Modern Process Measurement Technology from SICK

Proven analyzers and solutions from one source for forward-looking process measurement technology

SICK
Sensor Intelligence.

Modern Process Measurement Technology from SICK

Forward-looking solutions for the requirements of process measurement technology

In these times of accelerated change, far-reaching changes and revolutions in economics, politics and climate protection, the products and supply chains, which have established themselves over many years, are being put to the test. The process industry is affected by these changes in two respects.

On the one hand, the requirements placed on industry are increasing. Scarcer resources and increasing costs for energy transport demand more efficiency. Environmental considerations are increasingly being applied in globally strengthened regulations and laws. Globalization, as well as increasing competition from emerging countries, offers the chance – but also the risk – of a worldwide market and competition.

On the other hand, the process industry can play a key role in mastering these challenges. Numerous products, which are intended to provide a good and sustainable way of living for millions of people in the future, touch on processes that are still in the experimental stage or have not yet been invented. Future scenarios are based on the development of plant-based raw materials, new insulating materials and new coatings.

SICK is a competent partner in this change. SICK, with its proven products for process measurement technology and pronounced expertise, is able to advise customers and partners fully in order to jointly develop customized solutions for increased efficiency in production systems and processes.

SICK stands for innovation and technology leadership whose global sales and service network is available as a strong and competent partner for the monitoring of new processes and measurement tasks.

Convincing Performance

We deliver "Sensor Intelligence."

SICK sensor solutions for industrial automation are the result of exceptional dedication and experience. From development all the way to service: The people at SICK are committed to investing all their expertise in providing with the very best sensors and system solutions possible.

A company with a culture of success

Over 5,800 people are on staff, with products and services available to help SICK sensor technology users increase their productivity and reduce their costs. Founded in 1946 and headquartered in Waldkirch, Germany, SICK is a global sensor specialist with nearly 50 subsidiaries and representations worldwide.

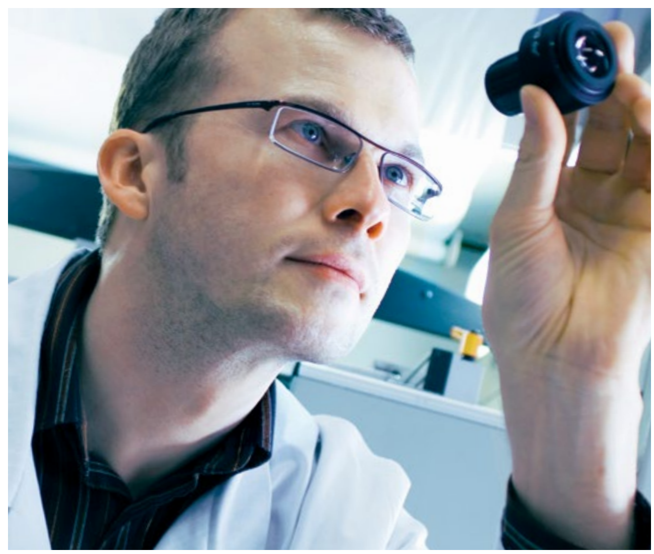
Our exemplary corporate culture fosters an optimum work-life balance, thus attracting the best employees from all over the world. SICK is one of the best employers – we have been among the winners of the prestigious German "Great Place to Work" award for many years in succession.

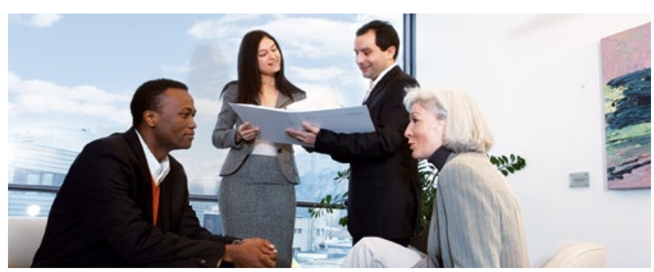
Innovation for the leading edge

SICK sensor systems simplify and optimize processes and allow for sustainable production. SICK operates at many research and development centers all over the world. Co-designed with customers and universities, our innovative sensor products and solutions are made to give a decisive edge. With an impressive track record of innovation, we take the key parameters of modern production to new levels: reliable process control, safety of people and environmental protection.

A corporate culture for sustainable excellence

SICK is backed by a holistic, homogeneous corporate culture. We are an independent company. And our sensor technology is open to all system environments. The power of innovation has made SICK one of the technology and market leaders – sensor technology that is successful in the long term.





Industry	Requirements	Solutions from SICK
Powerplants		
	Modern gas analysis is of increasingly greater importance during energy generation, particularly with fossil fuels. In addition to the processes introduced for the reduction of particulates, NO_x and SO_2 concentrations, gases such as HCl or SO_3 during the combustion of alternative fuels are gaining relevancy. Examples for types of process measurement:	SICK analyzer systems make a continuous monitoring of processes possible. Concentration gradients of gas components, dust and gas volume flows are precisely measured, process deviations are identified and procedures are optimized.
	• Monitoring of the coal bunker/coal mill	➜ CO, O_2 • In-situ: TRANSIC100LP (O_2) • Extractive: MKAS with SIDOR
	• Boiler wall measurement for detecting potential risk of corrosion of the boiler	➜ CO, O_2, CO corrosion level: • In-situ: GM960
	• Firing function, including combustion air	➜ O_2, volume flow • In-situ: ZIRKOR302, FLOWSIC100
	• Control absorption metering	➜ SO_3, H_2SO_4, HCl • Extractive: MCS100E HW
	• Exhaust gas denitrification system ($DeNO_x$), e.g. NH_3 slip control	➜ NO, NH_3 • In-situ: GM32, GM700
	• Dust removal (fabric filter, electric filter)	➜ Opacity, dust concentration • In-situ: DUSTHUNTER T200, SP100
	• Exhaust gas desulfurization ($DeSO_x$)	➜ SO_2 • In-situ: GM32 • Extractive: MCS300P HW
Waste incineration		
	For waste incineration systems as well as for the included burning of waste, it is essential to continuously measure the following harmful substances according to the legal requirements and conditions: HCl, HF, NH_3, CO, NO_x ($NO + NO_2$), SO_2, C_{total}, dust and mercury. This includes the parameters H_2O, O_2, pressure and temperature. For process measurement, the following measuring points are of importance:	For the combustion optimization and for the subsequent exhaust gas cleaning process, both in-situ as well as extractive measurements are considered. The measuring point conditions and the measuring task are the deciding factor for the preferred technology. As single manufacturer, SICK is able to offer the "best solution" from one source.
	• Firing function/optimization	➜ O_2, CO • In-situ: ZIRKOR302, GM901
	• Exhaust gas denitrification SNCR/SCR	➜ NO, NH_3 • In-situ: GM32, GM700
	• Raw gas scrubber input	➜ HCl, SO_2, H_2O (O_2) • Hot-extractive: MCS300P HW

Industry	Requirements	Solutions from SICK
Cement production		
	Plants for producing cement, as well as firing and crushing lime. The use of alternative fuels for the saving of primary fuels is gaining importance. This means the continuous and precise measurement and monitoring of all relevant processes. Examples for types of process measurement:	For the demanding requirements at cement plants, SICK measuring technology is particularly suitable. The wide product range offers the optimum solution for all operating parameters, even for high temperatures and dust concentrations.
	• Monitoring of the coal bunker/coal mill	→ CO, O_2 • In-situ: TRANSIC100LP (O_2) • Extractive: MKAS with SIDOR
	• Rotary kiln inlet	→ CO, NO, O_2, SO_2, CO_2, HCl • Hot-extractive: MCS300P HW with SCP3000
	• Preheater and calcinator	→ CO, NO, SO_2, O_2 • Cold-extractive: MKAS with SIDOR
	• Dust removal (electric filter)	→ Dust concentration • In-situ: DUSTHUNTER SP100
	• Exhaust gas conditioning	→ Volume flow • FLOWSIC100
	• Explosion protection on the electric filter	→ CO • Cold-extractive: MKAS with SIDOR
Metal and steel		
	Plants for melting or sintering ores as well as the production of non-ferrous metals. These areas are subject to harsh environmental conditions such as high dust loads and dust loads. The gases produced during the process are reprocessed and must be measured and monitored accordingly. Examples for types of process measurement:	Analysis technology and optical measuring technology ensure high product quality and trouble-free processing for the manufacturing, processing, transport and storage of steel and other metals. In addition to its many years of experience, SICK is the only manufacturer that offers the complete measuring technology from one source.
	• Blast furnace, top gas measurement	→ CO, CO_2, CH_4, H_2 • Cold-extractive: MAC800, GMS800
	• Exhaust air in basic oxygen converter	→ CO, CO_2, H_2, O_2 • Cold-extractive: MAC800, GMS800
	• Steel production	→ CO, CO_2, O_2, H_2, N_2O, HCl, dust, gas flow • Cold-extractive: MAC800, GMS800 • Dust measurement: DUSTHUNTER T, SB • Gas flow measurement: FLOWSIC100
	• Exhaust of the copper oxygen furnace	→ O_2, SO_2 • Cold-extractive: MAC800, GMS800
	• Impact mill	→ O_2, SO_2 • Cold-extractive: MAC800, GMS800
	• Reformer	→ CO, CO_2, O_2, H_2, CH_4 • Cold-extractive: MAC800, GMS800
	• Aluminum production	→ HF • In-situ: GM700

Industry	Requirements	Solutions from SICK
Chemical, petrochemical and refinery (HPI)		
	In order to remain competitive and be able to produce profitably in chemical plants, an optimized process control is necessary. Through the targeted control of key components in the reaction sequence, plant capacity, yield and product quality can be improved and the energy expenditure reduced. Therefore, concentration measurements as control parameter of the system play a decisive role. Additional central themes are also plant safety and environmental protection. The online analytics play an increasingly important role for the efficient operation of the plant through proven measurements with low amortization times of only several months.	Reliable and continuous analysis information is necessary for optimal control of a chemical plant. The low-maintenance and rugged analyzers with long-term stability from SICK are proven performers for gas and liquid analytics. Through automatic calibration, innovative operation concepts, powerful communication protocols, the analyzers and systems from SICK can be easily integrated into local process control systems.
	• Monitoring of safety lines	→ Phosgene ($COCl_2$) • Extractive: MCS300P, GMS800
	• Corrosion protection and process monitoring isocyanate production (raw material for polyurethane)	→ Cl_2, CO, phosgene ($COCl_2$), HCl, monochlorobenzene, isocyanate → Hot-extractive: MCS300P → Cold-extractive: GMS800 → Liquid measurement: MCS300P
	• Process monitoring of solvents in PVC production	→ Trace measurement water in dichloroethane • Liquid measurement: MCS300P
	• Exhaust air monitoring in foil production	→ Dichloroethane (CH_2Cl_2), trichloroethane (C_2HCl_3), acetone (C_2H_6O), methanol (CH_3OH), CO and H_2O • Hot-extractive: MCS300P
	• Ethylene plants	→ CO_2 in ethane feed after CO_2 scrubber and in decoking • Cold-extractive: GMS800 → CO, CO_2 in fission gas after condensate separation • Hot-extractive: MCS300P → Acetylene in fission gas before acetylene hydrogenation • Cold-extractive: GMS800 → Ethane in C_2 splitter head • Cold-extractive: GMS800 → Ethane in C_2 splitter sump • Hot-extractive: MCS300P → TOC in liquid waste • TOCOR with sample preparation
	• Process monitoring in polyethylene (PE) production	→ 1-butene, hexan • Hot-extractive: MCS300P
	• LNG (Liquefied Natural Gas)	→ CO_2 after amine scrubbing • Cold-extractive: GMS800
	• HyCO plants	→ CO after PSA plant • Cold-extractive: GMS800
	• VC/EDC plants	→ Moisture in EDC, plant corrosion protection • Hot-extractive: MCS300P • O_2 for the N_2 feed into VCM exhaust gas
	• Process water monitoring	→ TOC/TIC/TC • TOCOR with sample preparation → VOC • GMS800-FIDOR with stripper

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Additional areas of application	Requirements	Solutions from SICK
Inertization		
	Many storage and production processes require controlled and highly regulated gas atmospheres. Oxygen is frequently an undesired component due to its reactivity. During inertization, the atmospheric oxygen is replaced by inert gases. This process is applied, for example, during the storage and transport of perishable goods or for the prevention of the formation of explosive gas mixtures (explosion protection). • Monitoring of the oxygen concentration in inertization plants and pipelines	A cost-effective method for ensuring sufficient inertization is the direct measurement of the oxygen concentration in the medium to be monitored. For this measurement task, SICK offers a consistent transmitter design and makes the laser spectroscopy (TDLS) accessible for the field instrumentation. → O_2 • In-situ: TRANSIC100LP
LEL (lower explosion level) monitoring		
	Flammable materials are utilized or manufactured in numerous production processes. Therefore, personnel and plant safety play a higher-ranking role in these processes. For plant operators, it is essential to prevent the formation of explosive mixtures and detect the formation in good time. • Monitoring of volatile hydrocarbons in systems for painting, coating and drying	Analyzers from SICK measure the concentration of flammable gases or vapors for the prevention or detection of dangerous gas mixtures. → VOC • In-situ: FID
Additional areas of application		
	The industries listed are only a small selection of the application range. In many other application areas, the gas composition is a decisive parameter. Other fields are, for example:	There are specific measuring tasks to be solved within these industries. Together with its customers, SICK develops the matching analysis technology for the respective application.
	• Pharmaceutical plants	→ O_2, H_2, CO_2, CO • Cold-extractive: GMS800 • In-situ: TRANSIC100LP
	• Air separation plants	→ O_2 • In-situ: TRANSIC100LP
	• Process monitoring in enzyme production	→ O_2 • In-situ: TRANSIC100LP
	• System control of composting plants	→ CO_2, CH_4, O_2 • Cold-extractive: SIDOR
	• Process monitoring of landfill gas and bio fermenters	→ Cl_2 • Cold-extractive: GMS800-DEFOR • Hot-extractive: MCS300P
	• Chlorine chemistry	

Process measurement technology – made in Germany

Depending on the procedure, processes and plants differ significantly from each other. There are different measurement tasks to solve as well as process-related requirements to fulfill. With a wide product range, SICK offers a variety of measurement procedures and with its many years of experience can offer the right solution to these challenges.

In-situ measuring technology

Process parameters are best measured where they are relevant and are present in an unaltered state – directly in the process: "In-situ measuring technology" is the catch phrase here. Determination of the process parameters occurs under process conditions and places special requirements on the measuring equipment. This innovative technology from SICK for the direct installation at the respective measurement site has proven itself over many years. This technology features minimal maintenance requirements and extremely short response times.

SICK offers in-situ analyzers in two versions:
- **Versions with measuring probes** for overpressure in moist gases or for very high gas concentrations or dust loading. Optimized for the mounting of only one side, this in-situ solution offers advantages through a defined measured section under raw measurement conditions.

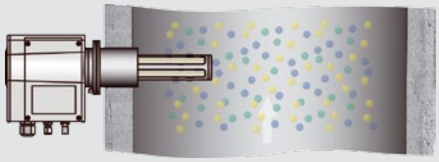
- **Cross-duct versions** for applications where representative measurements over the entire channel cross-section are required.

For in-situ measurements, optical procedures are advancing quickly. This is a trend that SICK has helped to lead for many years. The challenge is to be able to measure the process directly without changing it. The question how to calibrate respectively compare or monitor the measurement without intervening in the process here is a particular challenge.

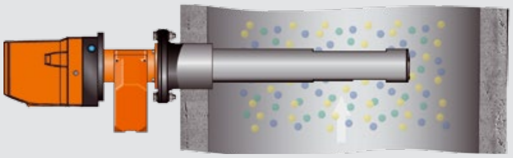
The in-situ measuring equipment from SICK performs automatical calibration procedures respectively measurement value monitoring in the measurement instrument. The measurement system must not be decoupled from the process here.

If the direct measurement in the process is not possible, a measurement in a bypass arrangement is considered. Here, a partial flow is sampled from the process, measured and immediately returned again.

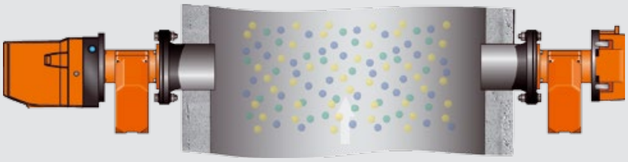
Measuring probes version, inline



Measuring probes version



Cross-duct version



Benefits:
- Continuous and direct measurement, no sampling required
- Cross-duct version for particularly representative measurement results or measuring probes version
- GMP measuring probe with open measuring gap or GPP gas diffusion probe

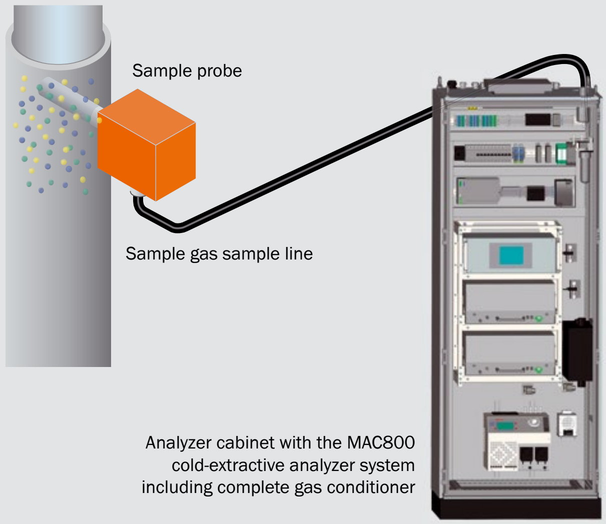
Extractive measuring technology

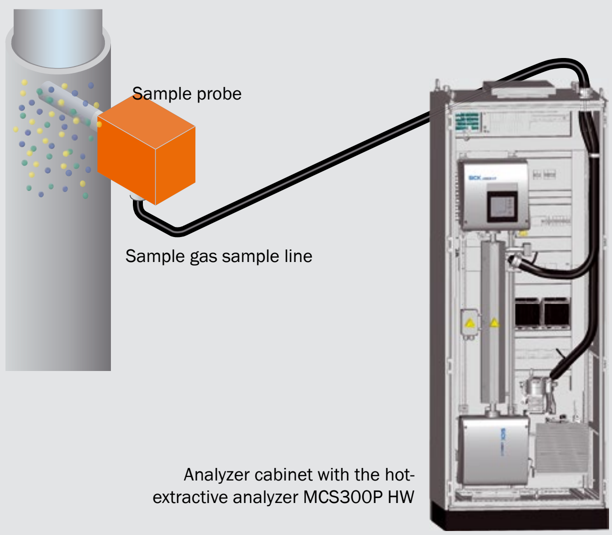
If the process conditions do not permit a direct measurement, the measurement medium must be extracted from the process and the analysis of the process parameters are realized under constant conditions. The catch phrase here is "extractive measuring technology". In other words, a partial gas flow is extracted from the gas duct, prepared and fed to the analyzer module under constant conditions. Depending on the process conditions and the measuring components, SICK offers complete solutions: from the sample probe, to the optimized gas conditioning, to the passive analyzer modules.

For extractive measurements, the mixture of the process is fed to the analyzer unaltered. The sampling and analysis technology must therefore be adapted to the respective process conditions.

Cold-extractive measurement technology
For process gases with low dewpoint, the analysis can occur without heated sample gas lines, i.e. cold-extractive. If process gases tend towards condensation, the gas sampling is carried out with heated (sample) lines and probes. To facilitate a "cold" measurement, a high-performance gas cooler is used to reduce the dewpoint to a defined value.

Hot-extractive measurement technology
For representative measurements, the gas matrix may not be modified in the process. A particular challenge is posed by the measurement of condensing or water-soluble gases. SICK solves this through the use of hot-extractive sample probes and analyses. In the process, all components that come in contact with the media including the analyzer are heated and held above the dew point (typically >200 °C).





Benefits:
- Optimally configurable analyzer modules for a wide range of applications
- Automatic validation/adjustment by test gases
- A solution adapted to the number of measurement components
- Precise and reliable measured results thanks to proven measuring principles
- Detection of aggressive, corrosive, combustible gases

Additional measuring principles and evaluation methods

- Diode laser spectroscopy (TDLS)
- Interference filter correlation, gas filter correlation
- Absorption (NDIR, NDUV)*
- UV absorption spectrometry
- Differential Optical Absorption Spectroscopy (DOAS)
- FTIR spectroscopy
- Zirconium dioxide (ZrO_2 flow sensor)
- Paramagnetic/electrochemical (O_2)
- Flame ionization detectors (FID)
- Zeeman Atom Absorptions Spectroscopy (ZAAS)
- Particle absorption/particle scattering

* (ND ... non-dispersive)

Everything from stand-alone devices to complete analyzer systems

SICK is able to supply application-oriented solutions through a combination of an extensive product range of analyzers and comprehensive experience. In addition to custom designs, there are also cost-optimized system housings, compact plug-and-play analyzers as well as complete systems for application-specific measurement tasks available. Moreover, we also plan, manufacture and supply complete analyzer systems such as ready-to-use analyzer containers, including all peripheral devices and commissioning.

The performance of an analyzer system depends not only on the quality of the analyzer used, it also depends significantly on the correct design of the sampling and preparation system. A precise matching of the analyzer to the process conditions is ensured in the application laboratories. For the optimal function, the analyzer is dependent on the interaction with the attached components such as sampling and preparation. Based on the process, the best-possible combination of analyzer and supporting periphery to the system is designed to be compatible and connectable. SICK realizes the entire analyzer system to allow the plant operator to focus on an efficient process.

In-situ transmitter TRANSIC100LP

In-situ measuring devices must be able to supply reliable process data directly on site under harsh process conditions even in potentially dangerous material concentrations. Robust measurement procedures are needed here. With the TRANSIC100LP, SICK is introducing its own intrinsically safe laser measurement technology into the world of O_2 process transmitters, also suitable for explosion proof areas.

TRANSIC100LP: in Zone 0, 1, 2 (Class 1, Div 1) process-side, Zone 1 + 2 (Class 1, Div 2) device-side

In-situ multi-component analyzer GM32

In-situ devices are used when measurements need to be especially fast or where a distortion of the gas matrix can easily occur. The GM32 in-situ analyzer measures directly in the process and is also certified for use in Ex-classified zones.

GM32: Mounting in Zone 2 (Zone 1, Class 1 Div2) device-side

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Extractive gas analyzers GMS800

The cold-extractive gas analyzer product family GMS800 facilitates the realization of measurement tasks both in rough industrial environment as well as in the Ex-Zones 1 + 2 (ATEX).

Device versions for individual measurement sites and complete solutions for different applications or multiple analyzer lines are configured and supplied as ready-to-use systems. Process measurements as well as emission measurements, are available as ready-to-use analyzer cabinets or containers. Depending on the requirements, the modern analyzers are available in 19" housing (Type GMS810), in wall-mount housing (Type GMS815P), in Ex-d housing (Type GMS820P) or in system installation housing (Type GMS830/831).

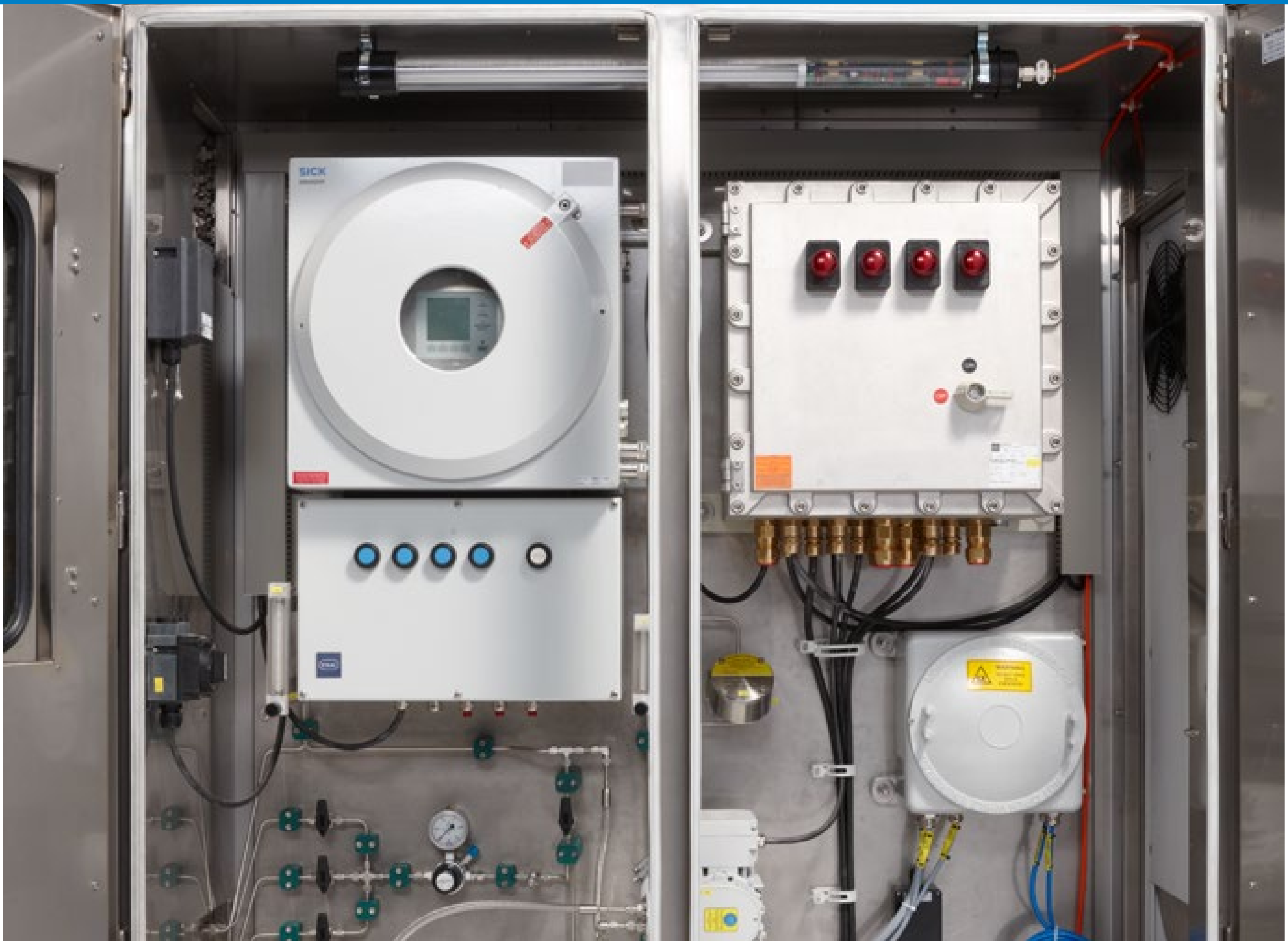
Type GMS815P: version in Ex-Zone 2

Extractive MCS300P multi-component analyzer

The MCS300P multi-component analyzer is suitable for a variety of application possibilities (gases and fluids) and features very low maintenance requirements, high reliability and long-term stability. The explosion-protected version of the MCS300P Ex is particularly suitable for process applications.

To prevent a drop below the dewpoint, SICK integrates this analyzer into complete hot-extractive analyzer systems.

MCS300P:
Raw gas measurements
in an analyzer container



In the process analytics, analyzers are often installed in explosion areas or measure materials that can form explosive mixtures. The regulations and standards are different throughout the world. For this, SICK offers measuring equipment that is approved for systems and division by classes and divisions as well as zones.

To meet the respective requirements, SICK pursues various application-dependent, Ex protection concepts.

- Through overpressure encapsulation, the formation of an explosive atmosphere is prevented by the use of a protective gas in the internals of the analyzer to maintain an overpressure vis-à-vis the atmosphere respectively a continuously sufficient dilution of the gases inside occurs which prevents the creation of an explosive mixture.
- With the pressure-resistant encapsulation, the creation of an explosive gas mixture inside the analyzer is permitted although ignition sources can be present. Any explosion that may possibly occur, however, is restricted to the inside of the housing.
- Analyzers with increased safety have no sources of ignition during normal operation. Sparks, arcs and high temperatures as well as malfunctions are protected by special measures.
- An intrinsically safe construction through a secure energy limitation prevents effects such as surface temperatures that could lead to an ignition or a spark formation – even in the event of a malfunction and taking energy storage effects into consideration.

Custom planning and engineering

Planning and engineering at SICK is combined with decades of experience in the field of emissions monitoring and process measurements of all kinds. Regardless of whether the application is in a power plant or under difficult conditions in a hazardous area of a refinery – SICK's engineers plan and design tailor-made solutions suitable for your specific requirements using the latest CAD systems. In doing so, not only is the latest technology in analyzers and sample conditioning deployed, but also state-of-the-art communications concepts. All systems are designed in accordance with the applicable international and national standards.

An experienced project management team and worldwide service organization are available to the customer not only for commissioning, but also to ensure reliable and sustained operation of the system.

Rugged analyzer systems and containers

Tailor-made designs including the complete range of peripheral equipment with component application consulting and comprehensive project management.

Performance factors

- All required technologies from a single source
- Comprehensive product spectrum for all requirements
- Solutions for many measuring tasks
- Cost-optimized standard solutions
- Application-oriented complete systems
- Ready-to-use analysis containers, tailor-made to meet customer specifications

Selection criteria for continuous process measurement systems

The selection of a measurement system for a specific application is not simple, however, the measurements will determine the product quality, the safety of plants and the efficient use of resources. The selection of the appropriate measurement system is thus directly results-relevant and costs of the procurement are only a small part of the factors to be considered.

9 steps to finding the suitable process measurement system

1 Which function does the measurement have in the process?

Measurements are only collected when they are relevant. A greater consideration about the meaning of the measurement helps with the specification of the measurement systems. Is the measurement relevant for:

- Plant safety?
- Product quality?
- Use of resources such as energy or raw materials?
- Quantity, type of output (product/emissions)?
- Compliance with laws or regulations?
- Appraisal of insurances?

2 Which requirements determine the data collected by the measurement system?

The requirements for the presence of the data regarding the process parameters to be monitored can be determined from the meaning of the measurement for the process.

- How often must the data be collected?
- Availability, reliability, repeatability of the data?
- Ramifications if measurement results are not present?
- Real-time measurement (reliable delay)?

3 How economical is the measurement?

Economical considerations play an important role for the specification of a measurement task in the process industry. Important cost-use criteria result from the measurement results. Lifecycle costs, increased efficiency and/or energy savings which are evaluated over a capital value method to a point in time are compared. These are:

- Costs for planning and commissioning
- Costs for initial and ongoing training
- Entire operating costs and organizational expenses
- Frequency and duration of calibrations and adjustments
- Test or calibration gases
- Energy consumption or consumption of operating materials such as instrument air
- Service life and disposal costs

4 What determines the process?

The direct requirements must be defined as precisely as possible by the process. Missing or insufficient information can place the selection of a measurement system into question and result in cost-intensive double procurement.

- Are the measurement parameters, the measurement area known with the required precision?
- How fast does the measurement need to be?
- Process temperature and pressure (min. – normal – max.)?
- Is the medium single-phase (droplets, gas bubbles, particles)?
- Requirements for the chemical resistance of the measurement systems: Are material compatibilities known?
- Requirements for the mechanical resistance: Flow speed, vibrations?
- Moisture content of the medium?
- Is the composition of the medium (matrix) completely known so that cross-sensitivites can be taken into account completely?
- Are guidelines, laws, standards or approvals for the devices used specified (e.g. explosion protection or electrical/functional safety)?

5 What conditions prevail at the operating site?

The environmental conditions pose additional requirements. If the installation situation is not specified sufficiently during the selection, a failure or loss of the system can result.

- Which environmental conditions (temperature, air pressure, air humidity) prevail at the site?
- Which temperature ranges (min./max.) Are to be expected during maintenance and start-up phases?
- Mounting location: Inside or outside? Dust and water protection (IP enclosure rating) requirements?
- How is the system mounted/secured: Cabinet or wall mounting? Is the measurement point accessible for the installation or maintenance?
- Which threads or flange connections are available? Can additional connections be provided?
- Energy supply, instrument air, calibration gas etc. present?

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6 How is the connection to the measurement point; how will the information be transferred?

The transfer of data is of crucial importance for process monitoring. The safety requirements for the data transmission are differentiated according to the importance of the measured values. The measurement system must be connectable to the plant.

- Is a display required on site? Can the measurement point be seen? Is an offset display necessary?
- Which output signals and alarms are required?
- Must alarms be able to be switched?
- Should an integration to the process control system occur?
- Redundancy?

7 Selection of the measurement system?

If the meaning of the measurement system is determined and all process-side and physical requirements are defined, a measurement system must be selected. Constructive and historical considerations for the specification of the measurement equipment play a role in this point.

- Is the suitable measuring principle selected?
- Has the measurement principle proven itself?
- Are there empirical values present for the equipment?
- Is a high constructive reliability of the measuring equipment ensured?
- Are there alternatives that can be included in the decision?

8 Solution competency?

The decision process shown does not necessarily follow a linear course. In reality, a more iterative process is found. A close cooperation with the manufacturer is as equally helpful as a dialog partner who has the necessary consulting competency. Requirements here are:

- Is sufficient competency of methods, knowledge and sufficient application experience present?
- Availability for a prompt replacement even on-site?
- Ability to also co-develop new applications?
- Is there an organization which can depict this?
- Is the necessary infrastructure e.g. through application laboratories present?

9 Maintenance and service?

Not only the competency but also the operative ability of a measurement system provider is of importance in the scope of the lifecycle consideration. Decisive questions are:

- Can the supplier support the measurement devices over the entire lifecycle?
- Is there a repair recommendation available for the measurement device?
- Does the supplier have an effective service network – also internationally?
- How fast can a service call occur in the event of a malfunction?
- How fast are replacements available, if necessary?

Current data via standardized communication

SICK's products come with a standardized data communications system for digital controllers in order that all data, measured values and parameters are available at all times and can be conveniently visualized and processed. This is an available cross-system from your own system network. As a result, you are able to access installations in remote areas.

Signals, interfaces and protocols

- Analog and digital signals
- Interfaces:
  - Serial interfaces such as RS-232/RS-485/RS-422
  - Ethernet network
  - OPC
- Protocols:
  - Modbus or Modbus TCP

Operation

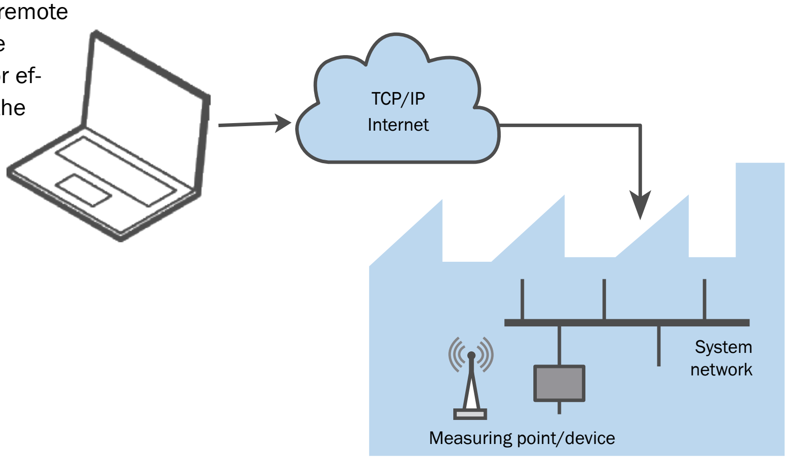
The operation of analyzers and systems is undertaken:

- Directly from the analyzer's operating unit
- Via a controller, enabling visualization and configuration for numerous analyzers
- Remotely via Ethernet or a mobile network
- With SOPAS ET, SICK's own visualization and configuration application

Remote diagnostics

Remote access to devices and systems can be realized online via:

- SICK's own remote diagnostics unit RDU via an analog telephone, cellular network or Ethernet network connection
- The FastViewer Desktop Sharing System with convenient remote access for remote diagnostics, remote maintenance and online support on the customer's PC. Also through firewalls for effective help thanks to rapid viewing of the content of your screen.



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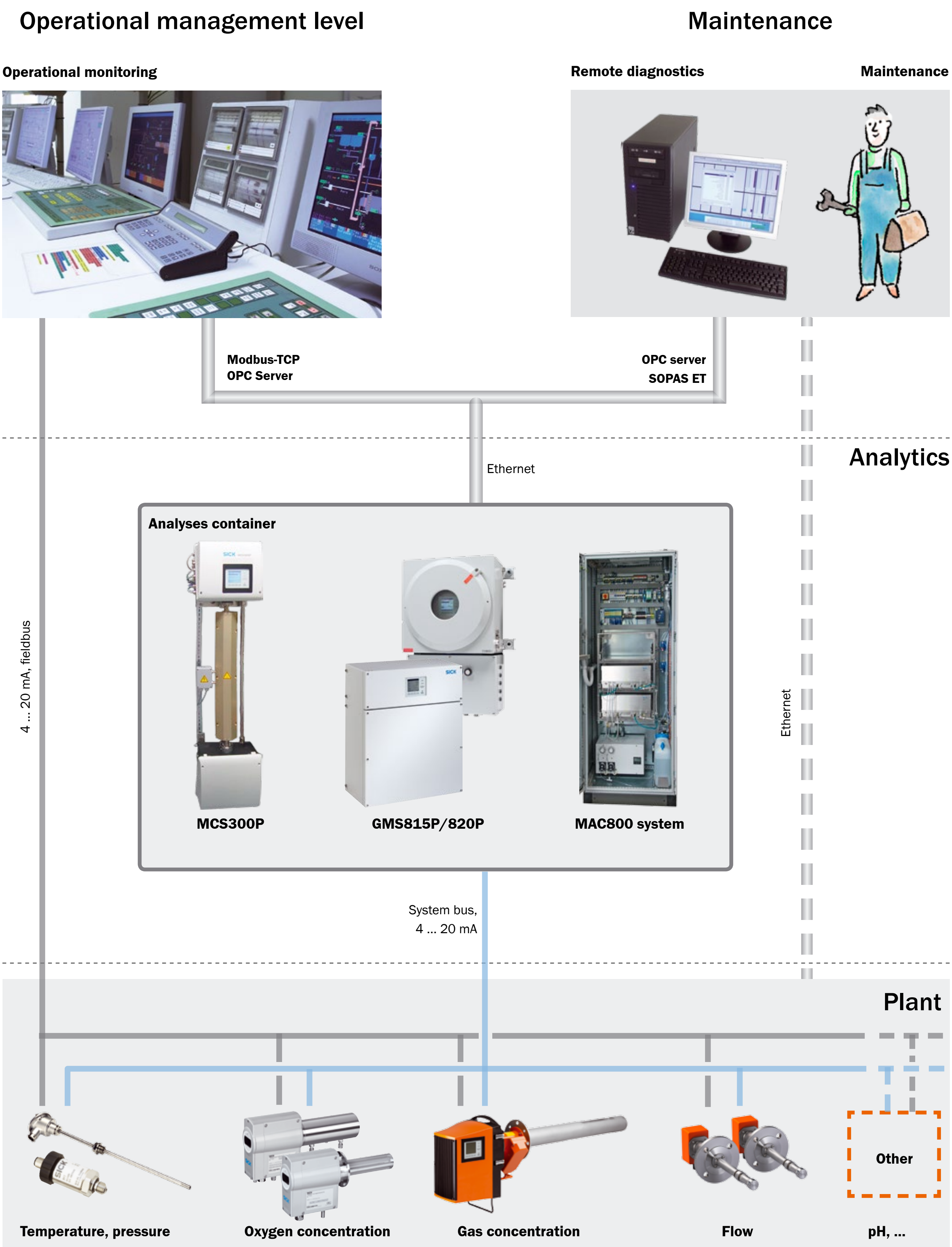

Operational management level
Maintenance
Operational monitoring
Remote diagnostics
Maintenance
Modbus-TCP
OPC Server
OPC server
SOPAS ET
Ethernet
Analytics
4 ... 20 mA, fieldbus
Analyses container
MCS300P
GMS815P/820P
MAC800 system
Ethernet
System bus,
4 ... 20 mA
Plant
Other
Temperature, pressure
Oxygen concentration
Gas concentration
Flow
pH, ...

Service for all your plant and measurement system requirements

Analyzers and measurement systems supply monitoring and control-relevant information, increase efficiency and protect people and systems. When optimally integrated and maintained, these components and systems enable montioring systems for safe processes, product quality and protection of people and the environment.

From the outset and over many years, SICK LifeTime Services offer suitable services for all aspects of your measurement systems and plants: from planning and conception, commissioning and operation to conversions and upgrades. Over 60 years of experience in the field and industrial expertise makes us a competent partner for the specific requirements of our customers.

Consulting and design

- Application consulting
- Planning services
- Project management
- Project and customer documentation

Modernization and retrofitting

- Software or firmware
- Customization of measuring ranges
- Expansion for additional measuring components

Product and system support

- Acceptance prior to delivery
- On-site commissioning
- Technical support
- Spares / wearing parts
- Maintenance and service contracts

Training and advanced training

- Operation & handling
- Maintenance
- Device software
- Statutory regulations, guidelines and directives

Inspection and optimization

- On-site acceptance
- System maintenance
- Logbook maintenance
- System support

Process measurement technology for efficient planning of sustainable technologies

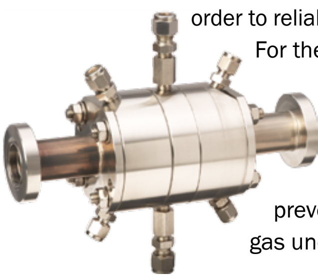
With the performance factors of a comprehensive range of products, all required technologies from one source, SICK is a reliable partner for cost-optimized solutions for numerous measurement tasks. SICK offers efficient planning of the most diverse projects for the realization of sustainable measurement technologies which have proven themselves over many years.

Rugged and robust

Both the process and the environment place direct requirements on the measurement equipment with demanding requirements for pressure, temperature and corrosion resistance as well exposure to high dust loads. To meet these requirements, SICK offers a large selection of high-quality corrosion-resistant materials. Based on the many years of experience, SICK analyzers have proven themselves in installations from the polar regions to the deserts of the world.

Secure

The requirements for secure operation of plants, the protection of personnel and the environment are continuously increasing. SICK implements these in the design of compact devices. Intrinsically safe, pressure-resistant or pressurized enclosure measuring equipment and systems are available for the prevention of explosions. In addition, SICK devices offer the ability to detect potentially dangerous gas concentrations that arise in order to reliably initiate countermeasures. For the prevention of injury to personnel during measurements of especially hazardous materials such as phosgene ($COCl_2$), components are used which prevent the leakage of the process gas under all conditions.



Available

Process parameters are continuously changing; information about the process must always be available and without delay. To secure a high operative availability of the measurement results, SICK utilizes pivotable filters and thus minimizes the time period for periodic calibrations. In order to increase operating uptime, even for unpredictable events, SICK offers a systematic, modular concept into its process analyzers. All information about calibration and sensor characteristics are stored in the modules. This guarantees the rapid detection of the malfunction and the targeted replacement of corresponding measurement modules – the process remains under control.

Fast

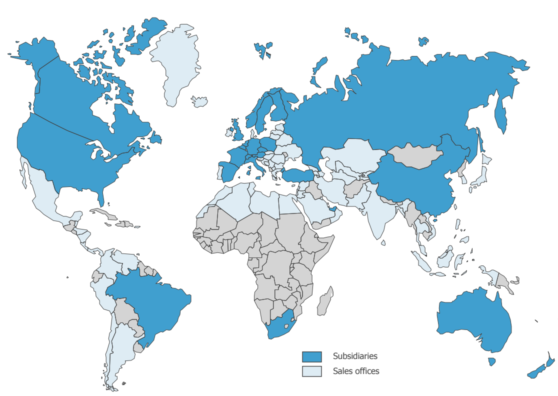
For the operation of the plant, it is decisive to always have the relevant process parameters in view and be able to react without delay to any changes. SICK develops in-situ measurement devices which precisely measure the process changes immediately and on-site. Likewise, SICK also optimizes the response time of extractive measurement systems. Through the systematic implementation of these premises, response times of 30 seconds can be realized even for cable length of 30 m.

Low operational costs

High product quality, sustainable use of resources, and safety of the plant place high expectations on the individual measurement tasks. SICK offers the use of especially reliable measurement principles and evaluation procedures. An example of this is laser spectroscopy where the oxygen concentration can be measured directly. The user can rely on robust measurements – free of drift with long calibration intervals of 12 months. The measurements remain stable over a long period of time.

Worldwide

SICK can offer its analyzers for use in different standards. E.g. For measurement devices that are used in explosion areas, concepts for American-influenced markets according to NEC500, for Europe ATEX or international IECEx. Likewise, the devices are registered for all important national approvals. As a reliable partner, SICK, with its with its global service organization, offers comprehensive services for plants and systems.



In-situ gas analyzers

GM32, GM32 Ex

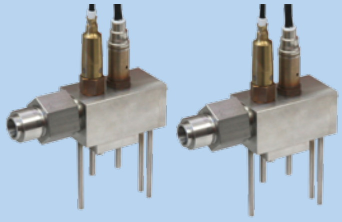
Direct measurement of aggressive gases
– in hazardous areas also

Technical data	
Measuring principle	UV spectroscopy
Measuring components	NH_3, NO, NO_2, SO_2, CH_3SH, $(CH_3)_2S$, $(CH_3)_2S_2$, H_2S, TRS
Max. number of measured values	4
Process temperature	0 °C to +550 °C higher temperatures available on request
Process pressure	60 hPa relative
Ambient temperature	–20 °C ... +55 °C temperature change max. ±10 °C/h
Hazardous area	Nonhazardous areas Hazardous area: Zone 2 (Zone 1, Class 1 Div2)
Device versions	Cross-duct version, measuring probes version
System components	Sender-receiver unit, sender-receiver unit in pressure-resistant encapsulated housing, measuring probe or reflector unit, connection unit, connection unit in pressure-resistant encapsulated housing, control unit SCU (option)
Note	The scope of delivery depends on application and customer specifications.

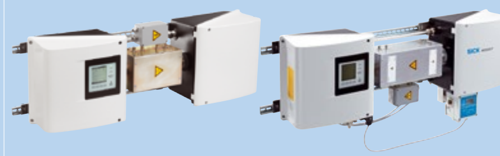
At a glance

- Direct, fast in situ measurement
- No sampling, no gas transport and gas conditioning
- Up to 9 measuring components at the same time
- DOAS and CDE evaluation methods
- Automatic self-test function (QAL3) without test gases
- Several independent measuring ranges with automatically optimized precision possible
- Pressure-resistant encapsulated device version for Ex-Zone 1 and 2, FM Class 1 Div2

Detailed information ➜ mysick.com/en/GM32

			
	GM700	**TRANSIC100LP**	**GM960**
	Greater efficiency of process analysis – even under difficult conditions	Laser measurement of oxygen in harsh industrial applications	Determination of CO corrosion level and corrosion load via grid measurement
	Diode laser spectroscopy (TDLS)	Diode laser spectroscopy (TDLS)	Zirconium dioxide (ZrO_2)
	HCl, HF, NH_3, O_2	O_2	CO, O_2
	1	1	2
	0 °C ... +430 °C higher temperatures available on request	–20 °C ... +80 °C	–
	250 hPa depending on type and purge air unit	800 hPa to 1,400 hPa	50 hPa to 100 hPa
	–40 °C to +50 °C four configurable ranges	–40 °C to +60 °C	–10 °C to +45 °C
	Nonhazardous area, Ex-Zone 2	Nonhazardous area, Zone 1 + 2 (mounting Zone 0), Class I Division 2, mounting Class I Division 1	Nonhazardous areas
	Measuring probes version, cross-duct version	Ex-type	–
	Sender-receiver unit, measuring probe or reflector unit, evaluation unit AWE	–	Boiler wall probe with CO and O2 sensor, connection box, master unit
	The scope of delivery depends on application and customer specifications.	The scope of delivery depends on application and customer specifications.	The scope of delivery depends on application and customer specifications.
	• High selectivity due to high spectral resolution • Short response times • No calibration required • No moving parts: minimal wear and tear • No gas sampling and conditioning required	• O_2 transmitter using effective laser spectroscopy • Optimized for use in harsh industrial environments – explosion-protected version • Measurement directly in the process or within the slip stream using a sample gas cell (option) • Resistant against aggressive chemicals and high moisture • Stable measuring values due to drift monitoring • Low maintenance requirements during the entire duration of operation • Heated optics to prevent condensation	• Up to 40 boiler wall probes, each with one CO and O_2 sensor for installation directly in the boiler wall • Up to 40 connection units for pressurized air, power supply and data bus • One master unit with standard network connection for operating the peripheral system components • Software MEPA-GM960 for graphical visualization of measured values, for process control, storage of data and communication
	→ mysick.com/en/GM700	→ mysick.com/en/TRANSIC100LP	→ mysick.com/en/GM960

Extractive Gas Analyzers

	 **GMS810/815P/820P/830**	 **MCS300P/MCS300P EX**
	Tailor-made gas analysis for process and emission monitoring	Simultaneous process monitoring of up to 6 measuring components
Technical data		
Measuring principle	NDUV-photometry, NDIR-photometry, interference filter correlation, paramagnetic dumbbell principle, electromagnetic cell, thermal conductivity measurement, flame ionization detection	Gas filter correlation, interference filter correlation
Measuring components	Ar, SO_2, $CHClF_2$, $CHCl_2F$, CH_2Cl_2, CH_4, CH_3OH, CO, $COCl_2$, CO_2, CS_2, $CO+CO_2$, C_2H_2, $C_2H_2F_4$, C_2H_4, C_2H_6, SF_6, C_3H_6, $(CH_3)_2CO$, C_3H_8, C_4H_{10}, C_4H_6, $C_6H_4Cl_2$, C_5H_{12}, O_2, C_6H_{14}, C_7H_{16}, COS, He, H_2, H_2O, H_2S, NH_3, NO, NO_2, N_2O, Cl_2, additional components available on request, C_{org}	Br_2, $(C_2H_5)_3N$, $(CH_3)_3SiCl$, C_2Cl_4, C_2H_2, $C_2H_2Cl_2$, C_2H_3Cl, C_2H_4, $C_2H_4Cl_2$, C_2H_5OH, C_2H_6, $C_2HBrClF_3$, C_2HCl_3, C_3F_5ClOH, C_3F_6, C_3F_6O, C_3H_6, C_3H_7OH, C_4H_8, $C_4H_9NH_3$, $C_6H_4Cl_2$, C_6H_5CHO, $C_6H_5NO_2$, CCl_2F_2, CCl_4, CH_2Cl_2, CH_3CHO, $CH_3COOC_2H_3$, CH_4, $CHCl_3$, $CHClF_2$, Cl_2, CO, CO_2, $COCl_2$, COS, CS_2, H_2O, HCl, HCN, HF, N_2O, NH_3, SF_6, SiF_4, SO_2, UF_6, NO, NO_2, C_3H_8, C_4H_{10}, C_6H_5Cl
Max. number of measured values	8	6
Process temperature	Input analyzer: 0 °C to +45 °C	+50 °C to +200 °C
Process pressure	Hosed gas lines: 200 hPa to 300 hPa Piped gas lines: 200 hPa to 1,000 hPa	0.8 bar ... 60 bar
Ambient temperature	+5 °C to +45 °C	–20 °C to +55 °C temperature change max. ±10 °C/h
Hazardous area	Nonhazardous areas, Ex-Zone 2, Ex-Zone 1	Nonhazardous areas, Ex-Zone 2 + 1
Device versions	19" rack, wall mounting housing, pressure-resistant encapsulated housing, system integration module	–
System components	–	Sample probe, sample gas line, sample point switching, sample preparation, analyzer
Note	The scope of delivery depends on application and customer specifications.	The scope of delivery depends on application and customer specifications.
At a glance		
	• 7 different analyzer modules: DEFOR (NDUV, UVRAS), FIDOR (FID), MULTOR (NDIR), OXOR-E (electrochemical O_2), OXOR-P (paramagnetic O_2), THERMOR (TC) and UNOR (NDIR) • 4 different types of enclosures • Gas module with sample gas pump and/or control sensors • New enclosure type for easy and quick integration in analyzer systems • Remote diagnosis via Ethernet with software SOPAS ET	• Simultaneous measurement of up to 6 components • Process cells up to 60 bar and 200 °C • Automatic sample point switching • Integrated adjustment unit (optional) • Safety devices for measurement of toxic or flammable mixtures • Extended operation via PC and software SOPAS ET • Flexible I/O module system
Detailed information	➜ mysick.com/en/GMS800	➜ mysick.com/en/MCS300P

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	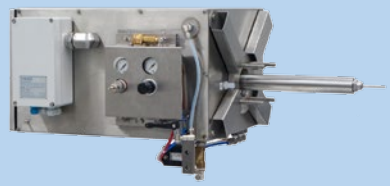	
GME700	**EuroFID (LEL)**	**MONOCOLOR 2Ex**
Sophisticated process analysis "brought into line"	Reliable UEG monitoring in processes	Colorimetric H_2S analysis over a wide concentration range
Diode laser spectroscopy (TDLS)	Flame ionization detection	Colorimetry
HCl, HF, H_2O, NH_3, O_2	C_{org}	H_2S
2	1	1
0 °C to +210 °C	Inline version: 0 °C to +350 °C Other versions: 0 °C to +200 °C	+5 °C to +45 °C temperature on the analyzer input
600 hPa to 1,200 hPa	50 hPa relative	60 hPa to 120 hPa relative
0 °C to +55 °C	Analyzer, terminal box: 0 °C to +55 °C Operating unit: 0 °C to +40 °C	+5 °C to +40 °C
Nonhazardous areas	Nonhazardous areas, Ex-Zone 1+ 2	Nonhazardous areas, Ex-Zone 1 + 2
19" rack	Inline version, version for Ex-Zone 1	19" rack, wall housing for Ex-Zone 1
Analyzer	Analyzer, operating unit, terminal box	–
The scope of delivery depends on application and customer specifications.	The scope of delivery depends on application and customer specifications.	The scope of delivery depends on application and customer specifications.
• High selectivity due to high spectral resolution • No calibration required • No moving parts: minimal wear and tear • Heated multipath measurement cell • Hot-wet measurement technology	• Integrated dilution of sample gas • No moving parts • All gas paths are heated • Optimum detector geometry	• Measuring ranges from ppm to vol% • Very specific measuring method • 19'' rack or wall mounting enclosure for hazardous area Zone 1 (ATEX) • Calibration slide for calibration without test gas
→ mysick.com/en/GME700	→ mysick.com/en/EuroFID	→ mysick.com/en/MONOCOLOR

Analyzer systems

	 **MCS300P HW**	 **MAC800**
	Simultaneous process monitoring of up to 6 measuring components	Modular, complete system for extractive gas analysis
Technical data		
Measuring principle	Gas filter correlation, interference filter correlation, zirconium dioxide sensor	In accordance with the integrated GMS800 analyzer modules
Measuring components	CO, CO_2, HCl, H_2O, NH_3, NO, NO_2, N_2O, O_2, SO_2	CO, CO_2, CH_4, NO, NO_2, N_2O, SO_2, O_2
Max. number of measured values	6	9
Process temperature	Process: ≤ +1.300 °C Measurement input: ≤ +220 °C	Process: ≤ +1000 °C Input analyzer system: ≤ +200 °C
Process pressure	800 hPa to 1,200 hPa	–
Ambient temperature	+5 °C to +35 °C temperature change max. ±10 °C/h With cooling device: +5 °C to +55 °C temperature change max. ±10 °C/h	Standard: +5 °C to +35 °C With cooling device: +5 °C to +50 °C
Hazardous area	Nonhazardous areas	–
Device versions	Steel sheet cabinet	Steel sheet cabinet, glass-fiber reinforced plastic cabinet
System components	Analyzer cabinet, sample probe, heated measurement gas line, sample point switching (max. 8 sample points)	Modular housing GMS830 or GMS831, analyzer cabinet, sample probe, measurement gas line, measurement gas cooler, NO_x converter (option), cooling unit (option), heating (option)
Note	The scope of delivery depends on application and customer specifications.	The scope of delivery depends on application and customer specifications.
At a glance		
	• Simultaneous measurement of up to 6 components plus O_2 • Measurement gas flow monitoring and measurement gas pressure detection • Temperature of the system components up to 220 °C • Automatic sample point switching for up to 8 sample points (optional) • Automatic adjustment to the zero and reference point • Integrated adjustment of the device without test gas (optional) • Extended operation via PC and software SOPAS ET • Flexible I/O module system • In combination with the SCP3000 from SICK: Gas sampling under harsh conditions at the rotary furnace inlet	• Cold-extractive analyzer system certified according to EN 15267-3 • Plug-and-play analyzer module with 24 V energy supply • Operating unit for displaying all measured values and status information on a touch screen • External sensors via interfaces connectable • Display and monitoring of external sensors possible • Remote control of the complete system via Ethernet, Modbus or optional GPRS modem
Detailed information	➜ mysick.com/en/MCS300P HW	➜ mysick.com/en/MAC800

	 **MKAS**	 **TOCOR**
	Complete system for extractive gas analysis	Reliable monitoring of organic water pollutants
	In accordance with the integrated S700 analyzer modules	TOC/TC measurement through thermal or UV oxidation of C to CO_2 with subsequent CO_2 measurement by means of NDIR photometry
	CH_4, CO, CO_2, NO, NO_2, N_2O, O_2, SO_2	C_{org} (TOC/TC)
	In accordance with the integrated analyzer modules	1
	Input analyzer system: 0 °C to +220 °C Process: 0 °C to +900 °C depending on sample probe	+5 °C to +45 °C
	–	900 hPa to 1,100 hPa
	Standard: +5 °C to +35 °C without being subjected to direct sunlight with cooling device: +5 °C to +50 °C	–10 °C to +35 °C
	Nonhazardous areas	Nonhazardous areas, Ex-Zone 2, Ex-Zone 1
	Steel sheet cabinet, glass-fiber reinforced plastic cabinet	–
	Analyzer SIDOR or S710, analyzer cabinet, sample probe, cooling unit(option), measurement gas cooler, measurement gas line, measurement gas pump, NO_x converter (option)	Analyzer, analyzer cabinet, sample filter
	The scope of delivery depends on application and customer specifications.	The scope of delivery depends on application and customer specifications.
	• Up to 3 analyzers S710 or SIDOR or NO_x converters • Includes all important system components • Test gas infeed via the gas sample probe • High-performance measuring gas cooler • Measuring gas bypass • Wired and tested ready for operation	• Very high measurement accuracy even with small TOC concentrations • Generates its own carrier gas in the system • Sample point switching for up to 4 sample points as an option • Versions for application in Ex-Zone 1 or 2 (ATEX) • Versions as stand-alone device or as wall device
	→ mysick.com/en/MKAS	→ mysick.com/en/TOCOR

Volume Flow Measuring Devices

		
	FLOWSIC100 Process	**FLOWSIC100 Process**
	Reliable and precise volume flow measurement in processes	Probe version for explosion areas Zone 2 (ATEX)
Technical data		
Measuring principle	Ultrasonic propagation time delay measurement	Ultrasonic propagation time delay measurement
Measuring components	Gas velocity, gas temperature, volume flow a.c., volume flow s.c., sound velocity, mass flow	Gas velocity, gas temperature, volume flow a.c., volume flow s.c., sound velocity, mass flow
Max. number of measured values	1	1
Process temperature	–40 °C to +260 °C other temperatures available on request	–40 °C to +260 °C other temperatures available on request
Process pressure	-0.5 bar ... 16 bar	-100 hPa to 100 hPa
Ambient temperature	Sender-receiver units FLSE100, control unit MCUP: –40 °C to +60 °C	Sender-receiver units FLSE100, control unit MCUP: –40 °C to +60 °C
Enclosure rating	IP 65	IP 65
Device versions	Cross-duct version	Measuring probes version
Note	The scope of delivery depends on application and customer specifications.	The scope of delivery depends on application and customer specifications.
At a glance		
	• Corrosion-resistant converter made of stainless steel or titanium • Up to 16 bar process pressure • Hermetically sealed ultrasonic converter • Integral measurement across the duct diameter • Measurements free of pressure loss and without influencing the process • Automatic operational check with zero and reference point test	• Corrosion-resistant converter made of titanium • Version with measuring probe for installation on one side • Explosion-protected for use in capstone Zone 2 (ATEX) • Automatic operational check with zero and reference point test
Detailed information	➜ mysick.com/en/FLOWSIC100 Process	➜ mysick.com/en/FLOWSIC100 Process

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	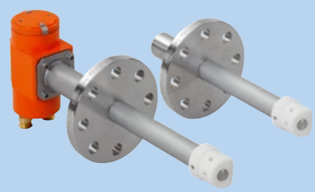 **FLOWSIC100 Flare**	 **FLOWSIC100 Flare**
	Reliable gas flow measurement in flare gas applications	Reliable gas flow measurement in flare gas applications
	Ultrasonic propagation time delay measurement	Ultrasonic propagation time delay measurement
	Gas velocity, gas temperature, gas volume and quantity, mass flow, volume flow a.c., volume flow s.c., molecular weight	Gas velocity, gas temperature, gas volume and quantity, mass flow, molecular weight, volume flow a.c., volume flow s.c.
	1	1
	Standard: –70 °C to +180 °C High-temperature zone 1: –70 °C to +280 °C High-temperature zone 2: –70 °C to +260 °C Low-temperature: –196 °C ... +100 °C on request	Standard: –70 °C to +180 °C High-temperature zone 1: –70 °C to +280 °C High-temperature zone 2: –70 °C to +260 °C Low-temperature: –196 °C ... +100 °C on request
	–0.5 barg to 16 barg	–0.5 barg to 16 barg
	Sender-receiver units FLSE100: –40 °C to +70 °C Sender-receiver units FLSE100: –50 °C to +70 °C option Control unit MCUP: –40 °C to +60 °C	Sender-receiver units FLSE100: –40 °C to +70 °C Sender-receiver units FLSE100: –50 °C to +70 °C option Control unit MCUP: –40 °C to +60 °C
	Sender-receiver units FLSE100: IP 65, IP 67 Control unit MCUP: IP 65 Control unit MCUP, Ex d housing: IP 66	Sender-receiver units: IP 65, IP 67 Control unit MCU: IP 65
	Cross-duct version	Cross-duct version
	The scope of delivery depends on application and customer specifications.	The scope of delivery depends on application and customer specifications.
	• Innovative sensor designed for very high gas velocities • Highly precise time resolution for measurement near zero • Right angle installation of the sensors • For pressures up to 16 bar • Hermetically sealed converter made of titanium or stainless steel • For explosion areas Zone 1, Zone 2 (ATEX/IECEx) and CSA Class I, Div1 • Optional with converter equipment • Automatic zero and reference point check	• High converter performance • Innovative sensor designed for very high gas velocities • Highly precise time resolution for measurements near zero • For pressures up to 16 bar • Hermetically sealed converter made of titanium or stainless steel • For explosion areas Zone 1, Zone 2 (ATEX/IECEx) and CSA Class I, Div1 • Optional with converter equipment (version EX-RE) • Automatic zero and reference point check
	➜ mysick.com/en/FLOWSIC100 Flare	**➜ mysick.com/en/FLOWSIC100 Flare**

Glossary

A

Accuracy
Qualitative term for the extent of approximation of detected results to the reference value, depending on determination of an agreement, this may relate to the true value, approximate value or an empirical value.

Analyzer system
Consists of piping, hardware and instrumentation that are required in order to obtain an automatic and continuous analysis of the process or a product flow. This includes the analyzer house, the sampling and preparation, the analyzers and the display units as well as the disposal (ASTM D 3764).

Availability
Is the ratio of the total operating time to the time in which the analyzer functions correctly.

C

Calibration
Determination of the link between measured value or expected value, the output quantity and the associated true or correct value, which as input quantity of existing quantity to be measured for an observed measurement equipment for specified condition (DIN 1319-1:1995).

D

DOAS – Diff. Optical Absorption Spectroscopy
For the differential optical absorption spectroscopy, a characteristic absorption spectrum is recorded for the gases to be specified. In the process, the gas concentrations from the characteristic difference of the absorption are calculated directly with the absorption structures. Through the evaluation of the characteristic absorption spectrum under consideration of the differences, the result remains uninfluenced from other gas components, dust and moisture.

Drift
Slow temporal change of the value of a measuring-technical feature of a measuring device (DIN 1319-1:1995).

F

FID – Flame Ionization Detection
Measurement procedure for determining the total hydrocarbon (TOC or C_{org}). In the detector, a flame is controlled with a hydrocarbon-free gas mixture and an electrical field is applied. Developing hydrocarbons are cracked and stripped and the CH fragments oxidize to CHO+ ions. The occurring ion flow is measured.

FTIR – Fourier Transformation Infrared
Measurement using a Michelson interferometer. The beam is divided at a beam splitter A beam is directed to a fixed mirror while the other one is reflected to a moving mirror. After the reflection, the beams are joined again and interfere with each other. This results in an interferogram which is calculated into a spectrum using a Fourier transformation.

G

Gas filter correlation
See interference filter correlation, the interference filter is replaced by gas-filled cells.

I

Interference filter correlation
Optical filters are alternatingly pivoted into a light beam. One filter allows the beam to pass, which is absorbed by the gas to be measured, while the other filter allows beams to pass that are not absorbed. The gas concentration is calculated from the difference of the absorption which is measured by a detector.

M

Measurement inaccuracy
Specific value gained from measurements and together with the measurement result serves for the identification of a value range for the true value of the measured value. The measurement inaccuracy is a quantitative measure for the qualitatively used term of the precision only (DIN 1319-1:1995).

Measuring principle
The physical basis of the measurement. The measuring principle makes it possible to determine another value instead of the measured value, in order to unambiguously derive the determined value from it (DIN 1319-1:1995).

N

NDIR – Non-Dispersive Infrared Absorption
Infrared radiation of a specific wavelength range is alternatingly pulsed via a chopper wheel and channeled into the measuring cell and the reference cell. The comparison of both measurements at the detector yields the gas concentration.

P

Precision
The agreement of independent measurements that arise through repeated measurement under the same conditions at the same probe. Precision is expressed in repeatability and reproducibility.

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R

Random errors
The random variation which is found in the population of measurement results despite a precise monitoring of the variables. Random errors influence the precision.

Reference method
With this procedure, a reference material is inserted into the analyzer and the measurement results are compared with the reference value of the reference probe (ASTM D3764). The use of optical filters can also be seen as reference method.

Reference standard
Material or substance with features whose values for the purpose of the calibration, the evaluation of a measurement procedure or the quantitative determination of material properties are sufficiently specified e.g. certified test gases (DIN 1319-1:1995).

Repeatability
Degree of the agreement of independent measurements which are gained from the same material from different persons, different analyzers, and in different laboratories.

Reproducibility
The difference between two consecutive analyzer results for which only one of 20 measurements is exceeded (95% level of confidence). The analyzer must be operated in normal operating conditions and with a sample of the same composition (ASTM D3764). The standard deviation of the analyzer is often used.

Resolution
Specification for the quantitative detection of the feature of a measuring device, in order to uniquely differentiate between measurement values that are very close to each other, e.g. through the smallest difference between two measurement values which the measuring device can clearly differentiate (DIN 1319-1:1995).

Response time
The time interval that elapses for a dramatic change at different points in the process until this change is displayed on the analyzer. It is dependent on the plant design and the flow rate (ASTM 3764). The response time of analyzer systems is made up of the time of the sampling, preparation and response time of the analyzer.

S

Sensitivity
Describes a change of value in the output variable of a measuring device based on the change of value of the input variable which causes it (DIN 1319-1:1995).

Standard deviation
Positive square root from the mean square deviation of the arithmetical average divided by the number of degrees of freedom.

Systematic error
Deviation of the expected value from the true value. Composed of known and unknown systematic deviations (DIN 1319-1:1995). Systematic errors influence the precision.

T

TDLS – Tunable Diode Laser Spectroscopy
A laser is modulated over an absorption line of the gas to be measured. The adsorption strength of the specific line is measured via a detector. Alternatively, the area under an absorption profile can be specified or the 2f method can be applied and the gas concentration thus measured.

Test gas
A calibration gas is a gas or mixture of gases suitable for calibration due to its known composition. It can also be used for validation or verification.

Testing method
For this method, a sample is taken of the sampling and analyzed according to specific specifications. The analysis results are compared with those of the analyzer under consideration of the response time (ASTM D3764).

Transit-time difference measurement
Measurement of the flow velocity via ultrasound. Sender and receiver are attached offset to the flow direction, the flow velocity is measured from the difference of the transit time in and against the direction of flow.

U

UVRAS – UV Resonance Absorption Spectroscopy
NO-specific gas filter correlation spectroscopy for use of a NO-specific plasma source.

Z

Zeeman Atom Absorption Spectroscopy (ZAAS)
The random variation which is found in the population of measurement results despite a precise monitoring of the variables. Random errors influence the precision.

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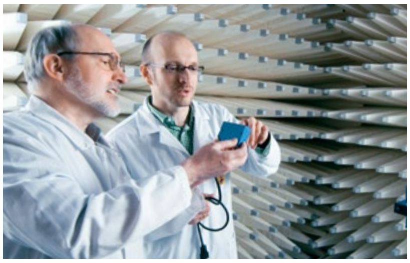
SICK at a glance



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