

SIEMENS



Process Analytics

# Reliability and efficiency in continuous gas analysis

A strong family for your success

[siemens.com/processanalytics](https://www.siemens.com/processanalytics)



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## Process analysis. Why with Siemens?

Siemens' success in process analytics is founded on comprehensive process know-how and on the reliability of our products. Efficiency and effectiveness are combined into a unique added value for customers, for example comparatively low operating costs. Covering development, production, commissioning and maintenance: as a global player we are able to competently support your process from the idea up to the product.

As a result of the systematic expansion of our product range for continuous gas analysis, we can currently offer our customers worldwide a comprehensive range of modern equipment for process analysis – from single analyzers up to individual system solutions. Thanks to our many years of experience we are acquainted with

the important aspects of a production process, and are therefore able to satisfy individual requirements. This is particularly carried out with FEED for Process Analytics – a service which helps toward optimization of the analytical systems in a production plant and thus minimization of your investment and operating costs.





## Solutions from a single source

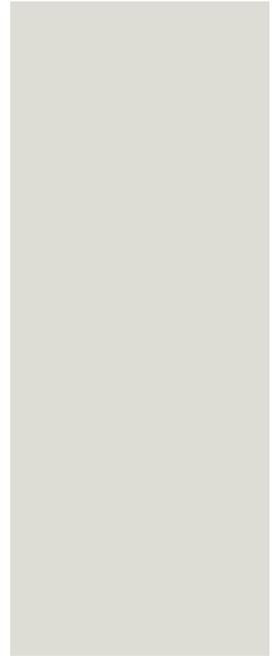
Our sound knowledge in the process automation sector allows us to offer complete solutions to our customers. The focus is on continuously increasing quality so that your processes profit from our expertise and experience.

In this sense, innovative products with state-of-the-art technologies on the one hand and compatibility, availability of spare parts, and service on the other are a significant component of our market policy.

We offer our customers tailored solutions up to a fully air-conditioned analyzer shelter. In addition to consulting, our specialists plan analyzer systems together with the user, and implement systems with state-of-the-art process analyzers. Siemens Process Analytics has consistently expanded this competence worldwide and supports its global customers by means of analytical specialists with long-term experience and industrial expertise.

### Your benefits

- Fast implementation of planning and assembly through reduced number of interfaces
- Lower costs thanks to solutions from a single source, flexible and optimized handling
- Increase in efficiency and saving of costs through predictive servicing and maintenance
- Global availability of spare parts and servicing



## Completely up-to-date with Siemens

Siemens is acquainted with the demands placed on process gas analysis and continuously studies market developments. We are therefore able to recognize future trends and develop efficient and individual solutions together with our customers.

### **Process optimization provides cost optimization**

Our reliable and efficient gas analyzers support you in the optimization of your processes.

### **Quality control**

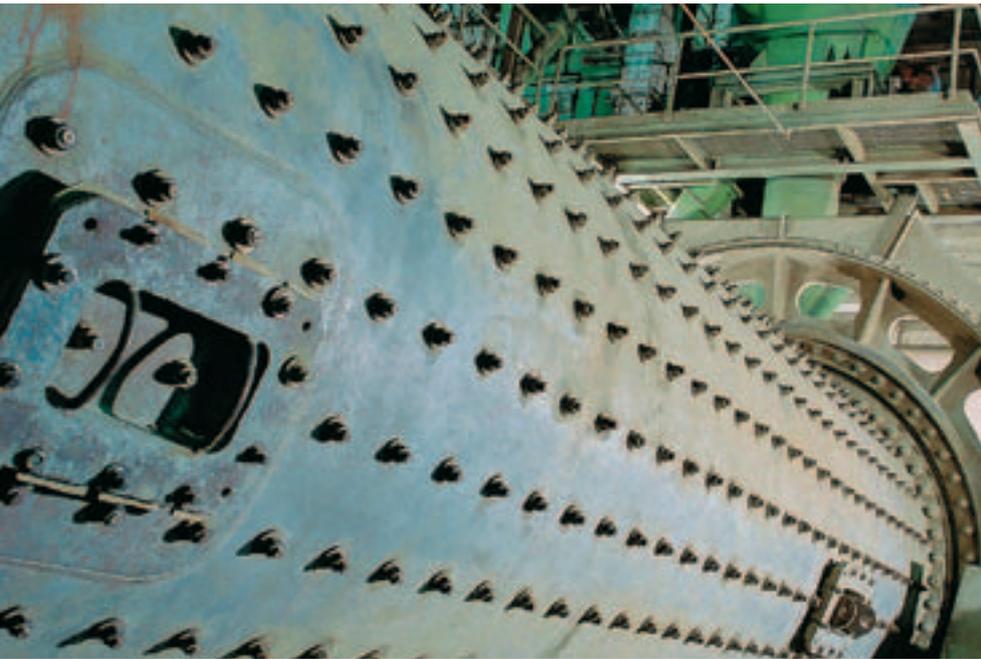
One of the most important customer demands is a uniformly high product reliability. This target can be reached using the continuous gas analyzers from Siemens. High customer satisfaction is thus guaranteed.

### **Safety for persons and machines**

Safety is particularly important when handling chemicals. Therefore reliable and safe equipment – Siemens gas analyzers have been assigned the relevant safety certificates – and continuous monitoring of the processes are essential. Plant safety, with the associated safeguarding of investments, as well as the protection of employees must be guaranteed.

### **Environmental protection**

Siemens Process Analytics is well aware of its responsibility toward the environment. The environmentally-friendly design together with the quality and reliability of our gas analyzers support your environmental management obligations.



## Siemens gas analyzers – at home in many industries

Siemens has traditionally set a strong focus on industrial applications. For only those who are acquainted with the specific requirements of the individual industries can develop and offer tailored products.

### Chemical industry

The significance of process analysis is increasing in all sectors of the chemical industry. Gas analysis is also a central consideration in many sectors of process control. Siemens gas analyzers increase the yield and guarantee a uniformly high product quality.

### Power generation

In the power industry, new technologies are improving the efficiency of power plants and reducing the emission of toxic materials, thus lowering the environmental impact. Process analysis provides exact and reliable data, thus enabling optimization of the various processes. High-performance measuring technologies are of great significance here.

### Oil and gas industries

Siemens has the appropriate answers to analytical questions concerning the oil and gas industries. From the characterization of basic materials up to the production of fuels – Siemens can offer the correct solution for the respective production step.

### Cement industry

Process optimization is only possible with reliable process data. Efficient measuring techniques are essential for this, and rugged devices are required for the harsh environmental conditions.



## Applications of Siemens process gas analyzers

Siemens gas analyzers have been used in the process industry for more than 50 years.

Their use in an extremely wide variety of applications is proof of their quality, reliability and measuring accuracy.



### Emission monitoring in power plants

One of the key issues in power plant operation is emission monitoring. This takes place with the help of the LDS 6 in-situ gas analyzer and the ULTRAMAT 6, OXYMAT 6 and FIDAMAT 6 or ULTRAMAT 23 extractive analyzers.

Which of these analytical techniques is used depends on the following factors:

- Measuring range
- Components to be measured
- Measurement location: standard power plant or waste incinerator power plant

The ULTRAMAT 23 is an approved analyzer for measuring CO, NO, SO<sub>2</sub> and O<sub>2</sub> in the exhaust gases of power plants with gas, oil or coal firing. The Series 6 analyzers – ULTRAMAT 6, OXYMAT 6, FIDAMAT 6 and LDS 6 – are also approved analyzers, and can be used in waste incinerator power plants. These analyzers can be used to measure CO, NO, SO<sub>2</sub>, O<sub>2</sub>, NH<sub>3</sub>, HCl and hydrocarbons.

All these factors must be considered before deciding on a particular measuring method. Nevertheless, the objective is quite clear: environmental protection.

### Analysis on rotary kilns in the cement industry

The main technology of a cement plant is the rotary kiln. This is the sector with the highest investment costs and the largest energy requirements. The optimum range of a rotary kiln with regard to the use of fuel is extremely limited. It is defined by the concentrations of oxygen and carbon monoxide.

The ULTRAMAT 23 determines the concentration of these gases and thus permits optimization of the combustion process. The use of fuel can be reduced by setting the ideal oxygen concentration.

Siemens offers a liquid-cooled probe for sampling the flue gases from a rotary kiln. This probe has been specially developed for the harsh operating conditions encountered there. The interaction between sampling probe and gas analysis technology is the basis for process economy.

#### ULTRAMAT 6

- Precise measurement of complex gas mixtures
- Reliably determines concentrations in the smallest measuring ranges, in line with legal requirements

#### ULTRAMAT 23

- Innovative multicomponent analyzer
- Using an electrochemical cell, oxygen can be measured in addition to the infrared-active gases



### Monitoring of hydrogen-cooled turbo generators

Turbo generators in power plants are gas-cooled to increase the efficiency. Hydrogen is used as the cooling gas. This provides the following advantages compared to air:

- Significantly better cooling properties
- Reduced friction losses on rotating parts due to lower gas density
- Higher electrical disruptive strength

Together with air, hydrogen forms an explosive mixture over a wide component ratio. In addition to safety aspects, it must also be considered that impurities in the hydrogen cooling gas can negatively influence the positive properties mentioned above. They increase the danger of explosion and reduce the efficiency. There are therefore significant economical reasons why the cooling gas should be continuously monitored for contamination.

### Process gas analyzers in plants for manufacturing ethylene oxide

Ethylene is an easily flammable gas which is highly explosive when mixed with oxygen. It is therefore important to monitor the oxygen concentration in the process gas for safety reasons. However, the yield increases proportionally with the oxygen concentration in the process gas. In order to optimize the yield, the oxygen concentration is set as close as possible to the lower explosion limit.

The economic efficiency of ethylene oxide plants can be decisively improved by monitoring the oxygen concentration using the OXYMAT 6 with its extremely fast and exact measurement.

The LDS 6 and SITRANS SL in-situ gas analyzers can be used to measure concentrations of oxygen directly in the process – without sample preparation.

#### CALOMAT 6

- For quantitative determination of hydrogen and helium in binary and quasi-binary noncorrosive gas mixtures
- Measurement of the concentrations of further gases if their thermal conductivity differs significantly from that of the residual gases

#### OXYMAT 6

- Due to its extremely short response time, it is unbeatable for the monitoring of safety-relevant systems
- Extremely versatile applications: whether for emission measurement or the control of production processes
- Long service life
- Corrosion-resistant



### NH<sub>3</sub> leakage monitoring in fluid column crackers

Flue gas denitrification is divided into primary and secondary measures. Primary measures are carried out directly on the burner. Secondary measures are based on chemical reactions between the flue gas and an additionally introduced reagent.

The DeNO<sub>x</sub> plant is responsible for flue gas denitrification. Ammonia is added for this purpose and reacts with the nitrogen oxides to produce nitrogen and water. Measurement of the leakage is used to control the quantity of ammonia added. This serves to optimize the denitrification process in two respects: on the one hand, the addition of a suitable quantity of ammonia significantly reduces costs, and on the other minimizes the emissions. The ammonia concentration is measured in real time by means of the LDS 6 in-situ gas analyzer which is installed directly in the exhaust stream. The measured values are used to guarantee the observation of limits, and also to control and optimize the DeNO<sub>x</sub> plant. Environmental protection in the petrochemical industry can therefore be taken into account through application of the in-situ gas measurement.

#### LDS 6

- Diode laser gas analyzer
- Works according to the principle of the specific light absorption of different gas components
- Suitable for contactless measurement within seconds of gas concentrations and temperatures in process and flue gases
- Can also be used together with a flow cell for extractive measurements

### Gas analysis in coal silos

With operations involving coal silos there is always a danger of random occurrences of partial spontaneous combustion of the coal. The resulting smoldering fires result in increased concentrations of CH<sub>4</sub> and CO at the top of the silo. These dangerous levels can be extractively measured with the ULTRAMAT 23. This is important since increased concentrations of CO not only indicate an active source of fire, they also constitute an independent hazard due to their toxic properties and potentially explosive atmosphere when mixed with air.

The almost immediate determination of the CO concentration using the SITRANS SL and LDS 6 in-situ analyzers provides an early warning and enables appropriate countermeasures to be taken in time.

#### SITRANS SL

- Diode laser gas analyzer
- In-situ measurements – no gas sampling required
- Inline reference cell – stable measuring operations even with “zero concentration” of the measured gas in the process
- Short response time
- Virtually immune to negative interference
- SIL 1 hardware

# Communication

Communication between operator or control system and the device is an important part of process analysis.

The facilities offered by a device have therefore become an important performance feature of analyzers.

Reliable functioning of analyzers is of decisive importance for process control. It is necessary to record, correct and transmit measured values, to set and modify parameters, to check functions, to update calibrations, and to scan status signals e.g. for preventive maintenance.

## Continuous gas analysis – extractive

The Series 6 analyzers (ULTRAMAT 6, ULTRAMAT/OXYMAT 6, OXYMAT 6, OXYMAT 61, FIDAMAT 6 and CALOMAT 6) as well as the ULTRAMAT 23 offer the following communications facilities in addition to data transmission over analog and binary outputs:

- RS 485 interface
- PROFIBUS DP/PA
- Ethernet
- AK interface (only OXYMAT 6, ULTRAMAT 6 and ULTRAMAT/OXYMAT 6)

The SIPROM GA software or SIMATIC PDM tool can be used as the service and configuration tool.

## Continuous gas analysis – in-situ

LDS 6 and SITRANS SL feature 4–20 mA and digital IO interfaces, and the SITRANS SL also includes a PROFIBUS DP or Modbus option. Data can be sent and received using the LDScomm software, which also enables settings to be made on the system. This installation and service tool can also remotely monitor and modify device status and calibration parameters. If required, complete system diagnostics can be carried out via the the data communication line.

If servicing is necessary, the required information (e.g. characteristics for the laser measurement, measuring and operating data of the laser) can be sent by modem to servicing technicians at Siemens who then prepare the appropriate measures or carry them out from the service center over the data link. This facility for remote maintenance and diagnostics is implemented using a standard LAN modem. Remote access is protected, and is administered on the central unit at the customer.

# Advantages of the Siemens product family

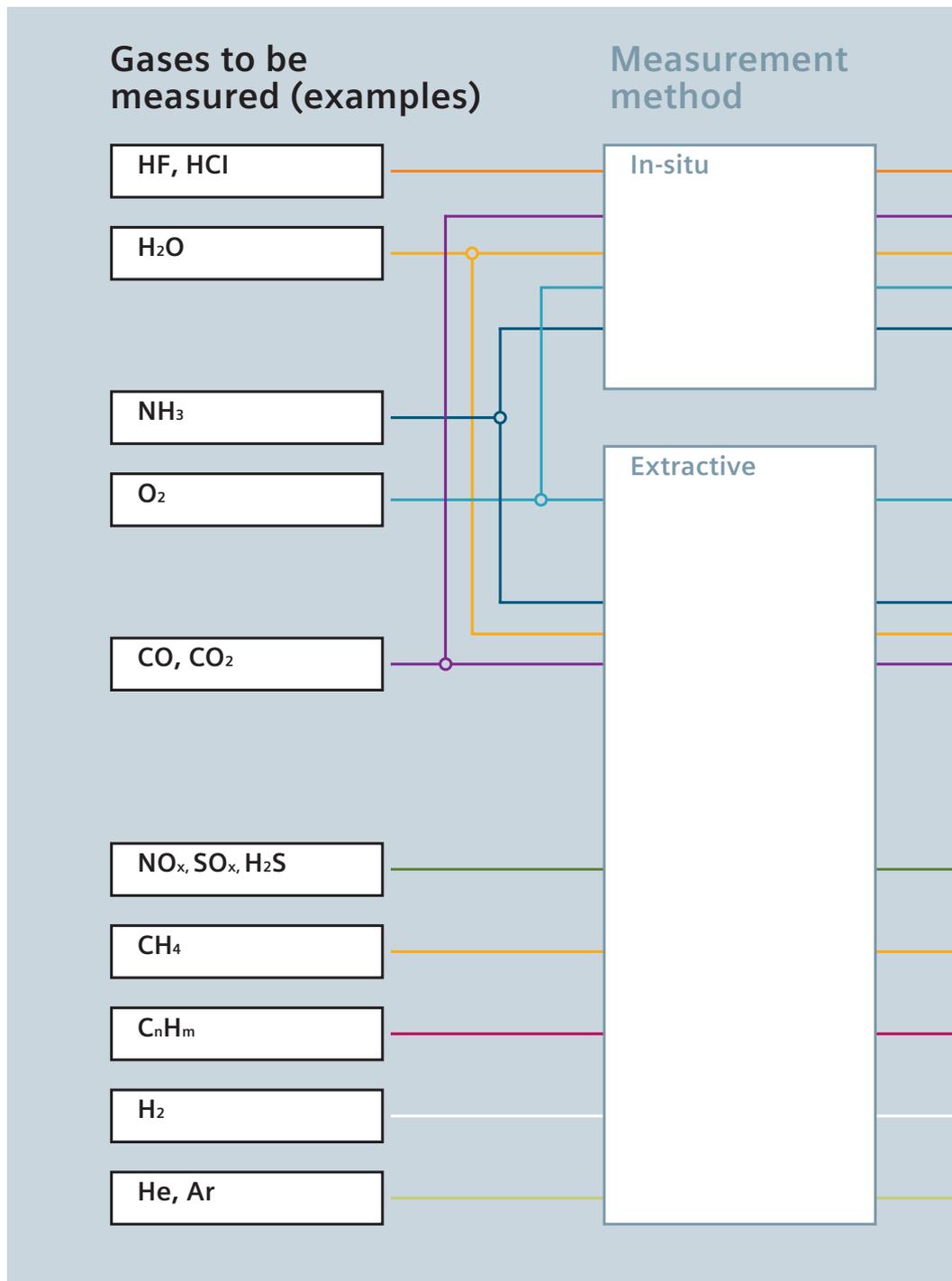
The answer to the special requirements of the individual industries: products from Siemens for continuous analysis of process gases. With our process gas analyzers, you profit from the advantages of a totally integrated product family.

The continuous gas analyzers have a common menu structure. Therefore, the handling is intuitive for a user who is already acquainted with one analyzer from the family. The uniform operating approach is embedded in the user functions. For example, selection of the gas for which the settings are to be made is followed by the main menu with its uniform functions. The operating functions are self-explanatory.

The analyzer parameters can be set on site specific to customer requirements.

Parameterization and configuration correspond to the NAMUR recommendations, and can be protected against impermissible operation using various code levels.

With gas analyzers from Siemens, you can be sure that you are always in full control of your production, and that you can react flexibly and rapidly to new requirements.

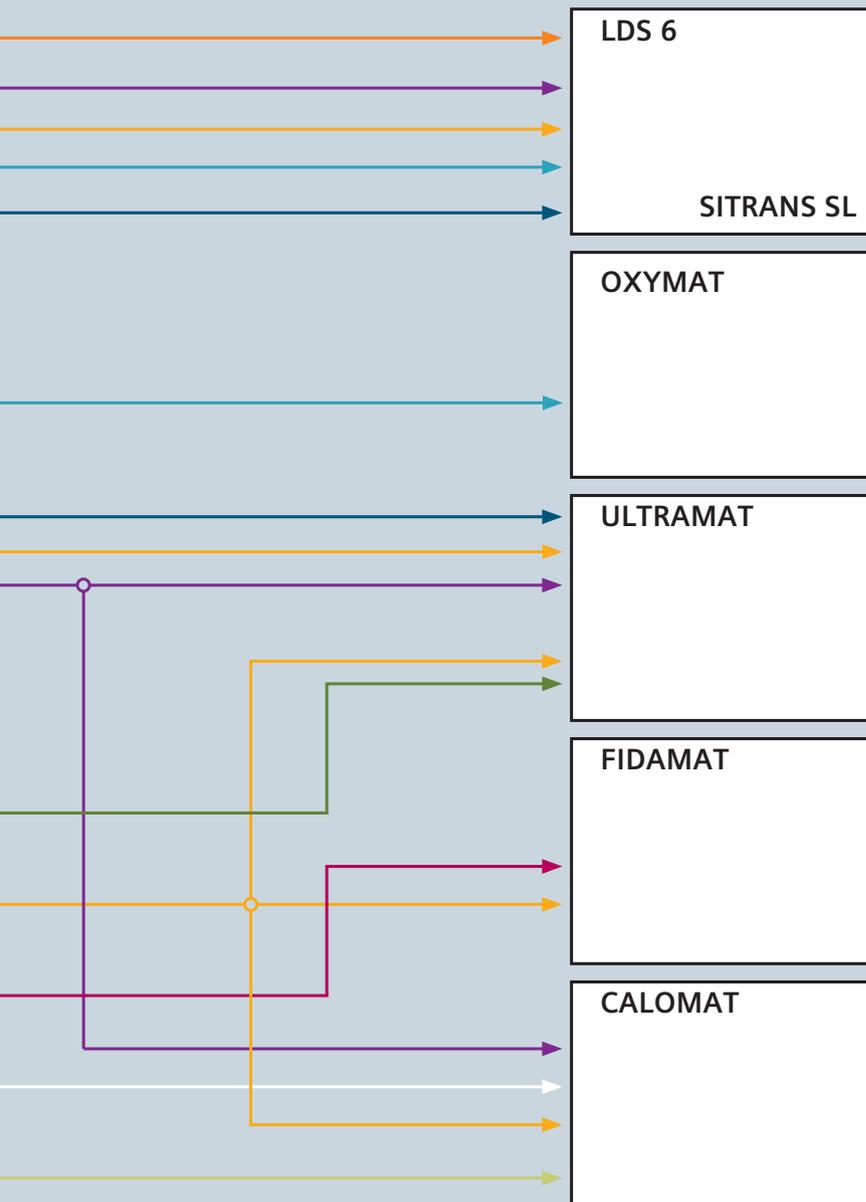


## How to find the right product

The diagram will help you find the appropriate analyzer for your measurement task.

## Analyzer

## Possible versions



# Siemens gas analyzers – extractive and in-situ



Measuring properties	Extractive analyzers					
	OXYMAT 6		OXYMAT 61	OXYMAT 64	ULTRAMAT 6	
Measurement method	Extractive		Extractive	Extractive	Extractive	
Measuring method	Paramagnetism		Paramagnetism	Zirconium dioxide probe	NDIR two-beam principle	
Max. number of components	1		1	1	4	
Components	Oxygen		Oxygen	Oxygen	e.g. CO, CO <sub>2</sub> , NO, SO <sub>2</sub> , CH <sub>4</sub> , hydrocarbons	
Smallest measuring range	0–0,5 %		0–2 %	0–10 vpm	Component-specific: 0–5 / 0–100 ppm	
Detection limit	50 ppm		200 ppm	100 ppb	Component-specific: from 0.05 ppm	
Housing / material	19" rack unit	Field housing	19" rack unit	19" rack unit	19" rack unit	Field housing
Degree of protection	IP20	IP65	IP20	IP20	IP20	IP65
Material of gas path	Viton, stainless steel, titanium	Stainless steel, titanium, Hastelloy	Viton	Stainless steel	Viton, stainless steel, titanium	Viton, stainless steel, titanium
Material of measuring chamber	Stainless steel, tantalum	Stainless steel, tantalum	Stainless steel	Stainless steel	Aluminum, TA layer	Aluminum, TA layer
Connections	6 mm / ¼"	6 mm / ¼"	6 mm / ¼"	6 mm / ¼" / 3 mm / ⅛"	6 mm / ¼"	6 mm / ¼"
Heater option	–	up to 130 °C	–	–	–	65 °C
Special applications	Further materials with special applications		–	–	Further materials with special applications	
Certificates / signals	19" rack unit	Field housing	19" rack unit	19" rack unit	19" rack unit	Field housing
TÜV	13./17. BlmSchV	13./17. BlmSchV	–	n.a.	13./17. BlmSchV	13./17. BlmSchV
Further approvals (emission)	QAL1, MCERTS	QAL1, MCERTS	–	n.a.	QAL1, MCERTS	QAL1, MCERTS
EX	ATEX II 3G Class I Div 2	ATEX II 2G/3G / 3D – Class I Div 2	–	–	ATEX II 3G Class I Div 2	ATEX II 2G/3G / 3D – Class I Div 2
Analog output	0/2/4–20 mA	0/2/4–20 mA	0/2/4–20 mA	0/2/4–20 mA	0/2/4–20 mA per component	0/2/4–20 mA per component
Communication	PROFIBUS, RS 485/Ethernet	PROFIBUS, RS 485/Ethernet	PROFIBUS, RS 485/Ethernet	PROFIBUS, RS 485/Ethernet	PROFIBUS, RS 485/Ethernet	PROFIBUS, RS 485/Ethernet
Binary inputs/outputs	6 of each as standard, expandable	6 of each as standard, expandable	6 of each as standard, expandable	6 of each as standard, expandable	6 of each as standard, expandable	6 of each as standard, expandable
Sample gas conditions	19" rack unit	Field housing	19" rack unit	19" rack unit	19" rack unit	Field housing
Temperature	Below the gas dew point, but min. 0 °C max. 50 °C	Below the gas dew point, but min. 0 °C max. 50 °C; with heated version max. 145 °C	Below the gas dew point, but min. 0 °C max. 50 °C	Below the gas dew point, but min. 0 °C max. 50 °C	Below the gas dew point, but min. 0 °C max. 50 °C	Below the gas dew point, but min. 0 °C max. 50 °C; with heated version max. 80 °C
Pressure (abs.)	500 to 1,500 hPa	500 to 3,000 hPa	800 to 1,200 hPa	High-pressure version 2,000 to 6,000 hPa Low-pressure version 1,050 to 1,100 hPa	600 to 1,500 hPa	600 to 1,500 hPa

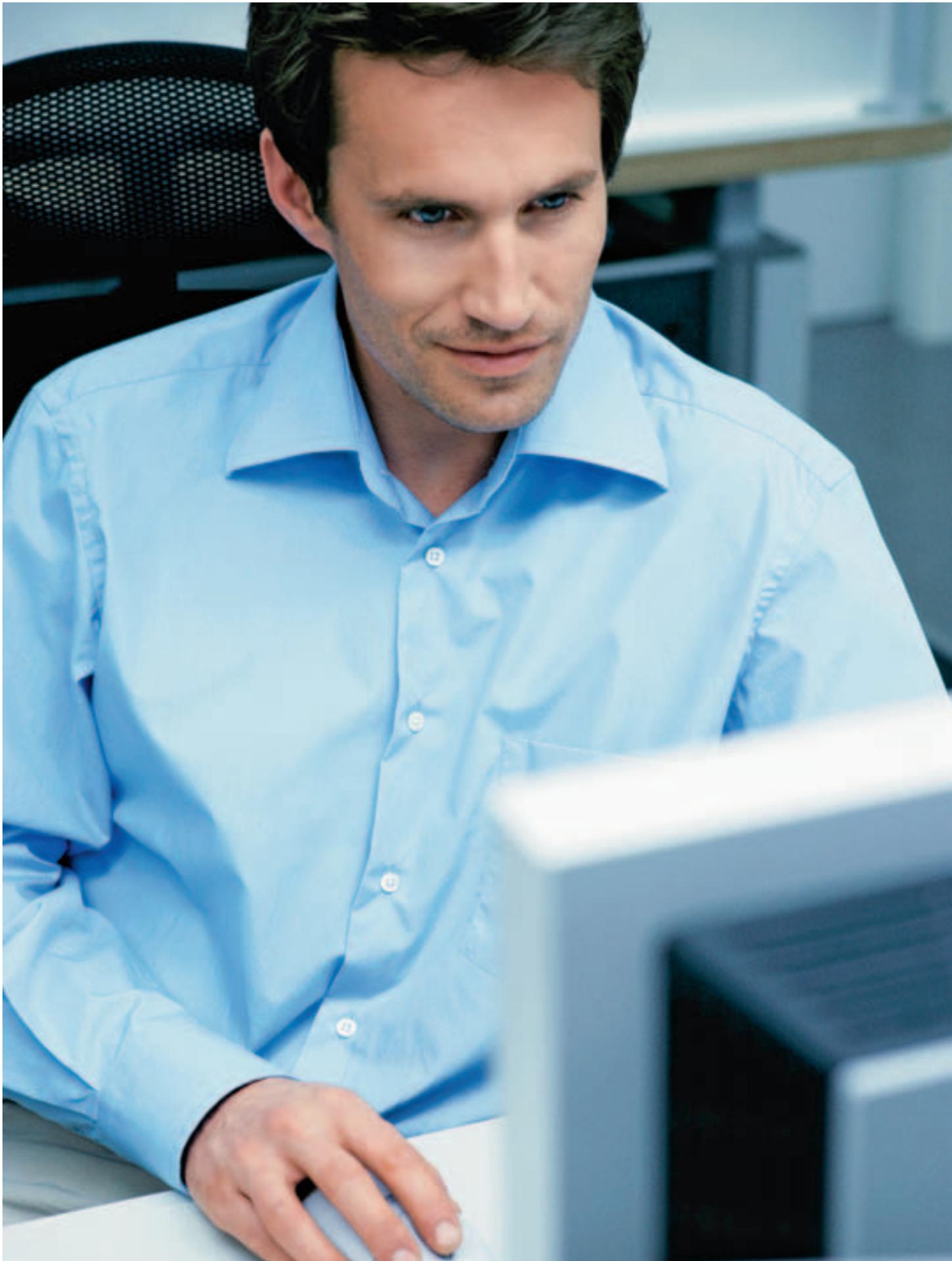


ULTRAMAT 23	ULTRAMAT / OXYMAT 6	CALOMAT 6		CALOMAT 62		FIDAMAT 6
Extractive	Extractive	Extractive		Extractive		Extractive
NDIR single-beam principle	Combination device	Thermal conductivity		Thermal conductivity		Flame ionization
3 IR + O <sub>2</sub> , H <sub>2</sub> S	2 IR + O <sub>2</sub>	1		1		1
e.g. CO, CO <sub>2</sub> , NO, SO <sub>2</sub> , CH <sub>4</sub> , O <sub>2</sub> , H <sub>2</sub> S	O <sub>2</sub> and IR-active components	e.g. H <sub>2</sub> , He		e.g. H <sub>2</sub> , Cl <sub>2</sub> , HCl		Total hydrocarbons
Component-specific: 0–50 / 0–500 vpm	See U6 and O6	0–1 %		Component-specific: 0–1 % / 0–10 %		0–10 vpm
Component-specific: from 0.5 vpm	See U6 and O6	0.01 %		Component-specific: from 0.01 %		50 / 100 ppb
19" rack unit	19" rack unit	19" rack unit	Field housing	19" rack unit	Field housing	19" rack unit
IP20	IP20	IP20	IP65	IP20	IP65	IP20
Viton, stainless steel	Viton, stainless steel, titanium	Stainless steel	Stainless steel	Stainless steel	Stainless steel, Hastelloy	Stainless steel
Aluminum	See U6 and O6	Stainless steel	Stainless steel	Stainless steel	Stainless steel, Hastelloy	Stainless steel
6 mm / ¼"	6 mm / ¼"	6 mm / ¼"	6 mm / ¼"	½" – 27 NPT	½" – 27 NPT	6 mm / ¼"
–	–	–	–	–	70 °C	up to 200 °C
–	Further materials with special applications	Further materials with special applications		Further materials with special applications		–
19" rack unit	19" rack unit	19" rack unit	Field housing	19" rack unit	Field housing	19" rack unit
13. / 27. / 30. BlmSchV/Kyoto	13. / 17. BlmSchV	n.a.	n.a.	n.a.	n.a.	13. / 17. BlmSchV
QAL1, MCERTS	QAL1, MCERTS	n.a.	n.a.	n.a.	n.a.	QAL1, MCERTS
ATEX II 3G Class I Div 2	–	ATEX II 3G Class I Div 2	ATEX II 2G/3G/ 3D – Class I Div 2	–	ATEX II 2G	[ATEX II 3 G] with cabinet
0 / 2 / 4–20 mA per component	0 / 2 / 4–20 mA per component	0 / 2 / 4–20 mA	0 / 2 / 4–20 mA			
PROFIBUS, RS 485/Ethernet	PROFIBUS, RS 485/Ethernet	PROFIBUS, RS 485/Ethernet	PROFIBUS, RS 485/Ethernet	PROFIBUS, RS 485/Ethernet	PROFIBUS, RS 485/Ethernet	PROFIBUS, RS 485/Ethernet
8 of each as standard, expandable	6 of each as standard, expandable	6 of each as standard, expandable	6 of each as standard, expandable	6 of each as standard, expandable	6 of each as standard, expandable	6 of each as standard, expandable
19" rack unit	19" rack unit	19" rack unit	Field housing	19" rack unit	Field housing	19" rack unit
Below the gas dew point, but min. 0 °C max. 50 °C	Below the gas dew point, but min. 0 °C max. 50 °C	Below the gas dew point, but min. 0 °C max. 50 °C	Below the gas dew point, but min. 0 °C max. 50 °C	Below the gas dew point, but min. 0 °C max. 60 °C	Below the gas dew point, but min. 0 °C max. 60 °C; with heated version max. 65 °C	0–200 °C
unpressurized < 1,200 hPa	See U6 and O6	800 to 1,100 hPa	800 to 1,100 hPa	800 to 1,100 hPa	800 to 1,100 hPa	FID-E: atm. / FID-G: 2,000 hPa



Extractive and in-situ analyzers		Measuring properties
<b>LDS 6</b>	<b>SITRANS SL</b>	
In-situ / extractive	In-situ / extractive	Measurement method
TDLS	TDLS	Measuring method
2	1	Max. number of components
O <sub>2</sub> , NH <sub>3</sub> , HF, H <sub>2</sub> O, CO <sub>2</sub> , CO, HCl	O <sub>2</sub> , CO	Components
Component-specific: 0–5 ppm to 0–5%	O <sub>2</sub> : 0–1% @ 1 m effective opt. path length CO: 0–100 ppm @ 1 m effective opt. path length	Smallest measuring range
Component-specific: from 0.1 ppm @ 1 m effective opt. path length	O <sub>2</sub> : 200 ppm @ 1 m effective opt. path length CO: 0.6 ppm @ 1 m effective opt. path length	Detection limit
Central unit: 19" unit, sensors: field version	Field version	Housing / material
Central unit: IP20, sensors: IP65	IP65	Degree of protection
Purging tubes: stainless steel, special materials on request	Purging tubes: stainless steel	Material of gas path
–	–	Material of measuring chamber
Sensor connections in DN 65 / PN6, ANSI 4"/150 lbs, DN 80 / PN 16	Sensor connections in DN 50 / PN 16, ANSI 4"/150 lbs	Connections
Extractive cell 200 °C		Heater option
Further materials and connections with special applications	Further materials and connections with special applications	Special applications
Central unit: 19" unit, sensors: field version	Central unit: 19" unit, sensors: field version	Certificates / signals
NH <sub>3</sub> , NH <sub>3</sub> /H <sub>2</sub> O, H <sub>2</sub> O, HCl, HCl/H <sub>2</sub> O applications: 17. BlmSchV	–	TÜV
QAL1, MCERTS	–	Further approvals (emission)
ATEX II 1GD T 135° EEx ia IIC T4	ATEX II 2 G Ex de op is IIC T6 /, ATEX II 2 D Ex tD A21 IP65 T85, FM Class I, II, III Div 1, FM Class I, Zone 1, FM Class II, Zone 21	EX
2 per channel (measurement spot) (up to 3 channels)	2	Analog output
Analog, Ethernet	Analog, PROFIBUS DP, Modbus RTU, Ethernet	Communication
6 per channel (measurement spot) (up to 3 channels)	2/2	Binary inputs / outputs
Central unit: 19" unit, sensors: field version	Central unit: 19" unit, sensors: field version	Sample gas conditions
Depends on component and application: 0–1,200 °C	Depends on component and application: –20–700 °C	Temperature
Depends on component: 0.8–5 bar, further ranges with special applications	Depends on component: 0,7–5 bar, further ranges with special applications	Pressure





# Service and support

Siemens offers proven concepts for process analytics and instrumentation from a single source.

Uniform development and a high level of safety are benefits you profit from.

Our range of services extends from planning and competent technical consulting, via interfacing to the control system, up to comprehensive servicing:

- Plant planning and deadlines
- Complete design planning and engineering of the analysis systems (FEED for PA)
- Specialists advise you on the selection of analytical and process devices
- Plant documentation
- Installation, test and commissioning
- Comprehensive after-sales service

## Training

To optimize system availability, Siemens Process Analytics offers a comprehensive training program for the customer's planning, operation and maintenance personnel. Training can be carried out specific to the system and application in the Siemens training centers (Karlsruhe, Houston, Shanghai) or also on site on the customer's system. Servicing can be carried out by customers using their own trained servicing personnel, and certain repair work can also be carried out.

## Repairs

Identified repairs are carried out in certified repair workshops worldwide and at short notice. In order to shorten downtimes, certain devices and components can be replaced from a pool of exchange units.

## Service worldwide

Plants must work reliably around the clock. Efficient process analytics and instrumentation are indispensable prerequisites. It must also be possible to rely on the fast and competent servicing of the supplier. Siemens is a globally active company. Whether you require consulting, fast delivery, or the installation of new devices, Siemens offers a network of experts who you can reach worldwide.

## Service round the clock

Our online support can help you rapidly and comprehensively independent of the time and location. Whether you require product support or service information, the Online Support from Siemens Industry Automation and Drive Technologies (IA&DT) is always your first choice, 24 hours/365 days a year.

[www.siemens.com/automation/service&support](http://www.siemens.com/automation/service&support)

## Further information

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