzer for H₂O, with all three units being qualified according to EN 14181 und EN 15267.

Optionally, further substances such as NO_x and SO₂ or the dust concentration can be measured. A computer performs certified

processing, evaluation and storage of the emission data, and it delivers the mandatory protocols containing the measurement data.

Measured Gas components

<input type="radio"/>	A	Measured component:	CO
<input type="radio"/>	C	Measured component:	CO ₂
<input type="radio"/>	D	Measured component:	CH ₄
<input type="radio"/>	F	Measured component:	C ₂ H ₄
<input type="radio"/>	M	Measured component:	C ₆ H ₁₄
<input type="radio"/>	N	Measured component:	SO ₂
<input type="radio"/>	P	Measured component:	NO
<input type="radio"/>	S	Measured component:	N ₂ O
<input type="radio"/>	V	Measured component:	SF ₆

Table 1: List of available NDIR measuring cells

Monitoring and optimizing production processes



The ULTRAMAT 23's range of applications is not limited to mandatory measurements of emission gases. There is a wide spectrum of areas in which it is being used. It can help to control and optimize production processes, for example by monitoring gases in biogas plants. A typical configuration would be an NDIR detector to quantify the two infrared-sensitive gases CO₂ and CH₄, in addition to electrochemical measuring cells for O₂ and H₂S. The low-ppm H₂S sensor has a long service life even at increased concentrations, with no diluting or backflushing necessary. It is worth noting that the German Technical Inspectorate TÜV has certified that it is permissible to use the ULTRAMAT 23 to measure the flammable gases occurring in biogas plants, for example 70% CH₄.

Another example is the thermal treatment of metallic workpieces

in industrial furnaces to optimize the material properties of their surfaces. For some of these processes surface oxidation by O_2 , CO_2 or H_2S has to be prevented by a controlled neutral gas atmosphere while the thermal treatment achieves a specific crystalline structure by tempering and annealing. During these processes a precisely defined atmosphere modifies the surface to influence the workpiece's hardness and adhesion (e.g. for applying paints). Carbonizing, decarbonizing and carbonitriding are examples of such treatments. When carbonizing, the surface of steel parts is enriched with carbon at high temperatures, for which a mixture of nitrogen and methanol is used. By contrast, decarbonizing reduces the hardness by removing carbon from the workpiece's surface. A further procedure is carbonitriding. In such cases, ammonia is added to the furnace atmosphere so that its nitrogen binds to the surface alongside the carbon, resulting in a particularly high degree of hardness. Many of these processes are influenced by CH_4 , hence its concentration must also be monitored. The ULTRAMAT 23 multi-component gas analyzer can measure CO , CO_2 and CH_4 concentrations in a single instrument, so it is ideally suited to monitor the gas composition with precision during thermal treatment.

Connectivity, integration and handling

The ULTRAMAT 23 gas analyzer has an open architecture, offering RS 485, RS 232, PROFIBUS and SIPROM GA interfaces for connectivity. This simplifies the integration into CEMS, which usually comprise a sample probe, a heated filter, a heated sample line and a sample gas conditioning unit. As a leading global technology group, Siemens offers not just the hardware but also the expertise and reach to assemble and install CEMS all over the world. Dealing with only a single experienced supplier

of the products and the related services ensures a smooth implementation process.

Handling the ULTRAMAT 23 is as easy as gas monitoring gets. The AUTOCAL feature allows day-to-day autocalibration to be performed with ambient air, which saves effort and costs, as calibration gases are not required. A test with calibration gases is necessary only once a year.

A further feature that keeps the running costs down is that the analyzer cuvettes can be reused: they are simply cleaned on site in the event of contamination.

Menu-assisted operation of the ULTRAMAT 23 is in plain text, with no manual required for operation, ensuring a high level of operator safety. Gas analysis is controlled via the SIPROM GA software, which is run on a connected PC or laptop, and it also comprises a service tool. Remote operation and control are possible. Coded input levels protect against unauthorized access and increase data and operative safety. There is service information in the logbook that supports personnel to perform preventive maintenance, saving costs over time.

So once installed, there is no need to worry about anything – the ULTRAMAT 23, renowned for its dependability, performance and versatility, can turn advanced analytics into a commodity.

CTA: Find out more about the ULTRAMAT 23 multi-component gas analyzer on the product web page: <https://new.siemens.com/global/en/products/automation/process-analytics/extraktive-continuous-process-gas-analytics/ultram-23.html>



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