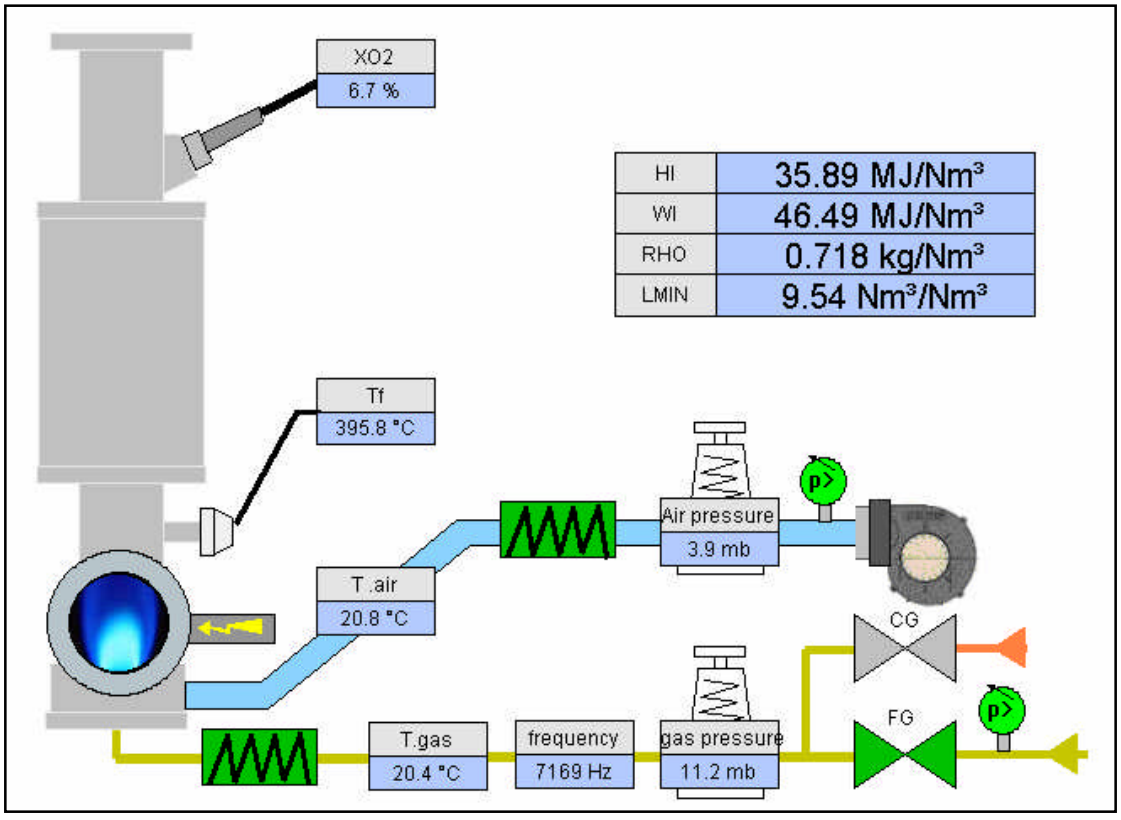
Product Information to the Gas Analyser System

RBM 3000

Reineke Fuel Gas Measuring System



Combustion measuring device for the rapid continuous measurement of fuel gases and their technical combustion properties

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Introduction

The fuel gas detection device was developed in conjunction with the BFI Research Institute, Düsseldorf.
The type RBM3000 measuring system is a universal gas measuring device which determines the most important combustion properties of fuel gases.
The measuring method belongs to the category of "non-calorific" measuring methods, where the physical properties of the process gas, that is, average density, average molar mass, residual oxygen content in the exhaust gas, can be measured.

The residual oxygen content in the exhaust gas (i.e. after combustion) is measured with a zirconium oxide broadband lambda sensor. From this, the minimum air requirement *(L_{min})* is calculated by means of the oxygen balance at the combustion chamber.
On the other hand, the frequency of the gas generated by the flow of the gas through the labial pipe is measured. Together with the gas temperature, the gas density (ρ) is calculated through the speed of sound.
With these two variables *(L_{min}* and *ρ*) the calorific value, Wobbe index and relative density are calculated and displayed on the basis of the plausibility check.
The measuring device always determines the lower calorific value (Hi) and the lower Wobbe index (Wi). The output of the calorific value (Hs) and the Wobbe index (Ws) is calculated using a fixed factor in relation to the calorific value (Hi) or the Wobbe index (Wi).

The advantage of this method of measurement is that unknown gas components are also taken into consideration, because we measure the process gas as a whole during combustion and in the gas analysis.

Depending on the customer's requirements, the required steady measured values are shown on the display and output as 4 - 20 mA signals, depending on the configuration.

The measuring device is characterised by its very short response time (T‹ = 10 sec) and highly accurate measurement (+/-1.5%). Even greater measuring accuracy (+/- 1.0 %) is achieved with natural gases.

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Possible applications

The RBM3000 is ideally suited for controlling combustion processes where variations in fuel gas quality must be compensated within a very short period of time.

This analyser is used to check the gas quality of natural gas deliveries, since it can resolve and measure fluctuations very well and very quickly. Thanks to its high long-term stability and the possibility of automatic calibration, measurements can be performed continuously.

For examining and checking fuel gas properties in the petrochemical industry, where the composition of the gases to be measured are not known

The analyser is also ideal for measuring various other gases, such as coke oven gas, blast furnace gas, mixed gases, etc. by adapting the measuring ranges to the gas to be measured.

General information:
Residual gases such as blast furnace gas, coke oven gas and process gas are mixed with natural gas and used to operate a power plant boiler for generating electricity.

Application:
Highly fluctuating gas compositions must be measured quickly, precisely and continuously, and control options must be provided.

Important measuring data:
Calorific value, Wobbe index, density, minimum air requirement

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Operation

For the continuous determination of combustion properties, two variables are measured, the frequency of the gas as it flows through the labial pipe, and the residual oxygen content in the exhaust gas. In order to determine these correctly, the combustion air and combustion gas volume flow is always kept constant.

To determine the measurements, the fuel gas flows through the analyser. The unburned gas flows through the labial pipe and creates a vibration whose frequency depends on the speed of sound of the gas. This frequency is recorded with a microphone whose output converts an analogue signal into a voltage signal.
Together with the measured gas temperature, its density is calculated using the following formula.

$$\rho_{n.} = K \cdot \frac{T_{gas}}{f_{gas}^{\,2}}$$

The constant K (proportionality factor) is determined by calibration.

The fuel gas is then premixed with the combustion air and fed to the combustion chamber. The air supply to the combustion chamber is factory-set so that the gas is always burned overstiochiometrically. This is why there is always a residue of oxygen in the exhaust gas after combustion. The residual oxygen concentration in the exhaust gas is measured with a zirconium dioxide broadband lambda sensor.

The minimum air requirement is calculated from the residual oxygen content in the exhaust gas by means of the oxygen balance.

The calorific value and the Wobbe index of the fuel gas are determined from an empirical correlation for the application in question, depending on the minimum air requirement and the density of the fuel gas. The required correlation is factory-set.
The measurement signals are forwarded to a programmable measuring and control unit for further processing. The control unit calculates the combustion properties and continuously forwards the measured values to the end user as 4 - 20 mA analogue outputs for further processing.

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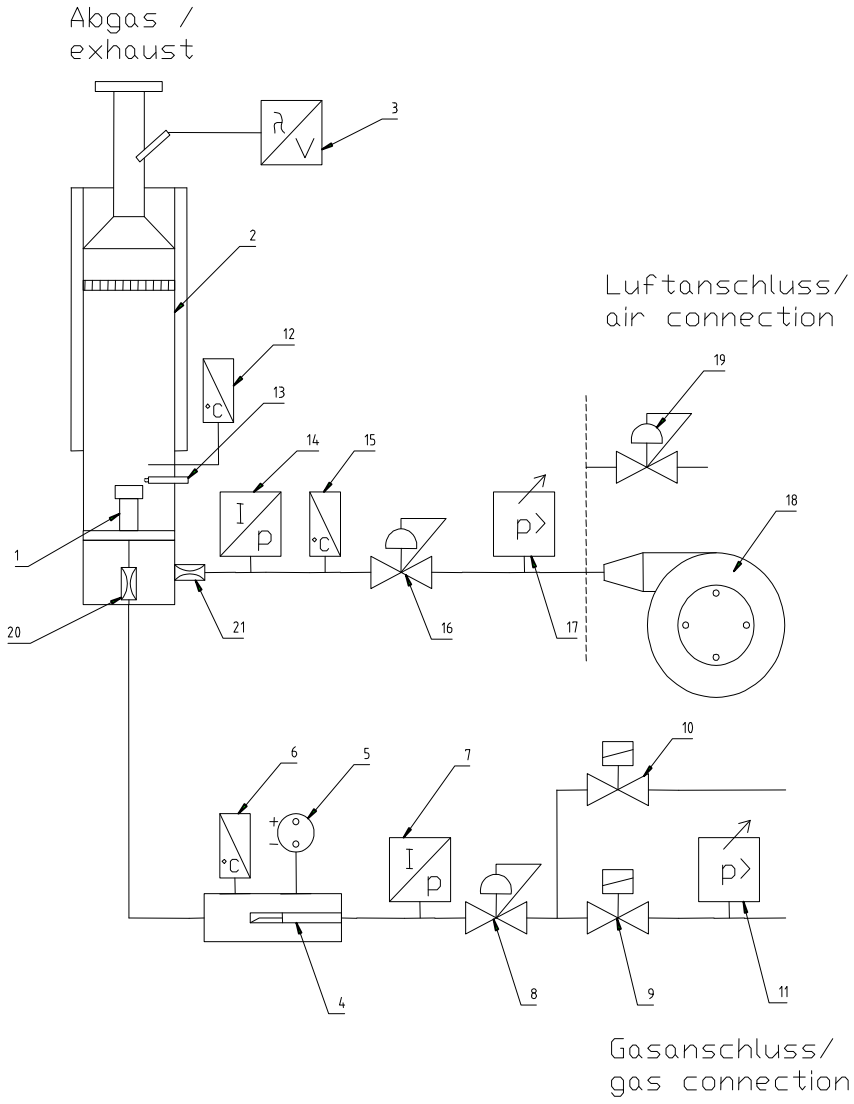
Measuring structure



1	Burner	12	Temperature sensor
2	Burner tube	13	Ignition electrode
3	Lambda probe	14	Pressure transmitter air
4	Labial pipe	15	Temperature sensor
5	Microphone	16	Pressure reducer air
6	Temperature sensor	17	Pressure switch air
7	Pressure transmitter gas	18	Air blower
8	Pressure reducer gas	19	Pressure reducer combustion air
9	Solenoid valve fuel gas	20	Gas orifice
10	Solenoid valve calibrating gas	21	Air orifice
11	Pressure switch fuel gas		

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Technical data

The actual values and options can be found in the test certificate.

Type: RBM 3000

Indication	:	9“–Touch-colour screen
Measuring range	:	freely selectable 50 – 100% from upper range value or according to prior agreement
Measurement unit	:	freely selectable MJ/m_n^3 kWh/m_n^3 $Mcal/m_n^3$ kBTU/SCF etc.
Measuring accuracy	:	dependent from the type of gas relating to final value of measuring range 1,0 % for natural gas 1,5 % for coke oven gas others for gas mixtures and lean gas
Response time	:	T50 = 5 sec. T90 = 10 sec.
Output-signals	:	according to prior agreement
Calorific value	:	4 - 20 mA
Wobbe index	:	4 - 20 mA
Specific gravity	:	4 - 20 mA (or density)
Minimum air requirement	:	4 - 20 mA
Power supply	:	230V/50Hz; Option: 230V/60Hz & 115V/60Hz other possibilities by agreement
Gas quality	:	clean, dry, combustible and flammable
Gas connection	:	∅ 8 x 1 mm (o.D.) tube
Gas entry pressure	:	30 mbar
Ambient area	:	15° - 35°C (59– 95 F)
Air connection	:	air blower or compressed air 3,5 bar, 20 Nm3/h , 12 mm tube (o.D.)
Paint	:	RAL 7035
Protection class	:	IP 10 to DIN 40050 / IEC 529 for connection housing IP 54 to DIN 40050 / IEC 529 for air blower

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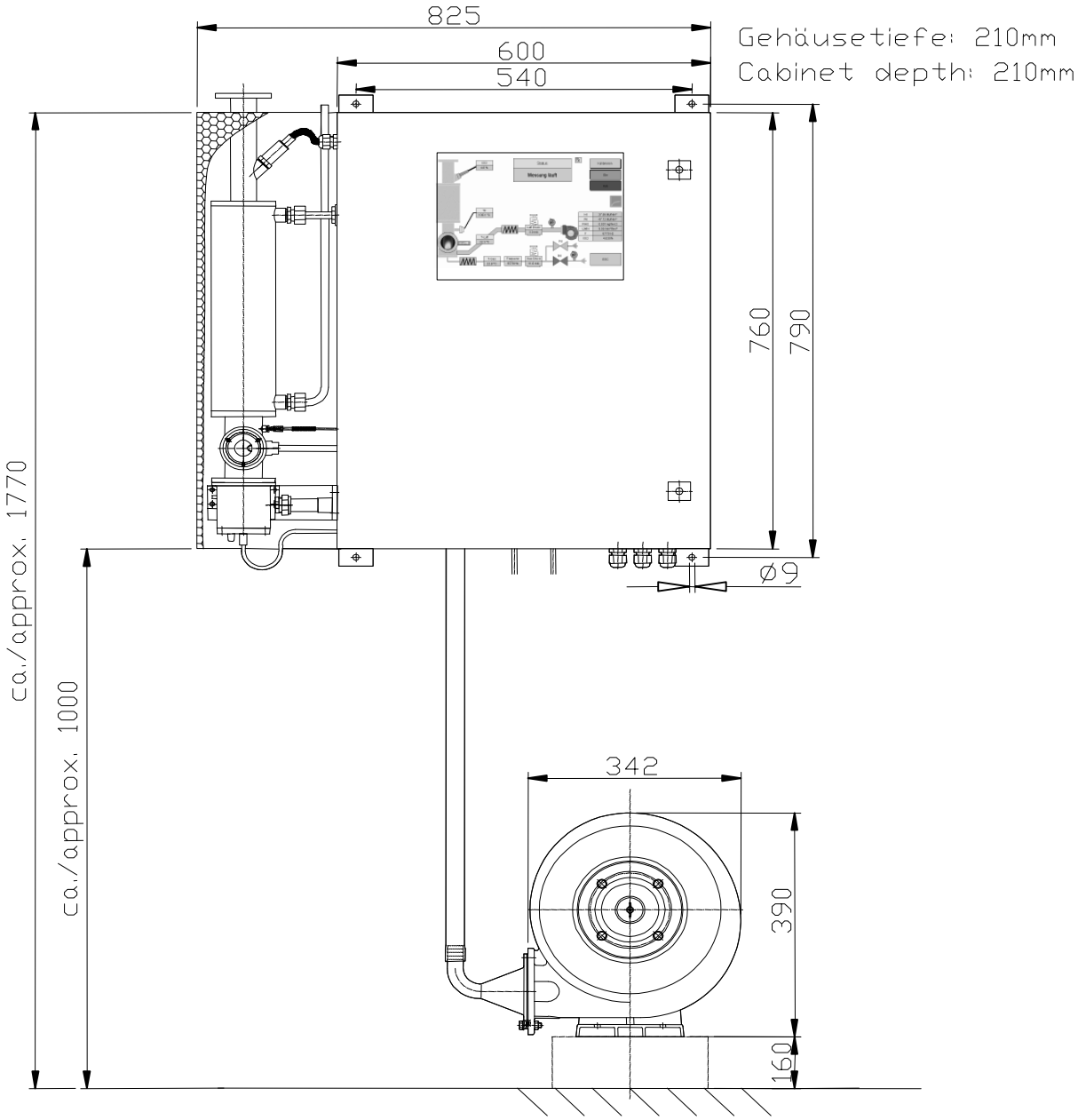
Weights and Measures



RBM3000 with air blower

Measures:

Gas analyser:	height	825 mm	Air blower:	height	390 mm
	width	825 mm		width	520 mm
	depth	210 mm		depth	500 mm

Weight:

Gas analyser:	65 kg
Air blower:	22 kg

Subject of technical alterations **Edition: January 2018**

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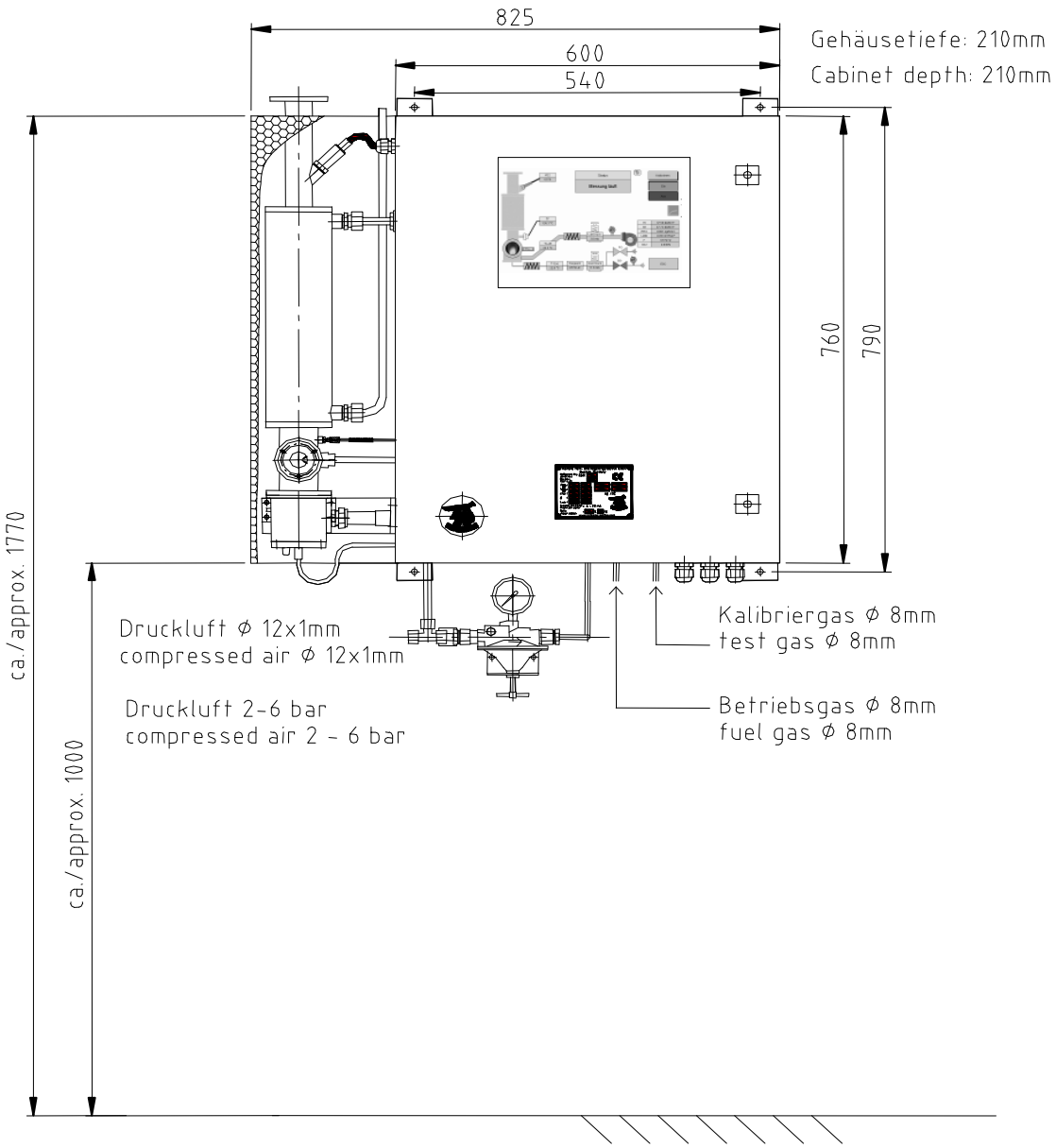

RBM3000 with compressed air connection

Measures:

Gas analyser:	height	825 mm
	width	825 mm
	depth	210 mm

Weight:

Gas analyser:	70 kg

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