Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

Translation; original: German*

Innerstaatliche Bauartzulassung

Type-approval certificate under German law

Issued to: FLOW COMP Systemtechnik GmbH
Schlossstraße 95 a
44357 Dortmund

In accordance with: Section 13 of the Law on Metrology and Verification (Verification Act) of March 23, 1992 (Federal Law Gazette I p. 711)

In respect of: Calorific value determination device
gas-lab Q1

Approval mark: 7.631
03.49

Valid until: unlimited

Number of pages: 29

Reference No.: 3.14 - 03000290

By order:

Braunschweig, 2003-08-29

Seal

Dipl.-Ing. Detlev Hoburg

394 00 c-rb

Characteristics of the instrument type approved, restrictions as to the contents, special conditions and approval conditions, if any, are set out in the Annex which forms an integral part of the type-approval certificate under German law. For notes and information on legal remedies, see first page of the Annex.

*) In case of dispute, the German text shall be valid

Physikalisch-Technische Bundesanstalt

Annex to type-approval certificate under German law

Regulations

The following is valid for measuring instruments of the type approved:

Legal provisions:

- General provisions of the Verification Act of August 12, 1988 (Federal Law Gazette I, p. 1657) last amended by article 8 of the Second Law to Amend the Medical Devices Act of December 13, 2001 (Federal Law Gazette I, p. 3586)
- Appendix 7 (Instruments for measuring gas) of August 18, 2000 (Federal Law Gazette I, p. 1307) to the Verification Ordinance
  - Section 2, Differential pressure gas meter (EO 7-2)
  - Section 6, Calorific value determination devices (EO 7-6)
  - Section 7, Instruments to measure the carbon dioxide fraction of fuel gases (EO 7-7)

Design and test specifications:

- PTB Requirements 7.61 "Instruments for measuring gas - Calorific value determination devices“ of January 1998
- PTB Requirements 7.62 "Instruments for measuring gas - Calorific value determination devices – Requirements for the place of use“ of January 1998
- PTB Requirements 7.63 "Instruments for measuring gas – Calorific value determination devices – Requirements for calibration gases for gross calorific value determination devices“ of January 1998
- PTB Requirements 50.1 "Interfaces on measuring instruments and auxiliary devices“ of December 1989
- PTB Requirements 50.7 "Requirements for electronic and software-controlled measuring instruments and auxiliary devices for electricity, gas, water and heat,“ April 2002 edition.

Information on legal remedies available

Objection may be made to this notification within one month of its receipt either in writing or orally recorded, to the Physikalisch-Technische Bundesanstalt at one of the following addresses:

Accepted rules of technology

In this Annex, reference is made to the following rules of technology:

– DVGW Data Sheet G 260 "Gas quality“ January 2000

– DIN 51 857 "Gaseous fuels and other gases – calculation of gross calorific value, inferior gross calorific value, density, relative density and Wobbe index of gases and gas mixtures,“ March 1997

– ISO 6976 "Natural gas - Calculation of gross calorific values, density, relative density and Wobbe index from composition,“ 1995

1 Designation and type of the measuring instrument

1.1 Designation

Correlative gross calorific value determination device gas-lab Q1.

1.2 Type

The overall measuring system consists of two components (see Figure 1): the Q1 measuring unit which contains the sensor system and the Q1 evaluation computer which calculates the result quantities, provides the main display, performs archiving as well as all input/output functions.

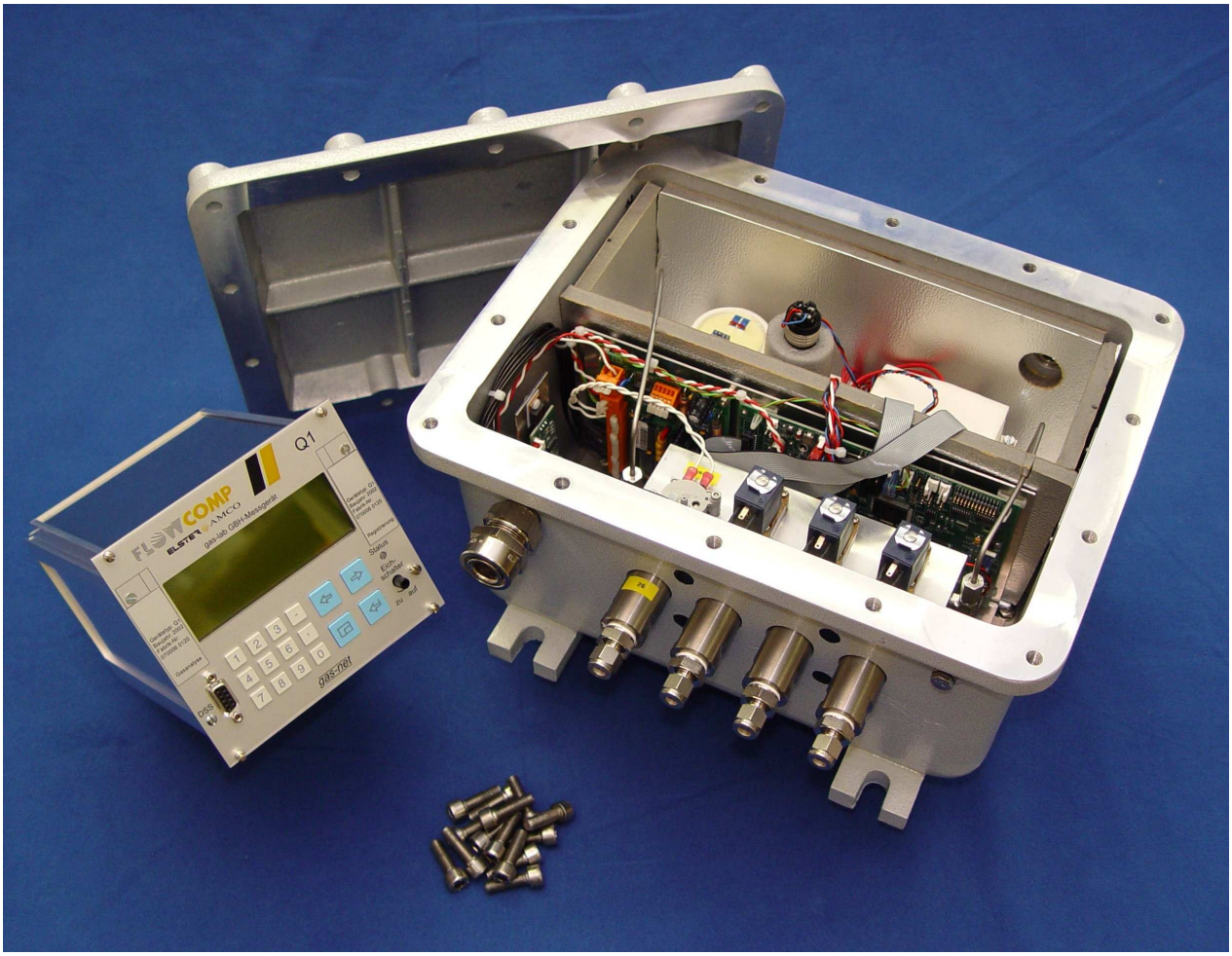


Figure 1: Q1 measuring unit (on the right) and Q1 evaluation computer (on the left)

1.2.1 Measuring unit

The sensor system proper is accommodated in a flameproof enclosure. It comprises two infrared sensors to measure the absorption of the hydrocarbons contained in the natural gas and of the carbon dioxide. Moreover, an additional sensor determines the thermal conductivity of the natural gas and thus also allows for gas components such as, for example, nitrogen which do not absorb infrared light.

The sensor system is installed on an electrically heated measuring bench (see Figure 2) in an insulated enclosure. Insulation and control of the heater ensures that the set temperature for air-conditioning (approx. 55 °C) is complied with also at changing ambient temperatures.

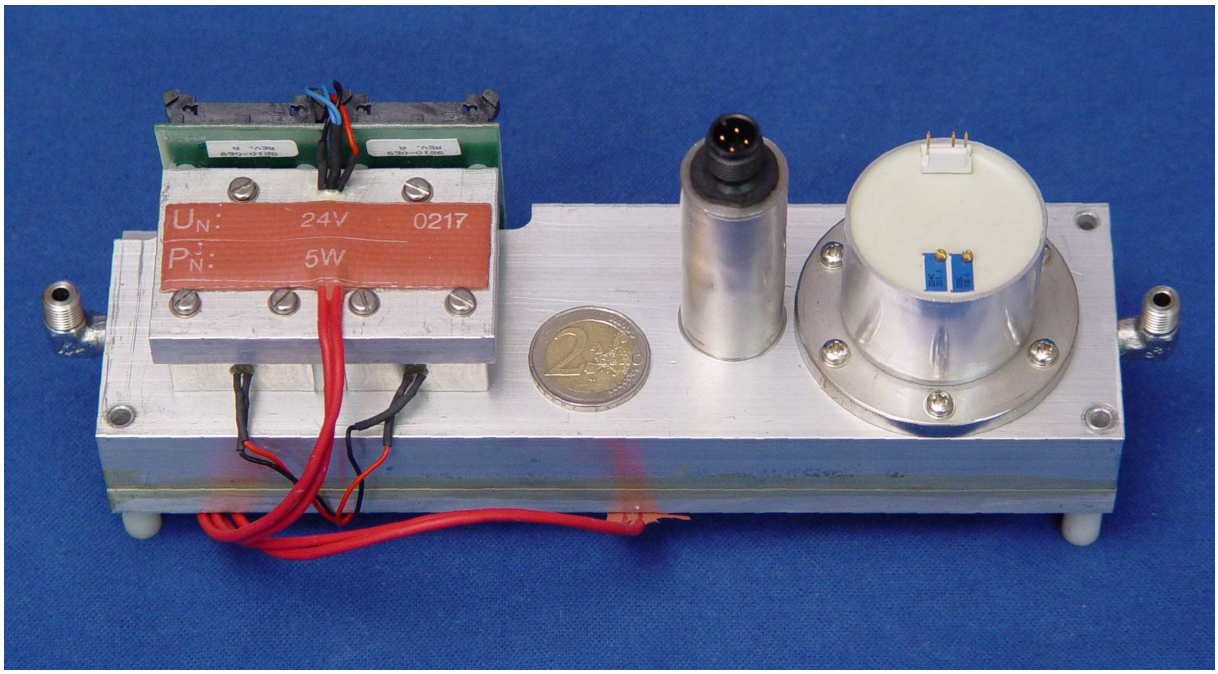


Figure 2: Sensor system with two IR filter photometers, pressure transducer and thermal conductivity sensor

Arrangement of the sensors in Figure 2 from left to right: IR(CO_2) sensor, IR(CH) sensor, pressure transducer and thermal conductivity sensor.

With the pressure transducer, the pressure of the gas in the receiving stream is measured and included in the evaluation.

Signal amplification and preprocessing take place directly on the detectors, further signal processing and system control is performed by an electronic sensor system.

The measurement values from the sensors are preprocessed by the sensor electronics. A communication board transmits the results of this processing step to the analyzing computer. In addition, the communication board controls the gas injection valves.

The measuring unit is supplied with 24V DC.

1.2.2 Gas injection

The measuring system is equipped with three inlets for process, calibration and test gases and one gas outlet for ventilation. All gas connections are protected by a flame arrester (capillary).

Switch-over between the gas connections is realized by a three-channel double-block-and-bleed valve block (DBB) with integrated piping. In DBB technique, each gas channel is blocked by two valves between which ventilation takes place. The DBB technique safely prevents contamination of calibration and test gases, also in the case of valve leakage.

1.2.3 Analyzing computer

The Q1 gas-lab analyzing computer can be installed separately from the measuring unit. Its main tasks are the control and monitoring of the measurement sequence, evaluation of the measurement values of the sensor system, calculation of the target quantities and assistance of the user in calibrations. In addition, the analyzing computer contains an integrated recording function, mainly for interval and event-controlled storage of analysis data, as well as the fault list and the logbook.

Interface cables, RS422/LWL converters (see Figure on page 30) and light pipe cables are used for connection (see Figure 3) between the Q1 measuring unit and the Q1 analyzing computer.

Figures 4 and 5 show the front and rear view of the Q1 gas-net analyzing computer. The display (8 lines with 32 characters each), the user keyboard and the verification switch as well as the interface for parameter setting (DSS) are arranged on the front side.

The gas-net Q1 evaluation computer can be used in two enclosure variants of different widths (see sealing diagrams, pages 24 to 29).

The gas-net Q1 evaluation computer is provided with several digital inputs and outputs which can be expanded through available slots for optionally insertable digital or analog input or output cards.

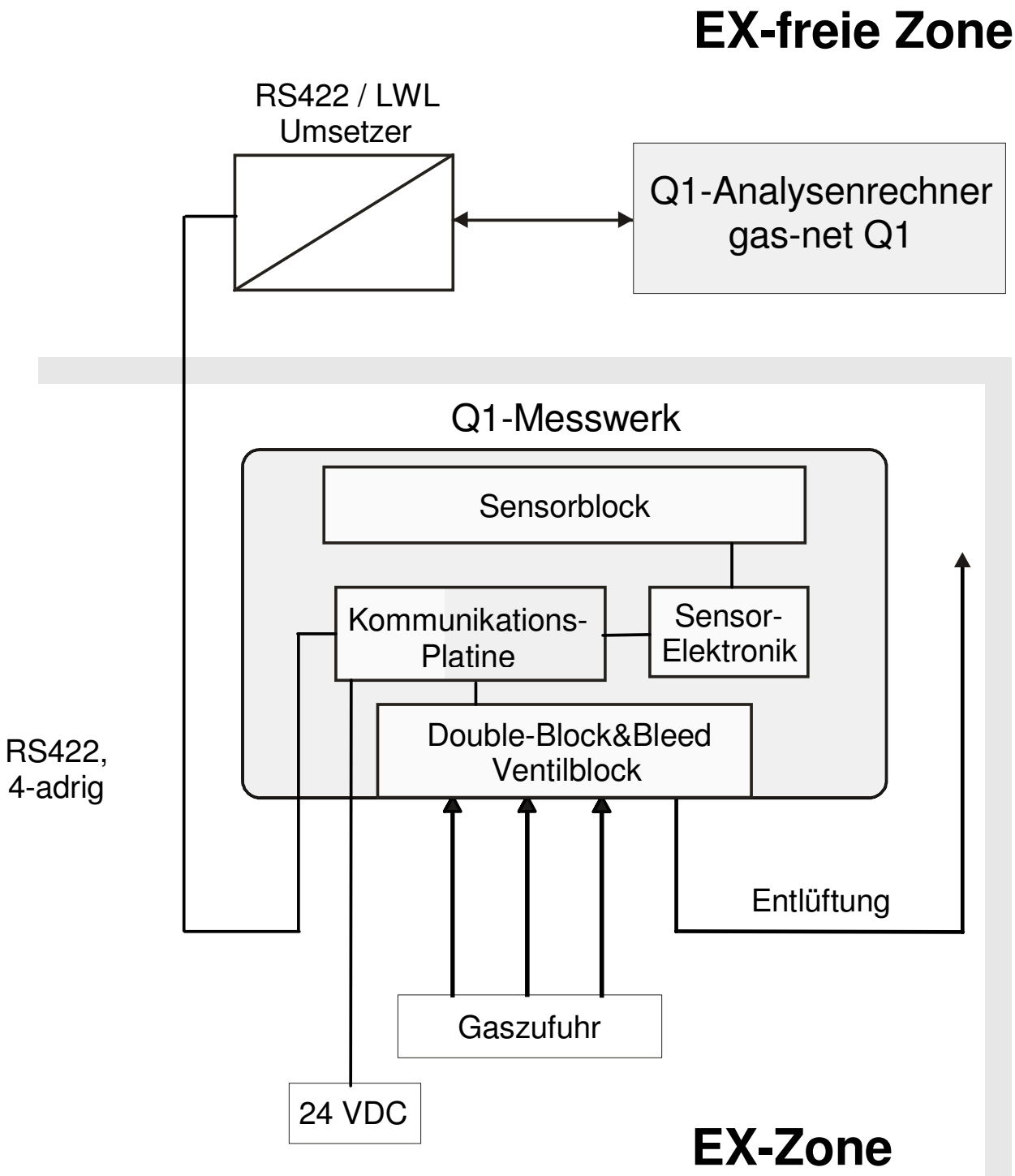


Figure 3: **Schematic diagram of Q1 measuring unit and Q1 evaluation computer (gas-net Q1)**

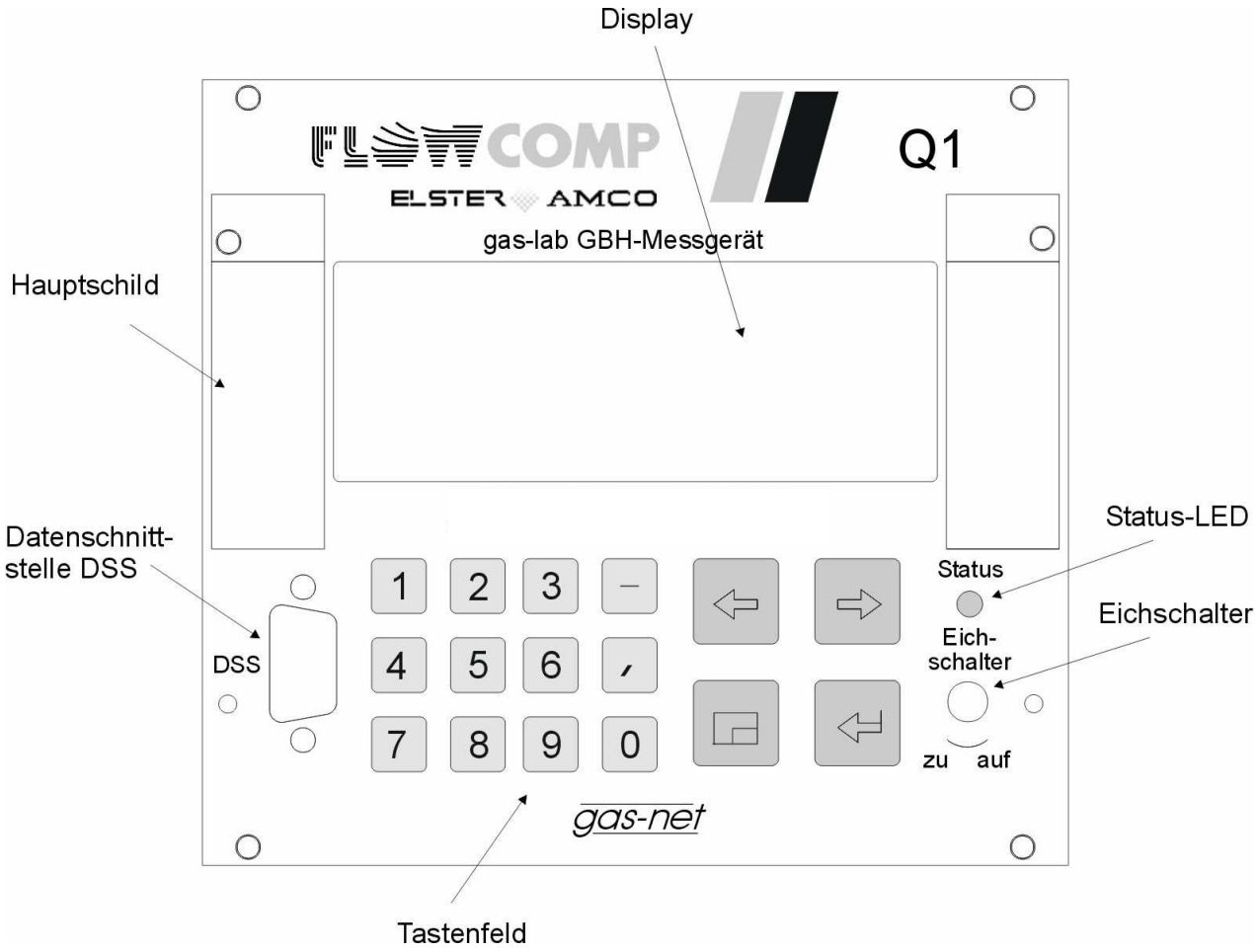


Figure 4: Front view of the Q1 gas-net evaluation computer

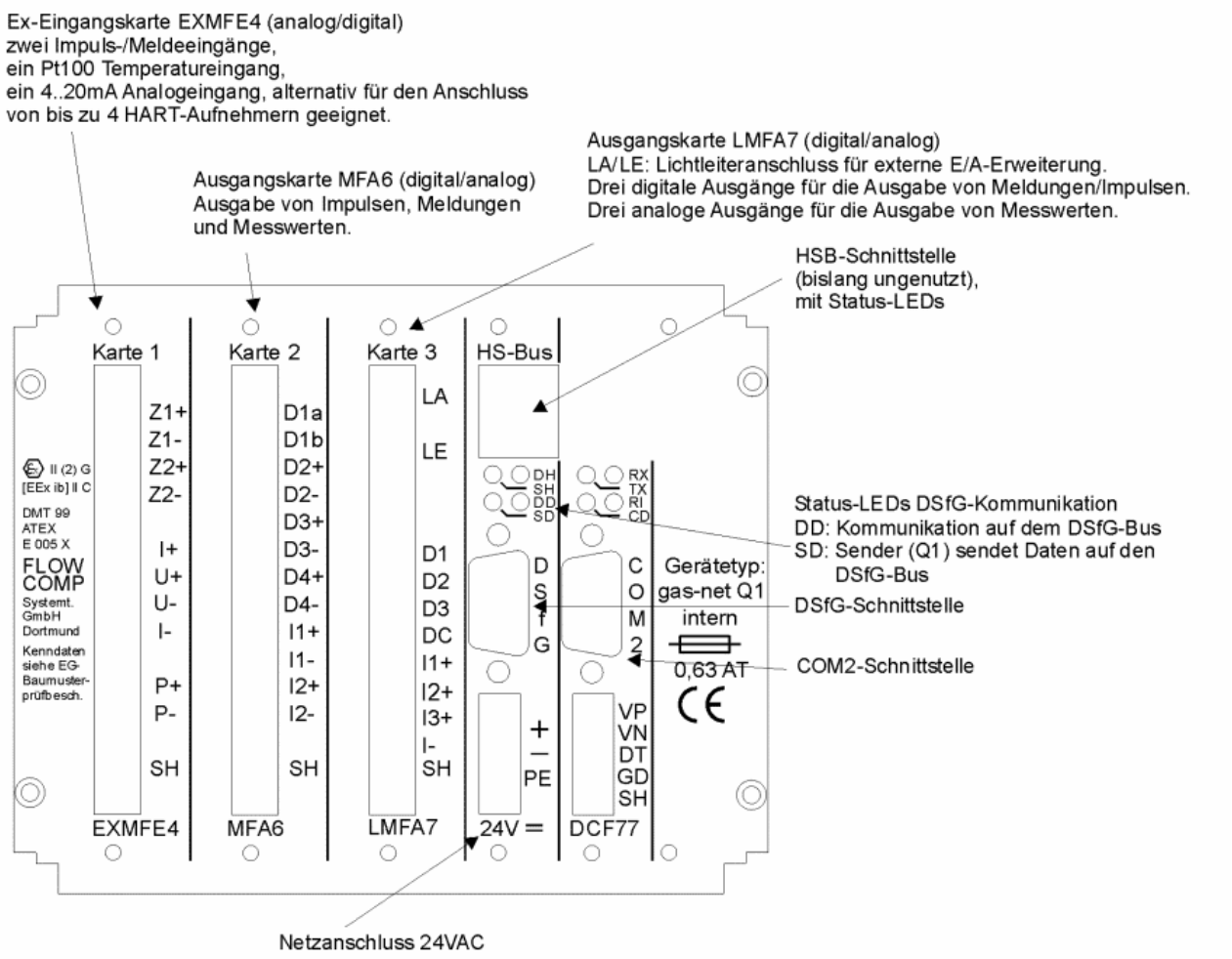


Figure 5: Rear view of the Q1 gas-net evaluation computer

1.2.4 Peripheral devices

As a typical configuration, Figure 6 shows the standard panel: A base plate accommodates the Ex-d enclosure of the measuring unit, the inlet pressure controllers as well as the terminal box for electrical connections. This base plate is an example of the gas and electrotechnical connection (for requirements for inlet pressure controllers to be used, see 6).

The measuring system typically operates at an overpressure of 80 mbar (+/- 10 mbar) and a typical flowrate of 30l/h (+/- 10 l/h) which can be read from a variable-area measuring instrument. The inlet pressure controllers are designed for initial pressures between 0.2 and 4 bar (overpressure). The base plate typically contains one inlet pressure controller each for process gas and methane. When automatic test gas injection is envisaged, another inlet pressure controller is added.

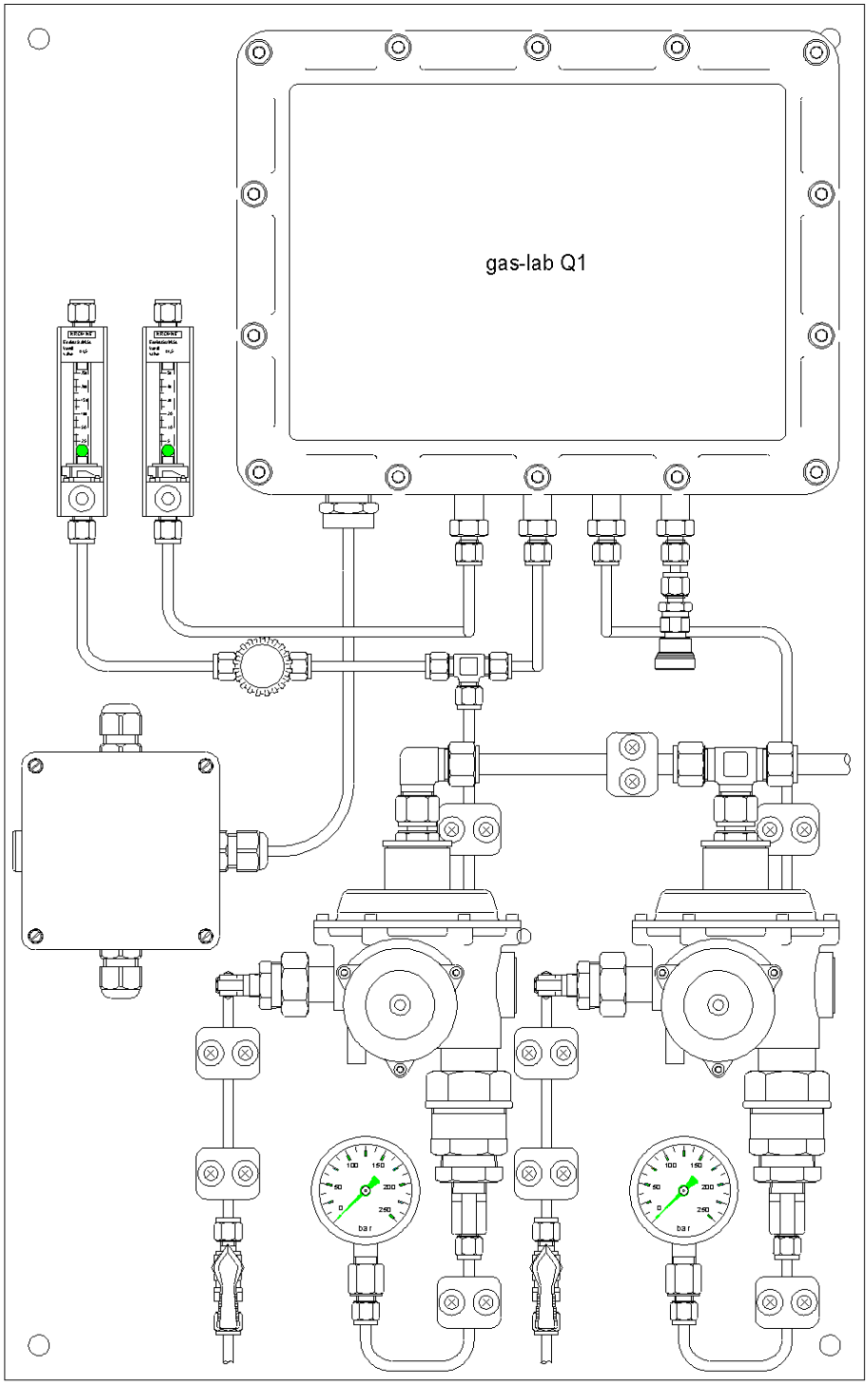


Figure 6: Mounting plate (example) with Q1 measuring unit, pressure controllers and connections

1.3 Metrological data

Measuring ranges acceptable for verification

Gross calorific value: 8.4 to 13.1 kWh/m³ corresponding to 30.2 to 47.2 MJ/m³

CO_2 content : 0 to 5 % mole fraction

Upon approval by the verification authority and after performance of a special examination (see DVGW data sheet G 486), the standard density determined by the device which is not acceptable for verification can be used to calculate the compressibilty factor (K number) of natural gas in accordance with SGERG 88.

The reliability of measured values output in addition has not been checked.

Reference conditions and conditions of use

The device has been approved to measure gases of the 2nd gas familiy (natural gases) in accordance with DVGW data sheet G 260.

It has not been approved for measuring natural gases to which additional or exchange gases like air (oxygen), gases of the 1st gas family or liquid gases have been added for conditioning purposes.

The following restrictions are valid for the composition of the gas to be measured:

Substance	Mole fraction ranges %
CH_4	75 –100
Sum of alkanes C_2H_6 and higher hydrocarbons	0 – 15
N_2	0 – 20
O_2	0 – 0.5
CO_2	0 – 5
Rest	0 – 0.1

The measuring instrument is suitable for use in locations meeting the "General requirements“ of PTB-A 7.62.

The ambient temperature in the space where the measuring instrument or one of its components (see 1.2) is installed must be between 5 °C and 35 °C. The ambient temperature must be monitored with a minimum-maximum thermometer (or by an equivalent method).

2 Description of type

2.1 Measuring principle

The procedure is based on the relationship between the gas quality characteristics gross calorific value, standard density and carbon dioxide content and diverse physical gas quantities. Instead of the gas quantities desired, quantities are determined which are physically related to target quantities and can more easily be measured under metrological aspects. The following measurands were selected for the present procedure:

- infrared (IR) absorbance of the CH gas: A_{CH}
- IR absorbance of CO_2: A_{CO2}
- thermal conductivity of the whole gas: λ

Successful description of the gas properties by only three suitable measurands is possible due to the typical composition of natural gas. According to a statistical analysis, typical natural gas is subdivided into three essential components:

- the sum of the hydrocarbons CH
- nitrogen N_2
- carbon dioxide CO_2

In typical natural gases, the sum of the residual gas components is not decisive for the accuracy of the measuring instrument aimed at.

The following two measuring techniques are used to ensure these three "virtual“ gas components:

2.1.1 Infrared (IR) spectroscopy

The IR measuring procedure is based on the fact that gas molecules are excited to vibrate when natural gas is exposed to white light; as a result, this light is attenuated at specific wavelengths in the infrared spectral range. Every IR active vibrating bond in the molecules contributes to the absorption of light; the different bonds make different contributions in specific spectral ranges to the absorption spectrum. The degree of absorption and its spectral distribution thus reflect the composition of the gas.

All decisive hydrocarbon fractions in typical natural gas can be detected by IR absorption; this allows the contribution of the hydrocarbon content for gas quantities such as gross calorific value, density or thermal conductivity to be determined by IR absorption.

Two IR photometers are used for the absorption measurements of hydrocarbons and CO_2.

2.1.2 Thermal conductivity

In addition to the IR sensors, the procedure makes use of a microsystem-based thermal conductivity sensor. This sensor reacts sensitively to all gas components and thus also allows for the nitrogen contribution.

Together with the IR measurements which provide the contribution of the CO_2 and CH fractions to the thermal conductivity and the normalization condition for three-component gas, a system of equations can be established. Solution of this system furnishes the hydrocarbon content xCH searched. All decisive gas components are thus directly or indirectly described by measurands.

2.1.3 Works calibration

Before a device is delivered, a works calibration is carried out by the manufacturer. This calibration serves to determine the instrument-specific calibration parameters by the measurement of three gases (nitrogen, methane and a synthetic gas mixture similar to natural gas).

The calibration data are filed in the non-volatile storage of the Q1 measuring unit.

2.1.4 In-plant calibration with methane

To guarantee reliability in routine operation, the drift of the overall measuring system is controlled and corrected by an in-plant calibration. For this purpose, a one-point calibation is repeated at regular intervals using a calibration gas (methane).

2.2 Calibration

The calibration gas (methane) used for the in-plant calibration described above must not contain more than 0.05% of impurities (purity 3.5). Proof of the purity must be furnished by an official certificate. For purified gases with a purity of 99.995% (purity 4.5) or better, a certificate of a manufacturer operating a recognized quality management system is sufficient.

2.3 Approval documents

The instrument type must be in compliance with the drawings and descriptions deposited at the PTB:

Part 1			
Item	**Designation**	**Document number**	**As of**
1	*Technical documentation of gas-lab Q1* *Function, operation, start-up and maintenance*	08 00 00 11	February 2003
2	Q1 analyzing computer (gas-net Q1), 1/3 mounting width, sealing diagram front view	07 00 06 10	04-09-2003
3	Q1 analyzing computer (gas-net Q1), 1/2 mounting width, sealing diagram front view	07 00 06 11	04-09-2003
4	Q1 analyzing computer (gas-net Q1), 1/3 mounting width, sealing diagram rear view	07 00 06 12	20-02-2003
5	Q1analyzing computer (gas-net Q1), 1/2 mounting width, sealing diagram rear view	07 00 06 13	20-02-2003
6	Q1 measuring unit, sealing diagram	08 00 01 30	21-02-2003
7	Electrical connections gas-net Q1 / Q1 measuring unit	08 00 01 31	14-02-2003
8	Requirements for normal operation	08 00 01 32	25-02-2003

Part 2			
1 General description			
Item	**Designation**	**Document number**	**As of**
1	General description of fundamentals and measuring technique of gas-lab Q1	08 00 01 40	24-07-03
1 Software			
Item	**Designation**	**Document number**	**As of**
1	General description of software	07 00 06 30	29-08-03
2	Interface description of connection to the measuring unit	07 00 06 31	24-07-03
3	Interface description of DSS	07 00 06 32	24-07-03
4	Interface description DSfG and COM2	07 00 06 33	24-07-03
5	Interface description Modbus / RK512	07 00 06 34	24-07-03
6	Interface description HSB	07 00 06 35	24-07-03

1 Hardware gas-net Q1

Item	Designation	Document number	As of
1	Block diagram gas-net Q1, 1 page	07 00 06 50	21-02-2003
2	CPU386 circuit diagram, 3 pages	07 10 00 01 01	15-07-1999
3	CPU386 parts list, 2 pages	07 10 00 01 02	15-12-1999
4	CPU386 component mounting diagram, 1 page	07 10 00 01 03	16-12-1999
5	CPU386 drilling plan, 1 page	07 10 00 01 04	31-01-2000
6	CPU386 block diagram, 1 page	07 10 00 01 11	16-12-1999
7	CPU386 description of printed circuit card, 1 page	07 10 00 01 12	16-12-1999
8	POWER circuit diagram, 2 pages	07 11 00 01 01	09-05-2000
9	POWER parts list, 2 pages	07 11 00 01 02	04-07-2002
10	POWER component mounting diagram, 1 page	07 11 00 01 03	01-02-2000
11	POWER drilling plan, 1 page	07 11 00 01 04	25-03-1999
12	POWER block diagram, 1 page	07 11 00 01 11	25-01-2000
13	POWER description of printed circuit card, 1 page	07 11 00 01 12	25-01-2000
14	COMDCF circuit diagram, 1 page	07 12 00 01 01	09-05-2000
15	COMDCF parts list, 1 page	07 12 00 01 02	09-05-2000
16	COMDCF component mounting diagram, 1 page	07 12 00 01 03	27-02-1999
17	COMDCF drilling plan, 1 page	07 12 00 01 04	27-02-1999
18	COMDCF block diagram, 1 page	07 12 00 01 11	17-02-2003
19	COMDCF description of printed circuit card, 1 page	07 12 00 01 12	13-07-2000
20	DISP circuit diagram, 2 pages	07 20 00 01 01	23-05-2000
21	DISP parts list, 1 page	07 20 00 01 02	23-05-2000
22	DISP component mounting diagram, 1 page	07 20 00 01 03	01-02-2000
23	DISP drilling plan, 1 page	07 20 00 01 04	01-02-2000
24	DISP block diagram, 1 page	07 20 00 01 11	25-01-2000
25	DISP description of printed circuit card, 1 page	07 20 00 01 12	25-01-2000
26	TAST circuit diagram, 1 page	07 21 00 01 01	11-08-1999
27	TAST parts list, 1 page	07 21 00 01 02	21-01-1999
28	TAST component mounting diagram, 1 page	07 21 00 01 03	12-08-1999
29	TAST drilling plan, 1 page	07 21 00 01 04	12-08-1999
30	EXMFE4 circuit diagram, 3 pages	07 30 00 01 01	07-02-2002
31	EXMFE4 parts list, 2 pages	07 30 00 01 02	07-02-2002
32	EXMFE4 component mounting diagram, 1 page	07 30 00 01 03	17-11-1998
33	EXMFE4 drilling plan, 1 page	07 30 00 01 04	17-11-1998
34	EXMFE4 block diagram, 1 page	07 30 00 01 11	17-11-1999
35	EXMFE4 description of printed circuit card, 2 pages	07 30 00 01 12	17-11-1999
36	EXMFE4 EC Type-examination certificate, 3 pages	---	18-03-1999

37	MFA6 circuit diagram, 2 pages	07 31 00 02 01	25-11-2002
38	MFA6 parts list, 2 pages	07 31 00 02 02	26-11-2002
39	MFA6 component mounting diagram, 1 page	07 31 00 02 03	26-11-2002
40	MFA6 drilling plan, 1 page	07 31 00 02 04	26-11-2002
41	MFA6 block diagram, 1 page	07 31 00 01 11	17-11-1999
42	MFA6 description of printed circuit card, 1 page	07 31 00 01 12	17-11-1999
43	MFE11 circuit diagram, 3 pages	07 32 00 01 01	26-09-2000
44	MFE11 parts list 2, pages	07 32 00 01 02	04-07-2002
45	MFE11 component mounting diagram, 1 page	07 32 00 01 03	28-09-2000
46	MFE11 drilling plan, 1page	07 32 00 01 04	28-09-2000
47	MFE11 block diagram, 1 page	07 32 00 01 11	28-03-2001
48	MFE11 description of printed circuit card, 1 page	07 32 00 01 12	28-03-2001
49	MSER2 circuit diagram, 2 pages	07 33 00 01 01	19-06-2001
50	MSER2 parts list, 2 pages	07 33 00 01 02	01-08-2001
51	MSER2 component mounting diagram, 1 page	07 33 00 01 03	01-08-2001
52	MSER2 drilling plan, 1 page	07 33 00 01 04	01-08-2001
53	MSER2 block diagram, 1 page	07 33 00 01 11	01-08-2001
54	MSER2 description of printed circuit card, 1 page	07 33 00 01 12	01-08-2001
55	LMFA7 circuit diagram, 2 pages	07 34 00 01 01	06-01-1999
56	LMFA7 parts list, 2 pages	07 34 00 01 02	18-11-1999
57	LMFA7 component mounting diagram, 1 page	07 34 00 01 03	17-11-1999
58	LMFA7 drilling plan, 1 page	07 34 00 01 04	17-11-1999
59	LMFA7 block diagram, 1 page	07 34 00 01 11	17-11-1999
60	LMFA7 description of printed circuit card, 1 page	07 34 00 01 12	17-11-1999
61	AE12 circuit diagram, 3 pages	07 35 00 01 01	27-05-2002
62	AE12 parts list, 1 page	07 35 00 01 02	28-05-2002
63	AE12 component mounting diagram, 1 page	07 35 00 01 03	28-05-2002
64	AE12 drilling plan, 1 page	07 35 00 01 04	28-05-2002
65	AE12 block diagram, 1 page	07 35 00 01 11	17-02-2003
66	AE12 description of printed circuit card, 1 page	07 35 00 01 12	17-02-2003
67	DA12 circuit diagram, 3 pages	07 36 00 01 01	03-06-2002
68	DA12 parts list, 1 page	07 36 00 01 02	10-06-2002
69	DA12 component mounting diagram, 1 page	07 36 00 01 03	10-06-2002
70	DA12 drilling plan, 1 page	07 36 00 01 04	10-06-2002
71	DA12 block diagram, 1 page	07 36 00 01 11	10-06-2002
72	DA12 description of printed circuit card, 1 page	07 36 00 01 12	10-06-2002
73	EMC test gas-net Z1 (HW similar to gas-net Q1)	---	20-12-1999

1 Hardware measuring unit Q1			
Item	**Designation**	**Document number**	**As of**
1	Block diagram of measuring unit	08 00 01 50	24-02-2003
3	SMS wiring diagram	---	10-10-2002
4	IR preamplifier circuit diagram, 1 page	---	09-10-2001
5	Heater control circuit diagram, 1 page	---	20-11-2001
6	DTMEII circuit diagram, 1 page	---	26-07-2001
7	Data sheet of pressure transducer CTE8000, 6 pages	---	01-10-2001
8	SMS circuit diagram, 1 page	07 42 00 01 01	20-06-2002
9	SMS parts list, 1 page	07 42 00 01 02	05-11-2002
10	SMS component mounting diagram, 1 page	07 42 00 01 03	08-07-2002
11	SMS drilling plan, 1 page	07 42 00 01 04	08-07-2002
12	EMC test measuring unit Q1	---	03-12-2002
13	EMV retest measuring unit Q1	---	03-02-2003

3 Type requirements

3.1 Frequency of measurements

Each operating gas flow connected is to be measured at least four times an hour.

3.2 Logging of measurements

Measurands subject to legal control which are not repeatably measured must be continuously recorded and/or stored. This can be done by means of an external or internal auxiliary device approved for this purpose.

At least the following data are to be recorded and/or stored:

- Designation of test point (station), date,
- Gross calorific value and CO_2 content, time of the day, at least four times an hour (where approproate as mean values); if more than one gas flow is measured, the designation of the gas flow measured is to be stored together with the measured values.

Measurement values relevant to invoicing must be stored in the storage subject to legal control, of the auxiliary device as long as this is required to allow the energy consumer to raise objections against incorrect billing. The absolute duration for the storage is not fixed here. Generally, a duration of approximately two years is to be provided.

Verified measurement values (gross calorific value, CO_2) must be specially marked. Reference to this regulation must be made in the display, in the records or in the operating manual.

Errors occurred and exceeding of maximum permissible errors are to be recorded with date and time of the day.

3.3 Behaviour after breakdowns

After breaksdowns (e.g. failure of the supply voltage) and recovery of normality, reliability (calibration) must be checked and, if necessary, adjustment with the internal calibration gas must be performed.

4 Auxiliary devices, interfaces, software

PTB-A 50.7 is valid analogously for auxiliary devices which display, record and store data subject to legal control.

4.1 Software

The following software versions have been approved:

gas-net Q1 software version 2.02a, checksum: 3DA320AD

4.2 Interfaces

The standard version of gas-net Q1 is provided with a DSfG interface (in accordance with DVGW data sheet G485).

This interface is protective and reliable and the only one to be used for connection of measuring instruments and auxiliary devices subject to legal control. Connection of measuring instruments and auxiliary devices not subject to legal control is also permitted.

In additon, the device is equipped with a serial DCF77 input to connect a radio clock and another serial interface (COM2) to which a modem for readout of the internal recording unit and remote control may be connected, as well as an interface for parameter setting on the front side.

An interface card (LMFA7) serves for communication (LWL connection) between analyzing computer und measuring unit: in addition, it provides the following outputs not acceptable for verification:

- 4 analog outputs for gas quality quantities
- 3 digital outputs for alarm, warning etc.

Optionally, other cards may be used (see also Figure 5):

- EXMFE4 card for monitoring of peripheral instruments of the gas measuring instrument with
  - 1 analog input which is also in a position to process the HART protocol with up to 4 HART transmitters, e.g. for monitoring bottle pressures
  - 1 digital input for monitoring the limiting temperature of gas bottles
  - 1 digital input for failure monitoring of the HD reduction
  - 1 analog input, e.g. for monitoring the ambient temperature
- MFA6 card with 2 analog and 4 digital outputs
- MFE11 card with 3 analog and 8 digital inputs
- AE12 card with 12 analog inputs
- MSER2 card with 2 serial channels (optionally RS485, RS422, RS232) which allows additional protocols to be operated without retroaction (e.g. Modbus).

These interfaces are protective, reliability has not been checked, they may be used only for applications not subject to legal control.

5 Conditions, special requirements and restrictions

5.1 Calibration and calibration intervals

For the period of validity of the verification, a calibration gas (for composition, see 2.2) in accordance with PTB Requirements 7.63 is permanently supplied to the measuring instrument as internal calibration gas. It serves as a reference for the verification technological test and for the calibrations and adjustments of the measuring instrument which are performed automatically and at regular intervals.

At least once a week, the measuring instrument must perform an automatic calibration/adjustment. If and when required, the user may select shorter intervals or perform additional manual calibrations/adjustments at any time.

5.2 Operating instructions, maintenance and control book

The user manuals for the measuring instrument, the auxiliary devices subject to legal control and a maintenance and control book must be available at the place of use of the measuring instrument.

All maintenance, repair and test activities must be entered into the maintenance book and signed by the person who has performed them.

5.3 Data storage

The current version of the internal auxiliary device for the storage of measurement data subject to legal control has a memory depth of 187 days. As an interim solution, to guarantee the required memory depth of 24 months, the data storage of each verified device is read out every five months (or earlier) by the official internal Flow Comp test centre GH84, subjected to a random test and made available to the respective user as printout.

FLOW COMP Systemtechnik GmbH commits itself to replace the current devices by a new version with sufficient storage, free of charge for the user.

5.4 Subsequent verification

The procedure for subsequent verification is equal to that for initial verification.

6 Verification technological test

The verification technological test is to be performed in compliance with the provisions of the Guideline for testing and monitoring in accordance with the Verification Act and the Verification Ordinance.

For the performance of the test the type approval, the user manuals and PTB Requirements 7.62 must be available.

The maximum permissible errors on verification for the quantities subject to legal control can be found in EO 7, namely in:

- EO 7-6, Gross calorific value
- EO 7-7, Carbon dioxide content in fuel gases

As standards for the accuracy test, two certified 3rd-order calibration gases (acc. to PTB-A 7.63) with at least eight relevant gas components (including carbon dioxide) are needed (for example: the calibration gases for process gas chromatographs stated in the Annex to PTB-A 7.63). The gases can be selected by the user.

The gross calorific value of the first gas must lie in the lower half of the measurement range for the gross calorific value, that of the second gas in the upper half of the measurement range.

These gases must be made available by the user or by a person authorized by him; this also applies to the required fittings and devices for the supply of these gases.

The verification technological test of the measuring device (measuring unit and control computer) is performed at the place of installation at the user's and covers the device as a whole, together with the existing auxiliary devices. The internal calibration gas bottle (see 2.2) must be connected in accordance with PTB-A 7.63 point 9.3. The device must be ready for use and have been calibrated.

6.1 External inspection

The following must be checked in addition to the control of the device's compliance with the approval documents:

– the room of installation (see 1.3 and PTB-A 7.62)

  Note that the room of installation may consist of several individual rooms, namely the rooms in which the sub-assemblies measuring unit, gas supply unit (e.g. pressure reduction) and analyzing computer with the required auxiliary devices are installed.

  It must be ensured that the gas inlet pipes between the sub-assemblies are protected against thermal influences which may exert an inadmissible influence on the measurement value.

– the purity of the calibration gas used (see 2.2),

– the function of the protocol printer or of the approved auxiliary device for data storage,

– the gas inlet pipes

Sampling lines and calibration gas supply lines as well as the exhaust gas pipe must be neatly arranged (the assignment to sampling, measuring instrument, gas bottles must be clearly recognizable). Additional injection points in the inlet pipes must be locked with a user seal.

– Control of the group of low-pressure controllers used

  Only controllers of group RG 10 may be used.

  The controllers have been parameterized and secured in the factory; parameters and specifications (controller group RG, closing pressure group SG, response pressure group AG) are stated on the controller and are to be checked.

6.2 Reliability test

The reliability of the measurement results is to be checked at two points in the measurement range.

The following test sequence is to be followed:

Calibration

Calibration/adjustment with internal calibration gas is to be performed.

Test with two external calibration gases

After calibration, two additional calibration gases (see above) are to be successively connected to the measuring instrument.

10 minutes after a gas has been connected, the valid measurement results can be read in the display of the analyzing computer.

The values shown in the display (main display) for gross calorific value and CO_2 content must comply with the values stated in the certificate of the calibration gas within the maximum permissible errors on verification.

6.3 Check of interfaces

If auxiliary devices subject to legal control are connected, reliability of the measured values transmitted which are subject to legal control must be checked by visual inspection (for information regarding non-reactiveness and reliability of the interfaces, see 4.2). This can most easily be done in the course of the test with the two external calibration gases described above.

Check of digital interfaces:

Reliability of digitally transmitted measurement data subject to legal control is to be checked by visually comparing transmitter (control unit, main display) and receiver (display of the auxiliary device). The data subject to legal control must be in agreement.

Check of connected measuring instruments or auxiliary devices subject to legal control

Checking of these devices and facilities is prescribed in their type approval certificate.

Configuration of the protection of data exchange via the DSfG interface

To be checked upon verification:

The starting or preset value for initialization of the signature of data traffic must be identically set in the data source (the measuring instruments or auxiliary devices connected) and in the data sink (of the DVE).

The preset value must be greater than zero. At zero setting, the signature procedure is switched off. This is not permitted.

Testing means and testing instructions must be made available by the manufacturer of the measuring instruments and auxiliary devices.

6.4 Test of the software version

The menu system is selected on the control panel of the measuring instrument (see operating instructions). The display shows the software version; the signature check sum is calculated and indicated.

The checksum and version number indicated must comply with those of the approved version (see 4.1).

7 Designations, inscriptions and locations for stamps

The data plate must be applied to the enclosure of the control unit.

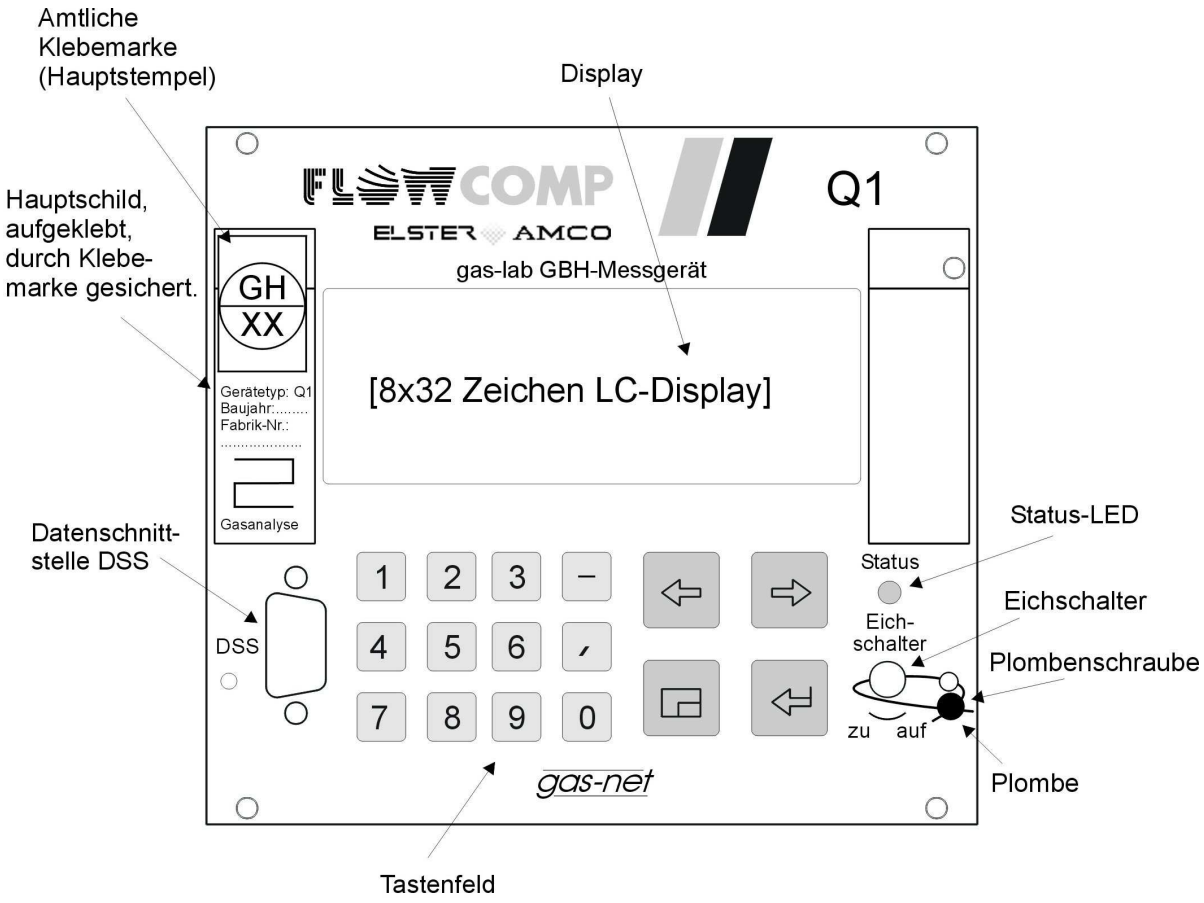
The measuring unit is to be provided with a plate showing approval mark, serial number, year of manufacture and measurement ranges for the quantities subject to legal control.

The locations for stamps can be taken from the following figures and sealing diagrams (see pages 24 to 29).

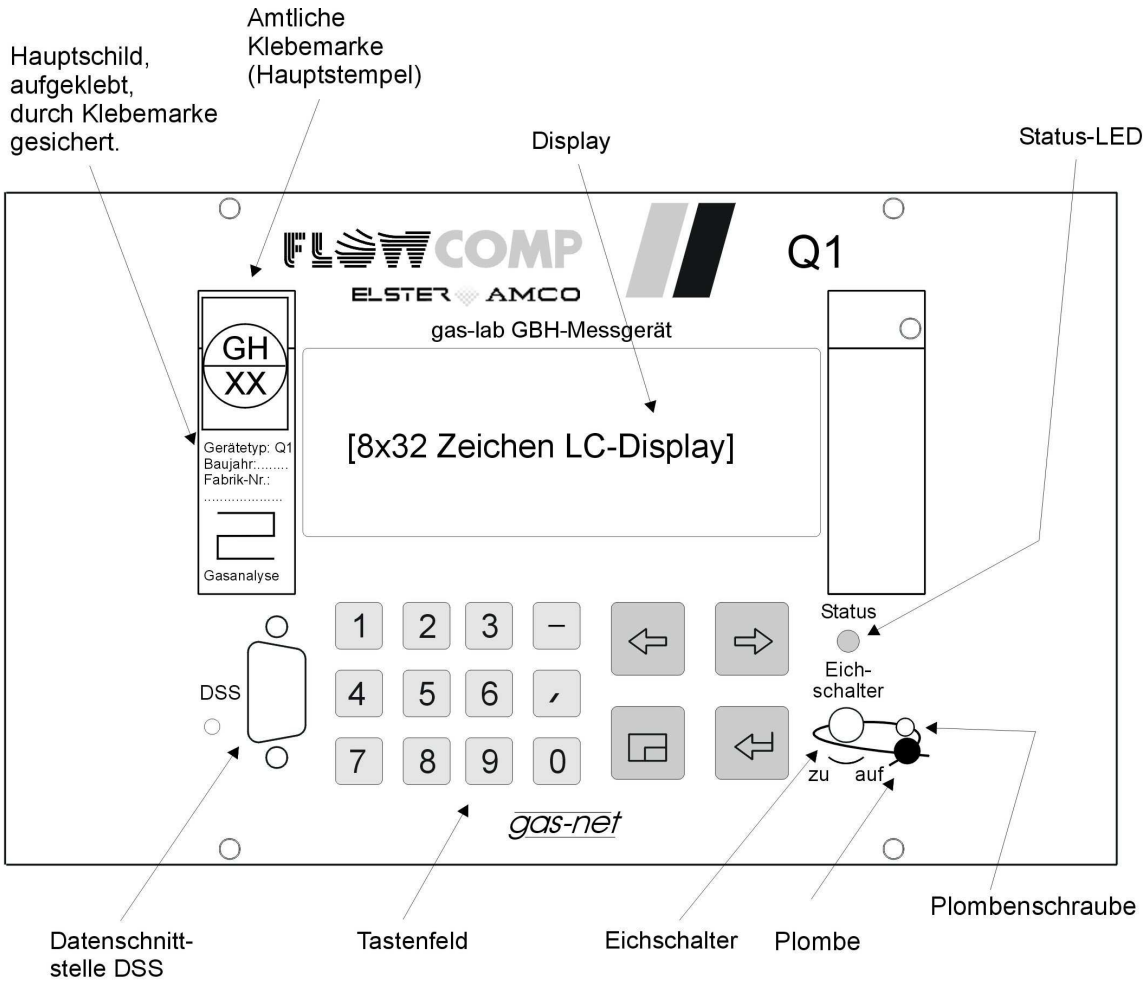
It is of particular importance to seal the write protection switch on the front plate of the analyzing computer.

The following is to be protected in addition:

- the gas connections (calibration gas) on the measuring instrument's connecting unit
- the connection of the calibration gas supply pipe on the internal calibration gas bottle
- the connecting cables between analyzing computer and connected auxiliary devices subject to legal control

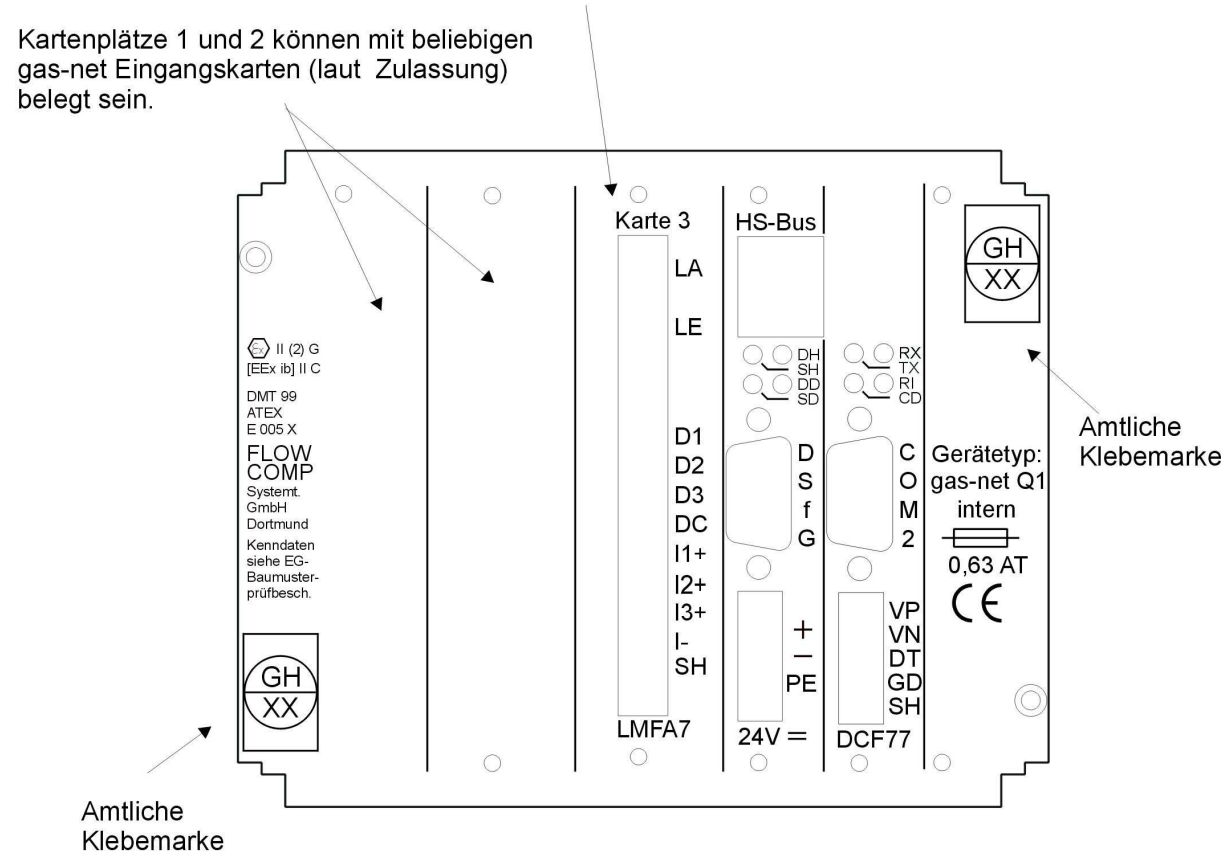


Q1 Analysenrechner (gas-net Q1) 1/3 Baubreite Plombenplan Frontansicht	**07 00 06 10**		
	Zeichnungs-Nummer		
	Gez.	04.09.2003	CH
Benennung	Gepr.	04.09.2003	JK
FLOW COMP Systemtechnik GmbH Dortmund	Freig.	04.09.2003	JK
		Datum	Name
	Dateiname: Q1plomben 040903.cdr (Seite 1)		



Q1 Analysenrechner (gas-net Q1) 1/2 Baubreite Plombenplan Frontansicht	**07 00 06 11**		
	Zeichnungs-Nummer		
	Gez.	04.09.2003	CH
Benennung	Gepr.	04.09.2003	JK
FLOW COMP Systemtechnik GmbH Dortmund	Freig.	04.09.2003	JK
		Datum	Name
	Dateiname: Q1plomben 040903.cdr (Seite 2)		

Ausgangskarte LMFA7 (digital/analog)
LA/LE: Lichtleiteranschluss für externe E/A-Erweiterung (Anschluss des Messwerks)
Drei digitale Ausgänge für die Ausgabe von Meldungen/Impulsen.
Drei analoge Ausgänge für die Ausgabe von Messwerten.

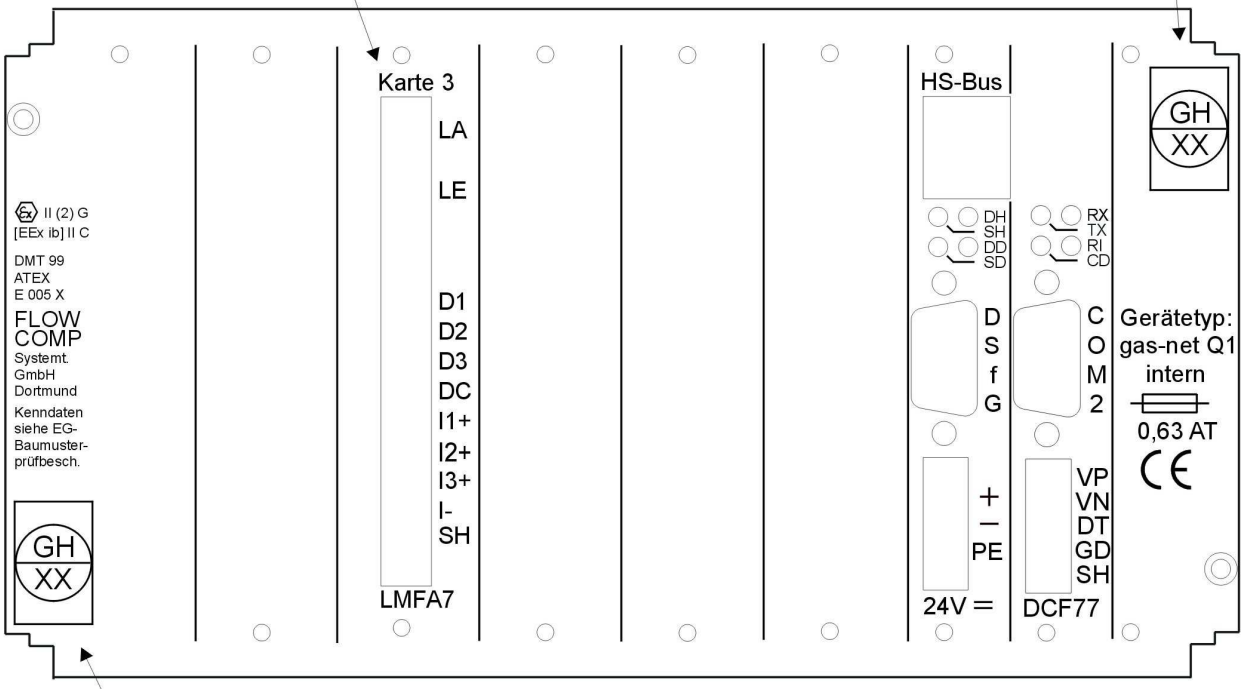


Q1 Analysenrechner (gas-net Q1) 1/3 Baubreite Plombenplan Rückansicht	**07 00 06 12**		
	Zeichnungs-Nummer		
	Gez.	14.02.2003	CH
Benennung	Gepr.	20.02.2003	JK
FLOW COMP Systemtechnik GmbH Dortmund	Freig.	20.02.2003	JK
		Datum	Name
	Dateiname: Q1plomben.cdr (Seite 3)		

Ausgangskarte LMFA7 (digital/analog)
LA/LE: Lichtleiteranschluss für externe E/A-Erweiterung (Anschluss des Messwerks)
Drei digitale Ausgänge für die Ausgabe von Meldungen/Impulsen.
Drei analoge Ausgänge für die Ausgabe von Messwerten.

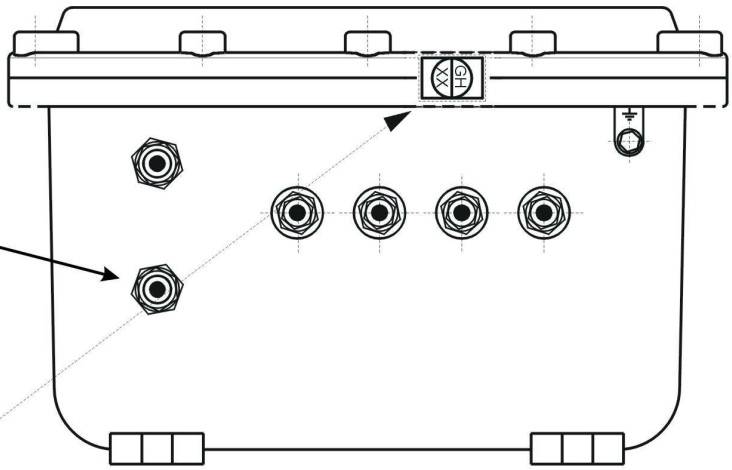
Amtliche Klebemarke

Kartenplätze 1, 2, 4, 5 und 6 können mit beliebigen gas-net Eingangskarten (laut Zulassung) belegt sein.



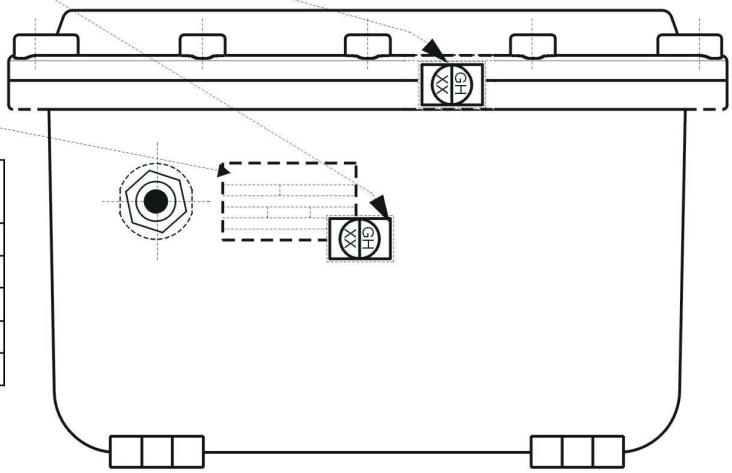
Amtliche Klebemarke

Q1 Analysenrechner (gas-net Q1) 1/2 Baubreite Plombenplan Rückansicht	**07 00 06 13**		
	Zeichnungs-Nummer		
Benennung	Gez.	14.02.2003	CH
	Gepr.	20.02.2003	JK
FLOW COMP Systemtechnik GmbH Dortmund	Freig.	20.02.2003	JK
		Datum	Name
	Dateiname: Q1plomben.cdr (Seite 4)		



Amtliche Klebemarke (Hauptstempel)

Typenschild:



FLOW COMP Systemtechnik GmbH Schloßstr. 95a D-44357 Dortmund		
gas-lab Q1	S.N.: 080001 XXXX	
C Ex II 2 G EEx d II B T4		
B.J.:.....	V: 24 VDC	P: 65 W
DMT 02 ATEX E 098 X		
threads in body ½" NPT		

Q1 Messwerk Plombenplan	**08 00 01 30**		
	Zeichnungs-Nummer		
	Gez.	05.09.2003	WF
Benennung	Gepr.	05.09.2003	JK
FLOW COMP Systemtechnik GmbH Dortmund	Freig.	05.09.2003	JK
		Datum	Name
	Dateiname: Q1plomben.cdr (Seite 5)		

Schnittstellenumsetzer
PSM-EG-RS-422/...

① **RS-422-Schnittstellenanschluß:**
• SUB-D-Steckverbinder

② **RS-422-Schnittstellenanschluß:**
• steckbare Schraubklemme COMBICON

③ Lichtwellenleiter-Anschlüsse (unter Schutzkappe)

④ Spannungsversorgung 24 V DC

⑤ LED: Betriebsbereitschaft

⑥ Rastfuß für Tragschienen nach DIN EN 50 022

⑦ Erdanschluß

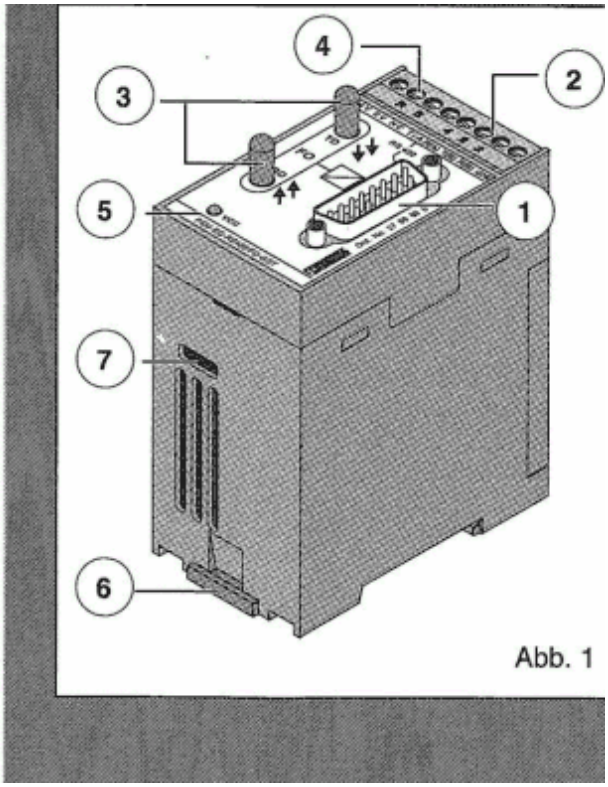


Abb. 1

RS422/LWL-Umsetzer