Gas Flow Measurement
BINDER -
The gas flow expert

Gas flow
Measurement & Calibration
Conditioning & Control
Biogas analysis

BINDER offers
customised solutions
in the following market segments

- Chemical industry
- Mineral oil processing
- Power generation and distribution
- Sewage treatment works
- Paper and wood pulping industry
- Food, pharmaceutical industry and biotechnology
- Semi-conductor manufacturing
- Machine and plant construction for the technical processing industry
- and devices for OEM customer

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The COMBIMASS® series enables gas flow measurement for various applications in all industry sectors. COMBIMASS® works according to the principle of thermal dispersion and determines the standard volumetric or gas mass flow, unaffected by pressure and temperature fluctuations.

**Performance characteristics**
COMBIMASS® enables
- direct measurement of the gas standard volumetric flow or gas mass flow
- unaffected by pressure and temperature fluctuations
- with a turndown ratio up to 1000:1
- with an accuracy of up to 1%
- at process temperatures of -40 °C up to 800 °C and pressures up to 100 bar

**For each application the right solution**
COMBIMASS® flow meters are versatile and can be used anywhere. They measure the flow rate
- of compressed air, supply and process gases
- of pure gases and gas mixtures
- of clean and sterile gases
- of dirty, moist or corrosive gases
- of flammable and toxic gases in all kinds of industries and for the most diverse applications.

**A modular concept**
COMBIMASS® enables the combination of various sensors with different basic modules and for this reason an ideal configuration for any possible measuring task. Each flow meter can be customised according to the application and the requirements.

**Basic modules**
Field transmitter
COMBIMASS® basic – the basic system for flow rate measurement of compressed air industrial gases at process temperatures up to 130 °C.
COMBIMASS® eco – flow meter for various standard applications even in potentially hazardous areas and at process temperatures up to 220 °C.
COMBIMASS® compact – high performance flow meter for extreme applications even in hazardous areas for zone 0 and at process temperatures up to 800 °C.
COMBIMASS® oem – customised system for original equipment manufacturers such as manufacturers of biogas plants or gas compressors
COMBIMASS® switch – flow switch
for gases and liquids, a switch for level, foam and separation layer detection as well as for monitoring and run-dry protection of pumps.

DIN rail models:

**COMBIMASS® master** – microprocessor based electronic module with additional signal inputs and outputs as well as extended monitoring, correction and evaluation capabilities for highly demanding applications also with data-logger.

**COMBIMASS® multi** – electronic module for multipoint measurements or redundant monitoring for gas flows with plausibility checking and various evaluation options (single point analysis, averaging, etc.).

**COMBIMASS® I.S. interface** - I/O module specially developed by Binder for COMBIMASS® Ex(ia) Zone 0-applications.

**Customised COMBIMASS® products** built out of the modular components complete the program.

**State-of-the-art electronics**
Due to the visionary sensor query and digital signal processing, COMBIMASS® electronics are distinguished by their superior stability and reliability. The use of state-of-the-art components enables that the data storage for calibration and sensor data as well as the entire signal analysis functionality can be incorporated with a minimum amount of space directly into the sensor head. In addition, COMBIMASS® electronics allows the selection of different measuring modes according to the constant power principle or the constant temperature principle and for this reason, offers the greatest flexibility for every application and measuring task.
The sensors
Sensors for thermal gas flow measurement have the advantage that they are designed for minimal pressure loss with no mechanical moving parts. The COMBIMASS® Sensors are robust, corrosion-resistant and require minimal maintenance. The sensor heads are heavy duty and made out of one-piece bar stock of stainless steel or more significant materials without weldings. For all probes, specially developed sensor elements of the latest generation are used. Production Process and Quality Control guarantee high-precision measuring elements with excellent accuracy and long-time stability. Due to its rotationally symmetrical design, the 1-Pin-Sensor ensures an identical flow. The classic 2-Pin-Sensor which is dependent of the flow direction is considered as an uncomplicated standard solution and is suitable in the case of fast-changing process temperature.

COMBIMASS® in action
For sterile application, for example in pharmaceutical or food industry, COMBIMASS® sensors with highly-polished surface and special process connections are available. In addition, models made of Titanium, Tantalum, Inconel, Hastelloy, ceramic or carbide are used to measure corrosive, aggressive or abrasive gases or gas mixtures. State-of-the-art technology and high safety standards allow the use of COMBIMASS® measurement systems also in the case of high pressures and process temperatures up to 800 °C. Special manual or hydraulically operated hot tapping units are used to insert or retract the sensor for control, cleaning or maintenance also during operation without any process disruptions. All sensors are manufactured with tested welds. Therefore they meet the requirements of the PED (module A/A1, B+F, G) and the AD 2000 for pressurized components and can be used without subsequent inspection of the plant.

All COMBIMASS® flow meters are also available in explosion proof EEx(ia) or EEx(ed) version for zone 0, 1, 2, 21 and 22 and meet the highest safety standards according the ATEX regulations. With stainless steel field housings, they are especially suitable for process applications in the chemical and petrochemical industries.

COMBIMASS® multipoint system is also used when profile distortions that occur with large nominal diameters or rectangular ducts are to be expected. They measure the flow velocity of gases at various points and average the individual readings.

Applications
General industries
Flow rate measurement, recording and balancing of compressed air, industrial and combustion gases such as nitrogen, argon, oxygen, carbon dioxide, superheated steam or propane, butane, etc.

Sewage treatment and environmental technology:
Measurement, balancing, control and distribution of aeration air, biogas, natural gas, ozone and oxygen. Measurement and monitoring of exhaust air, waste gases, low temperature carbonization gas, flue gas, etc.

COMBIMASS® flow conditioner
COMBIMASS® flow conditioners are used in the case of a complex pipe geometry, bends, reducers, fittings or pulsation of the gas flow. They balance out almost without any pressure loss the flow profile and ensure that there are reproducible conditions at the measuring point. With COMBIMASS® flow conditioners, the measuring section is only up to 3–7 fold of the pipe diameter. They are robust, insensitive to dirt and guarantee the highest measurement accuracy.
Power plants, garbage incineration plants:
Flow rate measurement of combustion air, residual gases, flue gas and ammonia.

Refining, petroleum processing:
Hydrocarbons, H₂S, hydrogen, flare gases, hydrogen/hydrocarbon gas mixtures even with a high quantity of particles and variable composition.

Pharmaceutical, biotech, nutrition and beverage industries:
Nitrogen and supply gases, sterile gases, hot air for sterilization chambers, CO₂, solvent vapors, waste gas and air exhaust.

Chemical industry:
Monitoring and control of synthetic processes. Flow rate measurement and balancing of supply and process gases such as air, nitrogen, hydrogen, chlorine, ammonia, hydrogen sulphide, amines, phosgene, acetylene, hydrocarbons, gas mixtures, exhaust air and waste gases, combustion and flue gases.

COMBIMASS® Flaremass
Variable operating conditions and mixed gases are a challenge for the flare gas measurement system.

Features:
- H₂-inline-compensation
- mixed gas lab calibration possible at CAMASS® calibration centre and on site
- inline validation system
- flow conditioning
- multi-point measuring systems
- hot tapping unit
- direct mass measurement, irrespective of pressure and temperature
- easy installation
- measuring range 1000:1
- minimal pressure loss
- corrosion-resistant sensors, insensitive to dirt
CAMASS®
Calibration technology for gas flow

The use of technological advanced systems for measurement and control of gases depends to a great extent on the calibration. In order to guarantee the highest measurement accuracy, each COMBIMASS® and VACOMASS® System is precisely calibrated at the CAMASS® calibration centre with exactly the real process conditions.

Unlike liquids, the characteristics of gas flows depend much more on the process conditions, the gas composition and the real flow ratio in the tube. If such parameters are ignored, significant restrictions as far as measurement results are concerned will be expected.

Therefore each COMBIMASS® and VACOMASS® system is calibrated under real process conditions before dispatch in order to guarantee the highest measurement accuracy.

At the CAMASS® calibration centre, exactly the same pressure and temperature conditions that will be encountered later in the plant is simulated with the corresponding gas mixtures. If required for difficult applications, even the corresponding tube geometries will be constructed.

Even for corrosive and explosive gases
There are five test stands for turbulent and laminar gas flow profiles in the state-of-the-art CAMASS® calibration centre in Ulm/Germany. Hermetically closed loops made up of special materials allow the safe handling even of corrosive and explosive gases and gas mixtures. For the reproduction of the piping and the adaption of the measurement system, variable fittings up to 9 m or longer are available if required.

Measurement standards
In order to guarantee the highest accuracy, we use as reference custody transfer approved differential pressure measurement devices that have been proved by the excise office.
In addition, standardised pressure and temperature transmitters enable the exact determination of the process conditions and the volumetric gas flow on site.
In addition, laser Doppler Anemometry, an optic calibration-free measurement system with an accuracy of +/- 0.2 %, serves as standard for reference measurement.

State-of-the-art computer and simulation programs which have been developed based on many years of experience provide a basis for the calculation of the calibration data and the determination of correction factors for the temperature compensation. The data is transferred without accuracy loss to the measurement systems.
CAMASS® services for gas flow
As expert for gas flow and the possibilities of our CAMASS® technology centre, we are a capable contact person especially in the case of demanding process applications. In addition to the calibration of measurement systems, our service contains the determination of gas flow and performance data of valves, compressors, vents and flow components.

Use the CAMASS® technology centre for your product development!
The low, medium and high pressure stands and the technology test stands of the CAMASS® centre allow the calibration of numerous industrial gases, process gases and gas mixtures:
- air and compressed air, oxygen, carbon dioxide, steam
- nitrogen, helium, argon, neon, methane, propane, butane, acetylene, ethane, ethylene
- hydrocarbons in different compositions
- hydrogen and hydrogen/hydrocarbon mixtures
- biogas in different compositions
- ammonia, hydrogen sulphide, chlorine
- nominal diameters up to DN 500 plus specials
- process pressures from 0.1 to 100 bar absolute
- process temperatures up to 500 °C
- standard flow velocities form 0.01 to 600 m/sec
- standard volumetric flows up to 90 000 Nm³/h
For decades now, Binder has been supplying leading plant constructors 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. When measuring biogas, variable methane concentrations and extremely wet and corrosive gas components with a high percentage of pollutants place high demands on the measuring system. A correction of the gas flow as a function of the gas composition is only possible in conjunction with an appropriate gas analysis.

COMBIMASS® Biogas flow measurement

COMBIMASS® sewage gas and biogas measurements have proven reliable for many years worldwide and have become the standard. Since the composition of these gases changes over time, the linking of flow measurement and gas analysis brings great advantages. Calibration is the 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 calibrated in the CAMASS® calibration centre. The pressure, temperature and load statuses that will later occur in the plant can be precisely simulated with appropriate gas mixtures. For difficult applications, flow conditioners can be installed if required.

COMBIMASS® Biogas measurement:
- Direct mass measurement, independent of pressure and temperature
- Calibration with real gas in the CAMASS® calibration centre and on-site adjustment to changed gas composition possible
- A basic calibration for all biogas, sewage gas and landfill gas applications
- Automatic correction of differing gas compositions possible in conjunction with appropriate gas analysis
- Optionally, the water content of biogas can be determined
- Measuring range from 0.25 - 25 m/sec
- Flow conditioning
- Insertion devices for sensors to allow easy installation and removal even during operation of the plant
- Minimum pressure loss
- Corrosion and dirt-resistant sensors

Measurements in a biogas plant

It is virtually impossible to operate modern biogas plants in a cost-effective and environmentally friendly way without appropriate measuring and analysis technology. The gas composition and flow in the individual fermentation stages must be taken into account. One measurement per hour is usually adequate as far as the gas quality is concerned. With our automatic analysis station COMBIMASS® GA-s,
almost any number of measuring points can be recorded with regard to the gas flow and gas quality and analysed.

**The bio/natural gas challenge**

Highest measuring accuracy of the gas analysis: Automatic sample measurements with test gas are taken regularly. The deviation from the reference value determined in this way is recorded and compensated.

**Application areas for sewage treatment plants**

Contrary to biogas plants, the existence of a sewage treatment plant does not mainly depend on the cost-effectiveness of gas generation. Since methane is far more environmentally damaging than CO₂, the fermentation process in the digester must be controlled. In the past the sewage gas was often combusted in a flare. With today's energy prices, it is imperative to use this free energy profitably.

**Landfill: Mobile and stationary measurements**

During the stable anaerobic methane phase, the landfill gas can be used energetically. The landfill gas is captured in multiple wells, collected in compressor stations and conveyed to the generator. A stationary measuring system is installed in the compressor station. Mobile gas flow and quality measurements are taken, at the possibly more than one hundred wells, monitored and stored in a measuring-point related manner by the touch of a button. Due to the enormous areas involved, it is not economical or operationally safe to permanently connect the individual wells. After the round has been completed, the mobile unit is reconnected to the docking station and the measured values transferred automatically.

**Monitoring of CHP plants**

For reliable and cost-effective operation, modern gas engines in biogas, sewage gas and landfill gas plants need a minimum gas quality, which is ever more frequently demanded by engine manufacturers and the plant insurance. Environmental regulations require a modern and high-performance gas measuring system with a corresponding data record of the gas flow, as well as methane, H₂S and oxygen concentrations. Monitoring of the engine efficiency gives early warning of damage and helps to minimise it. As a rule, stationary measuring systems are used in the CHP plant container.
The standard pressure and temperature compensation of our gas meters, combined with an automatic compensation of the gas composition, is a milestone in precision and long-term stability. The COMBIMASS® concept impresses due to its flexibility and scaleability.

COMBIMASS® Biogas analysis for mobile and stationary recording of biogas, sewage gas and landfill gas

The mobile COMBIMASS® GA-m gas analyser has been specially developed to provide users with a rugged and yet simple but extremely precise and high-performance manual measuring instrument with the basic channels $\text{CH}_4$, $\text{CO}_2$, $\text{O}_2$, $\text{H}_2\text{S}$ and $\text{NH}_3$. Two further electrochemical sensors can be optionally integrated in the mobile device. Stationary systems with a continuous measuring program are preferred for special applications such as continuous process monitoring on large biogas plants or landfills. In recent times, the stations have been used more frequently in process stages such as the desulphurisation stage in sewage and biogas processing plants.

As a result, not only does the operational safety of the installation increase, but damage to the CHP plant can also be prevented or detected at an early stage. The sophisticated control concept results in maximum user-friendliness. The measuring program, as well as the threshold values for alarm signals, can be easily adapted. The COMBIMASS® GA-e is a cost-effective alternative for a purely stationary system, it measures $\text{CH}_4$, $\text{O}_2$ and $\text{H}_2\text{S}$. One can also begin with a low-cost mobile solution and later upgrade to the more comfortable, stationary version, without losing mobility. Cost-effective full maintenance at a fixed price, if desired with a free replacement unit while the maintenance or repair is being carried out, allows a consequently, continuous process monitoring and control of the plant.

A uniform, ergonomic and clear operating philosophy in the native language makes expensive training of the personnel unnecessary. Future-proof: Requirements for extended compulsory documentation and data recording are to be expected. Our systems are fully equipped with this capability. The data format is compatible with EXCEL. Optionally, it can also be exported in an essentially manipulation-proof binary format. Sensors for humidity, temperature, pressure, flow, etc., can be interconnected via an analog signal or a serial interface.
COMBIMASS® Biogas analysis GA-m:
- Compact, battery-operated manual measuring system, ATEX-certificated
- Measurement of up to 7 gas components
- Long-term stable optical infrared analysis for CH₄ and CO₂ with pressure and temperature compensation
- Long-term stable electrochemical sensors, for O₂, H₂S, NH₃, H₂ and CO
- High-capacity measuring gas pump
- Easily replaceable superfine measuring gas filter
- Field replaceable battery pack
- Automatic monitoring of measuring accuracy, on-site calibration possible
- Data logger with standard measuring point-related measurements, readout via USB cable in an EXCEL table
- Optional: Measurement of the gas flow in Nm³/h or of the temperature possible with mobile sensor
- Can be upgraded to automatic analysis station GA-s

COMBIMASS® Biogas analysis GA-s
- Multi-lingual menu navigation
- Flow-, pressure- and temperature measurement readings can be recorded at the same time
- The precision of the gas analysis can be automatically controlled and held within an analysis accuracy tolerance
- Interfaces: Communication via Ethernet with TCP/IP, Modbus/RTU with RS485 or Profibus

COMBIMASS® Flow conditioners
are used for difficult pipeline configurations, after bends, cross-section changes, valves, or pulsating compressors. They smooth out the flow profile almost without pressure loss and ensure reproducible conditions at the measuring point. They reduce the inlet and outflow zones for measurements to 3-7 times the pipe diameter, are rugged, dirt resistant and guarantee highest measuring accuracy.
The precise regulation of the air supply is important
Approximately two thirds of the power consumption in any wastewater treatment plant is expended on the provision of aeration alone. If insufficient oxygen is supplied, the required legislative limits will be exceeded. If, however, too much oxygen is supplied, the energy consumption is too high. Whereas a supply of 2-5 mg/l of oxygen was standard in the eighties, 2 mg/l were classified as optimal oxygen supply at the millennium. For a state-of-the-art plant, an oxygen supply of 0,8-1,2 mg/l is the goal. However, such values can only be achieved with VACOMASS® as it can control the air supply so precisely that the oxygen concentration can be reduced without any risk to the minimal value.

The VACOMASS® concept for the local control of the air distribution
The conditions of the biological stage in a sewage plant are often fluctuating. The water level is rarely constant and the blowers are not running efficiently. Minimal changes to the pressure conditions, would demand extensive changes to the air header supply. This is a problem that cannot be solved with conventional technology. The modular VACOMASS® air supply system is solely optimised for such applications. Each local control loop detects minimal pressure variations in the distribution system and acts immediately to compensate for the change. Thus a constant air supply according to the local demand can be assured.

A modular concept
The VACOMASS® system consists of different components individually combined into the modular system according to the requirement, the capacity and the conditions on site.

VACOMASS® flow meter – a flow meter based on thermal dispersion principle for precise monitoring of the air supply.
VACOMASS® control valve – a diaphragm control valve with multi-turn actuator for precise control of air flow.
VACOMASS® tune valve – a manually operated diaphragm valve with measuring stub for fine adjustment of air distribution. The microprocessor-based electronics of the various VACOMASS® modules is located in DIN rail housings for easy installation in switch cabinets.

The VACOMASS® master - electronic module features autonomous determination of the actual oxygen demand and local control of the air supply.
The VACOMASS® slave – electronic
module features local control of the air supply according to external airflow setting via the VACOMASS® master or the PCS. The VACOMASS® econtrl – controls the blower pressure according to actual air requirement.

**In fact, energy cost can be reduced about 15 to 30 % in many wastewater treatment plants with a return on investments in 1 to 3 years**

With precise regulation of the air supply, you can reduce the oxygen concentration and less activation air is needed.

With the direct regulation of the pressure, costs can be reduced significantly, for example, if the plant is running under partial load at night. VACOMASS® only requires little differential pressure in order to regulate air flows precisely. Therefore the pressure in the supply line can be kept at a very low level.

With VACOMASS® pulsations of the control circuit are eliminated and all external disturbances which cause static or dynamic pressure changes are compensated.

**A one-stop system solution – A benefit for the plant designer**

VACOMASS® is a system without application restrictions. VACOMASS® measures, regulates and closes gas-tightly without downstream and upstream straight pipe-runs and, therefore, can be used at any preferred pipe location in the plant. VACOMASS® simplifies the planning, reduces the construction volume and replaces the cut-off and regulation valves.
BINDER GROUP - About us

Binder Group is an international active group of companies in the field of measurement & control. More than 40 years of experience has made us a competent partner to talk to about gas flow and pressure control.

Worldwide orientation
The group of companies includes manufacturing sites in European countries, own Binder Engineering Sales & Marketing companies and a worldwide distribution network. The independence of the individual companies grants a high level of flexibility and assures our close contact to the markets and customers. Steady focus on our core competence, short and quick decision steps due to the private ownership, highly motivated and professional employees, innovative ideas, superior products and satisfied customers are the reasons for the steady growth in the past and grant us a prosperous future.

Satisfied customers – our No. 1 goal!
The specific know-how and competence in providing consultation for gas flow and pressure control is our special strength. Our success find its ground in long-term field experience, specific process knowledge and the steady and close contact to our customers.

Binder Engineering companies are established in Germany, Switzerland, France, The Netherlands, Belgium and Singapore. Besides our own product lines we solely distribute products from other manufacturers. Complete customised solutions – for us a standard and business
as usual – is our special strength. Our No. 1 goal is to exceed the expectations of our customers and that our installed products work for the economical success of our clients. Acc. to the motto – only a satisfied customer stays as customer!

All we do every day is focused to achieve this goal.