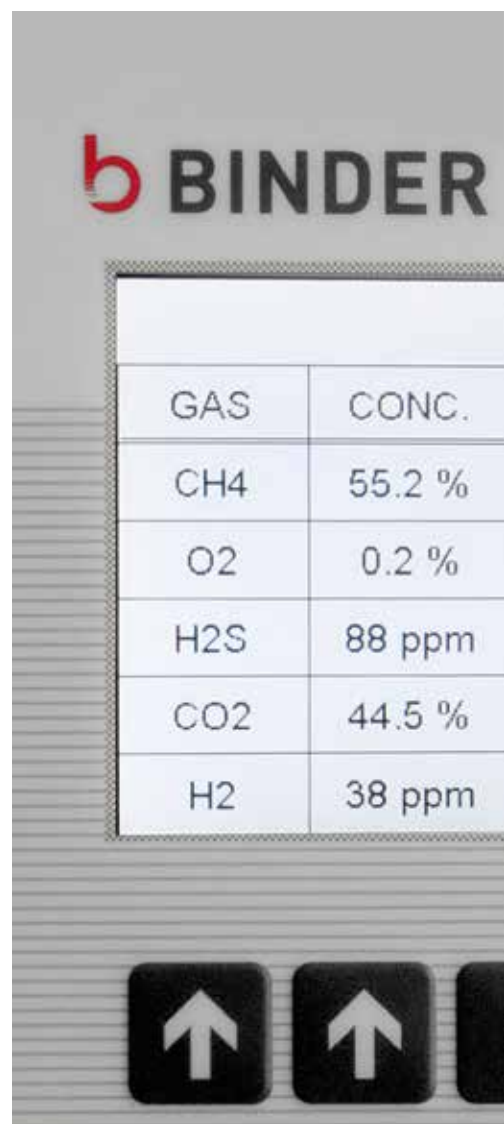


COMBIMASS®

Gas analysis and gas flow measurement systems for portable and stationary operation

For the qualitative and quantitative analysis of biogas, digester gas and landfill gas





Gas analysis and gas flow measurement

For reliable and cost-effective operation, modern gas engines in biogas, sewage gas and landfill gas plants need a minimum gas quality, the monitoring and recording of which is usually demanded by the engine manufacturer and the plant's insurance. Recording of the current gas production and quality permits improved process control.

Binder offers various solutions for these tasks with **COMBIMASS®**: precise biogas flow meter of **COMBIMASS® eco** series, completely modular designed analyzer station **COMBIMASS® GA-s hybrid** with flexible sampling frequencies and simple maintenance, a portable biogas analyzer **GA-m**, which can be fitted into the **COMBIMASS® GA-s docking station** to realize an automatic sampling (2-in-1-solution).

In all types of **COMBIMASS®** analyzer stations different gas flows and gas compositions of various sampling points are recorded and documented. Flow measurement errors due to changing gas composition, humidity, pressure and temperature are compensated automatically. In addition, rated energy contents of the gas flow and totalized gas flow can be calculated, monitored and transferred.

COMBIMASS® eco-bio+ SS FK §35 is a special manipulation-protected gas flow meter for agricultural anaerobic digestion plants or CDM-projects with integrated humidity correction for recording the annual raw biogas production in standard cubic metres and therefore is accepted as a documentation device by authorities.



Portable and stationary measuring systems for gas analysis and flow metering

For decades now, Binder has been supplying leading plant manufacturers with innovative systems for industrial gas flow measurement. In the last few years, the demand for reliable, precise and cost-effective measuring systems for biogas, digester gas and landfill gas as well as gas from solid waste fermentation plants has increased significantly.

Measurements in wet, corrosive and dirty raw gas place particular demands on the equipment like corrosion resistance, accuracy and long term stability.

Since the composition of these gases changes over time due to changes in feedstock composition or process management. Analysis technology is used in determination of the gas composition in the individual fermenter stages, in filter monitoring in gas processing and in front of the CHP.

Load-dependent management of gas storages by adjustment of the feeding cycles in biogas plants reduces the amount of feedstocks, increases the full load times of the CHPs, reduces the residual gas production in the fermenting residual storage, avoids runtimes of flares and improves the process stability, thus especially increasing efficiency of the plant.

In solid waste treatment facilities, bulk biomasses with a high dry substance share (biologically treatable residual materials) are fermented as substrate in dry fermenters and converted into high-quality compost. Since the process is implemented in batch operation, the biogas amount produced and the gas quality will change essentially across the cycle time.

The linking of flow measurement and gas analysis provides great advantages in both cases:

- Always providing the most precise flow measurement, even under changing conditions of humidity and gas composition
- Attractive additional functions by linking the data from both systems

In sewage treatment plans, the gas analysis is usually used for monitoring the gas quality from purification plants and the H₂S-filter upstream of the cogeneration plants. As compared to the biogas facilities, the quality is, however, subject to much lower fluctuations. Based on the measured values of the analysis station, a decision on when the filter material should be exchanged can be made with certainty, instead of generally replacing it after specific times.

On landfills, analysis technology is used for long-term monitoring of individual fields or monitoring of the landfill gas quality in the collector pipe. If the gas quality grows worse, it may be necessary to mix landfill gas with other flammable gases, such as biogas from an adjacent biogas or solid waste treatment plant, to ensure operation of the CHP.



The components of the modular concept are:

- **COMBIMASS® eco-bio+ SS** for biogas:
Thermal dispersion gas flow meter, ATEX certified, with integrated humidity correction (option) for direct determination of standard flow according to DIN 1343, manipulation-safe version (option), hot tapping unit (option)
- **COMBIMASS® eco-bio+ AL** for biogas:
Thermal dispersion gas flow meter, for the operation in EX-Zone 2, hot tapping unit (option)
- **COMBIMASS® eco** for gas from digester and landfills:
Thermal dispersion gas flow meter, with integrated humidity correction (option) for direct determination of standard flow according to DIN 1343, for the operation in ATEX-zones 1 and 2, with an integrated display (opt.)
- **COMBIMASS® OEIN hot tapping unit:**
For easy assembly/disassembly of the flow meter for maintenance
- **COMBIMASS® master:**
DIN-rail module for flow correction of humidity or changing gas composition
- **COMBIMASS® flow conditioner:**
To improve accuracy of flow measurement when the piping is unfavourable
- **COMBIMASS® GA-m:**
Portable analyzer instrument with battery and data logger, for up to 6 gas components, ATEX certified
- **COMBIMASS® GA-e:**
Gas analyzer instrument for up to 4 gas components, for stationary use only
- **COMBIMASS® GA-s:**
Docking station for gas analyzer **GA-m** and **GA-e** for fully automatic stationary operation with a plastic or stainless steel housing
- **COMBIMASS® GA-s hybrid eco:**
Simple, cost-efficient reliable and modular analyzer station for one to four gases
- **COMBIMASS® GA-s hybrid premium:**
Flexible, modular analysis station with diverse additional functions and options, simple handling and maintenance
- **COMBIMASS® GA-s feed control:**
Analyzer station with additional functionality control of feeding cycles and external access for data transmission



COMBIMASS® Biogas flow meter

The field transmitters of the **COMBIMASS® eco** series are suitable for gas flow measurement and cover a wide range of different applications. The instruments can be employed for process temperatures up to 130°C and are available in different explosion proof versions. The sensor head is made of a single piece, completely in stainless steel, and thus resistant to corrosion. The measured values are transmitted via an insulated 4–20 mA analogue output and a freely parametrisable impulse output. Optionally, a 10-digit display with operating panel is available to display the current flow rate or totalized.



Each flow meter will be tested prior to shipment and calibrated at our **CAMASS® Calibration Lab** under actual operating conditions (piping layout, gas composition, pipe diameter, flow direction...). The sensor uses the thermal dispersion principle and directly measures in dry gases the gas mass or volumetric flow at standard pressure and standard temperature (according to DIN 1343: 0°C, 1,01325 bar, 0 % rel. humidity). It consists of a heated electrode and a reference

electrode. The gas flowing past cooled off the heated sensor and thus constitutes a measure for the number of molecules flown past (mass flow). Biogas and gas from purification plants are usually wet gases. The moisture share is recorded to. The standard volume according to DIN 1343 thus cannot be determined directly. At saturation point, the water share in the gas is determined by calculation based on the gas temperature and compensated for directly in the sensor. This way, suitable selection of the

measuring site permits determination of the dry volumetric flow at standard conditions.

Thermal gas quantity measurements instruments are particularly suited compared to all other measuring procedures, since they will measure with high accuracy even at low gas speeds and pressures. Another essential benefit is that all required compensations can take place right in the meter without an additional compensation computer. This permits, e.g., use of the **COMBIMASS® eco-bio+** for proof of the annually produced raw biogas volume or in CDM-projects. For this proof, other special low-manipulation execution versions are available.

COMBIMASS® eco-bio+ for biogas

Compact sensor completely made of stainless steel for zone 1, or an aluminum housing version for zone 2, rugged, corrosion-proof and durable, very precise even at low gas flow and low gas pressure

- Direct mass flow measurement based on thermal dispersion principle at standard pressure and temperature even in wet gases directly after the digester, behind the gas cooler, H₂S-filter or in front of the CHP



- No temperature and pressure compensation necessary
- With integrated humidity correction for direct determination of dry gas flow in standard cubic meter according to DIN1343 (option)
- Manipulation-safe version **eco-bio+ SS FK §35** (option)
- With a hot tapping unit and ball valve with integrated gas sample connection (option)

COMBIMASS® eco for digester and landfill gas

Compact sensor completely made of stainless steel for zone 0, 1 or 2, rugged, corrosion-proof and durable, very precise even at low gas flow and low gas pressure

- Direct mass flow measurement based on thermal dispersion principle at standard pressure and temperature even in wet gases
- No temperature and pressure compensation necessary
- Calibration range adjusted to the application
- With integrated humidity correction for direct determination of dry gas flow in standard cubic meter according to DIN1343 (option)
- With a modular and expandable data logger for reading, storage and transmission of data (option)
- With a hot tapping unit and ball valve with integrated gas sample connection (option)

COMBIMASS® Flow conditioner

The patented **COMBIMASS®** flow conditioners are used for difficult pipeline configurations, after bends, cross-section changes, fittings or pulsating compressors. They smooth the flow profile, almost without pressure loss, ensuring reproducible conditions at the measuring location.

COMBIMASS® flow conditioner reduce the inlet and outflow straight pipe length for measurements to 3–7 times of the pipe diameter. They are rugged, dirt resistant and guarantee best measurement accuracy.

Guaranteed precision for COMBIMASS®

When using technically highly developed systems for measuring and controlling gases, calibration becomes the most decisive factor for success. To ensure maximum measuring accuracy, every **COMBIMASS®** measuring device or system **CAMASS® Calibration Lab** is calibrated precisely while simulating the actual operating conditions.

For difficult applications, even the corresponding pipeline configuration (up to nominal diameter DN 500) can be replicated exactly if necessary. In this way, every effect of flow on the measurement caused by the pipeline and the configuration can be recorded and compensated for.

COMBIMASS® Gas analysis

Different measuring procedures are used in the **COMBIMASS®** gas analysis devices and systems. In addition to the typical infrared sensors, electrochemical, paramagnetic and heat conductivity sensors are used to determine the gas composition. All values are measured pressure- and temperature-compensated, so that a high accuracy is achieved.

A manual or automatized calibration permits very good long-term stability of the measured values. All devices and stations are built modularly and can be expanded if required. Every system is inspected and calibrated in our **CAMASS® Calibration Lab** before delivery.

All analysis devices are service-compatibly designed. Wear parts can be replaced by the operator or may be provided for the time of maintenance. The following technical solutions for gas analysis are available in the **COMBIMASS® GA-series**:

COMBIMASS® GA-m

Measurement of up to 6 gas components using optical infrared analysis and long-life electro-chemical cells, with a powerful sample pump and data logging according to sampling sites

- Battery pack, exchangeable in the field

COMBIMASS® GA-s Docking Station

Multi-components analyzer station with a PLC and 4.3" graphic display, multilingual menus, operation via touch screen, prepared for 2 gas sampling points, design is based on standardized components for gas sampling and pre-treatment, data logging and processing, visualization and data transmission

- Visualization of actual data as well as graphical figures with historical data on a 7" graphic display
- The precision of the gas analysis can be checked with test gas at site and held within an possible tolerance (manual calibration mode)
- Analog inputs for **COMBIMASS®** gas flow meter, with automatic compensation of the flow signal based on actual gas concentration
- Automatic alarm triggering in case of under or overshoot of limits
- Data transmission to the local PLC via standard communication gateways (analog signal 4–20 mA, Ethernet Modbus TCP, Modbus RTU, Profibus DP or Profinet) or via Remote-dial-in (external access)
- External access/Remote-dial-in via a secure Internet connection or GSM/GPRS



- Field calibration of gas cells at site possible
- ATEX certified for operation in explosive environments; zones 0 and 1
- Portable measurement of gas flow and gas temperature with an optional sensor insertion type

COMBIMASS® GA-s hybrid

Multi-component gas analyzer station, pre-equipped for one gas flow, consisting of standardized components for gas supply and prep-treatment, data recording and processing, visualization and transfer



- Simple, cost-efficient design for one or two gas flows, designed and equipped for specific applications (version **eco**) or fully equipped with PLC and 4.3" graphics display (version **premium**) with multiple-language menu guidance and operation via touchscreen
- Visualization of the current measured values as well as graphical illustration of the history on a 7" graphics display possible (optionally in the version premium)
- Modular concept: individual equipment with sensor modules installed on top-hat rails are combined into customer-specific systems
- Different housings for operation in the indoor and outdoor area, as well as with or without measuring gas cooler, present for cyclic or continuous analysis
- The accuracy of gas analysis can be checked and held by connection of test gas right on site (manual calibration programme/auto calibration).
- Free analogue inputs for gas flow meter of the **COMBIMASS®** series, with automatic compensation for the gas volume signal based on the current gas composition
- Alarm trigger when limits are exceeded or undercut
- Data transfer to the central control system via standard interfaces (analogue signal 4–20 mA, Ethernet Modbus TCP, Modbus RTU, Profibus DP, Profinet) or via remote connection, e.g. to central data servers
- Data storage on integrated USB stick
- Remote access for maintenance diagnosis via secured internet or GSM/GPRS-connection possible

COMBIMASS® GA-s feed control

Basic equipment of the docking station **GA-s** is extended with hardware and software, to control the filling level of the gas storage by adapting the time cycles for feeding substrate

- Reduction of the amount of feedstock and improvement of the process (savings up to 15 %)
- External access by operator or expert microbiologist for fine tuning of control parameters





CAMASS® Calibration technology for gas flow

Calibration is an important factor for success when using technologically advanced systems for measuring and controlling gases. In order to ensure the very highest measurement and control precision, each **COMBIMASS®** system is precisely calibrated in the **CAMASS® Calibration Lab**, using real operating conditions.

In contrast to liquid media, the properties of flowing gases depend much more on operating conditions, gas composition and the actual flow conditions in the pipeline. If such parameters are not taken into account, considerable limitations must be expected regarding the accuracy of measurements.



Guaranteed precision

for COMBIMASS® Biogas flow meter

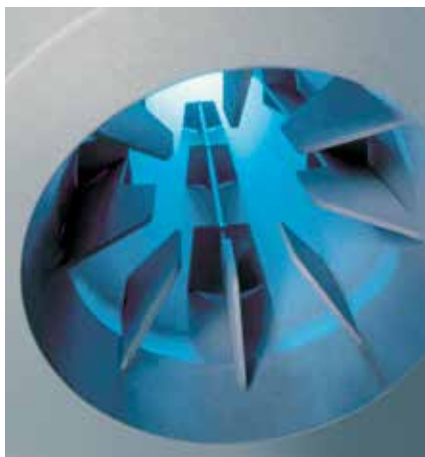
In order to guarantee the precision of the measurement and control systems, the pressure, temperature and loading conditions which will later occur in the customer's plant are simulated exactly using the appropriate gas mixture.

For difficult applications, even the corresponding pipeline configuration (up to nominal diameter DN 500) can be replicated exactly if necessary. In this way, every effect of flow on the measurement caused by the pipeline and the configuration can be recorded and compensated for.

COMBIMASS® Flow conditioners

The patented **COMBIMASS® flow conditioners** are used for difficult pipeline configurations, after bends, cross-section changes, fittings or pulsating compressors. They smooth the flow profile, almost without pressure loss, ensuring reproducible conditions at the measuring location.

COMBIMASS® flow conditioners reduce the inlet and outflow straight pipe length for measurements to 3 – 7 times of the pipe diameter. They are rugged, dirt resistant and guarantee best measurement accuracy.



Application biogas

Modern biogas systems can hardly be operated in a cost-effective and environmentally friendly way without appropriate measurement and analysis technology. Analysis technology is used for determination of the gas composition in the individual fermenter stages, in filter monitoring in gas treatment and in front of the CHP. Further applications are process monitoring in bio-methane upgrade plants, determination of the energy content in the biogas flow if gas is fed into local micro grids and sold to several customers.

Measurements right downstream of the digester serve to determine the gas yield from the supplied substrate and the control of the feed cycles. In agricultural anaerobic digestion facilities, the gas composition usually changes only slowly, while the gas flow is subject to larger fluctuations, as they are caused, e.g., by a mixer. The biogas downstream of the fermenter is particularly moist, usually even waterdamp-saturated. Therefore, it is suitable to install a **COMBIMASS® eco-bio+** with integrated humidity correction downstream of every fermenter to determine the dry biogas mass flow referring to the standard condition.

If, in contrast, the gas composition changes more strongly, such as in solid waste fermentation plants, a correction of the gas volume signal from every fermentation box based on the current gas composition can be sensible. Today, monitoring of the concentration of sulphure and methane when using the gas is of special importance, since these essentially influence the function, maintenance cycles and efficiency of the CHP.

While our **COMBIMASS® eco-bio+** thermal mass flow meter work reliably, accurately and almost without maintenance even under the most difficult conditions, a higher level of technical effort is needed for gas analysis equipment regarding long-term precision and reliability. This also affects the purchase price and maintenance costs.





Unlimited freedom of design with GA-s hybrid

The **COMBIMASS® GA-s hybrid** analysis station is set up completely modularly and can be built customized with various gas modules, pumps, valves, gas cooler and further components.

Visualization of the data, also with chart function, calibration of the gas cells on site or an auto-calibration of the gas modules, an integrated overload protection of the gas cells, alarming of the operator when limits are exceeded or undercut, a simple exchange of all spare and wear parts by a service company or the operator ensure a high operating safety, always precise measuring values and low costs for maintenance.

- **COMBIMASS® GA-s hybrid eco:**
for H₂S-filter monitoring, for monitoring of the CH₄-concentration upstream of the CHP or as combination of the two – this cost-efficient version offers standardized basic concepts based on a simple control; also available with continuous methane analysis
- **COMBIMASS® GA-s hybrid premium:**
Analyzer station with flexible measuring programs, PLC and graphics display, also for complex measuring tasks with multiple gas circuits, remote access and data transfer via GSM/GPRS possible

2-in-1 Solution with GA-s Docking Station

The standardized analyzer station stands out with its option of turning the portable instrument **GA-m**, which can still be used as a portable, into a fully functional stationary analysis system for up to 13 measuring points by connecting it to the docking station. 100 % system availability, also for maintenance and repairs, by plug-and-play exchange of the portable instrument are ensured. Multi-point calibrations of the gas cells permit high accuracy of the measured values even at different concentrations in the measuring gas.



Typical applications

Fermentation of organic waste (dry fermentation)

- A dozen sampling points for gas quantity and quality? No problem. Thanks to the unlimited scalability of the **COMBIMASS®** modular concept
- Thanks to automatic compensation, the highest measurement accuracy even for extremely variable gas composition
- The highest measurement accuracy, even for the lowest flows, without noticeable pressure loss

Gas-2-grid (biomethane)

Process monitoring at removal of hydrogen sulfate, carbon dioxide and remaining moisture from the raw biogas, continuous gas analysis, precise measurement of very small sulfur concentrations and precise measurement of low methane concentrations in the exhaust flow – thanks to high-quality measuring cells, adjusted measuring ranges and auto calibration of the gas modules with different test gases – available long-term stable. Spare modules on site ensure exchange within a few minutes.

Energy computation at gas sales

The measuring system consists of a **GA-s hybrid** analysis station with a continuous methane analysis and a gas flow meter (with special calibration at high accuracy, installed in a measuringpipe section to avoid pipe-related influences on the gas volume signal) of the **COMBIMASS®** series. A redundant pump, uninterruptable power supply, plausibility checks of the measured values and data transfer to a central data server to avoid manipulations permit an accuracy of calculation of the energy content better than 3 %.

Monitoring projects

There are special manipulation-free versions available which can be used for monitoring projects e.g. CDM or similar. A special data logger can be used to store the data on a SD-card or to transfer actual data frequently to a central data server.

More gas with less feedstock?

By monitoring and controlling actual gas production and quality using proven combination of **COMBIMASS®** biogas flow meter and analyzer and as well clever management of the gas storage tank time cycles for dosing the feedstock can be determined with **COMBIMASS® GA-s feed control** load-depending if gas consumption is known. Under and overdosing as well as the operation of the flare can be avoided. The total plant efficiency can be increased up to 15 %, with increase in the process stability, too.

Application sewage treatment plant

In contrast to biogas systems, the livelihood of a sewage treatment plant does not directly depend on the cost effectiveness of gas generation. Different priorities are set here, since methane is much more climate-hazardous than carbon dioxide, the fermentation process in the digester must run controlled under exclusion of air. In the past the biogas was often burnt off in a flare but today it is essential to utilize this valuable energy source and so reduce the operating costs of the plant significantly.

By operating sewage sludge fermentation and using the purification plant gas for energy production, not only energy can be produced, but the burden of the biological treatment part and thus the energy consumption for aeration drops by about one third. Digestion of sludge and use of the digester gas is therefore increasingly used in medium-sized and smaller sewage treatment plants when an overall energy balance is set up.

For reliable and cost-effective operation, modern gas engines for digester gas require a minimum gas quality. Environmental regulations require modern and powerful gas measuring technology with appropriate data recording.

Alongside the highest operational reliability and ability to communicate, a high level of cost effectiveness is also indispensable. Usually stationary measurement systems with stainless steel piping are preferred here. Along with the quantity, these record and document the concentration of methane, hydrogen sulfide and oxygen in the digester gas.





Special features for sewage treatment plants

Sewage treatment plants are often operated by wastewater treatment associations or companies in extended areas. As well as large plants that require the installation of stationary systems, there are numerous small sewage treatment plants. Here powerful, portable measurement systems are more cost-effective.

The **COMBIMASS®** concept offers both – stationary and portable measurement systems for better cost effectiveness in your sewage treatment plant

- Portable components are compatible with stationary systems and usually interchangeable. A portable component can also be used in the case of plant maintenance
- Competitive full maintenance at a fixed price, if desired with a free replacement unit while the maintenance or repair is being carried out
- Very little training needed for the personnel
- A uniform, ergonomic and clear operating philosophy makes expensive training unnecessary
- Maximum user-friendliness via a sophisticated control concept: Can be operated wearing gloves – the most important queries can be made with only 6 easily operable keys. The relevant function is displayed directly via a key in the local language and corresponds to the current menu on the screen
- External access for data transmission or diagnosis of maintenance
- All pipes and connectors can be supplied for lines in stainless steel
- Future-proof: Requirements for extended compulsory documentation and data recording are to be expected. Today our systems are already fully equipped to deal with this. The data format is compatible with Excel, but can also optionally be exported in an essentially manipulation-proof binary format
- Emergency operation: The **COMBIMASS®** concept provides optional battery backed-up operation (UPS). If the power supply fails, important alarm functions are ensured



For the highest demands

The COMBIMASS® analysis concept is impressive in its flexibility and scalability

In practical operation of a sewage treatment plant, the following design versions – in combination with the flow meter for digester gas **COMBIMASS® eco** – turn out to be of great benefit:

- **COMBIMASS® GA-s hybrid eco:**
Modularly built, simple and cost-efficient gas analysis station with fixed measuring programme, e.g. for methane and/or hydrogen sulphide only
- **COMBIMASS® GA-s Docking Station with a GA-m device for portable use:**
Autonomous portable gas analysis instrument with ATEX-certification, rechargeable battery operation, measuring gas pump and data logger, which is converted into a stationary measuring system by plugging into the docking station
- **COMBIMASS® GA-s hybrid premium:**
Modularly built gas analysis station with flexible gas modules and flexible measuring programme, e.g. for co-fermentation plants

Tried and tested a thousand times

COMBIMASS® eco flow meter for digester gas have proved themselves for many years in sewage treatment plants throughout the world and have matured into a standard. The new generation digester gas flow meter offers an integrated humidity correction for direct determination of dry gas flow at standard conditions.



Landfill application

Today, hardly any new landfill sites are being created in Europe, waste separation and waste avoidance are clearly a trend. All the same, high-quality gas measurement technology is needed here, too. During the stable, anaerobic methane phase, the landfill gas is used for energy production in CHPs. Modern gas engines require a minimum gas quality for reliable and economically efficient operation, the monitoring and recording of which are usually required by the engine manufacturer. The monitoring of motor efficiency gives early warning of damage and helps to minimize it. Taking current gas consumption and gas generation into account permits optimized performance control.

Combined systems for gas flow measurement and portable/stationary landfill gas analysis

In the **COMBIMASS® GA-s** analyzer station, gas consumption and gas composition are recorded, evaluated and documented. If the methane content drops over the course of the operating years, the gas flow signal is automatically corrected in combination with the analysis station. The landfill gas is captured in multiple wells, collected in compressor stations and guided to the generator. Each of the compressor stations needs a stationary measurement system for gas composition and gas quantity, but there is an important additional function: The connected wells are frequently scanned for gas flow and gas quality and the data must be saved. Due to the enormous areas involved, it is not economical or safe to connect the individual wells permanently for fully automatic monitoring. The only meaningful solution is to monitor the wells using portable technology.

The **COMBIMASS® GA-m** is removed from the docking station, whereby the permanently connected flow meter **COMBIMASS® eco** continues to record the gas measurements and compensates with the latest gas composition. For every individual well, the arising landfill gas volume and the gas composition are then recorded with a portable gas flow meter, and saved in the **COMBIMASS® GA-m** with measuring point recognition, date and measuring time by the push of a button. After the round tour, the data are read by a USB-interface and the analysis device is returned to the docking station. This way, several hundred measuring points can be monitored and documented with little effort and greatest operating safety. Even in older landfill sites, where the landfill gas is no longer used actively during the decaying methane phase and is only burnt off in a flare, environmental protection regulations require a further monitoring.





Application solid waste treatment plant

Use of the energy potential of biological wastes

Biological solid waste treatment plants often occur at deposit sites. There, mostly solid residual materials from households, such as green cuttings and other bio-degradable residues are treated according to the procedure of solids fermentation in single – or two-stage plants. In addition to gas use in CHPs, a high-quality end product results, which can be used to achieve further revenues as compost.

Since the resulting gas has a comparatively high methane concentration, it may also be mixed with landfill gas of lower methane concentration from older landfills and used together in cogeneration plants, since the CHPs pose a minimum requirement to the methane concentration.

Typically, every fermenter box is equipped with a **COMBIMASS® eco** gas flow meter and the signal is automatically corrected with the current gas composition. The **GA-s hybrid** analysis station is built completely modularly. Gas modules for different gases with different measuring ranges can be switched in parallel or subsequently. Depending on size of the plant, two to six or more parallel gas circuits are set up this way.

During filling and emptying processes, in particular the oxygen and hydrogen sulfide concentrations in the opened boxes must be measured and monitored. Redundant measuring cells with automatic plausibility check are often used if safety-technical aspects or person protection must be considered. Alarms when limits are exceeded are integrated serially.

Availability and accuracy of the measured values are very important. The gas modules are therefore typically automatically recalibrated at fixed intervals to keep the accuracy always high. Operators use a second set of gas modules to be operational again within just a few minutes if an exchange is required.



COMBIMASS®

A convincing concept

The COMBIMASS® concept is optimal if the following properties are important to you:

- Precise gas flow measurement without pressure loss even at low gas speed and flows
- Precise gas flow measurement even with variable gas composition
- Precise gas flow measurement, nearly no maintenance needed, portable and stationary use, at a reasonable price
- Precise gas analysis, with full maintenance and an exchange unit for 100 % availability at a reasonable fixed price
- Stationary analyzer systems as 2-in-1-solution or completely modular
- High-performance and long-time stable stationary analysis system with the highest level of precision, scalable, with flow measurement and humidity compensation, low maintenance, with independent measurement data recording and various types of data transmission

For all system operators with high demands who don't have money to waste!





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