

COMBIMASS®

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

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





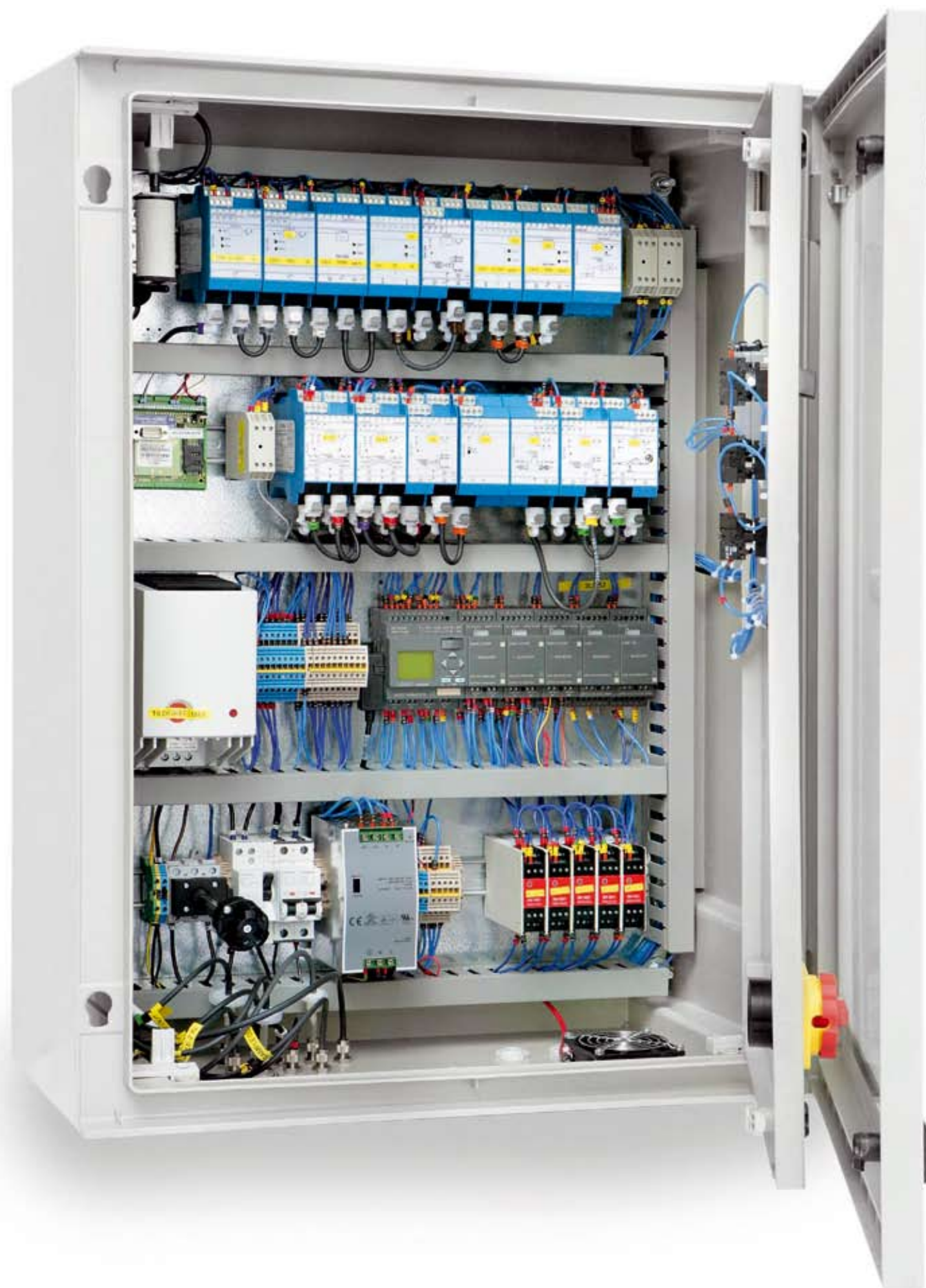
COMBIMASS® Gas analysis and gas flow measurement

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. The monitoring of engine efficiency gives early warning of damage and helps to minimize it. Taking current gas consumption and gas generation into account permits optimized performance control.

Binder offers the perfect solution for these tasks – with **COMBIMASS®**. Inserting the portable analyzer **GA-m** into the **COMBIMASS® GA-s** docking station, a stationary analyzer system with automatic sampling can be realized. In the stationary control system, **COMBIMASS® GA-s**, all the plant's gas flows and gas compositions are recorded and documented. Flow measurement errors due to changing gas composition, humidity, pressure and temperature are compensated automatically. In addition, rated thermal input and totalized gas flow can be calculated, monitored and transferred.

The complete modular designed system **COMBIMASS® GA-s Click!** makes a much more flexible sampling possible, maintenance and service work become much more easier, too. All correction algorithms of **COMBIMASS® flow meter** are also available in the **Click!** system.





COMBIMASS®

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

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, sewage gas and landfill gas 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, the linking of flow measurement and gas analysis provides great advantages:

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

Further possible applications are the control of H₂S filter in biogas plants, sewage treatment plants or landfills, or the control of the filling grade of gas storage to feed the digester load-dependent.

Reduction in feedstock, increase of full-load time of the CHP's, reduction or avoidance of gas formation in the digestate storage tank or "waste" of gas in the flare as well as additional increase in the process stability improve operational efficiency substantially.



The components of the modular COMBIMASS® concept are:

- **COMBIMASS® eco-bio+ SS:**
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), with data logger (option)
- **COMBIMASS® eco-bio+ AL:**
Thermal dispersion gas flow meter, for the operation in EX-Zone 2 with data logger (option)
- **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 7 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 feed control:**
Docking station for gas analyzer GA-m and GA-e with additional functionality control of feeding cycles
- **COMBIMASS® GA-s Click!:**
Flexible modular gas analyzer system for larger or more complex plants with multiple sampling circuits, dry-pipe sample system and additional gas modules



Special features of COMBIMASS® GA-s Click!

- Automatic analysis of up to 10 different gas components. Analyzer modules can be combined in different ranges and types using infra-red, electrochemical or thermal conductivity analysis methods
- Analyzer station with automatic sampling and unlimited number of sampling points due to use of parallel working gas sample circuits
- All components like pumps, valves and gas sensors are mounted onto DIN-rail modules, which can be easily maintained at site
- Gas, pump and valve modules can be refurbished and used again
- Visualization of actual data with graphical trend display of measuring data
- Flexible sampling sequences for each sampling point, splitting of gas sample streams inside the cabinet to achieve better accuracy
- Auto calibration check and adjustment functions available for control and automatic adjustment/automatic recalibration
- Automatic alarm triggering in case of under or overshoot of limits
- Integration of **COMBIMASS® flow meter** in standard m³/hr and automatic correction of flow signal based on actual gas composition
- Possible integration of further sensors including visualization and transmission
- Data transfer to the local PLC using industrial standards (analog signal 4 - 20 mA, Ethernet Modbus TCP, Modbus RTU, Profibus DP) and others on request or via Remote-dial-in (external access) via a secure Internet connection or GSM/GPRS
- Data storage on an integrated USB-stick
- Direct connection with a computer in the control room

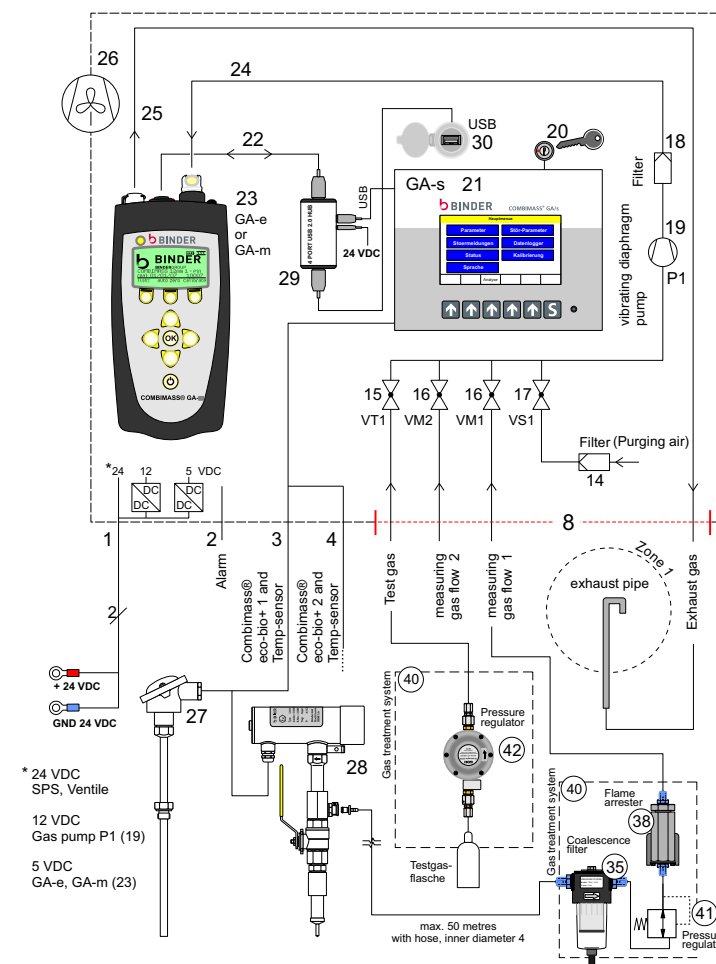
Special features of COMBIMASS® eco-bio+

- Compact sensor completely made of stainless steel for zone1, or an aluminum housing version for zone 2, rugged, corrosion-proof and durable
- Direct mass flow measurement based on thermal dispersion principle at standard pressure and temperature even in wet gases
- 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 versions (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)
- High accuracy even at low flow rates

- Used for many years in sewage gas, landfill gas and biogas applications

Gasanalysis display 1		Status	Sampling	0:1:54
- Sampling point +	CH4 %	Nm³/h	O2%	H2S ppm
0 digester 1	51.2	860	0.5	230.0
1 digester 2	52.1	973	0.5	126.0
2 collection pipe	52.2	954	0.6	187.0
3 CHP 1	52.4	481	0.6	7.0
5 CHP 2	52.4	473	0.6	11.0
Stop	<	Info	Menu	>
		Start		

Sampling menu



COMBIMASS® GA-s docking station

Special features of COMBIMASS® GA-m

- Measurement of up to 7 gas components using optical infrared analysis and long-life electrochemical cells
- Powerful sample pump
- Easy to exchange sample filter

- Up to 5 calibrated sensors can be inserted
- Battery pack, exchangeable in the field
- Field calibration of gas cells at site possible
- ATEX certified for operation in explosive environments; zones 0 and 1
- Measurement of gas flow in Nm³/h with an optional **COMBIMASS®** flow sensor
- Measurement of gas temperature with an optional temperature sensor
- Internal data storage and data transmission to a PC related to the sampling point
- Delivery of a spare analyzer for the duration of service and repair

Special features of COMBIMASS® GA-s

- Multilingual menu, operation via touch screen or 6 keys
- Up to 2 sampling points supported, with automatically compensated mass flow measurement, even in the base model
- Visualization of actual data as well as graphical figures with historical data
- The precision of the gas analysis can be controlled automatically with test gas and held within an possible tolerance
- Further external gas modules can be added
- The standardized pressure and temperature compensation of our gas flow meters, combined with automatic compensation of the actual gas concentration, represent a milestone for long-term stability and accuracy
- 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 or Profibus DP) or via Remote-dial-in (external access)
- Measurements can be stored on USB-stick
- Direct connection with a computer in the control room
- External access/Remote-dial-in via a secure Internet connection or GSM/GPRS
- Modular concept: Individual extensions and different gas analysis equipment are combined to create systems which fit the customer's requirements

Particular features of 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®** and **VACOMASS®** system is precisely calibrated in the **CAMASS®** calibration center, 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®** and
VACOMASS®

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.

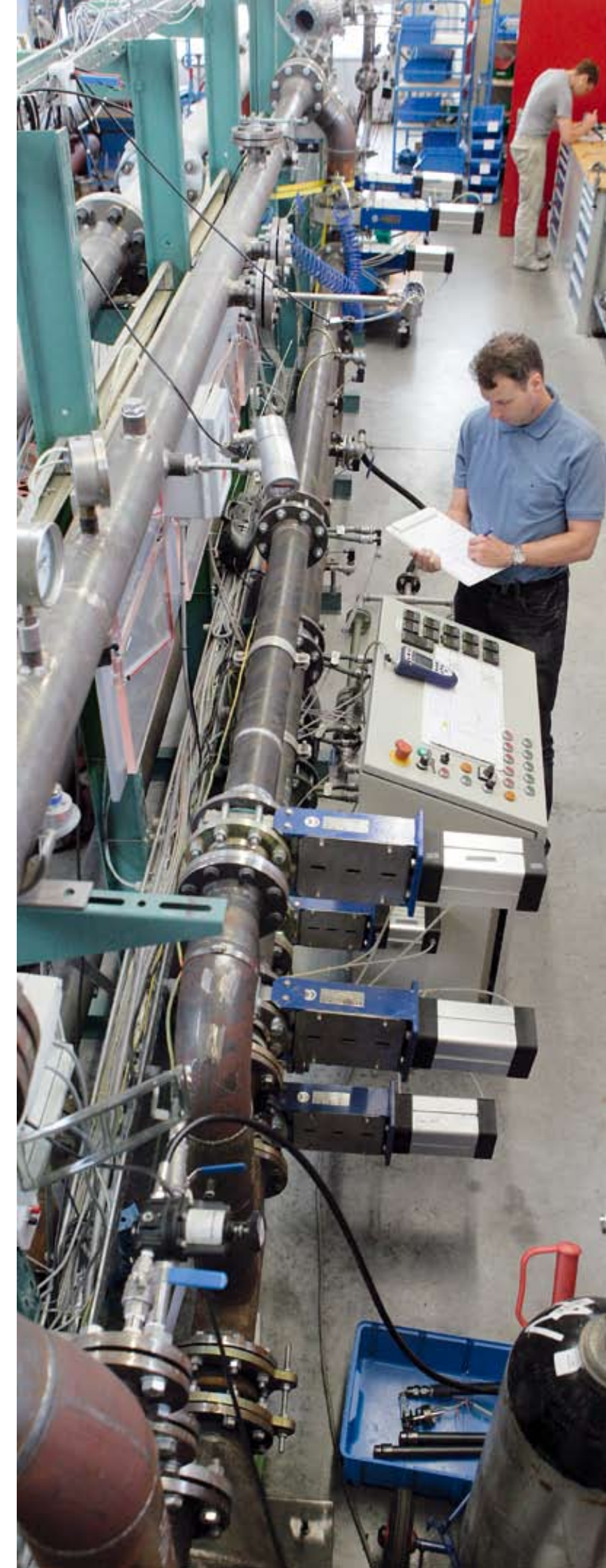
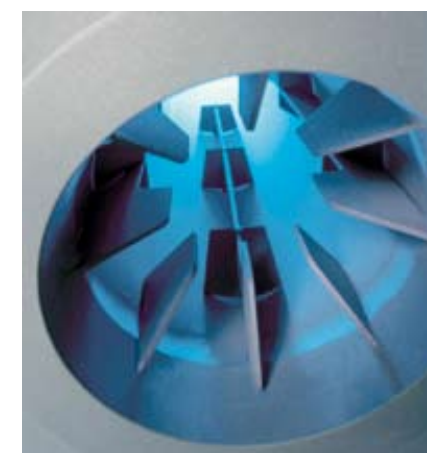
For difficult applications, even the corresponding pipeline configuration (up to nominal diameter DN 500) can be replicated exactly if necessary. In this way, every effect of flow on the measurement caused by the pipeline and the configuration can be recorded and compensated for.

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.



Biogas application

Docking station for stationary applications

Modern biogas systems can hardly be operated in a cost-effective and environmentally friendly way without appropriate measurement and analysis technology. A biogas flow meter is usually permanently installed in the CHP-container and the gas quality is also recorded in principle in some of the plants. But measurement errors due to varying gas pressure, temperature and composition are usually not taken into account. For the economic and safe operation of biogas plants however, it is necessary to determine the gas composition and gas quantity of each individual digester at standard conditions to make process improvements possible.

While our **COMBIMASS® eco-bio+** thermal mass flow meters 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. When using several gas analyzers, it is not just the above-mentioned costs that add up, but also the measurement uncertainty, so it becomes difficult to recognize a trend early.

A combination of portable analyzer and docking station can save initial costs as well as costs for service and



The latest technology

With our **COMBIMASS® GA-s** docking station gases from almost an unlimited number of sample points can be collected and evaluated.

Although the gas concentrations only change very slowly, the gas flow is subjected to certain regular variations, caused, for example, by a mixer. For this reason it is useful to permanently install a **COMBIMASS® eco-bio+** thermal mass flow meter and connect it to the docking station.

For the gas quality one current measurement per hour is completely sufficient. Here the individual sampling points can be connected to the docking station using small plastic or stainless steel pipes. The sampling points are then switched in sequence via internal solenoid valves and evaluated in the processor.

It is also possible to measure the gas quality automatically only at the CHP and use the mobile **COMBIMASS® GA-m** to record further measuring points. Here the portable gas analyzer **COMBIMASS® GA-m** can be removed during operation. Meanwhile the flow measurements continue to run and are offset using the latest gas analysis values.

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-dependent 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.

Advantages of the “2-in-1” gas analysis systems

- 100 % system availability; even with extensive maintenance via plug and play exchange of the portable unit
- 50 % cost saving; both stationary and portable analysis systems are needed in biogas and landfill systems. Maintenance costs are therefore halved. There are also significant cost advantages when starting with a portable and buying the docking station later on
- 50 % lower absolute measurement uncertainty; when two separate systems are used, the measurement errors are summed
- 0 % relative measurement uncertainty; when comparing stationary and portable measurements, there is no need to include an offset since the same measuring unit is used.



The modular concept

Unlimited freedom

The COMBIMASS® GA-s docking station can be combined with different gas analysis instruments

- COMBIMASS® GA-m: Fully portable gas analyzer with ATEX certification, battery operation, sample pump and data logger
- COMBIMASS® GA-e: Cost-effective, purely stationary gas analyzer, plug and play compatible, located in the same housing
- Third-party products can be connected via an analogue signal or a serial interface
- Can be operated wearing gloves: the most important queries can be made with only 6 easily operable keys. The relevant function is displayed directly above the key and corresponds to the current menu on the screen

Challenge: 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

Challenge: gas-2-grid (biomethane)

The highest measurement accuracy for gas analysis with field instruments. Automatic test measurements are carried out regularly with a test gas. Deviations from the set value determined in this way are recorded and compensated.

Challenge: 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.



Sewage treatment plant application

In contrast to biogas systems, the livelihood of a sewage treatment plant does not directly depend on the cost effectiveness of gas generation. In the past the biogas was often burnt off in a flare but with today's energy prices it is essential to utilise this valuable energy source and so reduce the operating costs of the plant significantly.

For reliable and cost-effective operation, modern gas engines in biogas, sewage gas and landfill gas systems need 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 sulphide 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 large 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 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. If the power supply fails, important alarm functions are ensured.



For the highest demands

The COMBIMASS® concept is impressive in its flexibility and scalability

In practice, the combination of our COMBIMASS® GA-s docking station with various gas analysis units proves to be very advantageous in a sewage treatment plant:

- **COMBIMASS® GA-e:**
Low-cost measuring components for a purely stationary gas analysis system; measuring methane, oxygen and hydrogen sulphide (carbondioxide optionally).
- **COMBIMASS® GA-m:**
Fully portable gas analyzer, with ATEX certification, battery operation, sample pump and data logger; the system is plug and play compatible and is accommodated in the same housing.
- **COMBIMASS® GA-s Click!:**
Modular designed analyzer station with flexible sampling sequences, e.g. for co-fermentation plants.

Tried and tested a thousand times

COMBIMASS® biogas and activation air measurements 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.



VACOMASS®

Air supply system for biological sewage treatment plants

VACOMASS® is an integrated measurement and control system, just like a construction system. In its simplest form, it is an air flow meter or only a control valve but the system can control depending on the loading, the air distribution and supply to the aeration basins.

VACOMASS®

- optimizes the biological degradation performance of the plant
- helps to avoid breakdowns
- ensures the process keeps within the limit values
- reduces your plant's energy costs by avoiding over-aeration
- and ensures cost effective operation of the whole plant.

A decisive factor is air supply according to actual demand

Two thirds of the energy consumption of a sewage treatment plant are used to supply air to the aeration basins. If too little air is supplied, the limit values in the effluent will be exceeded. But if too much air is supplied, the process can get upset and as well, the energy consumption is too high.

The heart of each system is the control valve with a sensitive drive. The valve secures the precise distribution of air and air supply. So dissolved oxygen concentration can be reduced within specific limits without any risk for the process.

The VACOMASS® jet control valve, compared to the already well-established square diaphragm control valve is especially impressive with its linear working characteristics from nearly 0 to 100% stroke. Due to its aerodynamically sophisticated design, it produces significantly lower pressure drop on the measuring and control piping section.

The operating conditions in the biology of a sewage treatment plant are often not stable. The compressor pressure varies, the water level changes and the dynamic pressure loss in the pipe system varies depending on the speed of the air. But extensive action in the air distribution is needed to achieve minimal changes in pressure conditions.

A problem which cannot be solved by conventional technology. This is precisely where the VACOMASS® concept of locally controlled air supply comes in. Each system recognizes the smallest shifts in pressure conditions and acts immediately. In this way, a regulated air supply according to the actual demand is always ensured.



VACOMASS®

A cost-effective concept

In many sewage treatment plants, using VACOMASS® can reduce energy costs by 15 - 30%, resulting in an investment payback period of only 1 - 3 years.

- VACOMASS® narrows down the oscillations in the control circuit. The aim is steady-state operation with high degradation performance.
- The oxygen concentration can be reduced by controlling the air supply precisely. Less air needs to be provided.
- Automatic control and adjustment of the pressure set-point results in significant savings, especially when the plant is operating at partial load.
- VACOMASS® requires only low pressure differences to control the air quantity precisely. This reduces the energy costs.
- VACOMASS® jet control valve has a linear working characteristics from nearly 0 to 100% stroke, made completely in stainless steel, closes gas-tight, needs no maintenance, has a very low pressure drop in normal control operation.
- All external disturbances resulting in static or dynamic pressure changes in the system are compensated for and do not influence performance. The operational reliability is increased.
- Gas-tight closure of the VACOMASS® jet control valve or the square diaphragm control valve respectively improves the running of the process in alternating zone operation and reduces the risk of dirt contaminating the aerators considerably.
- Disturbances in the system, e.g. in the aerators, measuring sensors or pressure supply, are registered during plausibility checks and action is taken without delay.
- The cyclic cleaning intervals for the aerators are adjustable.

A modular system solution from a one-stop shop – to the benefit of users, designers and the environment

- VACOMASS® is a system without application limitation.
- VACOMASS® measures, controls and, if necessary, closes the valve gas-tight, straight inlet and outlet pipe sections are not required and can be used therefore at any point in a system.
- With its universal design, VACOMASS® simplifies plant design, reduces installation sizes and replaces shut-off valves and butterfly control valves.
- VACOMASS® has a modular design. Depending on the requirements, system components can be used individually or in combination.
- System integration takes place via calibration in our CAMASS® calibration lab, according to the actual operating conditions in the system.



VACOMASS® jet control valve:
gas-tight closing, hydrodynamically optimized control valve with a linear working characteristic

Landfill application

Today, hardly any new landfill sites are being created in Europe; waste incineration, recycling and avoiding creating waste in the first place are much more environmentally acceptable. All the same, high-quality gas measurement technology is needed here, too.

The landfill gas is produced in high volumes during the stable anaerobic methane phase. So, the same metrological requirements are valid for the operation of the gas engine as for biogas and sewage treatment plants: For reliable and cost-effective operation, modern gas engines need a minimum gas quality, the monitoring and recording of which is usually demanded by the engine manufacturer and the plant's insurance.

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.

Binder offers the perfect solution for these tasks – with the modular COMBIMASS® concept.

In the stationary control **COMBIMASS® GA-s**, gas consumption and gas composition are recorded, evaluated and documented. Measurement errors due to changing gas composition, humidity, pressure and temperature are compensated for automatically.

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.

Binder's COMBIMASS® concept is also excellently suited for this application.



COMBIMASS® GA-m COMBIMASS® GA-s COMBIMASS® eco-bio+

**Portable/stationary landfill gas analysis
and portable/stationary gas flow measurement**

The **COMBIMASS® GA-m** is removed from the docking station, whereby the permanently connected flow meter **COMBIMASS® eco-bio+** continues to record the gas measurements and compensates with the latest gas composition.

The portable flow meter is then connected to the communication port of the portable analyzer. The **COMBIMASS® GA-m** is powered by its own ATEX-approved battery. The **COMBIMASS® eco-bio+** is operated by main power supply or via a 12 V battery outside the safety zone.

The formation of landfill gas and the gas composition for each individual well is then recorded and stored with the touch of a button in the **COMBIMASS® GA-m**, including sample location ID, date and time of measurement. A half inch ball valve connects the **COMBIMASS® eco-bio+** gas flow meter to the gas pipeline; the gas composition is measured simultaneously via a T-piece.

When the tour is completed, the portable unit can be reconnected to the docking station using USB-connection and the data can then be read out.

Comprehensive series communication interfaces

The individual docking stations are linked to each other and also communicate with the main PLC. Apart from the standard Ethernet Modbus TCP and Modbus RTU data transfer, other commercially available gateways, (e.g. Profibus) or wireless modems (e.g. W-LAN or GSM) can also be used. In this way, several hundred sampling points can be monitored and documented with least effort and the highest level of operational reliability.

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.



COMBIMASS®

A convincing concept

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

- Precise gas flow measurement without pressure loss
- Precise gas flow measurement for very small flows
- Precise gas flow measurement with a large measuring range
- 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
- High-performance 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 data transfer possibilities or local data storage – all at a reasonable price

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





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