

A photograph of the SICK MAIHAK GM31 In-situ Gas Analyzer. The device is a bright orange, rugged-looking unit with a cylindrical probe extending from its front. It is mounted on a metal flange. In the background, another similar unit is visible, and the scene is set against a light blue sky. The main unit has 'SICK MAIHAK' printed on its side. A blue semi-transparent box is overlaid on the left side of the image, containing the product name.

GM31 In-situ Gas Analyzer

Simultaneous or single measurement of SO₂, NO,
NH₃ or NO₂ as well as Temperature and Pressure

Measurement and Control with the GM31 Analyzer

Accurate, Real-Time Gas Analysis for Flue Gas Purification, Emissions Monitoring, and Manufacturing Processes

The concentrations of SO₂, NO, and NH₃ or NO₂ are critical in the control of flue gas treatment plants and a range of manufacturing processes. The GM31, an in-situ, multi-component analyzer from SICK MAIHAK, measures these values – along with the pressure and temperature – continuously and directly in the gas duct.

The short response time of the GM31 increases the efficiency of control loops, while emissions monitoring and process analysis applications benefit from its high availability, precision, and minimal maintenance requirements. The GM31 system is certified for use as an emissions measuring device.



POWER PLANTS

Limit values for the emission of pollutants (including SO₂ and NO_x) are defined by law. The GM31 allows you to monitor these emissions and control flue gas treatment plants and combustion processes.

Typical applications include:

- Denitrification (DeNO_x)
- Flue gas desulfurization (FGD)
- Emissions monitoring



WASTE TREATMENT PLANTS

Waste incineration plants with power and heat extraction lead the way in waste treatment, where the thorough treatment of flue gas is of paramount importance. Thanks to its reliability even under difficult operating conditions, the GM31 system is the ideal choice for the following applications:

- Denitrification (DeNO_x)
- Flue gas scrubbers
- Emissions monitoring



IRON AND STEEL INDUSTRY

The GM31 system is ideal for measuring SO₂ and NO or NO₂ in flue gas treatment and emissions monitoring processes, as well as during process control and monitoring (supply/return air). Applications include:

- Sintering ovens
- Converters
- Emissions monitoring

During configuration, the appropriate limit values (e.g. for temperature and dust content) for the operating conditions must be taken into account.



Controlling and Analyzing Processes

Whether in industry, power generation, or waste treatment, effective process control boosts operating efficiency and improves the ecological balance. Deploying the GM31 in FGD and DeNOx plants demonstrates its benefits:

- The flue gas desulfurization process is monitored and the supply of lime is controlled efficiently.
- In DeNOx plants (SCR/SNCR), the GM31 system monitors NH₃ slip. The ammonia supply is controlled by measuring the NO in the incoming gas. The NH₃ measurement in the outgoing gas is used to check efficiency. The control process is continuously adjusted on the basis of the readings.

Monitoring Emissions

GM31 detects and quantifies pollutants and technical gas/particles mixtures reliably, quickly, and accurately. Standardized interfaces support integration with higher-level data acquisition systems. Additional sensors allow pre-normalized measured values for volume, O₂ content, or humidity to be output – with no additional computation.

With the GM31, legal regulations and corporate requirements can be easily and reliably fulfilled.



CEMENT INDUSTRY

When waste is used as a substitute fuel, the emissions from cement works are subject to the legislation for waste treatment plants (e.g. the Federal German Pollution Control Act (17th Implementing Ordinance). Irrespective of the fuels used, the GM31 ensures that flue gas treatment can be controlled efficiently under variable conditions and that emissions are reliably monitored. Applications include:

- Denitrification plants (DeNOx)
- Emissions monitoring

PAPER AND PULP INDUSTRY

Special attention is paid here to reducing SO₂ during the combustion of black liquor.

- Flue gas scrubbers
- Emissions monitoring
- Optimization of black liquor combustion

PETROCHEMICAL INDUSTRY

- Emissions monitoring
- Catalyst
- Controlling and monitoring various process steps

Other applications

The GM31 system is ideal for a range of tasks that involve measuring SO₂, NO, and NO₂ or NH₃. Other examples include:

- Aluminium manufacture
- Sulfuric/nitric/phosphoric acid production
- Claus plant
- Landfill gas monitoring

GM31 – Technology that Sets Standards

GM31 – Leading the Way in Gas Analysis by Focusing on the Flow



The right canoeing technique

Stay ahead of the current to stay in control

Stick to the main current – avoid peripheral turbulence

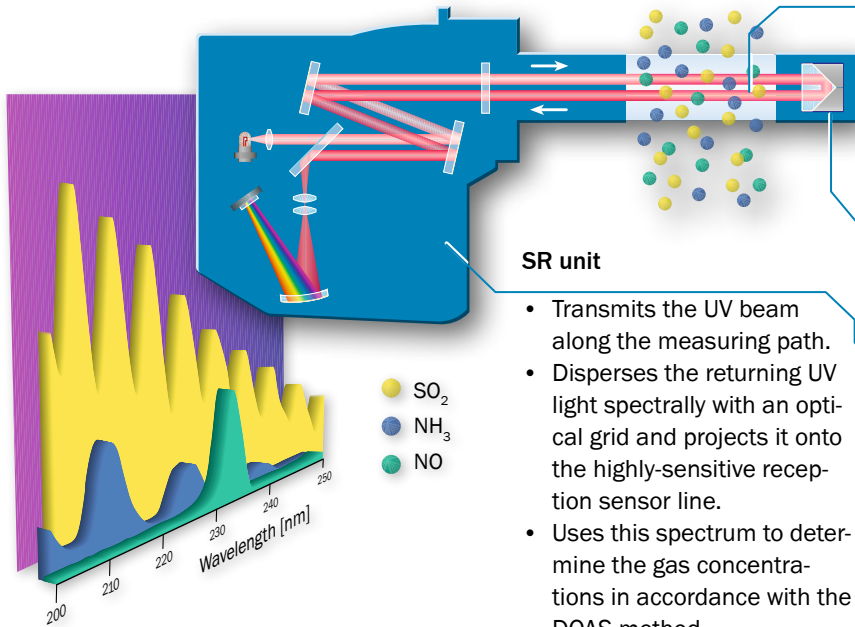
Don't drift off – countersteer and compensate for lateral forces

Detect and avoid obstacles early on

The right measuring technique

- The GM31 carries out direct measurements with UV light in the gas flow. This ensures an extremely rapid response time, particularly if an open measuring probe is used (GMP).
- If arranged and configured accordingly, the data measured by the GM31 can be used for controlling a process step before the measured gas concentrations even reach it.
- With different measuring paths and probe lengths, representative measurements can be taken from the main flow in virtually any application.
- Thanks to the DOAS measuring method with optimized algorithms, the GM31 effectively cancels out cross-sensitivities caused by extraneous factors.
- In regular, automatic control cycles, the zero and control point are aligned and contamination is compensated. In this way, the GM31 system ensures that measurements stay “on track”.
- The GM31 internal monitoring system is optimized to ensure that any interference is detected and specific, timely warnings can be output.
- Substitute values, which the system automatically switches to if the external measurement signal fails, can be set for the measured data from external sensors. A warning message is output at the same time.
- Diagnosis messages are divided into two categories: a warning message is output if plausible measurement results can still be expected. A fault message, however, is output if measurement mode is no longer reliable.

The Measuring Principle



UV absorption spectra for test gases in the GM31 evaluation range

Active measuring path in the gas duct

- Open measuring probe or with diffusion filter
- Optoelectronic, in-situ measurement directly in the duct; no gas extraction

Triple reflector on measuring probe

- Reflects the measuring beam back to the SR unit.

Signal evaluation in the UV spectrum

The GM31 records the characteristic absorption patterns of the gases to be measured in a UV wavelength range of between 200 and 250 nm. The optimized DOAS (differential optical absorption spectroscopy) algorithms from SICK MAIHAK cancel out cross-sensitivities with “external” gases, dust, and humidity, and increase accuracy. For this purpose, each device is assigned its own spectra library during in-factory calibration.

SR unit

- Transmits the UV beam along the measuring path.
- Disperses the returning UV light spectrally with an optical grid and projects it onto the highly-sensitive reception sensor line.
- Uses this spectrum to determine the gas concentrations in accordance with the DOAS method.
- Monitors the system and carries out automatic control cycles to align itself.

The AWE and TCU-MS Evaluation and Control Units

Joint features

- The GM31 system can normalize the measured values according to pressure, temperature, or external measured data, such as the volumetric flow, humidity, or O₂ content.
- Status outputs signal that the GM31 is operating properly or that it needs to be maintained (e.g. if excessively contaminated).
- Control cycles can be triggered externally and calibration data called up via binary inputs.
- Diagnosis and maintenance functions for the entire measuring system with plain-text message.
- Supports test gas measurement as prescribed in certain countries for all gas analyzers.

AWE GM31:

The compact, user-friendly solution

- A graphical LCD clearly displays the measured values, menus, parameters, and messages.
- Quick access via mode buttons
- Straightforward selection of units (mg/m³, ppm) and reference values
- Commissioning at the touch of a



- button: zero-point calibration and display of the calculated, normalized values as an XY chart
- PROFIBUS interface (optional)
- Robust field housing (IP 65, optional IP 67)

TCU-MS:

Flexibility at the highest level

- A freely definable formula generator allows you to calculate measured values, external signals, and parameters as required.
- Wide selection of inputs/outputs and interfaces
- Standard housing for installation in system cabinets (with optional field housing or 19" rack mounting kit)
- Measured data and diagnosis messages can be controlled, parameterized, and displayed on a four-line LCD using cursor keys or via powerful PC software.



GM31 – Customized to Your Requirements

System Components and Configuration Options

With the GM31, the choice is yours! You can configure a system customized to your requirements to create the optimum solution for your application.

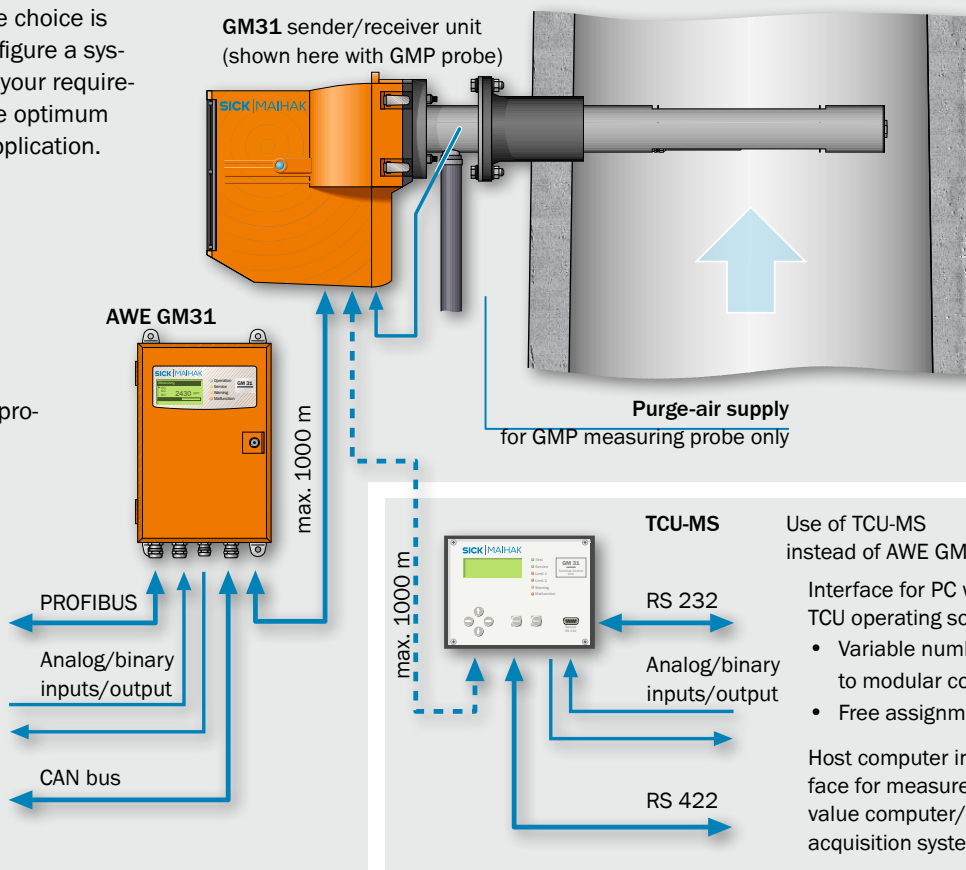
Interfaces with the plant environment

- Host computer
- Sensors
- Measured data processing
- Status signals

Additional analyzers

- O₂ analyzer
- H₂O analyzer

Configuration with AWE evaluation and control unit and GMP measuring probe



Use of TCU-MS instead of AWE GM31

- Interface for PC with MEPA TCU operating software
- Variable number thanks to modular concept
 - Free assignment

Host computer interface for measured value computer/data acquisition systems

Technical Data	AWE GM31	TCU-MS
Connections/interfaces		
Analog signals	<ul style="list-style-type: none"> • 3 outputs for measured values etc. • 4 additional via external module (optional) • 1 input for normalization values 	<ul style="list-style-type: none"> • 4 or 8 outputs, for measured data and calculated values • 4 or 8 inputs; user-defined assign./parameters
Binary signals	<ul style="list-style-type: none"> • 3 relay outputs: "Malfunction", "Maintenance request", and "Functional check" • 3 status inputs for floating contacts 	<ul style="list-style-type: none"> • 4, 8, or 12 relay outputs (floating), of which 3 are preassigned; the rest can be freely defined • 4 or 8 binary inputs for status signals
Interface for host computer / DAS	PROFIBUS (EN 50170) (optional), enabling bidirectional transfer of measured and calculated data	RS422 host computer interface for transferring measured and calculated data from the GM31
System-internal interfaces	<ul style="list-style-type: none"> • RS 422 and CAN bus for data exchange with SR unit, GPP probe, and additional O₂ or H₂O analyzer • RS 232 service interface for PC (terminal) 	<ul style="list-style-type: none"> • RS422 interface for data exchange with the SR unit, to which ext. analyzers can be connected • RS 232 service interface (modem capable)
Ambient conditions	-20 to +55 °C (-4 to 130 °F), max. 96% RH	-20 to +55 °C (-4 to 130 °F), max. 90% RH (standard)
Class of protection	IP 65/NEMA 4x (standard), IP 67 (optional)	IP 20 (control panel); IP 65/NEMA 4x (field hous.)
Power supply	115/230 V AC (-10% / +6%), 50/60 Hz, 50 VA max.	115/230 V AC, 50/60 Hz, 50 VA max.
Dimensions (W x H x D); weight	200 x 300 x 90 mm/8 x 11.8 x 3.5 in; approx. 5 kg/11 lbs (standard version, IP 65)	193 x 145 x 163 mm/7.6 x 5.7 x 6.4 in; 2.5 kg/5.5 lbs; 19" rack mounting option: 4 units

Overview of the Technical Data

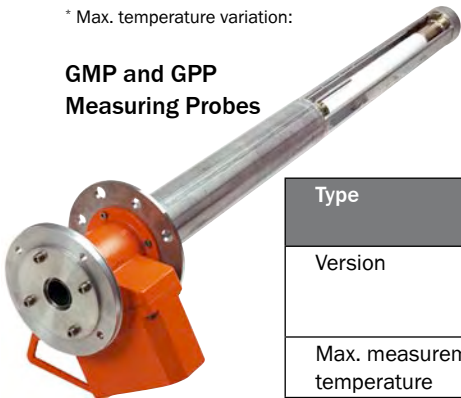


GM31 SR unit with GPP measuring probe

Technical Data SR unit	
Ambient temperature	-20 to +55 °C * -4 to 130 °F *
Ambient humidity	Max. 96 % RH
Class of protection	IP 65 / NEMA 4x
Power supply	115/230 V AC, 48 to 62 Hz, 350 VA max.
Dimensions (W x H x D)	291x530x570 mm 11.5 x 21 x 22.4 in.
Weight	29 kg / 64 lbs. (without probe)

* Max. temperature variation:

GMP and GPP Measuring Probes



Measuring probes are available with an integrated purge-air duct (GMP type) or with a gas-permeable, dust-proof filter membrane (GPP: gas-permeable probe).

The GM31 Sender/Receiver Unit

The SR unit is the core of the measuring system and contains the most important optical, mechanical, and electronic modules. The individual versions can be used for different measurable gas constituents and measurement ranges. The accuracy is generally $\pm 2\%$ of the measurement range end value.

Messkomponenten GM31-X		Messbereichs-Endwerte bzw. maximale Summenkonzentration Σ bezogen auf einen aktiven Messspalt von 1 m Länge [mg/(m ³ _{Betrieb} x m)]						
		GM31-1	GM31-2	GM31-3	GM31-4	GM31-5	GM31-7	GM31-8 LowNOx
SO ₂	min.	40	40	40	-	40	-	-
	max.	10,000	4,000	2,000	-	300	-	-
NO	min.	-	70	70	70	70	70	40
	max.	-	2,500	2,000	2,500	500	2,000	150
NO ₂	min.	-	-	200 *	-	-	200 *	25 **
	max.	-	-	2,000	-	-	2,000	100
NH ₃	min.	-	-	-	-	25	-	-
	max.	-	-	-	-	50	-	-
Σ	max.	10,000	4,000	2,000	4,000	850	2,000	300

Varying accuracy: * $\pm 5\%$ /** $\pm 10\%$ of the measurement range end value, respectively



(TA Luft)
TÜV certified accuracy
(2% of measurement range end value)



Certified and approved to U.S. EPA; CFR 40, Pt. 60/Pt. 75 GOST, MCERTS, and KAITEC standard



Suitability tested for plants acc. to Federal German Pollution Control Act (13th/17th BImSchV) and Clean Air Act

Type	GMP31 Open measuring probe	GPP31 – Suitable for test gas measurement
Version	Open measuring path in direction of flow; purge-air duct with outlet positioned longitudinally to the gas flow	Gas diffusion probe with ceramic filter for dry measurement gas or Teflon/ceramic filter for humid gas
Max. measurement gas temperature	500 °C / 930 °F (higher on request)	430 °C / 800 °F (ceramic filter) 200 °C / 390 °F (Teflon/ceramic)
Suitable for wet gas streams	Yes	Yes (with Teflon/ceramic filter)
System response time (T ₉₀)	≥ 5 s	≥ 120 s
Gas test acc. to U.S. EPA	-	Yes (test gas connections built-in)
Purge-air supply required	Yes	-
Dust concentration	< 15 g/m ³ (during operation)	< 30 g/m ³ (during operation)
Max. duct overpressure	60 hPa/24 in WC (dep. on purge-air)	120 hPa/48 in WC
Minimum duct diameter	≥ 350 mm/13.8 in (small. on request)	≥ 250 mm/10 in
Integrated sensors	Temperature and pressure sensor	Temperature and pressure sensor
Available probe lengths	0.9, 1.5, 2.0, 2.5 m/3.0, 5.0, 6.6, 8.2 ft	1.0, 1.5, 2.0 m/3.3, 5.0, 6.6 ft
Active measuring paths (shorter on request)	250, 500, 750, 1000, 1250, 1750 mm 9.8, 19.7, 29.5, 39.4, 49.2, 68.9 in	250, 500, 750, 1000 mm/ 9.8, 19.7, 29.5, 39.4 in
Test gas measurement	-	U.S. EPA: CFR40, Part 60; 75

ANALYZERS AND PROCESS INSTRUMENTATION

AT HOME IN THE INDUSTRIAL SECTOR

We can build on years of experience in the field of Analyzers and Process Instrumentation. That is why we are at home in the world of cement and power plants as well as in the chemical and petrochemical sector. Be it emission control at the waste treatment or process optimization for steel manufacturing, SICK MAIHAK offers tailor-made solutions.



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WE OFFER YOU A CHOICE

SICK MAIHAK offers a number of sensor-based techniques for analysis, ranging from the continuous gas and dust measurement to specialized applications for water and liquid analysis. Within the process measurement technology SICK MAIHAK products play a central role in determining volume flow of gases and level of bulk materials.



SICK GROUP

SICK MAIHAK represents the process automation segment of the SICK group, one of the worlds leading manufacturer of intelligent sensors and sensor solutions. With its 4,000 employees, SICK is able to offer an extensive portfolio of products and services on the market of factory and process automation. www.sick.com

