

COMBIMASS®

Thermal gas flow
measurement system

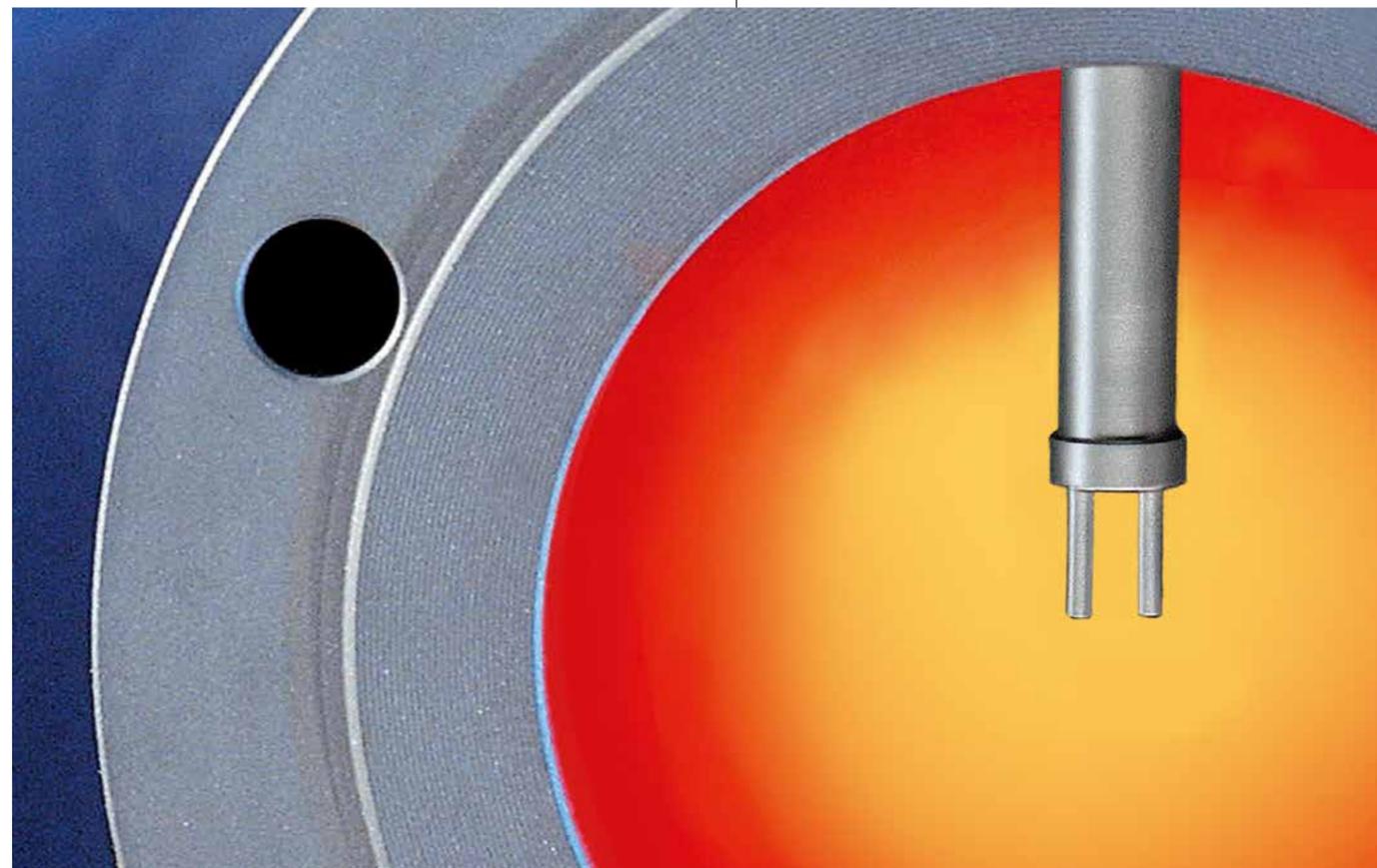
For measuring
and balancing of
standard volumetric
or gas mass flows



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COMBIMASS®

The **COMBIMASS®** series enables measurement of the normal volumetric flow or gas mass flow directly, unaffected by pressure and temperature fluctuations.

The modular concept is characterized by

- its advanced electronics
- multiple combinations as well as
- the expandability of the system

COMBIMASS® sensors for thermal gas flow measurement

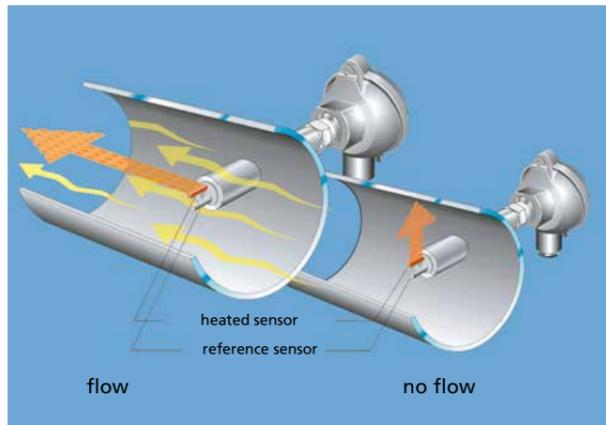
- are designed for minimal pressure loss
- are robust, corrosion-resistant and require minimal maintenance
- have no mechanical moving parts
- are available in various models and probe geometries

The use of state-of-the-art sensor technology in combination with a precise customized calibration ensures precise measuring results which are stable over time, even under extreme conditions and at high temperatures.

With **COMBIMASS®** you can configure your gas flow meter individually according to your specific application.

The principle of thermal measurement

Gas molecules flowing past a heated sensor element absorb heat energy, cooling down the sensor element. The degree of cooling depends on the number of gas molecules, this means on the gas mass. With other techniques of gas flow measurement, the operating volumetric flow is normally measured instead of the mass flow. In such case the reading of the flow meter varies significantly according to pressure and temperature fluctuations.



COMBIMASS® directly measures in dry gases the standard volumetric flow or the mass flow of the gas respectively according to DIN 1343. This key value for the flow rate is independent of the operating state of the gas and may be compared directly.

A heated sensor element and a reference element are used to determine the quantity of heat absorbed by the flowing gas. This value is directly proportional to the gas mass flow. The reference sensor determines gas temperature, which can be transmitted to the SCADA system via second analog output or Modbus.

Thus, a basic distinction is made between the following two principles and selected depending on the measurement task and application:

The constant power principle

evaluates the temperature difference. It has proven to be ideal for process applications and is characterized by an extremely stable flow signal. This measuring mode is the best choice for monitoring of low flow rates, for measuring dirty and wet gases as well for regulating tasks.

The constant temperature principle

regulates the heating output continuously and is mainly used for special measuring tasks. It is well known for its quick response characteristics. With clean gases the constant temperature principle is ideal for measuring high flow rates or monitoring dynamic processes.

The COMBIMASS® sensors are unmatched in precision and stability

The choice of an appropriate sensor is crucial for precise gas flow measurement in various applications and process conditions.

Various sensor models

Heavy-duty, fully encapsulated sensors made of high-grade stainless steel or special materials are available for a variety of applications. Depending on the nominal pipe size and the type of application, these probes are available in different diameters and lengths as well as with various process connections. Importantly, all sensor tips are made from one-piece solid bar-stock construction.

The sensor elements – High-tech in detail

All probes of the **COMBIMASS®** series use technologically advanced sensor elements of the latest generation. The platinum thin-layer resistors are randomly distributed on a ceramic board. The structures of the sensor elements are created using modern manufacturing laser technology.

COMBIMASS® sensors are characterized by

- high-precision resistors
- negligible drift of the raw signal
- excellent long-term stability

all while working under harsh operating conditions and at high temperatures.



COMBIMASS® The modular concept

The **COMBIMASS®** series is unique due to its advanced modular design. Each gas flow meter is customized to fit the application and your specific requirements. Once installed, a **COMBIMASS®** system can also be further expanded. Thus, changes in requirements do not require expensive replacement by a new, higher performance device. Depending on installation placement and requirements on explosion protection, there are

five standard enclosures available, from reasonable aluminum housing without display to a high-grade stainless-steel housing with several analog inputs and outputs as well as integrated display and Modbus. If the measuring sensor and display need to be mounted on different places, a separate graphic display in a field housing or mounting plate for assembly in a control cabinet is available.

COMBIMASS® convert enables transmission of data and alarms in different bus formats. HART 4–20 mA can use existing electrical wires of older systems for digital communication and setting up of industrial fieldbus systems. Besides various basic modules you may choose between **COMBIMASS®** sensors available in different materials, dimensions and with various process connections. Sensors are

available as insertion type sensors with compression fitting or cutting ring fitting, with a flange directly connected to the sensor or as an inline-sensor fixed mounting in a pipe with flanges on both ends for small pipe sizes. Additional manual or automated cleaning systems ensure reliable measurements in particle-loaded gas flows, which can build up deposits on the sensor tips.

The basic modules

COMBIMASS® enables the combination with various basic modules and for this reason it is an ideal configuration for any possible measuring task.

Field transmitter

COMBIMASS® basic is a basic flow meter for gas mass measurement of compressed air and technical gases at process temperatures up to 130°C

COMBIMASS® eco is a flow meter for various standard applications even in potentially explosive areas and at process temperatures up to 280°C (special versions up to 500°C)

COMBIMASS® eco-bio+ SS /AL is a customized meter/system for gases containing methane from agricultural anaerobic digestion or solid waste treatment plants at process temperatures up to 130°C, with integrated humidity compensation (option for SS type only)

COMBIMASS® AL100/SS100 is a customized meter/system with additional analog inputs providing bus connectivity for integrated compensation of external influences e.g. fluctuating process conditions, which would lead to falsification of measuring values

COMBIMASS® syngas is a customized system for flow measurement in syngas applications with automatic H₂ compensation using a second sensor of heat conductivity technology

COMBIMASS® oem-bio L is a customized system for original equipment manufacturers (OEM) in the industry, but also manufacturers of biogas plants or CHP cogenerators

Field housings

Modules are available for DIN rail assembly or in a field housing with or without the **COMBIMASS® graphic display**

COMBIMASS® convert is an electronic building block to transform an analogue 4–20 mA signal to a standard bus signal (Profibus DP, Modbus RTU, Modbus TCP, Profinet, Ethernet IP...)

COMBIMASS® corr is an electronic building block with additional signal inputs and outputs as well as extended monitoring, correction and evaluation capabilities for sophisticated applications, integrated data-logger as an option

COMBIMASS® multi is an electronic building block for multi-point measuring systems in large pipe sizes or ducts with irregular flow profiles

COMBIMASS® I.S. interface I/O module specially developed by BINDER for **COMBIMASS®** in EEx[ia] zone 0-applications

Customized products built out of the modular components complete the program.

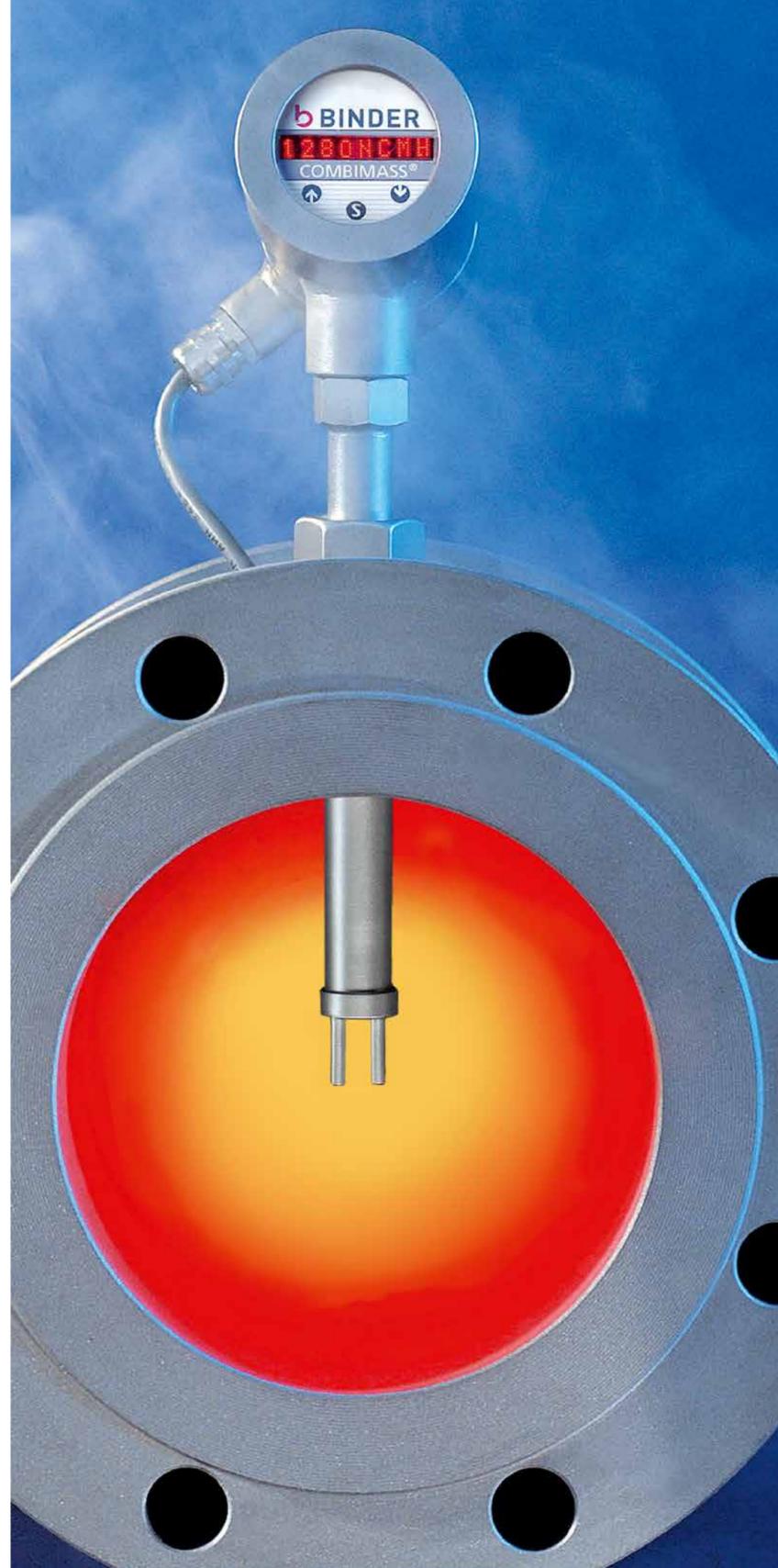
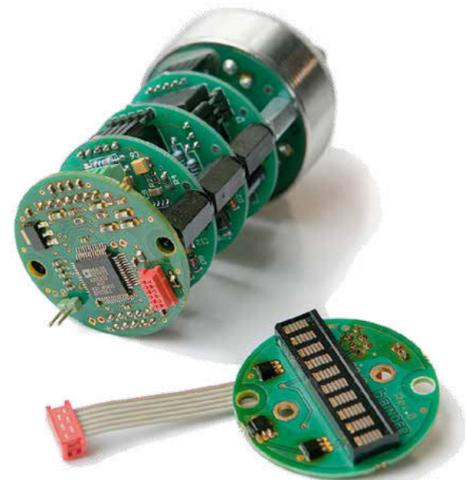
The electronics

Due to the visionary sensor query and digital signal processing the **COMBIMASS®** electronics are distinguished by their superior stability and reliability.

The use of state-of-the-art components allows the electronics to be miniaturized in size. Data storage for calibration and sensor data as well as the entire signal analysis functionality can be incorporated into the sensor head. Thus, it is possible to read and check the sensor data. If the sensor is connected to the electronic interface, the sensor electronics transfer the application data to the external module.

The **COMBIMASS®** electronics allow a selection of different measuring modes. Operation of the flow meter can be according to the constant power principle or the constant temperature principle, thus offering the greatest flexibility for every application and measuring task. The measuring mode will be selected prior to system calibration but can be changed at any time as needed.

Transmission of data can be realized without additional electronic components via: 4–20 mA analog signal for actual reading, HART 4–20 mA, one digital output with frequency signal for actual flow, temperature or as a counter and Modbus RTU RS 485.



The sensors

The solid machined sensor points of the **COMBIMASS®** series are welded to the sensor rod with a single weld only. This allows all sensors to be manufactured with tested welds. **COMBIMASS®** flow meter therefore meets the requirements of the PED and the AD 2000 for pressurized components and can be used without observing any particular safety guidelines even at high operating pressures.

Modern technology and the consideration of high safety standards allow these thermal gas flow meter to be deployed not only for simple applications but also in areas with explosion hazards, at high pressures and for process temperatures up to 280 °C (as a standard). Manual or hydraulically operated hot tapping units for operating pressures up to 100 bar are used to insert or retract the sensors during operation. This enables the sensors to be checked, cleaned and maintained at any time without difficulty. As an option BINDER supplies a sensor with integrated cleaning system. Cleaning can be done manually or automatically without removing sensor from pipe.

If the sensors are installed outdoors, a weather protection shield can be supplied to protect the sensor against direct sunlight. If the sensors are used in pipes with high gas temperatures, a sensor extension is provided along with an additional shield protection cover which is used to protect the sensor head against heat.

Explosion protection without compromises

COMBIMASS® flow meter are available in explosion proof version according to ATEX regulations. The measuring systems therefore meet the highest safety standards and can also be used for applications in explosive areas classified up to zone 0. Versions for zone 1, 2, 21 and 22 are also available. Thus, these devices cover a broad spectrum of process applications in the chemical and petrochemical industries up to various biogas applications.

The **COMBIMASS®** instruments can be configured as intrinsically safe versions Ex [ia] or shipped with a pressure-proof dual compartment enclosure rated Ex [de] for hazardous location use. The Ex [ia] configuration meets the requirements of category 1 as well as temperature class T4.



COMBIMASS® flow meters are versatile and can be used anywhere

The devices measure the flow rate of

- compressed air, supply and process gases
- pure gases and gas mixtures
- clean and sterile gases
- dirty, moist or corrosive gases
- flammable and explosive gases

in all kind of industries for the most diverse applications

The high-performance gas flow meter measure

- directly the normal volumetric or the gas mass flow in dry gases
- without affect from pressure and temperature fluctuations
- with a turndown ratio up to 1000 : 1
- with an accuracy up to 1% of reading
- at process temperatures up to 280 °C (special versions up to 500 °C)
- at operating pressures over 100 bar and guarantee precise results even for difficult measuring tasks

COMBIMASS® – Always the best choice for your application

The COMBIMASS® series of flow meter were developed for a great variety of different tasks in many types of industries and branches. COMBIMASS® covers a broad range of diverse applications.

For sterile areas, such as pharmaceutical or food industry, COMBIMASS® sensors are available with highly-polished surface, approved materials and special process connections. Models made of Titanium, Tantalum, Inconel, ceramics or carbide are used to measure corrosive, aggressive or abrasive gases or gas mixtures.



COMBIMASS® flow conditioners

COMBIMASS® flow conditioners are used for complex pipe geometry with bends, reducers, valves, fittings or pulsating gas flows downstream to blower. They balance the flow profile with minimal pressure loss and ensure that there are stable flow conditions at the measuring point. With COMBIMASS® flow conditioners, the measuring section is only up to 3–7-times of the pipe diameter.

They are robust, corrosion-proof, insensitive to dirt and guarantee the highest measurement accuracy.

The principle

At the inlet, swirl-reducing guide plates cause counter-vortices which neutralize the swirl flow. Profile guide plates create cross flows, which are mixed with the fast and slow speed regions generating in, a homogeneous outlet flow.



The COMBIMASS® applications Biogas metering

Variable methane concentrations in wet and corrosive gases combined with dirty particles are a challenge for each measuring system. A gas mass flow meter with integrated humidity correction measures the biogas flow at standard conditions according DIN 1343. Using a further combination with a gas analyzer, the gas mass flow can be corrected by the actual methane concentration in the gas. The modular user friendly analyzer station with maintenance diagnosis fulfills multiple measuring tasks. The portable analyzer is a very compact and rigid hand-held instrument. The reliable measuring results increase significantly process efficiency and reduce costs for repair and maintenance of sensible components, e.g. CHP stations.



Flare mass flow metering

Variable operating conditions and permanent changes in gas compositions are the challenge for the COMBIMASS® syngas measuring system with:

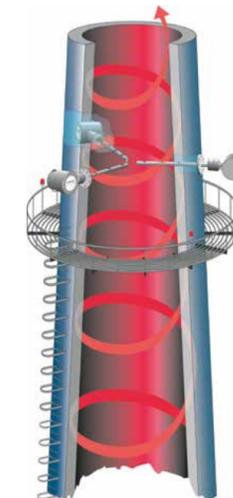
- H₂-inline-compensation, mixed gas calibration possible at CAMASS® Calibration Lab and on site
- Inline validation system
- Flow conditioning
- Corrosion-resistant sensors, insensitive to dirt



Multipoint measurement

Flow profile distortions, such as those which occur with large nominal diameters, rectangular ducts and short inlet and outlet pipe sections, lead to falsification in the flow rate measurement.

COMBIMASS® multi systems measure the flow velocity of gases at various points of the cross-section and form area-related average values based on the individual readings. Thus, deviations in readings caused by flow profile distortions are suppressed.



CAMASS® Calibration technology

With such high-precision measuring technology, correct calibration of the gas flow meter is key to precise flow rate measurement. In our CAMASS® calibration lab, we simulate the same process conditions that will be encountered later in your plant. Each flow meter is calibrated individually. Depending on the application there are 3 different calibration loops available.

The modern and unique world-wide CAMASS® Calibration Lab offers technology and service for gas flow applications even for corrosive and explosive gases with

- nominal diameters up to DN 500 as standard
- operating pressures from 0.1 to 100 bar (abs)
- operating temperatures up to 500 °C
- standard flow velocities from 0.01 to 600 m/sec
- standard volumetric flow unlimited

Besides various international standards for flow rate measurement, the laser doppler anemometry can be used as a reference as well with an overall accuracy of +/- 0.2 %.

COMBIMASS®

The applications

General industrial use

Flow rate measurement, recording and balancing of compressed air, technical and combustion gases such as nitrogen, argon, oxygen, superheated steam, propane, butane etc.

Sewage treatment and environmental technology

Measurement, balancing, control and distribution of aeration air, digester gas, landfill gas, biogas, natural gas, ozone and oxygen. Flow measurement and monitoring of exhaust air, waste gases etc.

Power plants, garbage incineration plants, coal and steel industry, mining

Flow rate measurement of combustion air, flue gas and recirculated flue gases, coke oven gas and ammonia gas

Refining, petroleum processing

Hydrocarbons, hydrogen sulphide, flare gases, hydrogen/hydrocarbon gas mixtures even with a high quantity of particles and variable composition

Pharmaceutical, biotech, food and beverage industries

Nitrogen and supply gases, sterile gases, hot air for sterilization chambers, solvent vapors, waste gas and exhaust air

Chemical industry

Monitoring and control of synthesis 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



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