Rosemount Analytical
FISHER-ROSEMOUNT

Operation Manual

BINOS® 100 2M

Microprocessor - Controlled
NDIR - / Oxygen Analyzer

1. Edition 07/98

Catalog - No.: 90 002 957

Process Analytic Division

ROSEMOUNT ANALYTICAL

FISHER-ROSEMOUNT Managing The Process Better

Fisher-Rosemount GmbH & Co assumes no liability for any omissions or errors in this manual. Any liability for direct or indirect damages, which might occur in connection with the delivery or the use of this manual, is expressly excluded to the extend permitted by applicable law.

This instrument has left the works in good order according to safety regulations. To maintain this operating condition, the user must strictly follow the instructions and consider the warnings in this manual or provided on the instrument.

Troubleshooting, component replacement and internal adjustments must be made by qualified service personnel only.

According to the report No. "IBS/PFG-No. 41300392 (N III)" about the approval of "DMT - Gesellschaft für Forschung und Prüfung mbh, Fachstelle für Sicherheit - Prüfstelle für Grubenbewetterung", the stationary gas analyzer BINOS® 100 2M is suitable for measuring the concentrations of methane between 0 and 80 % CH_4,of carbon dioxide between 0 and 80 % CO_2, of carbon monoxide between 0 and 200 ppm CO and between 0 and 10 % CO. According to the report No. "IBS/PFG-No. 41300292 (N III)" the stationary gas analyzer is suitable for (paramagnetic or electrochemical) measuring the concentrations of oxygen between 0 and 10 % O_2. The system control with serial interfaces as described in this operation manual have not been subject to the DMT-approval.

Misprints and alterations reserved

1. Edition: 07/98

Read this operation manual carefully before attempting to operate the analyzer !
For expedient handling of reports of defects, please include the model and serial number which can be read on the instrument identity plate.
Look for the error check list please too (see Item 29. of this manual)

Fisher - Rosemount GmbH & Co.

European Technology Center

Process Analytic Division

Industriestrasse 1
D - 63594 Hasselroth • Germany

Phone + 49 (6055) 884-0
Telefax + 49 (6055) 884-209

Internet: http://www.processanalytic.com

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OPERATION

TROUBLESHOOTING

Safety Summary

Outside and/or inside MLT or at operation manual resp. different symbols gives you a hint to special sources of danger.

Source of danger !
See Operation Manual!

Electrostatic Discharge (ESD) !

Explosives !

Hot components !

Toxic !

Risk to health !

Analyzer specific notes for the user !

In operation manual we will give partly additional informations to these symbols.
Strictly follow these instructions please !

1. General

- The following general safety precautions must be observed during all phases of operation, service and repair of this instrument !
  Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture and intended use of this instrument !
  Failure to comply with these precautions may lead to personal injury and damage to this instrument !

- Fisher-Rosemount GmbH & Co. does not take responsibility (liability) for the customer´s failure to comply with these requirements !

- Do not attempt internal service or adjustment unless other person, capable of rendering first aid and resuscitation, is present !

- Because of the danger of introducing additional hazards, do not perform any unauthorized modification to the instrument !
  Return the instrument to a Fisher-Rosemount Sales and Service office for service or repair to ensure that safety features are maintained !

- Instruments which appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

Operating personnel must not remove instrument covers !
Component replacement and internal adjustments must be made by qualified service personnel only !

Read this operation manual before attempting to operate with the instrument !
Be sure to observe the additional notes, safety precautions and warnings given in the operation manual !

Operate analyzer as table-top version or as rack-mounting version (built-in) only!

Do not operate the instrument in the presence of flammable gases or explosive atmosphere without supplementary protective measures !

At photometer or heated components there could be exist hot components !

2. Gases and Gas Conditioning (Sample Handling)

Be sure to observe the safety regulations for the respective gases (sample gas and test gases / span gases) and the gas bottles !

Inflammable or explosive gas mixtures must not be purged into the instrument without supplementary protective measures !

To avoid a danger to the operators by explosive, toxic or unhealthy gas components, first purge the gas lines with ambient air or nitrogen (N_2) before cleaning or exchange parts of the gas paths.

3. Supply Voltage

⚠ The socket outlet shall be installed near the equipment and shall be easily accessible to disconnect the device from the socket outlet.

⚠ Verify whether the line voltage stated on the instrument ore power supply agrees with that of your mains line!

⚠ Be sure to observe the safety precautions and warnings given by manufacturer of power supply !

- BINOS® 100 2M is a Safety Class 1 instrument

⚠ The analyzer is provided with a protective earth terminal.
To prevent shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument must be connected to the AC power supply mains through a three-conductor power cable, with the third wire firmly connected to an electrical ground (safety ground) at the power outlet.
If the instrument is to be energized via an external power supply, that goes for the power supply too.
Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury. Deliberate disconnection is inadmissible / prohibited !

⚠ For 24 V dc - supply of externalcomponents/analyzers with the internal power supply, a fuse is to be connect in series to the consumer which limits the current consumption to max. 2 A !

⚠ Verify correct polarity for 24 V dc - supply of externalcomponents !

4. Analyzer specific notes for the user

The installation site for the instrument has to be **dry** and remain **above freezing point** at all times.
The instrument must be exposed neither to direct sunlight nor to strong sources of heat. Be sure to observe the permissible ambient temperature !
For outdoor sites, we recommend to install the instrument in a protective cabinet. At least, the instrument has to be protected against rain (e.g., shelter).

Do not interchange gas inlets and gas outlets !
All gases have to be supplied to the analyzer as conditionned gases !
When the instrument is used with corrosive gases, it is to be verified that there are no gas components which may damage the gas path components.

Permissible gas pressure max. 1,500 hPa !

The exhaust gas lines have to be mounted in a declining, descending, pressureless and frost-free and according to the valid emission legislation !

In case it is necessary to open the gas paths, close the analyzers gas connections with PVC caps immediatly !

Use only from our factory optional delivered cables or equivalent shielded cables to be in agreement with the CE - conformity.
The customer has to guarantee, that the shield is be connected bothsided.
Shield and connectors housing have to be connected conductive.
Sub.-min.-D-plugs/sockets have to be screwed to the analyzer.

By using of optional delivering terminal strip adapters the analyzer is not be in agreement with the CE - conformity. In this case CE - conformity is to be declared by customer as “manufacturer of system”.

5. Additional notes for service / maintenance

⚠ Operating personnel must not remove instrument covers !
Component replacement and internal adjustments must be made by qualified service personnel only !

⚠ Always disconnect power, discharge circuits and remove external voltage sources before troubleshooting, repair or replacement of any component !

⚠ Any work inside the instrument without switching off the power must be performed by a specialist, who is familiar with the related danger, only !

⚠ In case of exchanging fuses the customer has to be certain that fuses of specified type and rated current are used. It is prohibited to use repaired fuses or defective fuse holders or to short-circuit fuse carriers (fire hazard).

5.1 Electrostatic Discharge

The electronic parts of the analyzer can be irreparably damaged if exposed to **e**lectro**s**tatic **d**ischarge (ESD).

The instrument is ESD protected when the covers have been secured and safety precautions observed. When the housing is open, the internal components are not ESD protected anymore.

Although the electronic parts are reasonable safe to handle, you should be aware of the following considerations:

Best ESD example is when you walked across a carpet and then touched an electrical grounded metal doorknob. The tiny spark which has jumped is the result of electrostatic discharge (ESD).

You prevent ESD by doing the following:

Remove the charge from your body before opening the housing and maintain during work with opened housing, that no electrostatic charge can be built up.

Ideally you are opening the housing and working at an ESD - protecting workstation.
Here you can wear a wrist trap.

However, if you do not have such a workstation, be sure to do the following procedure exactly:

Discharge the electric charge from your body. Do this by touching a device that is grounded electrically (any device that has a three - prong plug is grounded electrically when it is plugged into a power receptacle).
This should be done several times during the operation with opened housing (especially after leaving the service site because the movement on a low conducting floors or in the air might cause additional ESDs).

6. Operating Conditions according to DMT - Approval

(Chapter 6 of the supplement I to the DMT - reports “IBS/PFG-No. 41300392 NIII” and “IBS/PFG-No. 41300292 NIII” about the performance test of the stationary gas analyzers BINOS® 100 (M/2M) and OXYNOS® 100.

According to the system version and measuring results included in this report, the stationary gas analyzer BINOS® 100 2M from Fisher-Rosemount GmbH & Co. is suitable for measuring the concentrations of methane between 0 and 80 % CH_4, of carbon dioxide between 0 and 80 % CO_2, of carbon monoxid between 0 - 200 ppm CO and 0 - 10 Vol.% CO and of oxygen between 0 - 10 Vol.-%, if the features and system version go conform with the details contained in the enclosed documents as stated in this report, if the analysis system is operated accordingly and if the following requirements are met:

- When using the gas warning system, it must be ensured that the permissible variations will not be exceeded, taking into account the systematics failures of the measuring signals (as indicated in this report) and the local operating conditions. Consider the Code of Pratice No. T032 of the Labor Association of the Chemical Industry "Usage of stationary gas warning systems for explosion protection".

- Verify that the explosion protection requirements are met when using the gas warning system.

- Depending on the situation, it must be verified that the preset values are low enough to allow the system to activate the necessary protection and emergency measures and, thus, to prevent any critical situations in a minimum period of time.

- When at system installation, a release of one or both measuring components in the ambient air might occur, its influence on the measuring result should be proved. A sealed cell or an external housing purging with sample-free air of measuring gases can be used, if required.

- The operatability of the alarms and the displays of each system should be tested with clean air and test gas after the initial operation, after each long-time interruption, and periodically. The tightness of gas pathes should also be tested. The tests must be documented by keeping accounts.

- The intervals for the periodical tests must be settled by the person being responsible for the system´s security and in accordance with the Code of Pratice No. T023 of the Labor Association of the Chemical Industry "Maintenance of stationary gas warning systems for explosion protection".

- Consider the superproportional dependency of the barometric pressure on the measured value for CO_2.

- The system control with serial interfaces described in this operation manual have not been subject to this investigation.

- Sample gas condensation in analyzer (components) must be prevented by taking the necessary steps.

- When the system is used with aggressive gases, it is to be verified that there are no gas components which might damage the gas path components.

- Appropriate dust filters must precede the used systems.

- The pressure and flow values recommended by the manufacturer should be observed. An external monitoring of the sample gas flow through the analyzer should be provided.

- The results of this investigation are based on the systems using software versions "3.03" and "4.00" and "4.01". A change of the software version used must be certified by the Testing Association.

- It should be ensured that the system parameters for the analog output have been correctly adjusted. End of range of low concentration should not be identical or lower than the begin of range. Disregarding these versions, the measurement range should be adjusted between 0 to 80 % CH_4, 0 to 80 % CO_2, 0 to 10 % CO or 0 to 10 % O_2 resp. when the systems are used for explosion protection.

- Read and follow the operation and maintenance manual supplied to and certified by PFG. It is important that the temperature is kept between 5 and 45 °C.

- The analyzer housings must be provided with a permanent type plate indicating the name of the manufacturer, model number, serial number, and the following reference and date of testing:

  "IBS/PFG-Nr. 41300392" (for CH_4, CO_2 or CO)
  "IBS/PFG-Nr. 41300292" (for O_2)

  Other designation requirements, such as these according to ElexV, are still valid. With this type plate, the manufacturer conformes that the features and technical data of the delivered system are identical with those described in this report. Any system which is not provided with such a type plate does not go conform with this report.

- The chapter 6 of this report must be included in the operation and maintenance manual.

- The manufacturer has to supply the customer with a copy of this report, if required.

- A print of the report in an abridged version requires the agreement of PFG.

- The results included in this report may not be altered in publications produced by the manufacturer.

Introduction

The BINOS® 100 2M gas analyzer is a member of the family of our gas analyzers program. It is intended for the continuous monitoring of gas concentrations.

The compactness of the BINOS® 100 2M permits its use in a wide variety of applications in industry and research. Energy conservation, occupational safety, and quality assurance are the major areas addressed.

Some typical specific applications are:

- ❏ Flue - gas analyses for optimizing combustion in firing systems (CO / CO_2)
- ❏ Analysing waste dump gas for the assessment of its energy content (CH_4 / CO_2 - , CO_2 / O_2 -, CH_4 / O_2 - combination)
- ❏ Monitoring metallurgical processes in metals refining and processing (CO / CO_2 / HC)
- ❏ Monitoring fermentation processes in biotechnology (CO_2)
- ❏ Quality monitoring of natural gas (CO_2)
- ❏ Room - air monitoring in greenhouses for the optimization of plant growth and ripening periods (CO_2)
- ❏ Monitoring contolles atmospheres in fruit warehouses (CO_2)
- ❏ Biotechnology (CO_2)
- ❏ Respiratory gas analyses / biomedical engineering applications
- ❏ Motor vehicle exhaust gas analyses (CO / CO_2 / HC)

The analyzers of the BINOS® 100 2M - series are complete, ready - to - use, gas analyzers which may be directly inserted into existing or planned gas lines.
A gas preparation has to connect to the analyzer.

The analyzer is microprocessor controlled. Programming available with use of the options "Solenoid Valves" and "Gas Sampling Pump" permit fully automatic operation of the analyzer.

All inputs required may be activated by a host computer via an optional serial interface (RS 232 C / RS 485), for networking applications.

For single - channel analyzers:
The display, entries and error messages for the second channel described in this manual are inapplicable.

1. Setup

The analyzer it incorporated in a 1/2 - 19" - rack mounting housing, 3 height units tall.

The optional (portable) tabletop housing is fitted with a carrying strap and rubber feets additional.

1.1 Front Panel

The front panel (see Fig. A-1) includes the LED - displays for both analysis channels and all of the analyzer operating controls.

The fine dust view filter with integrated needle valve for setting the gas flow and the flow meter for monitoring the gas flow rate are built in at the front panel too.

Additional there are the function LED for the options “Solenoid Valves” and “Gas Sampling Pump” and the key “PUMP” to switch on and switch off resp. the gas sampling pump.

1.2 Rear Panel

The rear panel (Fig. A.2) includes

❑ the gas line fittings

❑ the plug for the electrical supply input

❑ the subminiature “D” mating socket for the analog signal outputs

The outputs are not galvanically isolated !

❑ the subminiature “D” plug for the digital outputs (concentration limits)

❑ **optionally** the subminiature “D” mating socket for the RS 232 C / RS 485 - interface

❑ **optionally** the subminiature “D” mating socket for the status signals (relay outputs)

1.3 Internal Setup

The analyzer includes the following components:

- ❑ Depending of analyzer
  - one IR - Photometer
  - one O_2 - Sensor (paramagnetic or electrochemical)
  - two IR - Photometer
  - one O_2 - sensor (paramagnetic or electrochemical) and one IR - Photometer

- ❑ Optionally one gas sampling pump
  [pumping rate maxi. 2,5 l/min.,(<u>not</u> for 2 - channel analyzer with parallel gas paths)].

  The gas sampling pump can be switch on and switch off by a key at the front panel (Fig. A-1, Item 8).
  If the pump is switching on there is ligthening a green LED (**PUMP** , Fig. A-1, Item 3) at the front panel.

- ❑ Optionally one pressure sensor (range of 800 to 1100 hPa).
  The concentration values computed by the analyzer will then be corrected to reflect the barometric pressure to eliminate faulty measurements due to changes in barometric pressure (see technical data).

- ❑ Integrated power supply (230 / 120 V AC).

- ❑ Optionally solenoid valve unit (<u>not</u> for 2 - channel analyzer with parallel gas paths).

  For this case there are built in 4 solenoid valves (Sample Gas - Zero Gas - Span Gas 1- Span Gas 2) at the analyzer.

  For manual or automatically adjustment the zero gas and the span gases will be fed to the solenoid valves controlled by the analyzer.

  If a solenoid valve is open there is ligthening a green LED (Fig. A-1, Item 3) at the front panel.

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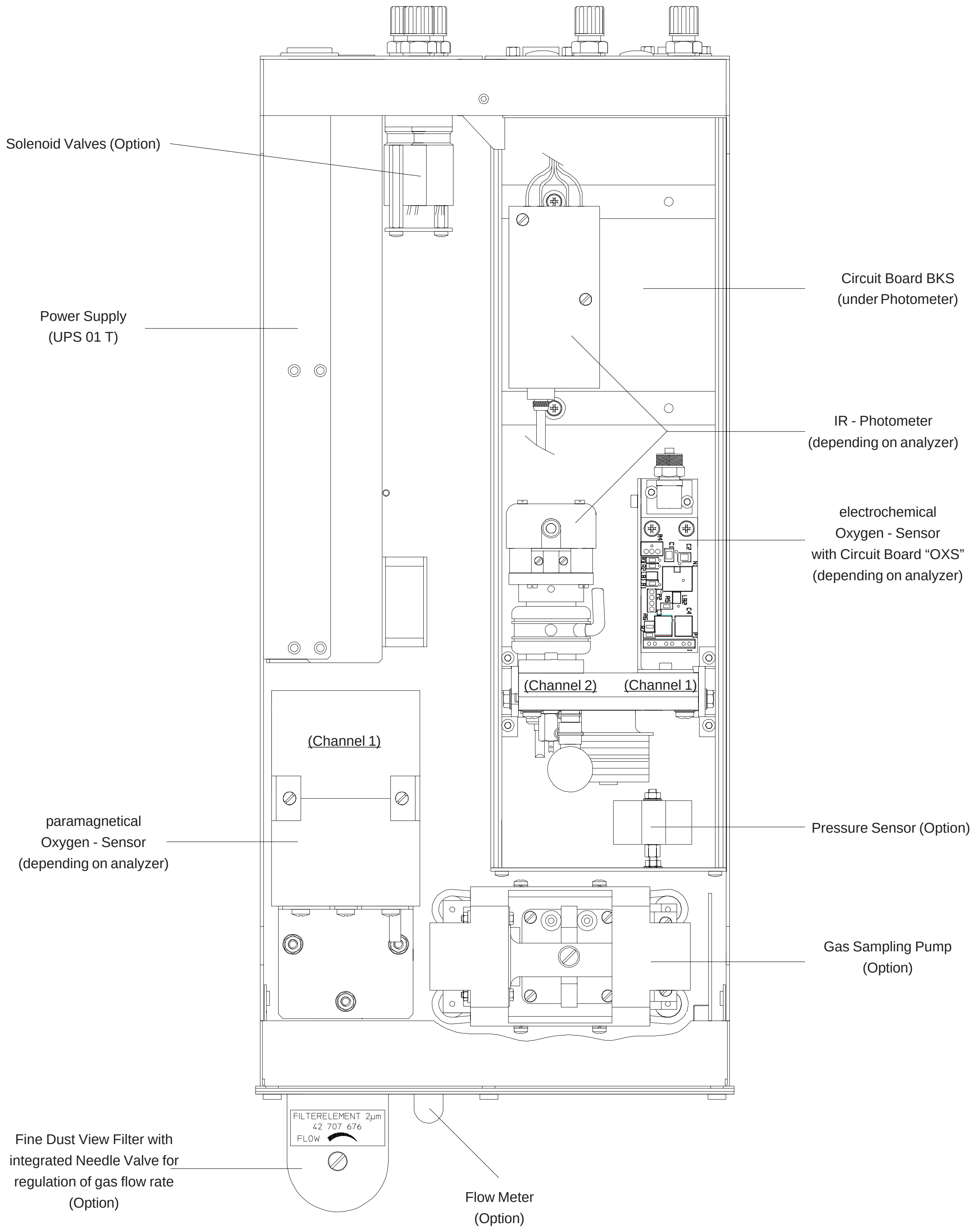


Fig. 1-1: Inside View BINOS® 100 2M
(IR - channel / oxygen measurement, combined)

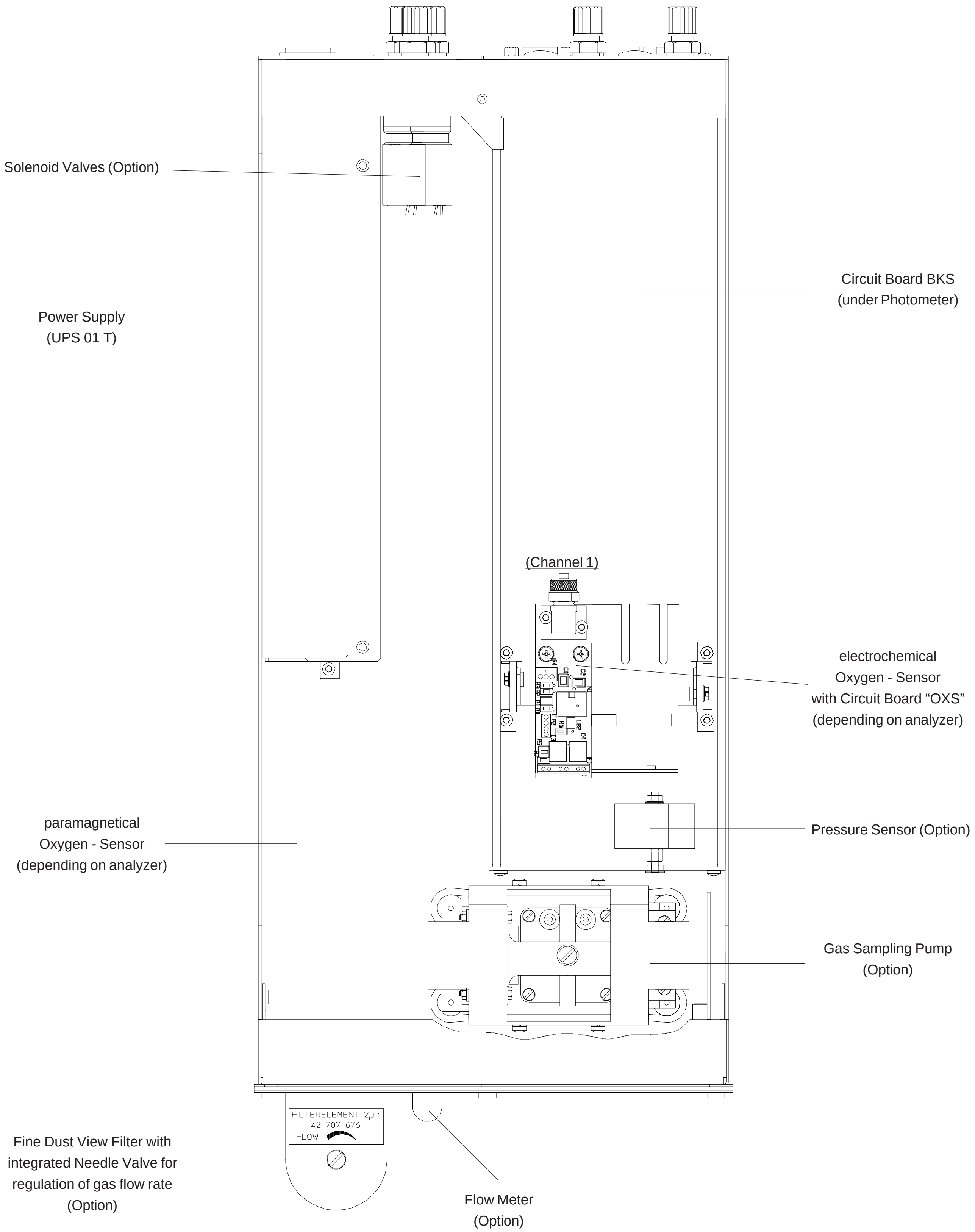


Fig. 1-2: Inside View BINOS® 100 2M
(1 - channel - oxygen measurement, electrochemical)

2. Photometer Assembly

Depending on gas component and measuring range, different photometer assemblies will be realized in BINOS® 100 2M.
Optional the photometer can be sealed to ambient air. In this case all parts are sealed with O - rings.
The entire photometer assembly is mounted as a unit on the main circuit board (BKS) by means of a bracket. The main circuit board is inserted into guide rails in the analyzer housing, to which the front panel (membrane keypad) and the rear panel are assembled.

2.1 Photometer with Pyroelectrical Detector (Solid-state detector)

Fig. 2-1 shows the schematical photometer assembly for dual - channel operation.

The base element for the photometer assembly is the chopper housing (03), upon which the light source (thermal radiator, 07), the analysis cell (cuvette, 09), and the signal detection unit [filter cell (14/15), pyroelectrical (solid-state) detector with integrated preamplifier (16)] are all mounted.

The chopper housing also incorporates the duplex filters (04/05) for the selection of spectral band-pass ranges from the broadband emission of the light sources.

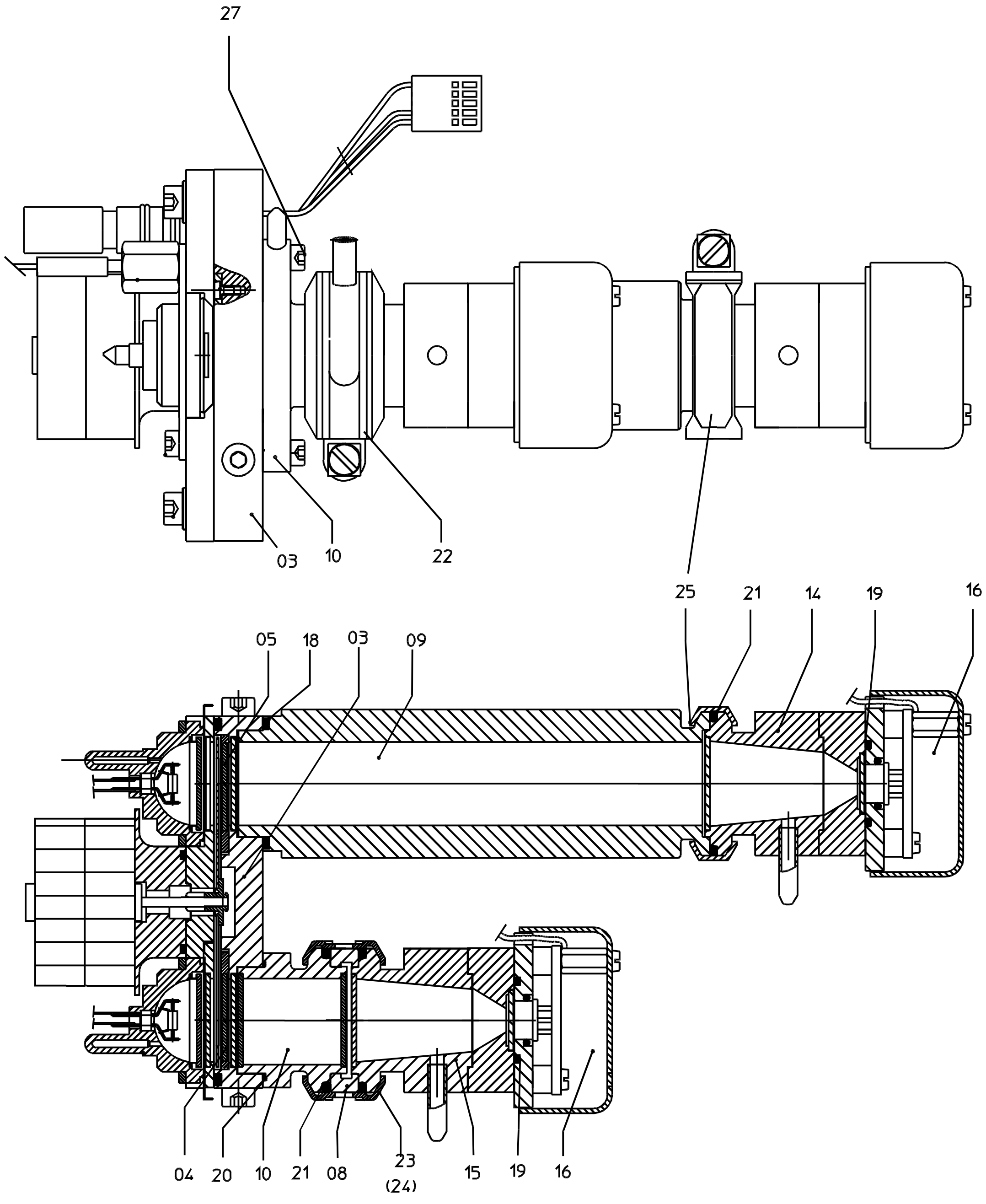
Between the two halves of the chopper housing (03), which are sealed together with an O-ring, is the chopper blade, driven by a stepping motor. Both the chopper housing and the motor encapsulation are hermetically sealed with respect to the ambient in order to prevent entry of gases, such as atmospheric CO_2, which could produce background absorptivity (preabsorption) leading to drift effects. An absorber material provides for constant removal of any traces of CO_2 which may enter the interior of the chopper housing via diffusion.

The chopper housing additionally incorporates a photoelectric gate for providing a reference signal for the phase angle of the chopper blade, plus a temperature sensor (28) for monitoring continuously the photometer assembly temperature. This temperature information is used by the signal processing electronics for the compensation of thermal effects.

The analysis cells are merely aluminum tubes equipped with sample gas inlet and outlet fittings. This extremely simple and windowless design enables easy cleaning of the cells in the event of contamination.
The only optical surfaces which also might become contaminated are the chopper windows and the windows of the filter cells; these are accessible upon removal of the cell body.

The filter cell (14/15) has a necked conical shape for optimal adaptation of the analysis cell beam cross - sectional profile to the active area of the detectors.

For high measurement ranges (up to 100 %), an adapter cell (10) is required.
The use of a spacer ring (08) creates an analysis cell in the space between the exit window of the adapter cell and the entrance window of the filter cell.



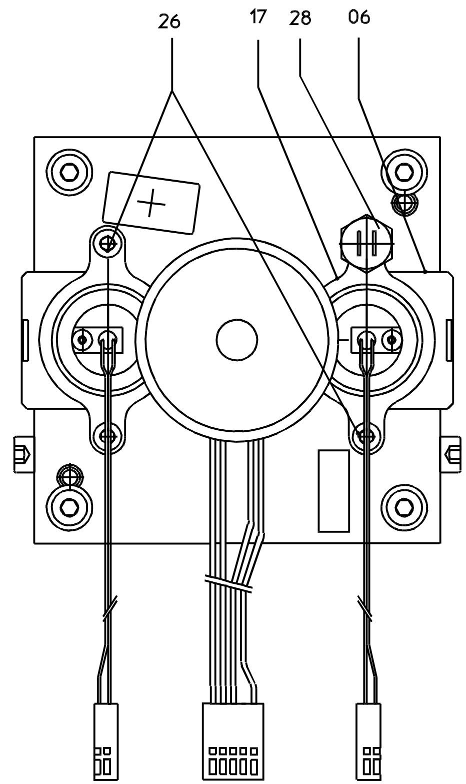


Fig. 2-1: Photometer Assembly with Pyroelectrical Detector

Legends:

03	Chopper Housing
04 / 05	Duplex Filter Disc
06	Zero - Adjustment Baffle (not for sealed photometer)
07	Light Source (thermal radiator)
08	Analysis Cell 1 - 7 mm (spacer ring)
09	Analysis Cell 50 - 200 mm
10	Adapter Cell
14/15	Filter Cell
16	Detector
17	Flange (light source)
18-21	O - Rings
22	Clamp (analysis cells 1-7 mm)
23 (24)	Clamping Collar (analysis cells 1-7 mm)
25	Clamp (analysis cells 10-200 mm)
26	Light Source Mounting Screws
27	Mounting Screws for Analysis Cells/Adapter Cells
28	Temperature Sensor

2.2 Photometer with Gas Detector

Fig. 2-2 shows schematically the photometer assembly.

This assembly is similar to the assembly with pyroelectrical detector.

The analysis cells are separated into two halves by means of an internal wall along its axis and both ends are sealed with windows. This divided the analysis cell in measuring side and reference side.
Sample gas is flowing through measuring side while the closed reference side contains inert gas (N_2).
To prevent measuring errors by preabsorption, two absorber, fitted to the gas connections of the reference side, absorb CO_2 - parts.

The filter cell has a single - stage conical shape.

The gas detector is connected by a shielded cable to the separate preamplifier.
For small measuring ranges the preamplifier is mounted at the analysis cell.
For high measuring ranges the preamplifier is mounted at two holding clamps.

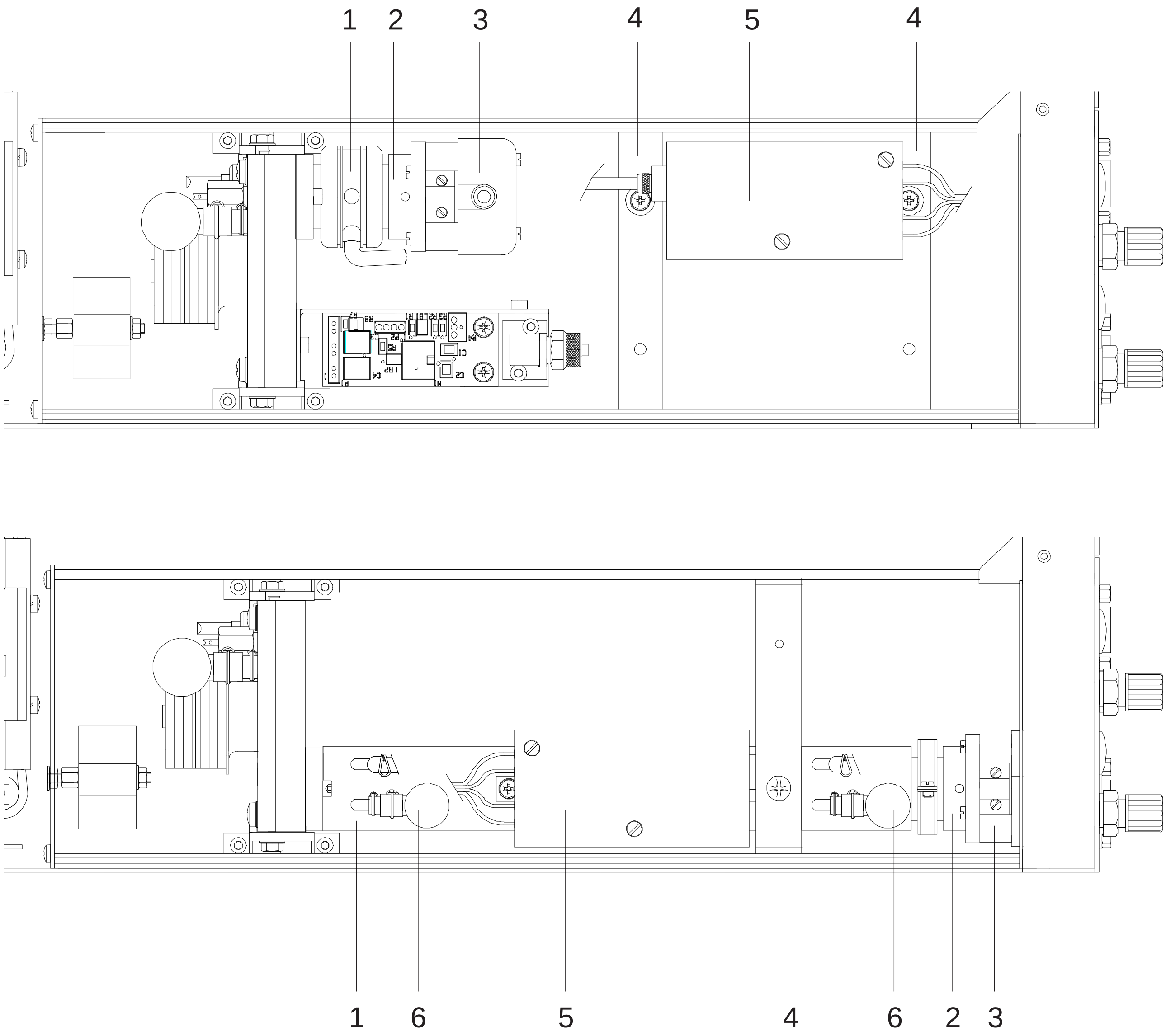


Fig. 2-2: Photometer Assembly BINOS® 100 2M with Gas Detector
*[example above: **high** measuring ranges (combined with electrochemical O_2 measurement),*
*example below: **small** measuring ranges(without O_2 measurement).*

1	Analysis Cell
2	Filter Cell
3	Gas Detector
4	Holding Device
5	Preamplifier
6	Absorber

3. Measuring Principle

Depending on analyzer model different measuring methods will be used.

3.1 IR - Measurement

The analyzers are non - dispersive infrared photometers (NDIR) using measurement of selective radiation in a column of gas.
The measuring effect devided from absorption of infra - red radiation is due to the gas being measured. The gas - specific wavelengths of the absorption bands characterize the type of gas while the strength of the absorption gives a measure of the concentration of the component measured. Due to a rotation chopper wheel, the radiation intensities coming from measuring and reference side of the analysis cell produce periodically changing signals within the detector.
The detector signal amplitude thus alternates between concentration - dependent and concentration - independent values. The difference between the two is a reliable measure of the concentration of the absorbing gas component.

Dependent on measuring component and measuring concentration, two different measuring methods will be used.

3.1.1 Interference Filter Correlation (IFC Principle)

The undivided analysis cell is alternately illuminated with filtered light concentrated in one of two spectral separated wave length ranges. One of these two spectrally separated wave length bands is chosen to coincide with an absorption band of the sample gas, and the other is chosen such that none of the gas constituents expected to be encountered in practice absorbs anywhere within the band.

The spectral transmittance curves of the interference filters used in the BINOS® 100 analyzer and the spectral absorption of the gases CO and CO_2 are shown in Fig. 3-1. It can be seen that the absorption bands of these gases each coincide with the passbands of one of the interference filters. The fourth interference filter, used for generating a reference signal, has its passband in a spectral region where none of these gases absorb. Most of the other gases of interest also do not absorb within the passband of this reference filter.

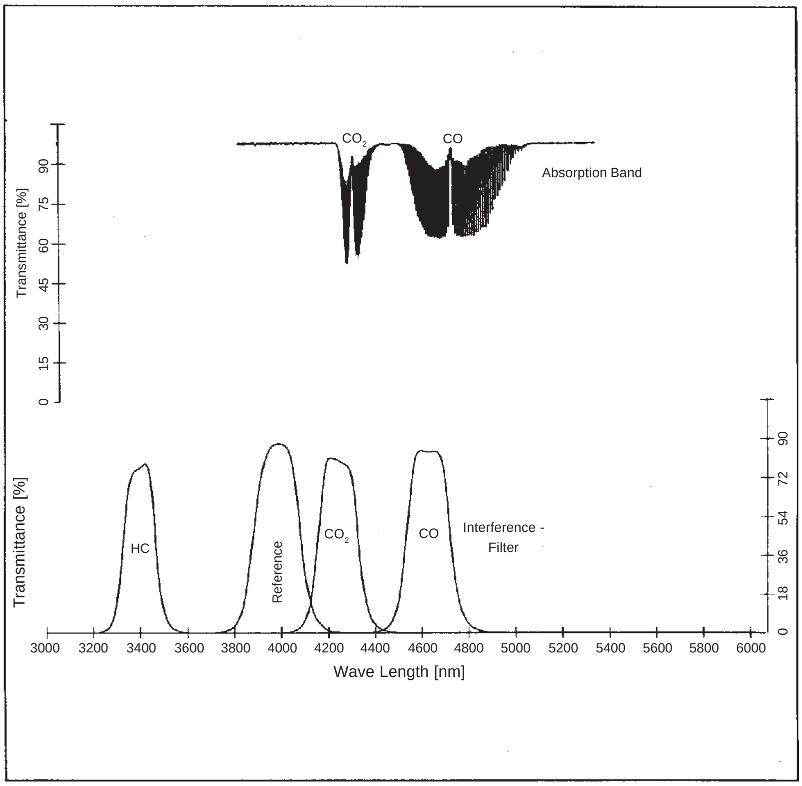


Fig. 3-1: Absorption Bands of Sample Gases and Transmittance of the Interference Filters used

The signal generation happens by a pyroelectrical (solid-state) detector.

The detector records the incoming IR - radiation. This radiation intensity is reduced by the absorption of the gas at the according wave lengths. By comparing the measuring and reference wave length an alternating voltage signal is developed. This signal results from cooling and heating of the pyroelectrical material of the detector.

3.1.2 Opto - Pneumatic Measuring Principle

A thermal radiator generates the infrared radiation passing through a chopper wheel. This radiation alternately passes through a filter cell and reaches reaches the measuring and reference side of the analysis cell with equal intensity.

After passing another filter cell the radiation reaches the pneumatic detector.

The pneumatic detector compares and evaluates the radiation from the measuring and reference sides and converts them into voltage signals proportional to their intensity via a preamplifier.

The detector consists of a gas-filled absorption and a compensation chamber which are interconnected via a flow channel.

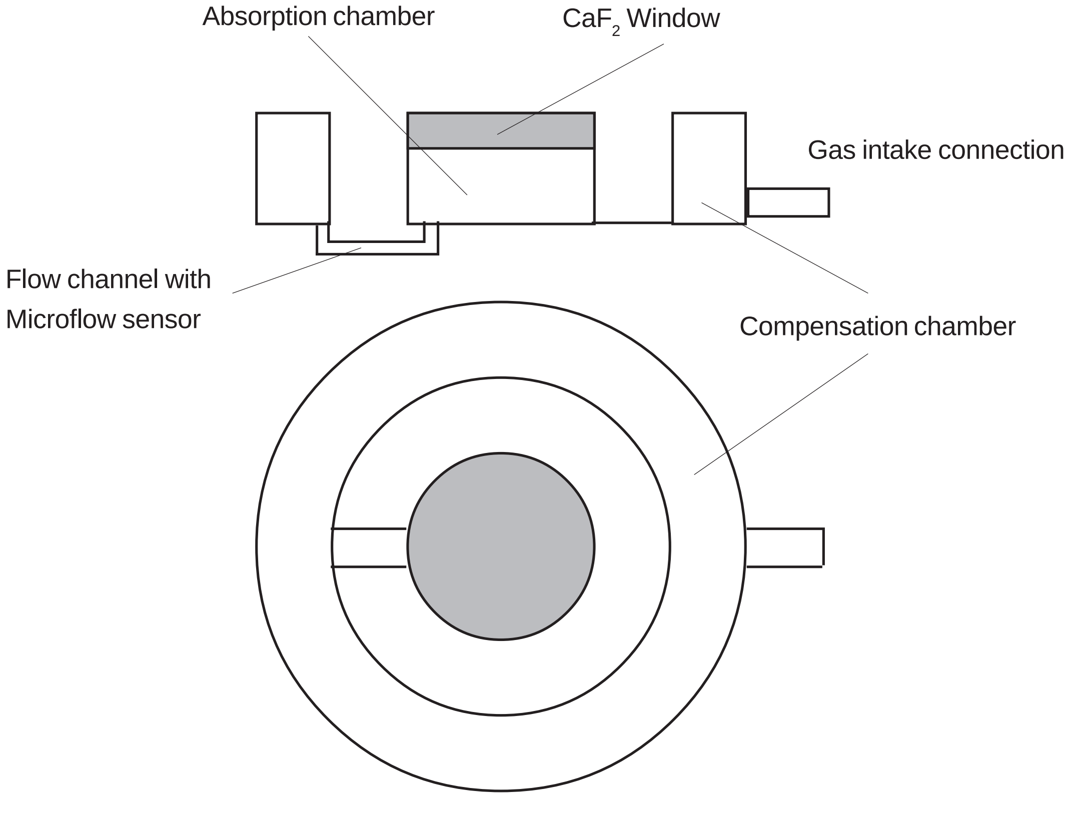


Fig. 3-2: Principle Design of Gas Detector

In principle the detector is filled with the infrared active gas to be measured and is only sensitive to this distinct gas with its characteristic absorption spectrum. The absorption chamber is sealed with a window which are transparent for infrared radiation [usually CaF_2 (Calcium fluoride)].

When the IR - radiation passes through the reference side of the analysis cell into the detector, no preabsorption occurs. Thus the gas inside the absorption chamber is heated, expands and some of it passes through the flow channel into the compensation chamber.

When the IR - radiation passes through the open measurement side of the analysis cell into the detector, a part of it is absorbed depending on gas concentration. The gas in the absorption chamber then is heated less than in the case of radiation coming from reference side. Absorption chamber gas become colder, gas pressure in the absorption chamber is reduced and some gas of compensation chamber passes through the flow channel into the absorption chamber.

The flow channel geometry is designed in such a way that it hardly impedes the gas flow by restriction. Due to the radiation of chopper wheel, the different radiation intensities lead to periodically repeated flow pulses within the detector.

The microflow sensor evaluates this flow and converts it into electrical voltages.
The electronics, which follow, evaluate the signals and convert them into the corresponding display format.

3.1.3 Technique

The broadband emission from two IR sources (in the case of dual - channel analyzers) passes through the chopper blade, then, if IFC, through combinations of interference filters, if optopneumatic principle depending on application through an optical filter (reduction of influences) and enters the analysis cells. The light transmitted through these cells is focused by filter cells onto the according detector. The preamplified detector output signal is sent to microprocessor circuitry, which converts the analytical signals to results expressed directly in physical concentration units (Vol.-%, ppm, mg/Nm^3 etc.).

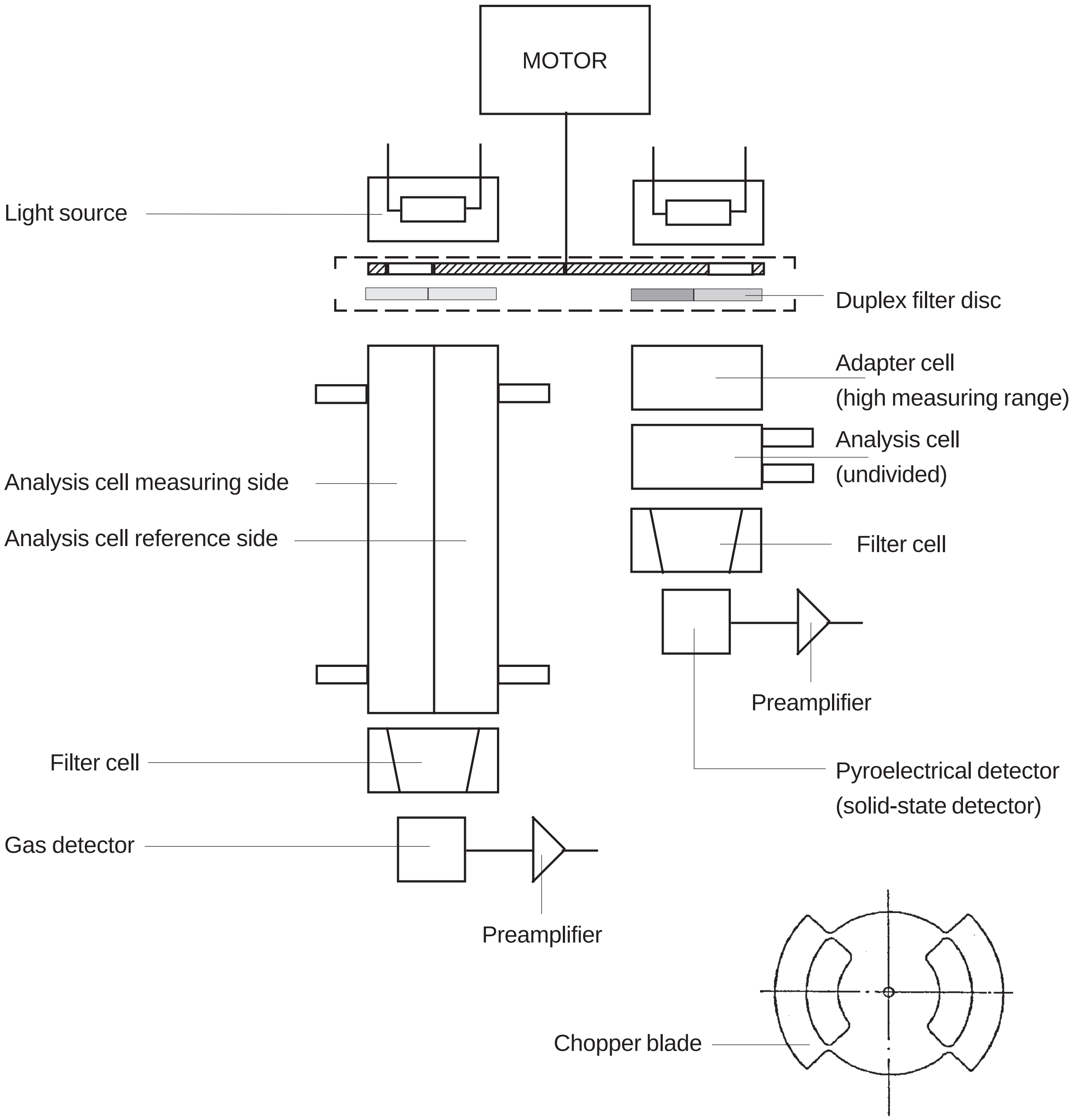


Fig. 3-3: Principle Representation

3.2 Oxygen Measurement

Depending on analyzer model different measuring methods will be used.

The installed type of oxygen sensor is to identify at the channel code (see Fig. A-1).

% O_2 para. = paramagnetic Sensor
% O_2 chem. = electrochemical Sensor

3.2.1 Paramagnetic Measurement

The determination of O_2 - concentration is based on the paramagnetic principle (magneto-mechanic principle).

Two nitrogen-filled (N_2 is diamagnetic) quartz spheres are arranged in a "dumbbell" configuration and suspended free to rotate on a thin platinum ribbon in a cell.
A small mirror that reflects a light beam coming from a light source to a photodetector, is mounted on this ribbon. A strong permanent magnet especially shaped to produce a strong highly inhomogeneous magnetic field inside the analysis cell, is mounted outside the wall.
When oxygen molecules enter the cell, their paramagnetism will cause them to be drawn towards the region of greatest magnetic field strength. The O_2 - molecules thus exert different forces which produce a torque acting on the sphere arrangement, and the suspended “dumbbell”, along with the mirror mounted on its suspension ribbon, will be angulary rotated away from the equilibrium position.
The mirror then will deflect an incident light beam onto the photodetector which itself produces an electric voltage. The electric signal is amplified and fed back to a conducting coil at the “dumbbell”, forcing the suspended spheres back to the equilibrium position.
The current required to generate the restoring torque to return the “dumbbell” to its equilibrium position is a direct measure of the O_2 - concentration in the gas mixture.

The complete analysis cell consists of analysis chamber, permanent magnet, processing electronics, and a temperature sensor. The sensor itself is thermostatted up to approx. 55 °C.For warming up the measuring gas is conducted via a heat-exchanger.

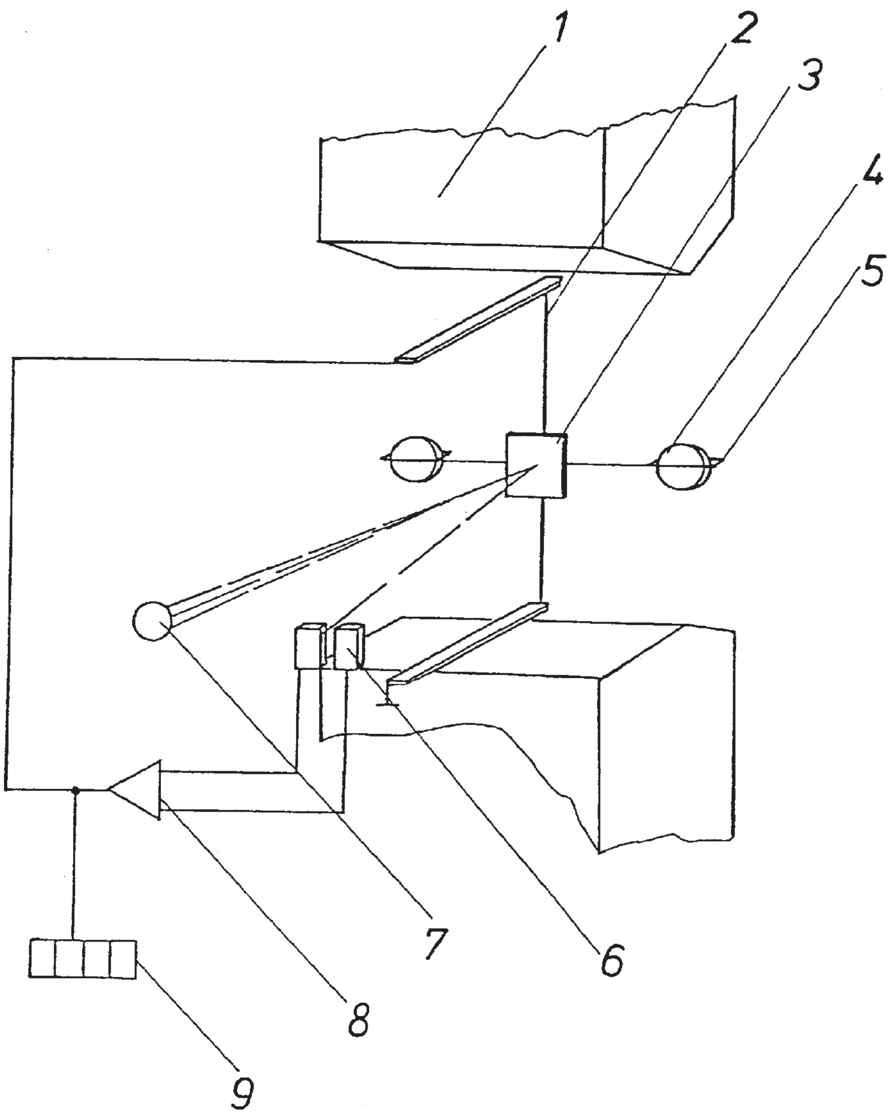


Fig. 3-4: Principle Construction of paramagnetic Analysis Cell

1	Permanent magnet
2	Platinum wire
3	Mirror
4	Quartz spheres
5	Wire loop
6	Photodetector
7	Light source
8	Amplifier
9	Display

3.2.2 Elektrochemical Measurement

The determination of O_2 - concentrations is based on the principle of a galvanic cell.
The principle structure of the oxygen sensor is shown in Fig. 3-5.

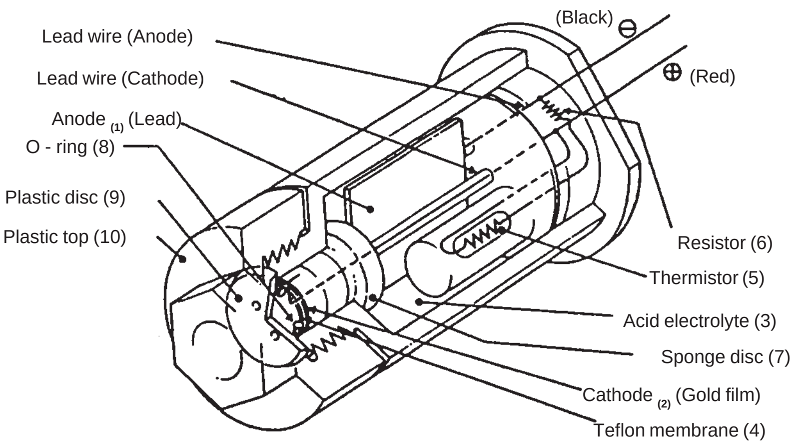


Fig. 3-5: Structure of electrochemical Oxygen Sensor

The oxygen senor incorporate a lead/gold oxygen cell with a lead anode (1) and a gold cathode (2), using a specific acid electrolyte. To avoide moisture losses at the gold electrode a sponge sheet is inserted on the purged side.

Oxygen molecules diffuse through a non-porous Teflon membrane (4) into the electrochemical cell and are reduced at the gold-cathode. Water results from this reaction.
On the anode lead oxide is formed which is transferred into the electrolyte. The lead anode is regenerated continuously and the electrode potential therefore remains unchanged for a long time.
The rate of diffusion and so the response time (t_{90}) of the sensor is dependent on the thickness of the Teflon membrane.

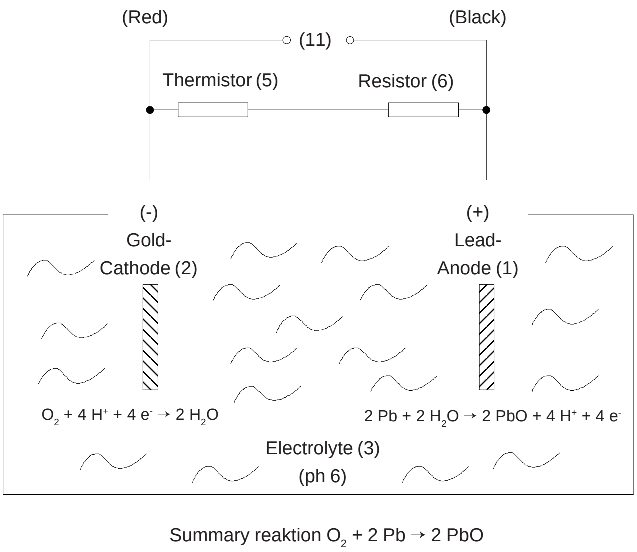


Fig. 3-6: Reaction of galvanic cell

The electric current between the electrodes is proportional to the O_2 concentration in the gas mixture to be measured. The signals are measured as terminal voltages of the resistor (6) and the thermistor (5) for temperature compensation.

The change in output voltages (mV) of the senor (11) represents the oxygen concentration.

Note !

Depending on measuring principle the electrochemical O_2-cell needs a minimum internal consumption of oxygen. Admit cells continuously with sample gas of low grade oxygen concentration or with oxygenfree sample gas could result a reversible detuning of O_2-sensitivity. The output signal will become instabil.
For correct measurement the cells have to admit with a O_2 concentration of at least 2 Vol.-%.
We recommend to use the cells in intervall measurement (purge cells with conditioned ambient air at measurement breaks).
If it is necessary to interrupt oxygen supply for several hours or days, the cell have to regenerate (admit cell for about one day with ambient air). Temporary flushing with nitrogen (N_2) for less than 1 h (e.g. analyzer zeroing) will have no influence to measuring value.

4. Main Features

- 1/2 - 19" - housing, 3 HU

- Possibility of two measuring components (2 - channel analyzer)
  Depending of analyzer
  - one IR - Photometer
  - one O_2 - Sensor (paramagnetic or electrochemical)
  - two IR - Photometer
  - one O_2 - sensor (paramagnetical or electrochemical) and one IR - Photometer

- 4 - digit LED - measuring value display and operators prompting via this displays for each measuring channel

- Integrated power supply (230 V / 120 V ; 50 / 60 Hz)

- Integrated gas preprocessing (option), consisting of fine dust view filter with needle valve for setting of flow rate and flow meter (not for 2 - channel analyzer with parallel gas paths)

- Monitoring of two free adjustable concentration limits for each measuring channel (“Open Collector”, maxi. 30 V, 30 mA, optically isolated)

- Automatic calibration using zeroing and span gases at preselected intervals (optional “solenoid valves” are required for this, not for 2 - channel analyzer with parallel gas paths)

- Optionally one gas sampling pump (not for 2 - channel analyzer with parallel gas paths).

- Optionally one pressure sensor (range 800 to 1100 hPa).

- Optionally solenoid valve unit
  Logical allocation for sample gas valve, zero gas valve and two span gas valves and the activation of these valves using the keyboard or automatically for zero and span gas adjustment (not for 2 - channel analyzer with parallel gas paths).

- Optional digital outputs for status signals
  (Non-voltage-carrying contacts, max. 30 V / 1 A / 30 W)
- The response time (t_{90} - time) can be adjusted separately for each measuring channel
- RS 232 C / RS485 serial interface for data intercommunications with external computers (optional).
- Interference compensations for the reduction of disturbing effects due to extraneous absorption by secondary gas constituents
- Self - diagnostic procedures, plus maintenance and servicing support functions
- Plausibility checks
- Temperature compensations
- Operator prompting for the avoidance of operator errors

5. Preparation

Please check the packing and its contents immediately upon arrival.
If any item is damageg or lost you are kindly requested to notify the forwarder to undertake a damage survey and report the loss or damage to us immediately.

5.1 Installation Site

The analyzer must not operate in explosive atmosphere without supplementary protective measures !

Free flow of air into and out of the analyzer (ventilation slits) must not be hindered by nearby objects or walls !

The installation site for the analyzer has to be dry and remain above freezing point at all times. The analyzer must be exposed neither to direct sunlight nor to strong sources of heat.
Be sure to observe the permissible ambient temperatures (c.f. Item 24: Technical Data). For outdoor installation, we recommend to install the analyzer in a protective cabinet. At least, the analyzer has to be protected against rain (e.g., shelter).

The analyzer has to be installed **as near as possible to the sample point**, in order to avoid low response time caused by long sample gas lines.
In order to decrease the response time, a sample gas pump with a matching high pumping rate may be used. Eventually, the analyzer has to be operated in the bypass mode or by an overflow valve to prevent too high flow and too high pressure (Fig. 5-1).

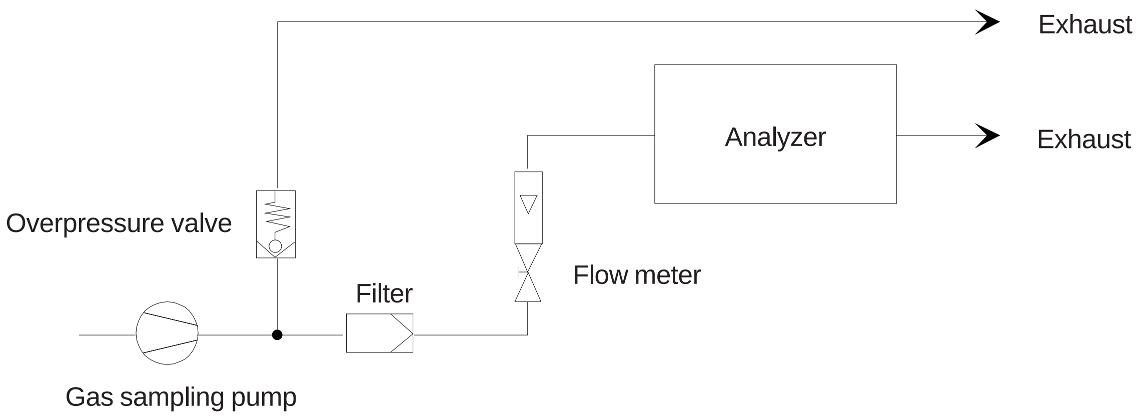


Fig. 5-1: MLT, Bypass installation

5.2 Gas Conditioning (Sample Handling)

The conditioning of the sample gas is of greatest importance for the successful operation of any analyzer according to extractive method.

All gases have to be supplied to the analyzer as conditioned gases !
When the instrument is used with corrosive gases, it is to be verified that there are no gas components which may damage the gas path components.

The gas has to fullfil the following conditions:

It must be

- free of condensable constituents
- free of dust
- free of aggressive constituents which are not compatible with the material of the gas paths.
- have temperatures and pressures which are within the specifications stated in “Technical Data” of this manual.

Inflammable or explosive gas mixtures may not be introduced into the analyzer without supplementary protective measures !

When analysing vapours, the dewpoint of the sample gas has to be at least 10 °C below the ambient temperature in order to avoid the precipitation of condensate in the gas paths.

Suitable gas conditionning hardware may be supplied or recommended for specific analytical problems and operating conditions.

5.2.1 Fine Dust Filter (Option

Optionally a fine dust view filter having a pore size of 2 µm is built in into the analyzer (Fig. A-1, Item 10, not for 2 - channel analyzer with parallel gas paths).

5.2.2 Gas Sampling Pump (Option)

Optional the analyzer can be equipped with a gas sampling pump (pumping rate max. 2.5 l/min.) (not for 2 - channel analyzer with parallel gas paths).

The gas sampling pump can be switch on and switch off by a key at the front panel (Fig. A-1, Item 8).
If the pump is switching on there is ligthening a green LED (**PUMP** , Fig. A-1, Item 3) at the front panel.

5.2.3 Pressure Sensor (Option)

It is possible to integrate a pressure sensor with a range of 800 - 1100 hPa.
The concentration values computed by the analyzer will then be corrected to reflect the barometric pressure to eliminate faulty measurements due to changes in barometric pressure (see technical data).

5.2.4 Gas Flow

The gas flow rate should be within the range 0.2 l/min to maxi. 1.5 l/min !

A constant flow rate of about 1 l/min is recommended.

! The gas flow rate for analyzer with paramagnetic oxygen sensor is allowed to max. 1.0 l/min !

It is possible to integrate a flow sensor (Fig. A-1, Item 9, not for 2 - channel analyzer with parallel gas paths). In this case gas flow can be shown via front panel.
Flow control can be done with a screw driver via a optional integrated throttle into the optional built-in dust filter (see Item 5.2.1).

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5.3 Gas Connections

All the fittings for gas line connection are situated on the rear panel of the analyzer and are clearly marked (Fig. 5-2).

The exhaust gas lines have to be mounted in a declining, pressureless and frost-free way and according to the valid emission legislation !

Do not interchange gas inlets and gas outlets !

Permissible gas pressure max. 1,500 hPa !

5.3.1 Standard

The following gas connections are installed:

in = Gas inlet	out = Gas outlet
Channel 1 = measuring channel 1	Channel 2 = measuring channel 2

Zero gas and span gas are introduced directly via the sample gas inlet. The test gas containers have to be set up according to the current legislation.

Be sure to observe the safety regulations for the respective gases (sample gas and test gases / span gases) and the gas bottles !

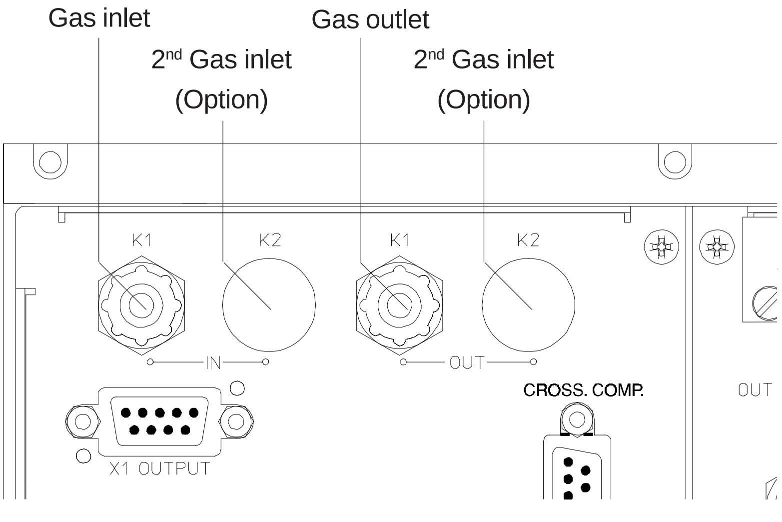


Fig. 5-2: BINOS® 100 2M, standard gas connections

5.3.2 Solenoid Valves (Option)

For operation with optional solenoid valves, the following indications have to be considered:
Operation with solenoid valves is not possible for 2 - channel analyzer with parallel gas paths.
All necessary gases have to be connected at the corresponding solenoid valve at a over - pressure of 50 - maxi. 500 hPa.
The necessary test gas containers have to be set up according to the valid regulations.

Be sure to observe the safety regulations for the respective gases (sample gas and test gases / span gases) and the gas bottles !

If a solenoid valve is open there is ligthening a green LED (Fig. A-1, Item 3) at the front panel.

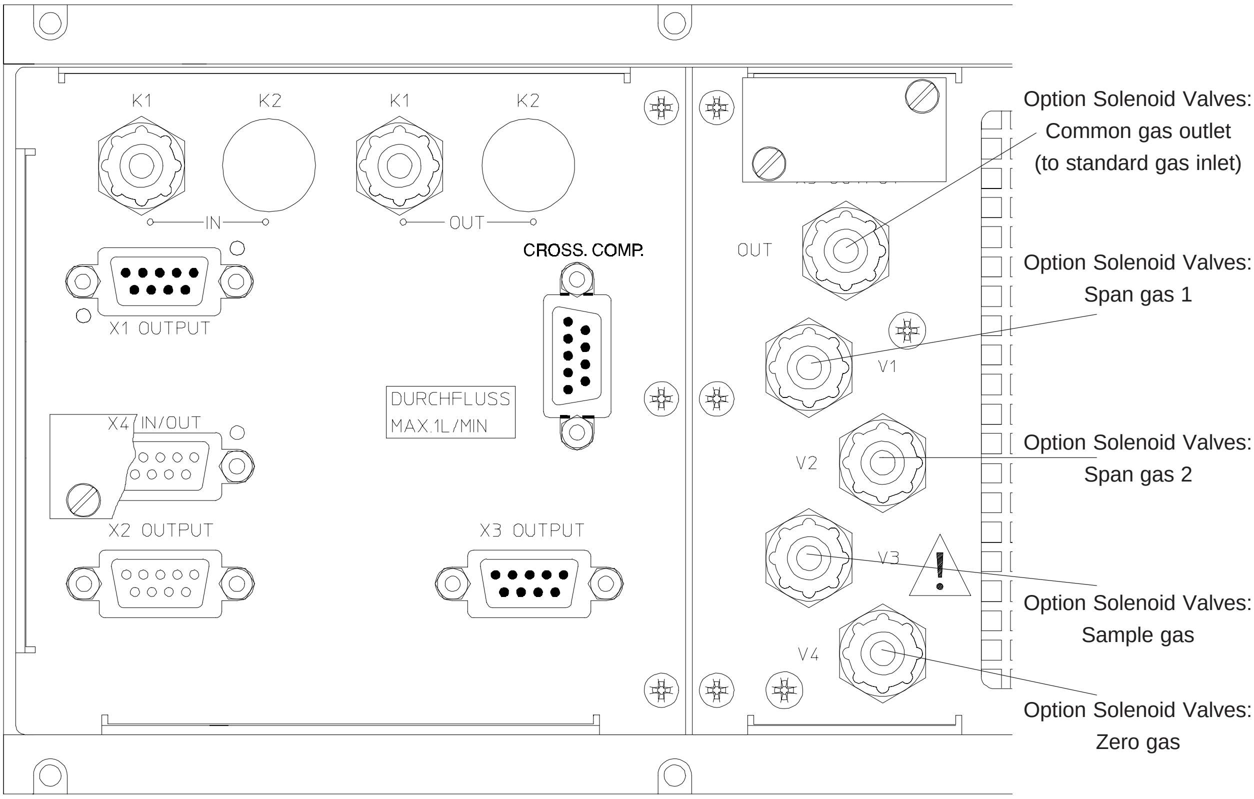


Fig. 5-3: BINOS® 100 2M, gas connections "solenoid valves" (option)

6. Switching On

Once the analyzer has been correctly assembled and installed in accordance with the general instructions of section "5. Preparation", the analyzer is ready for operation.

The equipment has an internal power supply with "autoranging" is specified for an operating voltage of 230 V AC or 120 V AC resp., 47-63 Hz.

For supply of external components / analyzers there is built in a 24 Vdc outlet (a 3-pole XLR flange, female, max. 2 A).

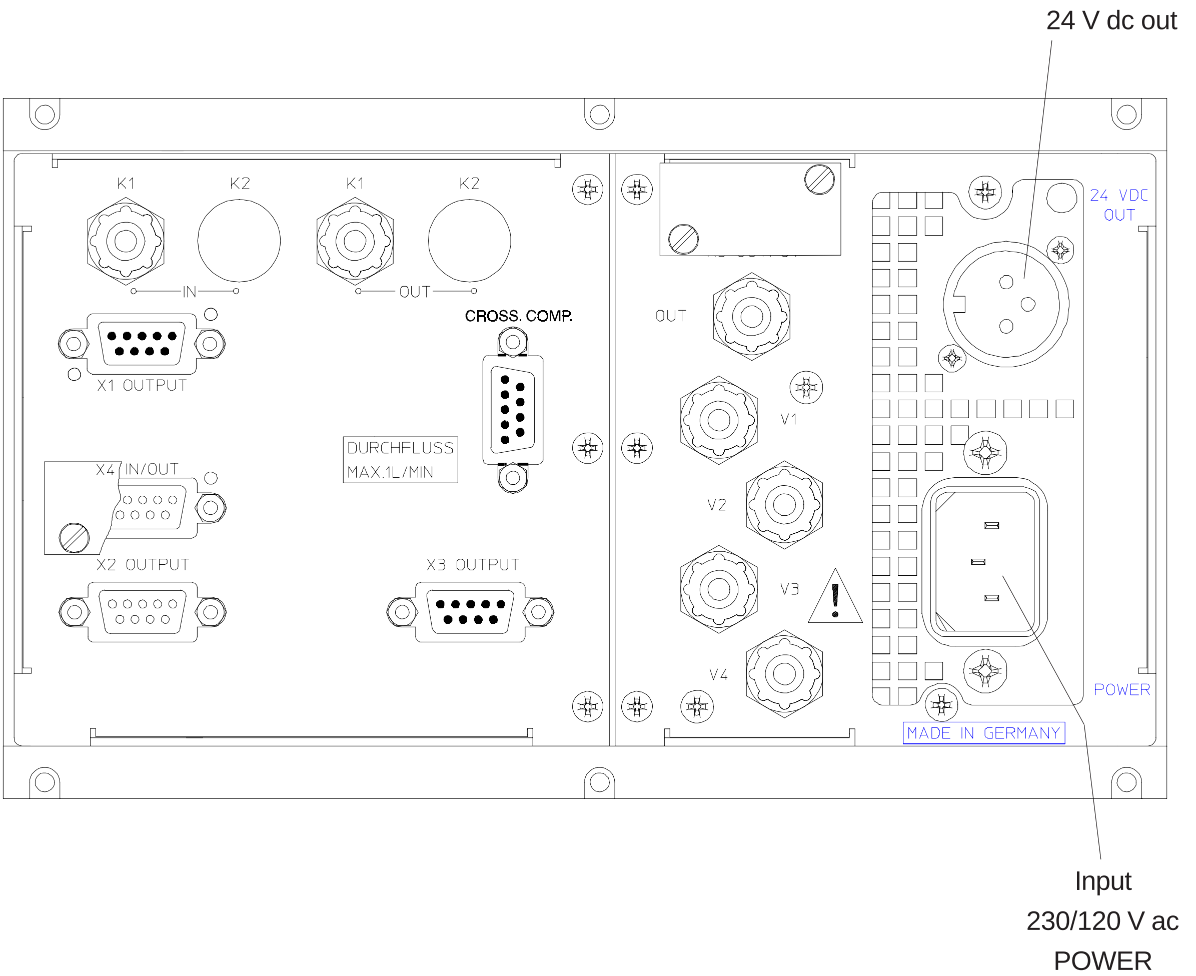


Fig. 6-1: Supply Voltage BINOS® 100 2M

❍ Connect internal power supply and external components (Fig. 6-1, 24 V dc out).

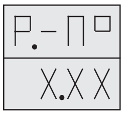
For 24 V dc - supply of externalcomponents/analyzers with the internal power supply of this analyzer, a fuse is to be connect in series to the consumer which limits the currentconsumption to max. 2.0 A !

Verify correct polarity for 24 V dc - supply to externalcomponents before operation (Section 26.) !

❍ Connect mains line and internal power supply.

Verify beforehand that the line voltage stated on the power supply agrees with that of your power supply line !
The socket outlet shall be installed near the equipment.

The presence of the supply voltage will be indicated by the illumination of the LED displays. Upon connection of the supply voltage, the analyzer will perform a self - diagnostic test routine. First the actual program version will be shown.



Finally either concentration values or error messages will be displayed
If as a result of a battery fault the default values were charged, this will be shown by a flushing **"batt.**"
This message will disappear after depressing any key.

Analyzer warming-up takes about 15 to 50 minutes, depending on the installed detectors !

Before starting an analysis, however, the following should be performed:

❑ entry of the desired system parameters,
❑ calibration of the analyzer.

NOTE:
The "X's" shown in the display indicate a number or combinations of numbers.

7. Key Functions

The operation and programming of the analyzer is performed using the membrane - type keypad with its four keys (see Fig. A-1, Item 3 - 6).

Operator guidance prompts will appear on the 4 - digit LED - displays.

Battery - buffering of the stored parameters prevents their loss in the absense of a power supply failure.

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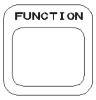
7.1 FUNCTION

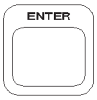


Depressing this key (Fig. A-1, Item 3) addresses the individual analyzer functions in sequence. Merely addressing an analyzer function will not initiate an analyzer action or operation. The analyzer will continue to perform analysis throughout keypad entry procedures.

The following analyzer functions and their sequences (see also Fig. 7-1) are shown:

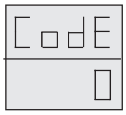
0 -1	Zeroing channel 1	
0 -2	Zeroing channel 2	
S -1	Spanning channel 1	
S -2	Spanning channel 2	
t-A0	Interval Time for automatic Zeroing	**Only in combination of digital outputs and external solenoid valves, and if Auto = 1**
t-AS	Interval Time for automatic Spanning	
L I.	Entry of concentration limits	
SYS.- PArA.	Entry of system parameters.	
S IP.	Entry of serial interface parameters	**Only with Option RS 232 C/485 Serial Interface**

7.2 ENTER



The **ENTER** - key (Fig. A-1, Item 4) is used for the transfer of (keyed - in) numerical data to the corresponding operating parameters and for the initiation of certain operations, such as zeroing and spanning.

Depressing within the function sequences (following the sequences from "Zeroing (0 - 1)" to the "interface - parameter (SIP.) using the **FUNCTION** - key) the first time only the **ENTER** - key



will appear on the display.

This indicates that - for safety - a password (user code) must be entered in order to enable the entry level.

If an incorrect password is entered, the CODE display will remain, and the entry displayed will be reset to the value “0”.

When the correct password has been entered, a transfer to the protected entry level will be effected.

This password has been set to the value “1” in our plant before shipment.

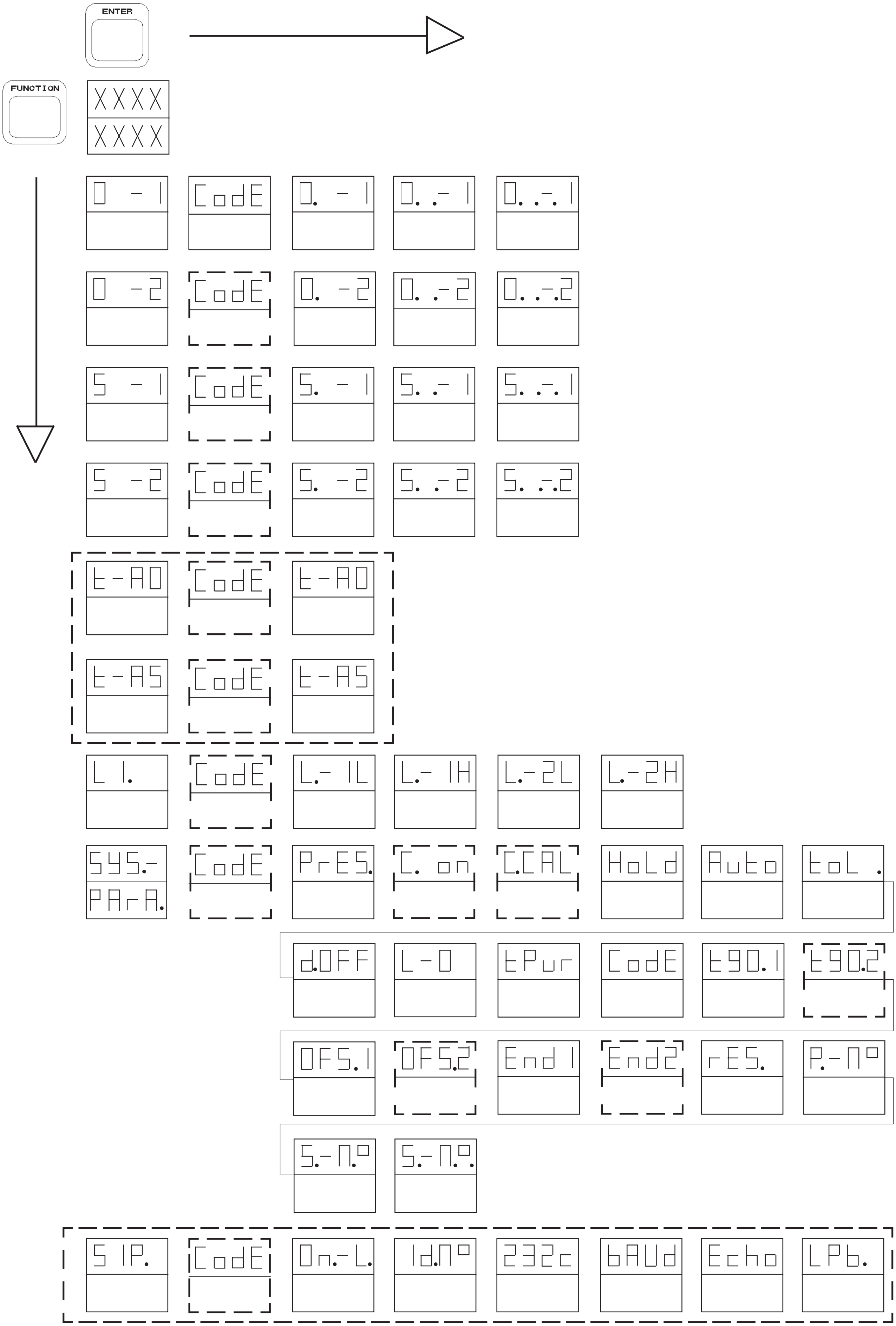
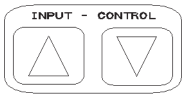


Fig. 7-1: BINOS® 100 (M) Operating Function Matrix

7.3 INPUT - CONTROL



This keys (Fig. A-1, Item 5 and 6) are used for the adjustment of the individual entry parameter values. Momentary depressions of either key will alter current values by +/- 1.

UP △ increase current value by 1

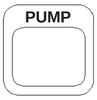
DOWN ▽ decrease current value by 1

If either of these keys is held depressed, the value will be altered continuously. Altering rate starts with the slower rate, and shifts automatically to the faster rate. When the minimal value is reached, the analyzer will automatically revert to the slower rate in order to facilitate entry of the minimal value .

Each of the entry parameters is assigned an accepted tolerance range which must be observed when entering parameter values. In addition, all entries are subjected to a plausibility check as added protection against operator errors.

❗ If within about 60 - 120 seconds no further keys have been depressed, the analyzer will automatically revert to the “analysis display”.

7.4 PUMP



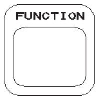
Optionally there is built in a gas sampling pump (pumping rate maxi. 2,5 l/min.).

This can be switch on and switch off by a key “PUMP” at the front panel (Fig. A-1, Item 8).

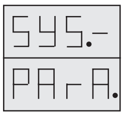
If the pump is switching on there is ligthening a green LED (**PUMP**, Fig. A-1, Item 3) at the front panel .

8. Entry of System Parameters

Depress the key

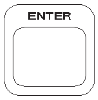


until the text

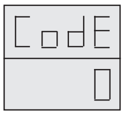


appears.

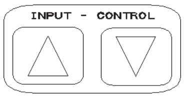
Depress the key



If the **Code** had not already been entered, there will appear

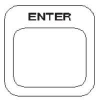


Use the keys



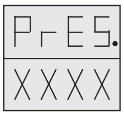
to select the **Code**

and then using



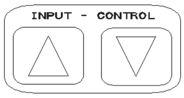
The display will now show:

8.1 Pressure Correction

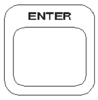


To eliminate faulty measurements due to changes in barometric pressure or sample gas pressure, the operator is offered the opportunity to enter the current pressure expressed in **hPa** (mbar) in a range of 800 to 1300 hPa. The concentration values computed by the analyzer will then be corrected to reflect the barometric pressure or sample gas pressure resp. entry.

The entry is effected using

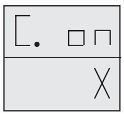


and



It is possible to integrate a pressure sensor with a range of 800 - 1100 hPa.
The concentration values computed by the analyzer will then be corrected to reflect the barometric pressure to eliminate faulty measurements due to changes in barometric pressure (see technical data). .
In this case it is not possible to enter pressure value manually. In attempting to enter pressure value manually, the analyzer will automatically revert to the display of measured pressure value.

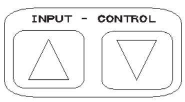
8.2 Cross - Compensation



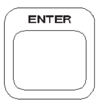
This control permits switching the electronic cross - compensation feature on and off.
The cross - compensation feature is designed minimize mutual interferences between the two gases (e. g., CO_2 and CO) measured by the analyzer.

Entry of 0: cross - compensation is disabled
Entry of 1: cross - compensation is enabled

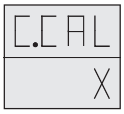
Effect the entry using



and



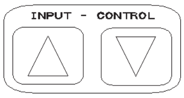
8.3 Cross - Compensation Calibration



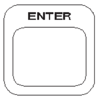
Determination of cross - compensation correction factors is performed during the span adjustment. Pure test gases are required for this operation. Once cross - compensation corrections have been determined, span adjustments may be performed using test gas mixtures.

Entry of 0: spanning <u>without</u> cross-compensation correction (**test gas mixtures**)
Entry of 1: spanning <u>with</u> cross - compensation correction (**pure test gases**)

Effect the entry using



and



To perform a calibration with cross - compensation correction, proceed as follows:

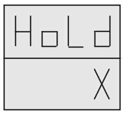
First perform a **zeroing** for **both** analysis channels (see 9.1.1).
Then perform a **spanning** for **both** analysis channels as described in section 9.1.2.

The spanning for the first of the analysis channels calibrated must then be repeated.

The entries described in sections 8.2 and 8.3 must be “1” for performance of a calibration with cross compensation correction !
Use only pure test gases !

When using test gas mixtures, “C.Cal” must be set to “0” !

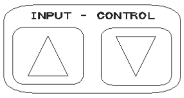
8.4 Hold



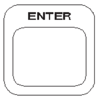
The analyzer function **HOLD** permits keeping the analog signal outputs and the concentration limits locked at the last values measured during a calibration procedure.

Entry of 0: The outputs remain unlocked.
Entry of 1: The outputs will be locked.

Use the keys

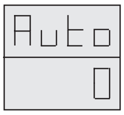


and



for the entry.

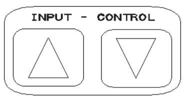
8.5 Automatic Calibration



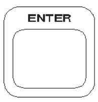
For operation with optional, internal or external solenoid valves it can be selected, if there is a time - controlled (automatic) calibration possible or not (in combination with digital outputs).

Entry of 0: Time - controlled calibration is not possible
Entry of 1: Time - controlled calibration is possible

Use the keys

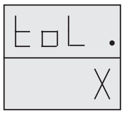


and



for the entry.

8.6 Tolerance Check



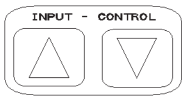
The **tolerance** function is for the activation and deactivation of the tolerance check procedure for various calibration gases.

If the tolerance check procedure has been activated, the microprocessor will verify during calibration procedures whether the used calibration gas shows a deviation of more than 10 % from measuring range of zero (zero - level) or more than 10 % of the nominal concentration value entered resp. (span).

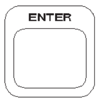
If this **tolerance is exceeded**, **no calibration** will be **performed**, and an error message will appear (see Section 13).

Entry of 0:	Tolerance check is deactivated.
Entry of 1:	Tolerance check is activated.

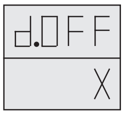
Perform the entry using



and



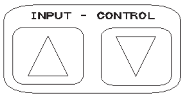
8.7 Display Off



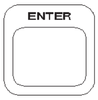
If 1 is entered, the DISPLAY will be deactivated about 1 to 2 minutes after the last key depression. If any key is depressed while the DISPLAY is deactivated, all display elements will be reactivated without any further operation being initiated.

Entry of 0: Display is activated
Entry of 1: Display is deactivated

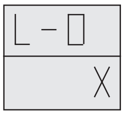
Entry is performed using



followed by



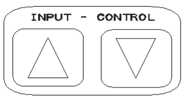
8.8 Analog Signal Outputs



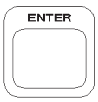
The analog signal outputs (optically isolated) are brought out to the 9 - pin sub - miniature D- connector X2 on the analyzer rear panel.

Entry of 0: Output signal of 0 - 10 V (Option: 0 - 1 V) / 0 - 20 mA.
Entry of 1: Output signal of 2 - 10 V (Option: 0.2 - 1 V) / 4 - 20 mA. (**life zero** mode)

Use the keys



and



for entry.

Note:
The begin of range concentration (OFS.) and the end of range concentration (END) are free programmable (see Item 8.12 and 8.13).
For type of voltage output (standard or option) look at order confirmation or identify plate resp., please.

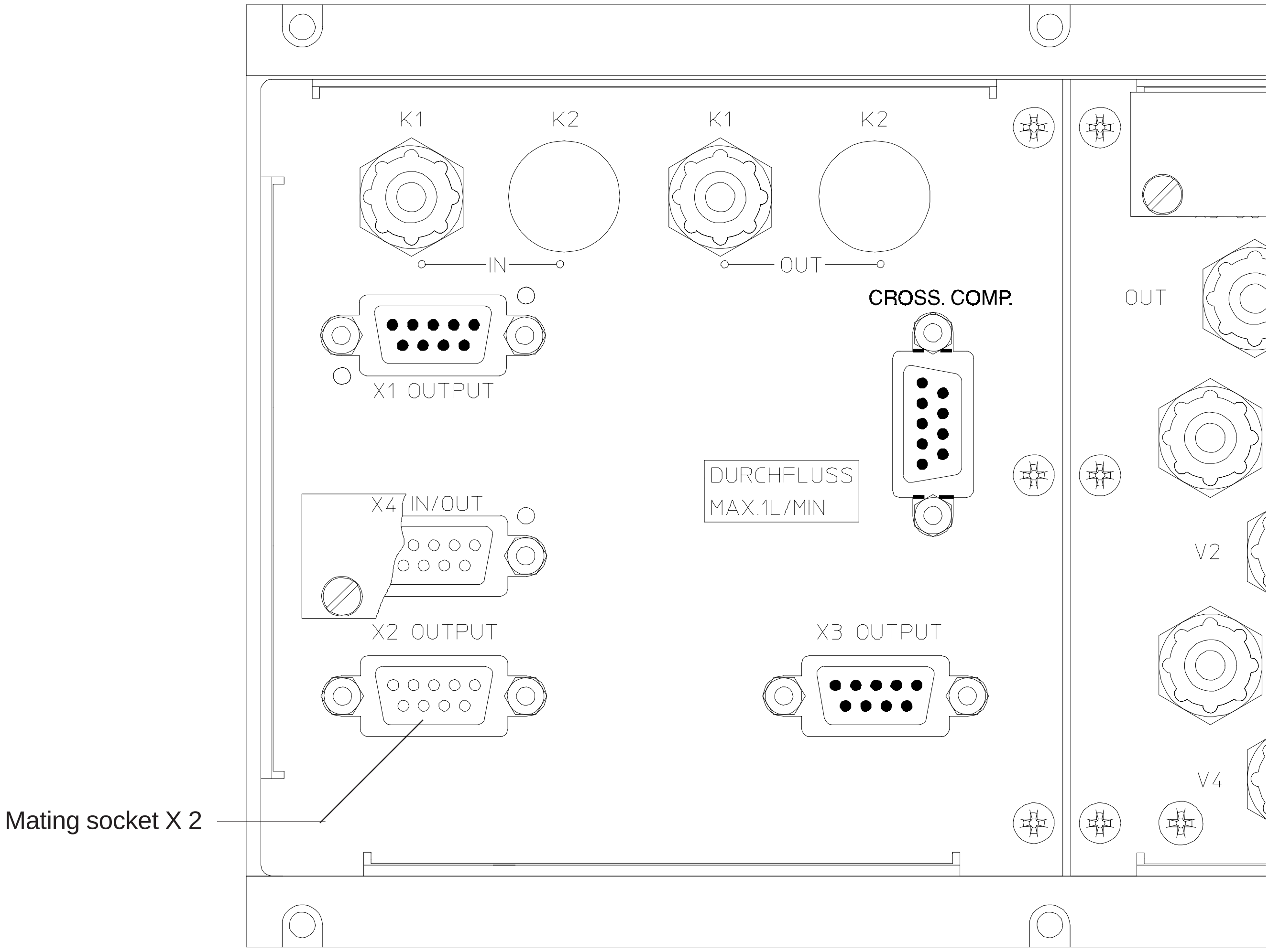


Fig. 8-1: Mating socket X 2 (analog signal outputs)

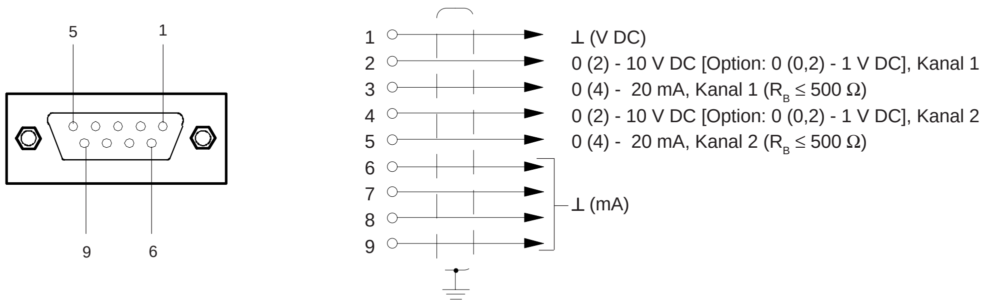
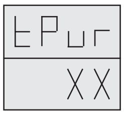


Fig. 8-2: Pin assignments X 2 (analog signal outputs)

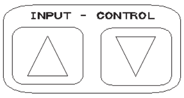
8.9 Flushing Period



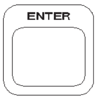
For calibration, the gas paths must be supplied with sufficient calibration gas. The flushing period has to be fixed adequate; perform calibration only after a suitable flushing period (the calibration gas flow should be identical with sample gas flow).

This period may be selected in the range **0 - 99 sec.** depending on calibration conditions.

Use the keys

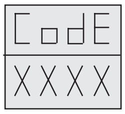


and



for entry.

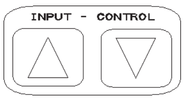
8.10 User Code



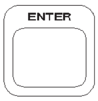
The value 1 has been set in our plant.

To prevent parameter alterations by unauthorized persons, the operator may specify another password (user code).

Use the keys



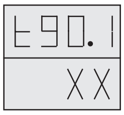
and



for entry.

Please take care for filing the user code.

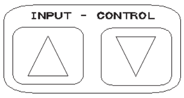
8.11 Response Time (t_{90})



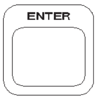
For some types of analysis an alteration of the analyzer damping factor, i.e. its electrical response time, t_{90}, may be required. The operator is offered the option of selecting a response time optimal for each application.

The **range of** accepted **entries** is **2 - 60 sec.**.

Use the keys

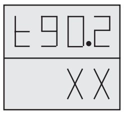


and

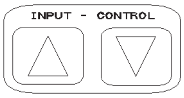


for the entry.

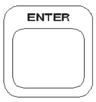
Entry possibility for channel 2



Use the keys



and



for the entry.

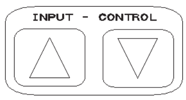
8.12 Offset (Begin of range)

The operator is here offered the opportunity to introduce a scale offset for the analog signal output (begin of range).

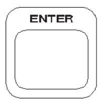
Example:

For an analyzer concentration range of 0 - 25 % it is desired to measure only concentrations in the range 10 - 25 %. If the operator enters here the value 10 %, the analog signal outputs of 0 V / 0 mA or 2 (0.2) V / 4 mA will then correspond to a gas concentration of 10 %.
The displayed values are not affected.

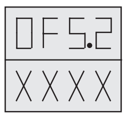
Effect the entry using



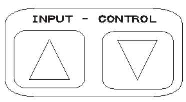
and



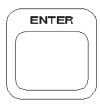
Entry possibility for channel 2



Use the keys



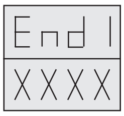
and



for the entry.

Note:
The **specifications of the analyzer** written in the data sheet are **only for OFS. = 0 and END = full - scale range set in our factory** !
It is part of customer to enter logical values for OFS. and END !

8.13 End of Range Value

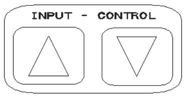


The operator is here offered the opportunity to introduce a full - scale range for the analog signal output.

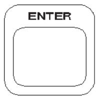
<u>Example:</u>

For an analyzer concentration range of 0 - 25 % it is desired to measure only concentrations in the range 0 - 15 %. If the operator enters here the value 15 %, the analog signal outputs of 10 (1) V / 20 mA will then correspond to a gas concentration of 15 %.
The displayed values are not affected.

Use the keys

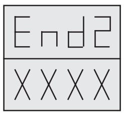


and

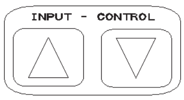


for the entry.

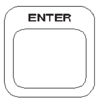
Entry possibility for channel 2



Use the keys



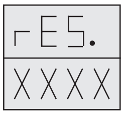
and



for the entry.

Note:
The **specifications of the analyzer** written in the data sheet are **only for OFS. = 0 and END = full - scale range set in our factory** !
It is part of customer to enter logical values for OFS. and END !

8.14 Reset



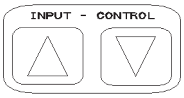
The reset operation restores the settings of the analyzer to the parameters and calibration factors set in our factory at the time of its manufacture.

This is equivalent to switching off the electrical supply line and switching off the battery buffering of the RAM's by removing the battery jumper, J7.

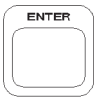
All parameters and calibration factors entered by the user will be lost whenever a reset operation is performed.

The currently valid user identification code must be entered before a reset will be executed; this will prevent inadvertent resets.

Entry is performed using



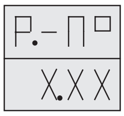
followed by



Whenever a reset operation is initiated, the analyzer operating program will be restarted, just as it is when the instrument is first switched on (see Section 6).

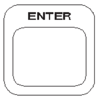
Jumper J6, which activates the watchdog circuitry must be inserted if the reset operation is to be correctly executed.

8.15 Program Version

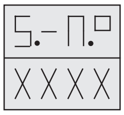


The Program Version (No. of the installed software - version) will be displayed.

Depress the key

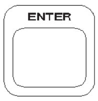


8.16 Serial - No.

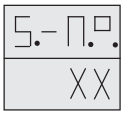


The Serial - No. will be displayed. (Please note this number for further contact with our factory-maintenace, service, etc.)

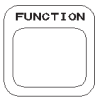
Depress the key



Continuation of Serial - No.

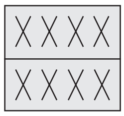


Depress the key



until

the displays show



The analyzer now is back in the analysis mode.

9. Calibration

To insure correct measurement results, zeroing and spanning should be carried out once a week. Spanning can be performed only after zeroing before.

For the calibration procedure the required test gases have to be fed to the analyzer through the respective gas inlets (cf. section 5.3) with a no - back - pressure gas flow rate of about 1 l/min (the same as with sample gas) !

After switching on the analyzer, wait at least approx. 15 to 50 minutes (depending on installed detectors) before admit gas to the analyzer !

Note !
For operation with optional, internal or external solenoid valves the solenoid valves are activated automatically by the respective function (via digital outputs). If the analyzer is in “calibration mode”, a digital status signal “calibration” can given optional (see Item 10.3).

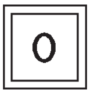
Zeroing
For zeroing, the analyzer has to be flushed with nitrogen (N_2) or adequate zerogas (e. g. synth. air or conditionned air).

Spanning
The span gas concentration should be in a range of 80 % - 110 % of full - scale range ! For lower span gas concentrations the measuring accuracy could be lower for sample gas concentrations, which are higher than the span gas concentration !
Spanning for oxygen measurement can be done using ambient air as span gas, if the oxygen concentration is known and constant.

When using span gas mixtures the entry for “C.Cal” must be set to “0” (see section 8.3)! If there is no built-in pressure sensor, the correct pressure must be entered before performing the calibration, if you want to have the possibility of pressure correction (see 8.1) !

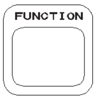
9.1 Manual Calibration

9.1.1 Zeroing

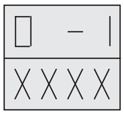


Zeroing will set the actually measured gas concentration to “zero”.

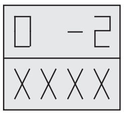
Depress the key



until the display shows

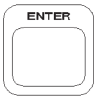


(Zeroing channel 1) or

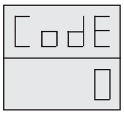


(Zeroing channel 2) resp.

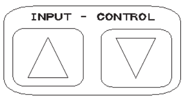
Depress the key



There will appear

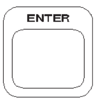


Use the keys

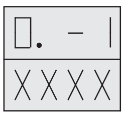


to select the correct **user - code**

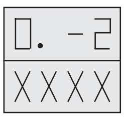
and enter using.



The displays will now show



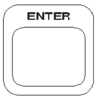
or

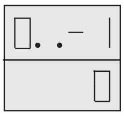


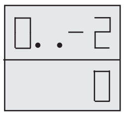
resp.

The **actual** zero - level will be displayed.

Wait at least the entered flushing - period and t_{90} - time.

Depress the key 

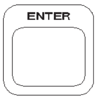
The **nominal value** 

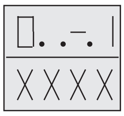
or 

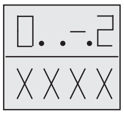
will be displayed.

If the actual and nominal zero - levels agree, the next function can then be selected using the **FUNCTION** - key (without zeroing).

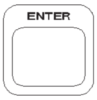
If the two values disagree, then

depress the key 

The actual measuring value 

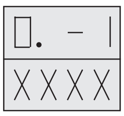
or 

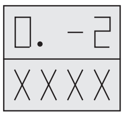
will be displayed

To start zeroing press 

again.

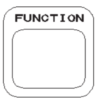
As soon as zeroing has finished, the display indicates

the **actual measuring value** 

or 

resp. will be displayed.

The keyboard will only be released after another flushing - period and t_{90} - time.
The analog signal outputs and the concentration limits are released too, if Hold = 1.

To leave "calibration mode" press 

9.1.2 Spanning

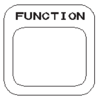
Verification of the span calibration is essential for accurate concentration measurement.

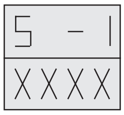
Spanning can be performed only after zeroing before.

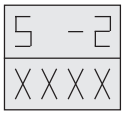
Spanning will set the actually measured gas concentration to the entered “span gas setpoint”.

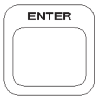
Note: The span gas concentration should be in a range of 80 % - 110 % of full - scale range !
For lower span gas concentrations the measuring accuracy could be lower for sample gas concentrations, which are higher than the span gas concentration !
Spanning for oxygen measurement can be done using ambient air as span gas, if the oxygen concentration is known and constant.

When using span gas mixtures the entry for “C.Cal” must be set to “0” (see section 8.3)!
If there is no built-in pressure sensor, the correct pressure must be entered before performing the calibration, if you want to have the possibility of pressure correction (see 8.1) !

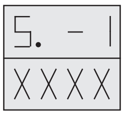
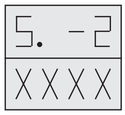
Depress the key 

until the display shows  (Spanning channel 1) or

 (Spanning channel 2) resp.

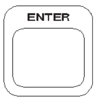
Depress the key 

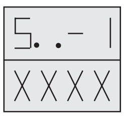
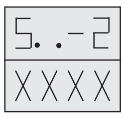
Enter the correct **user code**, if not already entered

The displays will now show  or  resp.

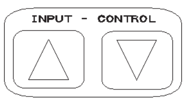
The **actual** concentration - level will be displayed.

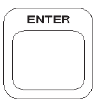
Wait at least the entered flushing - period and t_{90} - time.

Depress the key 

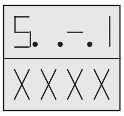
The **test gas setpoint**  or  resp. will be displayed.

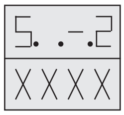
If necessary, enter the true test gas setpoint value (taken from the manufacturer's certification on the gas bottle)

using the key 

and 

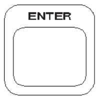
using.

The actual measuring value 

or 

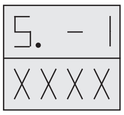
resp. will be displayed

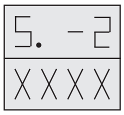
Leave calibration mode by pressing the **FUNCTION - key** (enter of nominal value without span calibration)

or press 

again to start spanning .

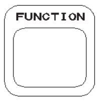
As soon as spanning has finished, the display indicates

the **actual** measuring value 

or 

resp. will be displayed.

The keyboard will only be released after another flushing - period and t_{90} - time.
The analog signal outputs and the concentration limits are released too, if Hold = 1.

To leave calibration mode press 

When using span gas mixtures the entry for “C.Cal” must be set to “0” (see section 8.3)! If there is no built-in pressure sensor, the correct pressure must be entered before performing the calibration, if you want to have the possibility of pressure correction (see 8.1) !

9.2 Automatic Calibration Mode (Option)

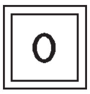
A time-controlled calibration only can be done with internal or separate external solenoid valves via digital outputs. The automatic function of the analyzer must also be activated correctly (cf. Section 8.5).

With this function, the analyzer can perform an automatic calibration at preset time intervals. The displays of the analyzer shows additional the functions **t - AO** and **t - AS** using the **FUNCTION** - key.

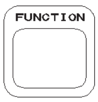
Note !
For a time-controlled calibration procedure, the test gases **must** be fed through "solenoid valves" controlled by the analyzer in order to ensure the supply of test gases in due course.

If the test gas concentration has changed, the correct setpoint is to enter first (see 9.1.2).

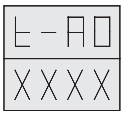
9.2.1 Zeroing



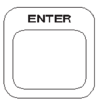
Depress the key



until the displays show

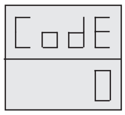


Depress the key

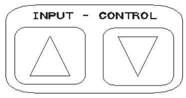


If the correct **user code** has not yet been entered,

the displays shows

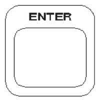


Use the keys

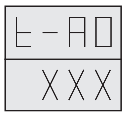


to select the correct **user - code**

and enter using.



It appears



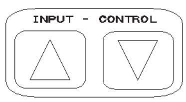
You can enter a time interval (hours), when an automatic zeroing has to be performed.

Point of reference is the real time of entry.

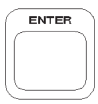
Range of accepted entries: **0 - 399** (hours)

Note !
If the entry is "0" (zero)**, the time - controlled calibration is switched off.**

Entry is performed using

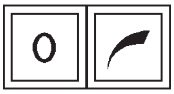


followed by



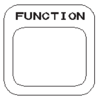
After entry of interval, zeroing will be done automatically at the end of the entered time interval.

9.2.2 Combined Zeroing and Spanning

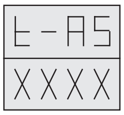


With this function a span calibration will be performed after completion of zeroing.

Depress the key

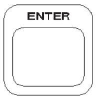


until the message



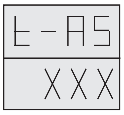
appears

Depress the key



Enter the correct **user code**, if not already entered

The displays will now show



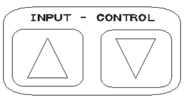
You can enter a time interval (hours), when a automatic zeroing and after that a spanning has to be performed.

Point of reference is the real time of entry.

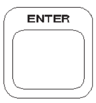
Range of accepted entries: **0 - 399** (hours)

Note !
If the entry is "0" (zero)**, the time - controlled calibration is switched off.**

Entry is performed using



followed by



After entry of interval, calibration will be done automatically at the end of the entered time interval.

10. Digital Outputs

All analyzer standard digital outputs are brought out to plug X 3 on the rear panel.
The loading of the outputs ("Open Collector") is max. 30 V DC / 30 mA.

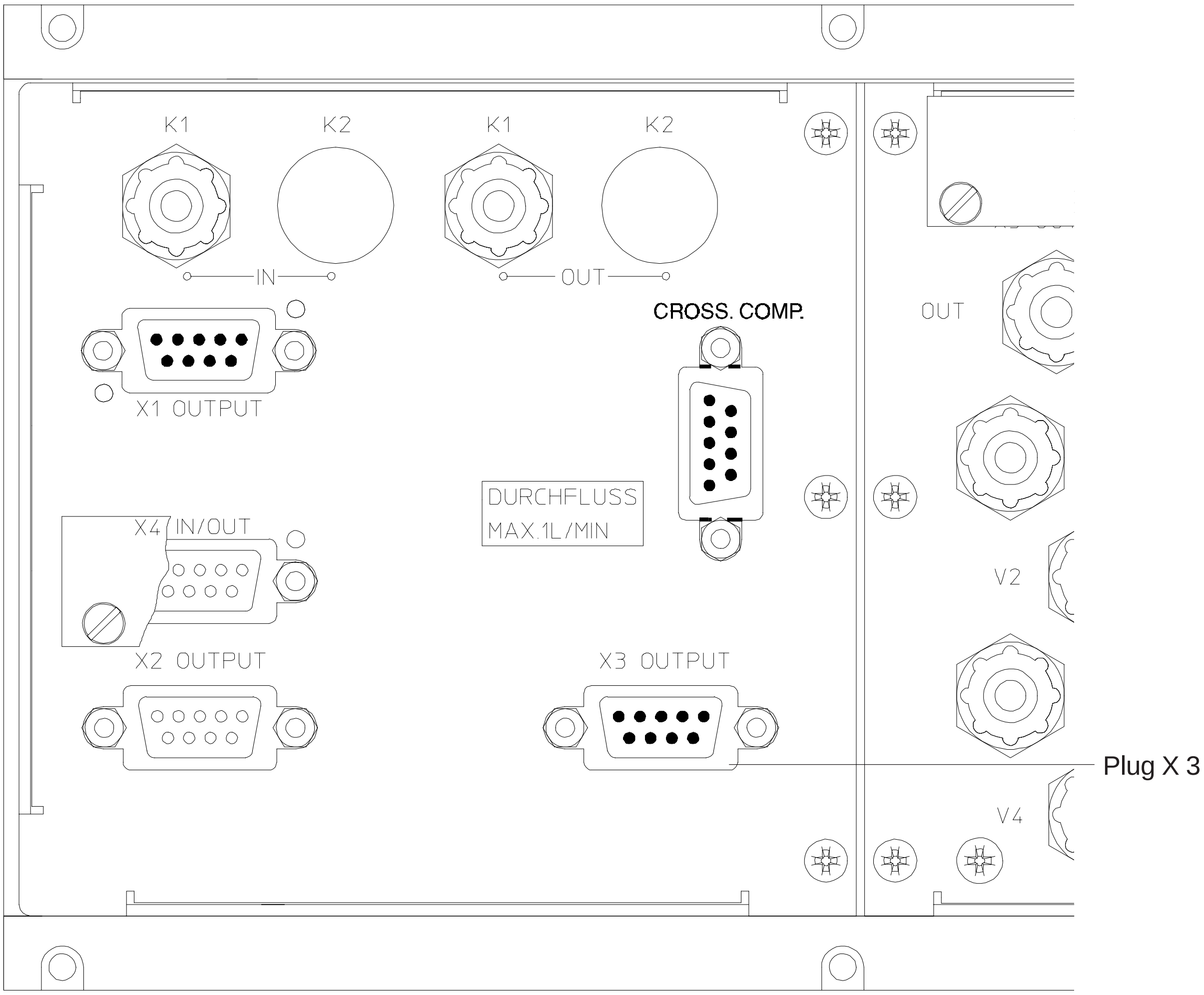


Fig. 10-1: Plug X 3 (Digital Outputs)

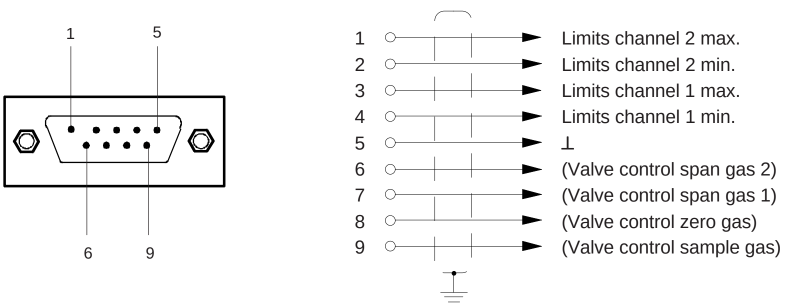
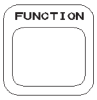
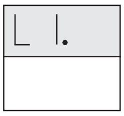


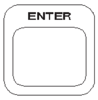
Fig. 10-2: Pin - Assignments X 3 (Digital Outputs)

10.1 Concentration Limits

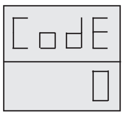
It may be assigned one upper and one lower concentration limit for each channel, freely selectable by the operator within the available concentration range.
The rightmost decimal of the related display will start to blink whenever a limiting concentration value is reached.
Additional digital signal outputs for the concentration limits are brought out to plug X 3 on the rear panel.("Open Collector", max. 30 V DC / 30 mA).

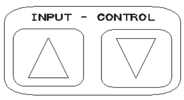
Depress the key  until the text

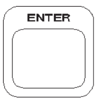
 appears.

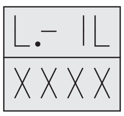
Depress the key 

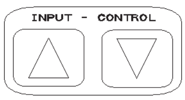
If the correct **user code** has not yet been entered,

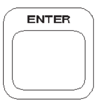
the message  will appear.

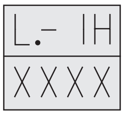
Depress the keys  to select the correct **user code**,

enter with the  key.

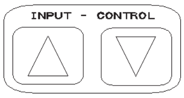
The displays will now show  **lower limit channel 1**

Use the keys  to set the limiting value.

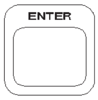
Depress the key  to enter the value.

There will then appear 

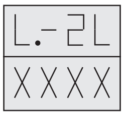
upper limit channel 1

Use the keys 

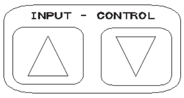
to set the limiting value.

Depress the key 

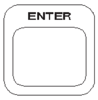
to enter the value.

The displays will now show 

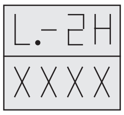
lower limit channel 2

Use the keys 

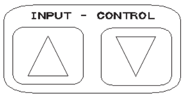
to set the limiting value.

Depress the key 

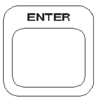
to enter the value.

There will then appear 

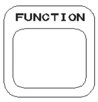
upper limit channel 2

Use the keys 

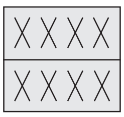
to set the limiting value.

Depress the key 

to enter the value.

Depress the key 

until

the displays show 

The analyzer is now back in the analysis display.

10.2 Valve Control

The valve control for operation with optional <u>external</u> solenoid valves will be done via plug X 3 on the rear panel, too (see Fig. 10-1 and 10-2).

10.3 Status Signals (Option)

The analyzer has been optionally equipped with two status signal outputs. These are fed to the 9-pin subminiature D-plug X 1 on the rear panel of the analyzer (see Item 9. and 13., too). These signals are non-voltage-carrying contacts with a maximal loading of 30 V / 1 A / 30 W !

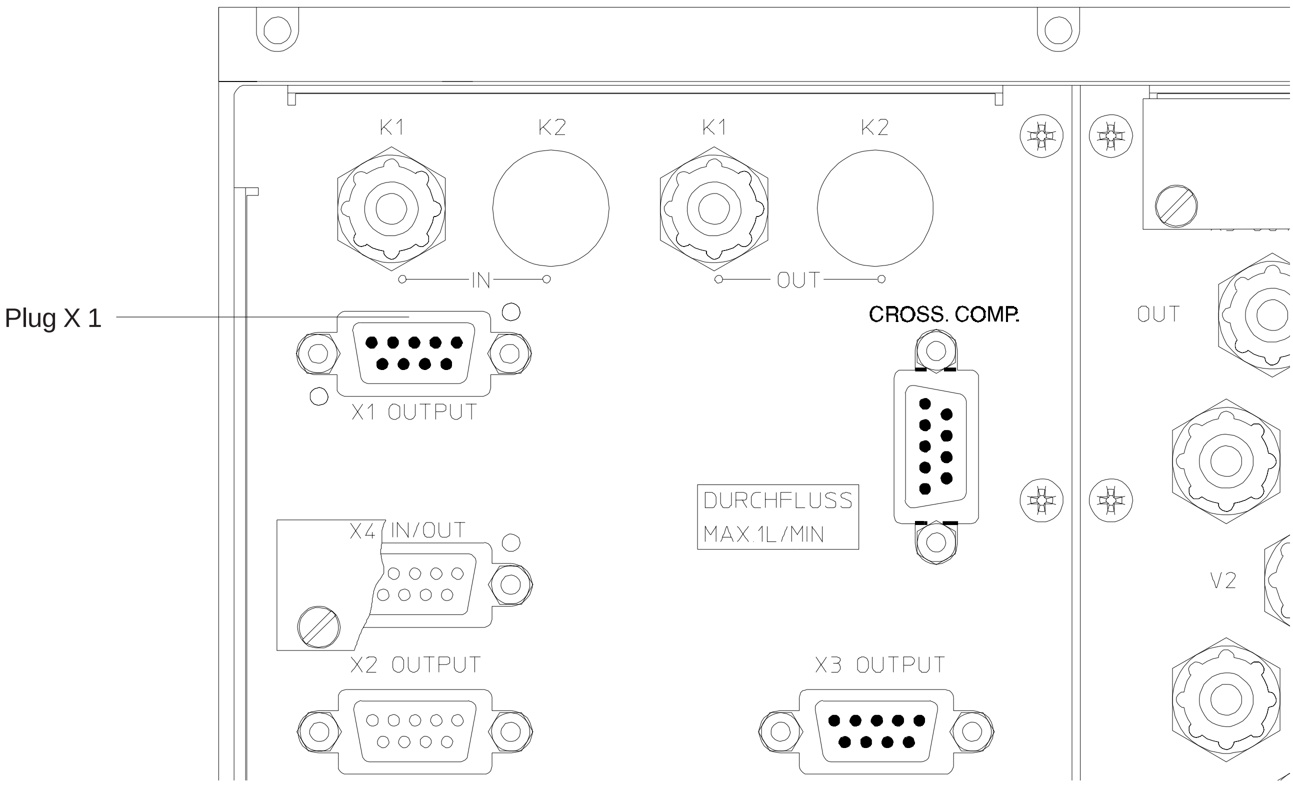


Fig. 10-3: Plug X 1 (Status Signals)

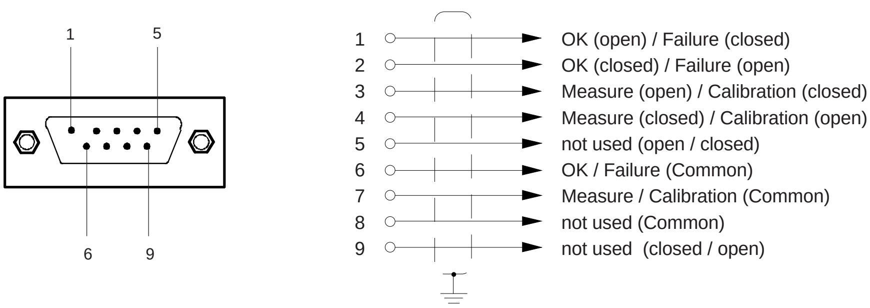
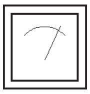


Fig. 10-4: Pin - Assignments X 1 (Status Signals)

11. Measurement / Switching Off

11.1 Measurement

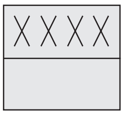


The primary step in the measurement of the concentration of a gas component is the admission of sample gas to the analyzer.

! Analyzer warming-up after switching on takes about 15 to 50 minutes, depending on the installed detectors !

- ❍ Admit sample gas at the gas inlet fitting (section 5.3).
- ❍ Switching on optional sample gas pump (press “PUMP” key).
- ❍ Set the gas flow rate (with optional needle valve) to allowable rate.

The analyzer must be in the “analysis mode”, i. e. the displays must show



Note !
If some other mode has been selected, the analyzer will automatically return to the analysis display when a period of 60 - 120 seconds has elapsed after the last key actuation or after the last completion of an operation !
The analyzer will remain at analysis display, until some other mode has been selected.

Note for analyzers with electrochemical O_2-cell!
Depending on measuring principle the electrochemical O_2-cell needs a minimum internal consumption of oxygen. Admit cells continuously with sample gas of low grade oxygen concentration or with oxygenfree sample gas could result a reversible detuning of O_2-sensitivity. The output signal will become instabil.
For correct measurement the cells have to admit with a O_2 concentration of at least 2 Vol.-%.
We recommend to use the cells in intervall measurement (purge cells with conditioned ambient air at measurement breaks).
If it is necessary to interrupt oxygen supply for several hours or days, the cell have to regenerate (admit cell for about one day with ambient air). Temporary flushing with nitrogen (N_2) for less than 1 h (e.g. analyzer zeroing) will have no influence to measuring value.

11.2 Switching Off

Before switching off the analyzer, we recommend first purging all the gas lines for about 5 minutes with zeroing gas (N_2) or adequate conditioned air. The full procedure for shutting down is as follows:

! For analyzers with electrochemical O_2-cellpurge all gas lines of analyzer with conditioned ambient air first before closing the gas line fittings for transport or depositing the analyzer.

- ❍ Admit zeroing gas at the respective gas inlet fitting.
- ❍ Switching on optional sample gas pump (press “PUMP” key).
- ❍ Set the gas flow rate (with optional needle valve) to allowable rate.

After 5 minutes have elapsed:

- ❍ Switch Off by disconnecting the voltage supply.
- ❍ Shut Off the gas supply.
- ❍ Close all gas line fittings immediately.

12. Serial Interface (Option)

12.1 Retrofitting of Serial Interface / Status Signals

(status signals only:	PCB BSI 10, Catalog - No.: 43 001 590,
RS 232 - Interface:	PCB BSI 10 with PCB SIF 232, Catalog - No.: CH 000 069
RS 485 - Interface:	PCB BSI 10 with PCB SIF 485, Catalog - No.: CH 000 070, see Item 12.3.2, too)

! Be sure to observe the safety measures !

- ❍ Opening the housing (see 21.)
- ❍ Connect circuit board to the threated bolts at the rear panel and mounting with the washers and the screws.
- ❍ Connect cable subject to code pin to BKS - pin connector **J9** .

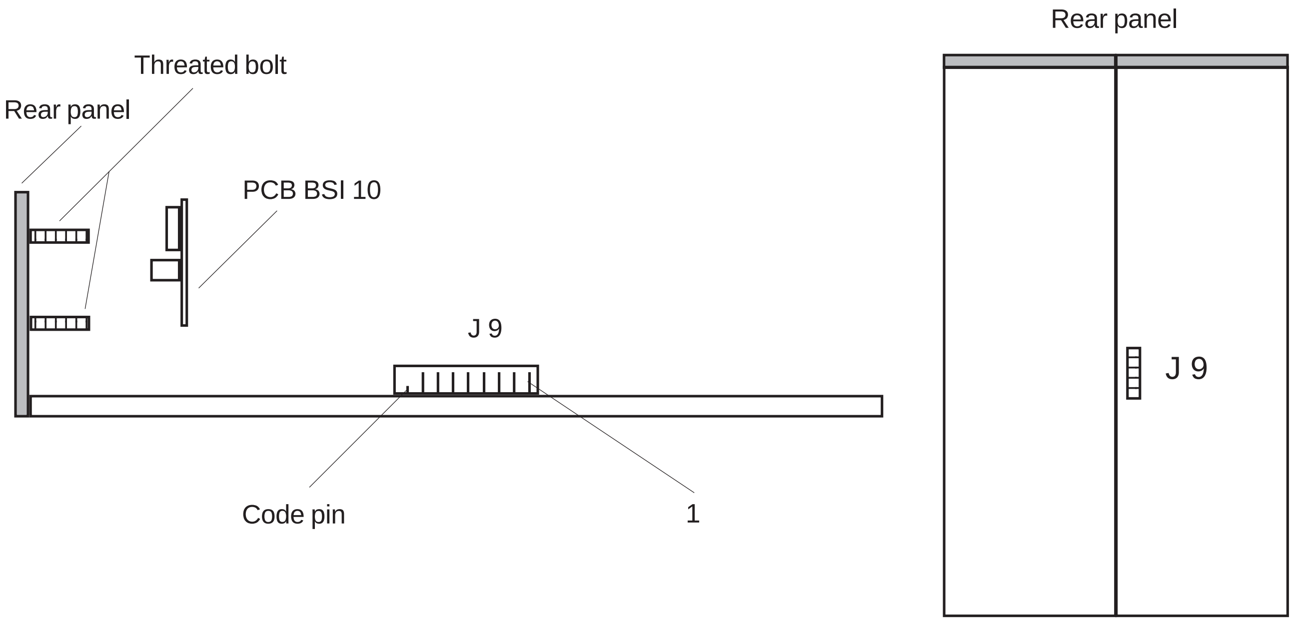


Fig. 12-1: Installation of PCB BSI 10

- ❍ For retrofitting serial interface insert enclosed EPROM (see Item 25.).

12.2 General

The analyzer is equipped with a serial interface enabling communications with a host computer. The host computer can call up, prescribe, or alter parameters, as well as initiate analyzer operations, using standardized protocols. The optional BSI 10 plug in circuit board constitutes the hardware interface. This may be configured as RS 232 C or RS 485 interface. The RS 485 interface permits networking several analyzers. Each analyzer may then be addressed using an assignment numerical ID - code.

Communications are always initiated by the host computer; i.e., analyzer behave passively until the host computer requests information from them or demands commencement of an action.

Communications use so - called “telegrams” being exchanged between the host computer and the analyzer(s). Syntax for these telegrams is established in protocols.

Telegrams always commence with the **"$" start character**, immediately followed by a three - digit instruction code.

Subsequent elements of telegrams are segregated by the **";" hyphen character**.

The final element of all telegrams transmitted must be the “CR” termination character.

Upon receipt of the terminate character, the analyzer attempts to evaluate the current contents of its input buffer as a valid telegram. If the syntax of the transmitted telegram is correct, the analyzer will transmit a response telegram to the host computer. This consists of the start character, an instruction code, requested data, a block - parity byte, and the termination character.

If the syntax of the transmitted telegram was not correct, the analyzer will transmit a status telegram containing an error message to the host computer. Each terminate character reception thus initiates an analyzer response.

To avoid detecting transmission errors, the host computer can insert a message -length parity byte immediately preceding the terminate character for verification by the analyzer.

The analyzer invariably transmits message - length parity bytes immediately preceding termination characters.

The elapsed time between the reception of start characters and termination characters is not limited by the analyzer; i.e., there are no “time - out” periods.

If the host computer transmits any new characters before the analyzer has responded to the preceding telegram, the analyzer’s input buffer will reject them; i.e., these characters will be ignored by the analyzer.

The **transmission rate** may be set between **600** and **4.800 baud**.
An **echo - mode** may also be activated.

The analyzer software is configured such as that telegrams may be sent to the host computer at time intervals of 150 ms and greater.

12.3 Start Up

The analyzer has been set in our factory to RS 232 C or RS 485 interface via the plugged PCB SIF 232 or SIF 485 on the PCB BSI 10.
The parameter 232c has also been set to 0 = NO or 1 = YES in the SIP (Serial Interface Parameters) line.

Interconnection to the interface is via the 9 - pin socket „Interface“ on the analyzer rear panel (Fig. 12-2).

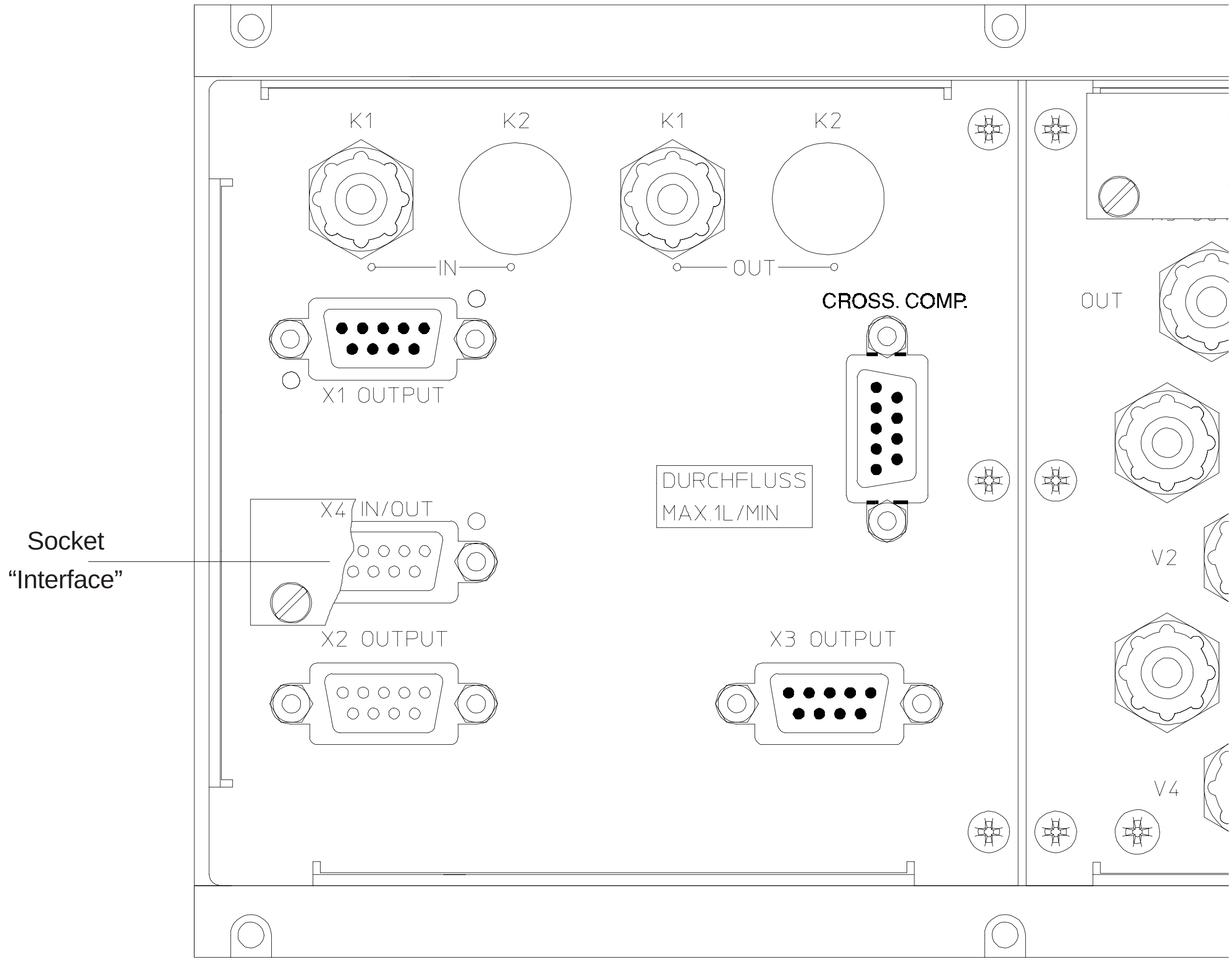


Fig. 12-2: Socket “Interface” (Serial Interface)

12.3.1 RS 232 C

This interface requires a shielded cable having at least three internal conductors.

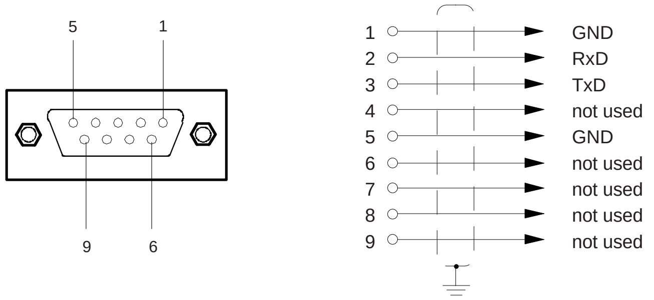


Fig. 12-3: Pin - Assignments "RS 232 Interface"

12.3.2 RS 485

Configure 2- or 4-wire operation via solder bridge LB 1 of PCB SIF 485 before mounting the PCB. Connecting of [1 - 2] 2-wire-operation is selcted. Connecting of [2 - 3] 4-wire-operation is active. Connect Jumper P2 at both ends of interface connection (termination). For network operation with several analyzers via RS485 interface, termination has to be done at both ends of network connection only. For the other analyzers remove the Jumper.

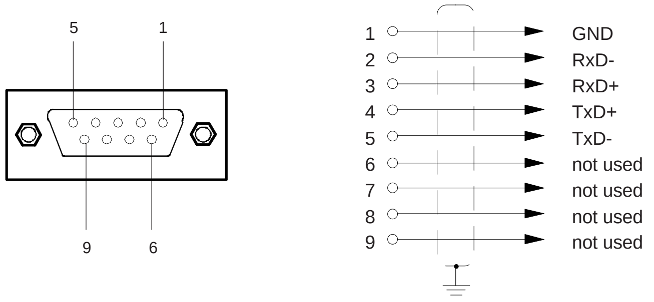


Fig. 12-4: Pin - Assignments "RS 485 Interface"

In contrast to RS 232 C operation, simultaneous transmission and reception is not implemented in this standard. This would not result in damage to the electronics, but could lead to destroy of data. The analyzer behaves passively in this mode of operation; i.e., it keeps its transceiver set for reception whenever it is not transmitting. Since the time periods for transmission and reception are controlled by protocols, "data collisions" are excluded.

12.3.3 Switching ON/OFF Interface Operation

The analyzer may be set to either **"on - line"** or **"off - line"** status. This setting may be performed either from the keypad or via telegram input.

Keyboard setting:

SIP - parameter On.-L. = 1 for on - line status
SIP - parameter On.-L. = 0 for off - line status

Telegram setting:

Instruction code 6: sets analyzer on - line status
Instruction code 7: sets analyzer off - line status

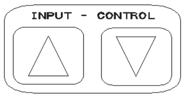
If the analyzer is set to **off - line** status, it will accept only instruction code 6. All other instructions will be ignored and result in transmission of appropriate status telegrams.

12.3.4 Setting Interface Parameters

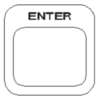
Agreement of interface parameters between analyzer and host computer is a fundamental requirement for communication without errors.
The following analyzer parameters are concerned:

- ❑ baud rate: 600 / 1.200 / 2.400 / 4.800 bits/s
- ❑ data bits: 8
- ❑ stop bits: 2
- ❑ parity bit: none
- ❑ echo mode: on / off (received characters will be retransmitted immediately)
- ❑ LPB-test: on / off (message - length parity check)
- ❑ ID-no.: 0 to 99 (device ID - no. in RS 485 mode)

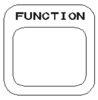
All entries are made using the keys



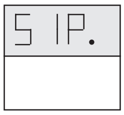
and



Depress the key

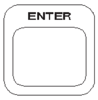


until

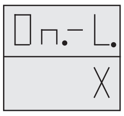


appears,

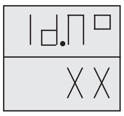
then depress the key



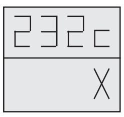
The unit is now ready for **code** entry, if such has not already been performed.



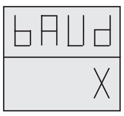
0 = off - line status
1 = on - line status



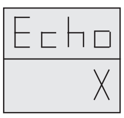
Each device is assigned a device number for operation through the RS 485 interface (0 - 99).



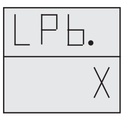
Select interface type:
0 = RS 485   1 = RS 232 C



Set baud rate:
0 = 4.800   1 = 2.400
2 = 1.200   3 = 600



Echo-mode operation:
0 = OFF   1 = ON



Message - block parity check
0 = OFF   1 = ON

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12.4 Telegram Syntax

Telegrams are assembled as follows:

12.4.1 Start Character (“$” = Hex 24)

If the start character is missing, this will result in transmission of an appropriate status telegram by the analyzer.

12.4.2 Terminate Character (“CR” = Hex OD)

If the terminate character is missing, no decoding of the transmitted information will be performed, and the analyzer will not respond. No response message will be transmitted.

12.4.3 Instruction Code

Each instruction is assigned a unique three digit numerical instruction code. If a received instruction code should be other than three - digits in length or contain non - numerical ASCII-characters, the analyzer will transmit an appropriate status telegram. Reception of unassigned instruction codes will also result in the transmittal of a status telegram.

In the RS 232 C mode of operation, the instruction code immediately follows the start character; in the RS 485 mode of operation, the start character is followed by a two - digit device identification code, the separator character. “;”, and a three - digit instruction code, in this order.

12.4.4 Hyphen Character (“;” = Hex 3B)

Individual elements of a telegram line are separated by this hyphen character. Missing hyphen characters can lead to misinterpretations of telegrams, and will result in transmission of an appropriate status telegram.

12.4.5 Status Telegram

If telegram syntax is faulty, or analyzer is unable to act upon an instruction received, then the analyzer will transmit a status telegram to the host computer.

These status telegrams are listed here for reference:

$ID;000;S100;LPB<CR>	unrecognized instruction code
$ID;000;S101;LPB<CR>	LP - byte in error
$ID;000;S102;LPB<CR>	start character missing
$ID;000;S103;LPB<CR>	input buffer overflow
$ID;xxx;S104;LPB<CR>	analyzer off - line status
$ID;xxx;S105;LPB<CR>	text line too long
$ID;xxx;S106;LPB<CR>	undefined instruction
$ID;xxx;S107;LPB<CR>	invalid integer value
$ID;xxx;S108;LPB<CR>	numerical value outside defined range
$ID;xxx;S109;LPB<CR>	invalid failure/status code
$ID;xxx;S110;LPB<CR>	instruction can not be done here
$ID;xxx;S111;LPB<CR>	failure in transmitted character
$ID;xxx;S112;LPB<CR>	zeroing running
$ID;xxx;S113;LPB<CR>	spanning running
$ID;xxx;S114;LPB<CR>	invalid real number
$ID;xxx;S115;LPB<CR>	automatic calibration mode off
$ID;xxx;S116;LPB<CR>	parameter outside defined range
$ID;xxx;S117;LPB<CR>	preflushing period is running

xxx:	instruction code
ID:	device ID - no. in RS 485 mode
LPB:	message - length parity byte
<CR>:	terminate character

12.4.6 Numerical Representations

Telegrams may contain integers or real numbers. The formats for these numbers are subject to the following restrictions.

Integers:
- maximum value = 2^{16} - 1
- positive numbers only accepted
- no decimal points allowed

Real:
- maximum of 6 digits accepted
- no alphabetic characters (e.g. 2.2E-6) allowed
- analyzer output is 6 - digit real numbers

12.4.7 Block Parity Check

The master control computer may insert a message - length parity byte into telegrams. These invariably consist of two characters.

The message - length parity byte is the cumulatively EXCLUSIVE - OR correlation of all previously transmitted characters of the telegram line. Representation is in hexadecimal format. For example, if the decimal value should be decimal 13, this will be represented by the two characters “OD”, i.e., 030H and 044H.

The verification procedure may be enabled or disabled at the analyzer (see Section 12.3.4).

12.5 Instruction Syntax

Code definitions:

RP:	receive parameters	analyzer is accepting values
SP:	send parameters	analyzer is sending values
RI:	receive instructions	
k:	channel numbers 0 to 1	
m:	range number (for BINOS® 100 2M is invariably 1)	
w:	value	
<ID>:	analyzer ID - no. for RS 485 mode of operation; follows start character	
LPB:	message - length parity byte	
<CR>:	terminate character	

Receipt of any instruction codes not listed in the following section will be acknowledged by transmittal of status code 106. Future expansions will make use of code numbers not currently in use.

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12.5.1 Instruction Listing

Instruction syntax:	Instruction description:
$ID;001;k;LPB<CR>	RI stand-by status
$ID;002;k;LPB<CR>	RI sample gas valve open
$ID;003;k;LPB<CR>	RI zeroing gas valve open
$ID;005;m;k;LPB<CR>	RI span gas valve open
$ID;006;LPB<CR>	RI on - line status
$ID;007;LPB<CR>	RI off - line status
$ID;011;m;k;LPB<CR>	SP at full scale range
$ID;013;k;LPB<CR>	SP t_{90} (response time)
$ID;014;w;k;LPB<CR>	RP t_{90} (response time)
$ID;017;k;LPB<CR>	SP preflushing period
$ID;018;w;k;LPB<CR>	RP preflushing period
$ID;019;k;LPB<CR>	SP preflushing period
$ID;020;w;k;LPB<CR>	RP preflushing period
$ID;023;k;LPB<CR>	SP concentration
$ID;028;m;k;LPB<CR>	SP span gas concentration
$ID;029;w;m;k;LPB<CR>	RP span gas concentration
$ID;030;LPB<CR>	SP status messages
$ID;031;t;LPB<CR>	SP serial number (t=0, max. 10 characters) channel identification (t=1: ch.1, t=2: ch. 2)
$ID;603;k;LPB<CR>	SP gas component
$ID;604;k;LPB<CR>	RI automatic zeroing
$ID;605;k;LPB<CR>	RI automatic spanning
$ID;606;0;LPB<CR>	RI automatic zeroing & spanning
$ID;627;LPB<CR>	SP failure message (possible error **batt**. is clearing by read out)
$ID;645;0;LPB<CR>	SP pressure value
$ID;646;w;LPB<CR>	SP solenoid valve status (w=1: samplegas valve, w=2: zerogas valve, w=4: spangas 1, w=8: spangas 2)

12.5.2 Response Telegrams

Response telegrams follow with the same syntax as the appropiate (SP-) commands (see 12.5).

The response telegram for instruction

"$ID;030;LPB<CR> SP Status messages"

shows as follows:

$ID;030;a;b;c;LPB<CR>

This means:

a: OK-Status — 0 = Relay without power — 1 = Relay active

b: Value of variable "calibration" — 0 = Relay without power — >0 = Relay active

b	Meaning
0	No Calibration
1	Zeroing channel 1
2	Zeroing channel 2
3	Zeroing channel 1 + 2
4	Spanning channel 1
5	Spanning channel 2
6	Spanning channel 1 + 2
7	Spanning channel 1 first, then channel 2
8	reserved
9	reserved
10	Waiting for flushing time and t_{90} response time

c: Relay 3 — 0 = Relay without power — 1 = Relay active

13. Error List

Some of the failures which may arise during measurement will be reported on the displays in forms of error codes.

When such a failure arises, the display's will show the concentration value

alternating with E. XX (E = ERROR).

Note !
If there is an "error message", a digital status signal "Failure" can be given optional (see Item 10.3)!

Be sure to observe the safety measures for all workings at the analyzer!

Error Code	Possible Reasons	Check / Correct
No Display	1. Displays are "switched OFF"	1. Press any key. Check parameter dOFF (see 8.7).
	2. Voltage supply absent.	2. Check electrical supply (see Fig. A-2, Item 3).
	3. Connection front panel /BKS absent.	3. Check connection BKB - BKS (X1) (see 15.1).

Error Code	Possible Reasons	Check / Correct
Flushing bAtt	Battery buffer faulty. The EPROM - default values were charged.	Check, if Jumper J 7 is plugged (see 16.). Exchange battery, if battery voltage < 3,5 V (BKS - Jumper J7 plugged). The error is clearing after depressing any key or with serial interface instruction $627.
E. 11 Channel 1 E. 12 Channel 2 A/D-Conversion-End-Signal absent	1. Jumper not or incorrect plugged. 2. Positive or negative reference voltage absent. 3. Light barrier signal absent. 4. IR-channel: Chopper drive inoperative 4. Supply voltage (internal 6 V DC) absent.	1. Channel 1: Check Jumper J1 Channel 2: Check Jumper J2 (see 16.) Switch analyzer off and then on again. 2. Check reference voltage (see 14.1.2/14.1.3). 3. Check connection X9 / light barrier (see 15.) Check measuring point 14.1.6 4. Check connection X2 / chopper drive (see 15.) Check measuring point 14.1.4 4. Check measuring point 14.1.1
E. 14 Temperature compensation inoperative	1. Start-up of A/D-conversion in temperature channel absent. 2. Supply voltage (internal 6 V DC) absent.	1. Switch analyzer off and then on again. 2. Check measuring point 14.1.1

Error Code	Possible Reasons	Check / Correct
E. 16 Channel 1 E. 18 Channel 2 Tolerance error Zero-gas value deviates more than 10% of measuring range from zero.	1. Incorrect zero gas in use. 2. IR-channel: Photometer section contaminated. 3. Analyzer not calibrated.	1. Check zero gas in use. 2. Check analysis cell and windows for contamination. Cleaning of contaminated parts (see 22.3). 3. Switch off the tolerance check before starting an adjustment (see 8.6).
E. 17 Channel 1 E. 19 Channel 2 Tolerance error Span-gas value deviates more than 10% from nominal value.	1. Incorrect nominal value. 2. Incorrect span gas in use. 3. IR-channel: Photometer section contaminated. 4. Analyzer not calibrated.	1. Enter the correct nominal value (certification of span gas bottle) (see 9.1.2). 2. Check span gas in use. Use another or a new gas bottle. Enter the correct nominal value 3. Check analysis cell and windows for contamination. Cleaning of contaminated parts (see 22.3). 4. Switch off the tolerance check before starting an adjustment (see 8.6).
E. 20 Channel 1 E. 21 Channel 2 Measuring value more than 10% over full-scale range.	1. Concentration of measuring gas too high.	1. Check concentration of measuring gas. Use another analyzer suitable for the concentration-range involved.

Error Code	Possible Reasons	Check / Correct
E. 22		
E. 27	Time - out for XON of serial interface.	At drive of serial interface XON - character is absent (Time - out > 60 s).
E. 37 Pressure sensor defective	1. Measuring range failure. 2. Connection faulty. 3. Pressure sensor faulty.	1. pressure not into the sensor measuring range (800 - 1100 hPa). 2. Check connection P1 (at BAF 01) / pressure sensor (see 15.). 3. Exchange pressure sensor.
E. 38 EPROM Checksummary defective	1. EPROM faulty. 2. BKS faulty.	1. Exchange EPROM (see 25.). 2. Exchange BKS.
E. 39 Test for RAM - IC's defective	RAM - IC's / BKS faulty.	Exchange BKS.
Analog output absent	BKS faulty.	Exchange BKS.
Fluctuating or erroneous display	1. Leakage into gas circuit. 2. Ambient air contains gas constituent to be measured in excessive concentration.	1. Perform a leakage check. (see 20.). 2. Replace absorber material for the light sources and chopper housing. Use sealed photometer (Option). Flush out the analyzer.

Error Code	Possible Reasons	Check / Correct
Fluctuating or erroneous display	3. Gas pressure subject to excessive fluctuations.	3. Check the gas lines preceding and following the sensor cell. Eliminate any restrictions found beyond the gas outlet fitting. Reduce pumping rate or flow rate.
	4. Oxygen senor / detector not connected.	4. Check connections: BKS X5 / Oxygen sensor (detector channel 1) BKS X6 / detector channel 1 (channel 2) (see 15.).
	5. Electrochemical oxygen sensor is already consumed.	5. Exchange sensor (see 23.)
	6. IR-channel: Light source not connected or faulty.	6. Checkconnection: BKS X3(1/2) / light source channel 1 BKS X3(4/5) / light source channel 2 (see 15.) Light source is cold: For dual-IR-channel analyzer interchange the two light-sources. Replace the suspect light source (see 23.2).
	7. Faulty analog preamplifiering.	7. Check measuring point 14.1.7 or 14.2.1 resp.
	8. Contamination of the gas paths.	8. Check analysis cell and windows for contamination. Cleaning of contaminated parts (see 22.3). Check gas paths and gas conditionning to contamination.

Error Code	Possible Reasons	Check / Correct
Fluctuating or erroneous display	9. Barometric pressure effects. 10. Temperature below the dew point in the gas paths. 11. Faulty A/D - converter.	9. Enter the correct value for barometric pressure (see 8.1). Pressure sensor faulty (E.37). 10. Check the temperature of the gas paths and eliminate any reason of condensation, Maintain all temperatures at values at least 10 °C above the dew point of sample gas. 11. Exchange BKS.
Response - time too long (t_{90} - time)	1. Incorrect response time (t_{90} - time). 2. Pumping rate inadequate. 3. Contamination of the gas paths.	1. Check the value for t_{90} - time (see 8.11). 2. The feeder line between the sampling point and the analyzer is too long. Use a larger, external pump; consider adding a bypass line to the process stream for sampling purposes (see 5.1). 3. Check gas paths and gas conditionning to contamination. Clean gas paths and exchange the filter elements.

Error Code	Possible Reasons	Check / Correct
No gas flow	1. Needle valve is not opened (Option)	1. Open needle valve (Option, see Fig. A-1)
	2. Sample gas pump (Option) is not switched on	2. Press key PUMP
	3. Membrane of pump is defective	3. Exchange membrane of the pump.
	4. Sample gas pump is defective	4. Exchange sample gas pump
	5. Solenoid valves defective (Option)	5. Check the valve face of the solenoid valves and exchange if necessary. Exchange solenoid valves
	6. Contamination of the gas lines	6. Check gas lines including filters to contamination. Clean the gas lines and exchange the filter elements.

14. Measuring Points of BKS and OXS

Be sure to observe the safety measures !

14.1 Measuring points of BKS

All measuring points are measured against ground (X 11 / X 28 or X 29) !

14.1.1 Supply Voltage + 6 V

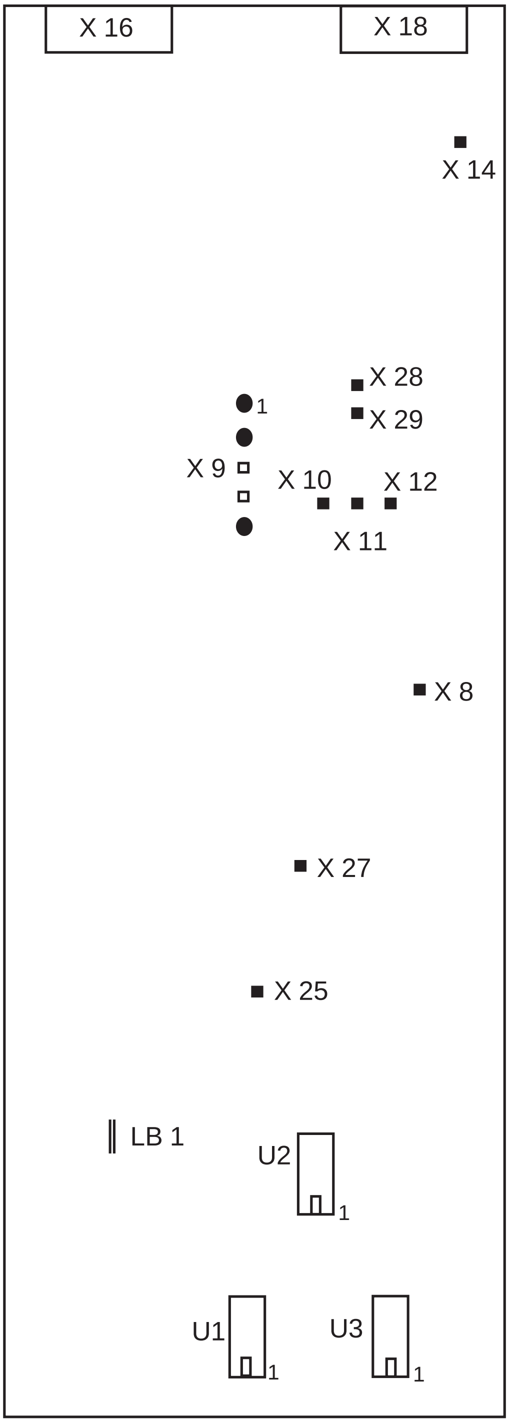
Measuring point: X 14
Measuring device: DVM
Signal: + 6 V DC (+10 / -200 mV)
(adjust with Potentiometer R 90, if necessary)

Failure: No signal

Possible reasons:
a) Voltage supply is absent.
b) Voltage supply < 9 V or polarity reversal
c) BKS faulty.

14.1.2 Reference Voltage positive

Measuring point: X 10
Measuring device: DVM
Signal: + 5,535 V DC (± 60 mV)



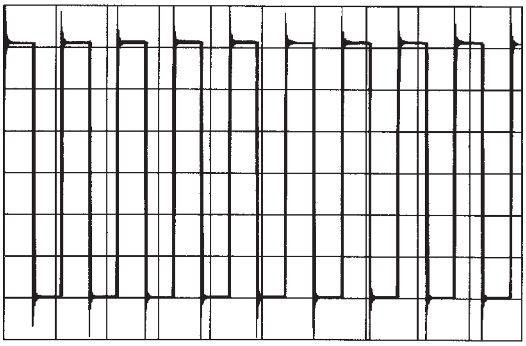
Front panel

14.1.3 Reference Voltage negative

Measuring point: X 12
Measuring device: DVM
Signal: inverse [reference voltage positive]

The difference between negative reference voltage and positive reference voltage must be no more than 10 mV ($U_{ref. pos.} + U_{ref. neg.} \leq \pm$ 10 mV) !
If the difference is bigger, exchange BKS.

14.1.4 Motor Drive (for IR channel only)



Measuring point: LB 1
Measuring device: Oscilloscope
Signal: square impuls U = 6 V_{SS} (± 0,3 V)
frequency = 1152 Hz (± 20 Hz)

Failure: No signal or incorrect frequency

Possible reasons: a) internal 6 V DC absent (see 14.1.1)
b) µP do not work:
1. Is the EPROM insert correctly ? (see 25)
2. Perform a RESET (see 8.14).
3. BKS faulty (exchange BKS).

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14.1.5 Temperature Sensor

Measuring point: X 8
Measuring device: DVM
Signal: approx. 0 ± 500 mV DC (at ambient temperature)

Failure. Signal > + 3,5 V DC

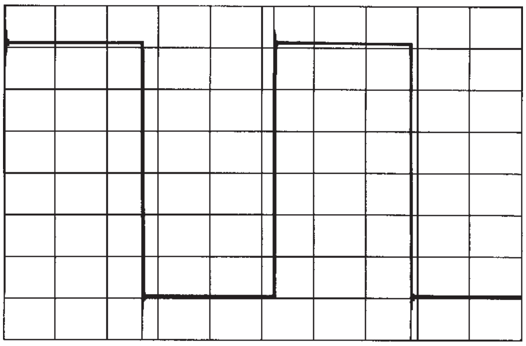
Possible reasons (IR measurement or paramagnetic oxygen measurement):

a) Temperature sensor not connected (see 15.1).
b) Temperature sensor faulty (exchange sensor).
c) Broken cable of temperature sensor (exchange sensor).
d) BKS faulty (exchange BKS).

Possible reasons (electrochemical oxygen measurement):

a) Temperature sensor not connected (see 15.2).
b) PCB OXS faulty (exchange OXS).
d) PCB BKS faulty (exchange BKS).

14.1.6 Light Barrier Signal



Measuring point: Plug 9, pin 2

Measuring device: Oscilloscope

Signal: square impulse U = 6 V_{SS} (± 0,3 V)
Frequency = 24 Hz (± 0,1 Hz)

Failure: No signal

Possible reasons (IR measurement):

a) Chopper not connected (see 15.1).
b) Chopper inoperative (switch analyzer off and then on again).
c) Light barrier not connected (see 15.1).
d) Broken cable of light barrier or faulty light barrier (exchange chopper).
e) BKS faulty (exchange BKS).

Possible reasons (oxygen measurement without IR channel):

a) Solder bridge LB 18 not closed.
b) BKS faulty (exchange BKS).

14.1.7 Analog Preamplifiering

a) paramagnetic oxygen measurement

Measuring point: X 25 channel 1

Measuring device: DVM

Signal: At zero gas purge: 0 V dc (± 50 mV)
At ambient air (approx. 21 Vol. - % O_2): 500 mV dc (± 50 mV)

Failure: No signal or incorrect measuring values.

Possible reasons:
a) oxygen sensor not connected (see 15.).
b) oxygen sensor faulty (exchange sensor).
c) BKS faulty (exchange BKS).

a) IR measurement

Measuring point: X 25 channel 1 (not for analyzer with oxygen measurement)
X 27 channel 2

Measuring device: DVM

Signal: At zero gas purge: 0 V dc (± 100 mV)

There should be a minimum difference of 600 mV (measuring ranges < 1000 ppm difference 500 mV) between zeropoint voltage and sensitivity voltage.

Failure: No signal or incorrect measuring values.

Possible reasons:
a) Detector not connected (see 15.).
b) Detector faulty (exchange detector).
c) BKS faulty (exchange BKS).

14.2 Measuring points of OXS (electrochemical oxygen measurement)

14.2.1 Sensor Signal

Measuring device: DVM

Measuring point: Tp 1 (Signal)
Tp 2 (⊥)

Signal: At ambient air (approx. 21 Vol. - % O_2): 700 mV to 1000 mV

Failure: No signal or faulty voltage

Possible reasons:

a) Oxygen sensor not connected to PCB "OXS"
b) PCB "OXS" not connected / faulty
c) Oxygen sensor faulty or consumed
d) BKS faulty

Note !

If the measuring value is lower than < 700 mV at gas flow with ambient air, the sensor is consumed. Exchange the sensor.

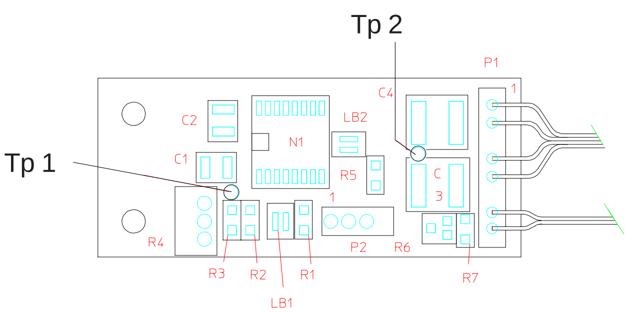


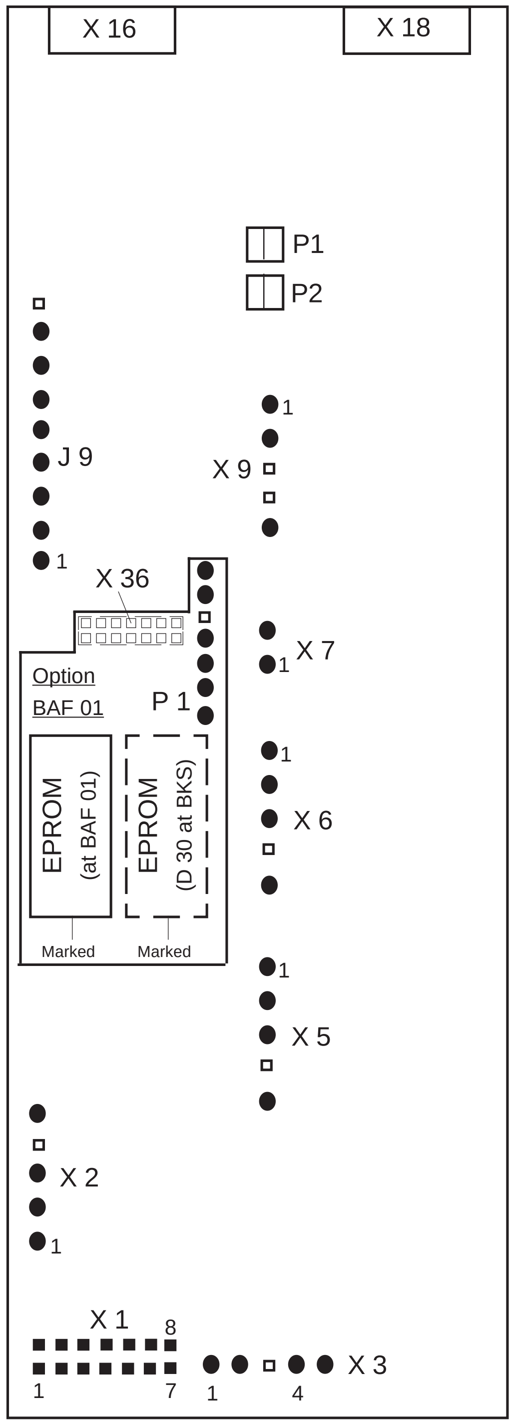
Fig. 14-1: PCB “OXS”, assembled, horizontal projection

15. Plug Pin Allocation of BKS and OXS

! Be sure to observe the safety measures !

15.1 Plug Pin Allocation of BKS

P 1 oder P2	24 VDC - supply to optional internal consumer (heater of paramagn. O_2 sensor e.g.)
X 1	Front panel BXF (P8)
X 16	Digital Outputs, parallel
X 18	Analog Outputs
J 9	Option BSI 10: Status signals and serial interface resp.
X 36/ D 30	Option BAF 01: Pressure sensor PCB
P 1	at Option BAF 01: Connector for pressure sensor



Front panel

15.1.1 IR - measurement without oxygen channel

X 2		Chopper
X 3	(4/5)	Light source channel 1
X 3	(1/2)	Light source channel 2
X 5		IR - detector (channel 1)
X 6		IR - detector (channel 2)
X 7		Temperature sensor (chopper)
X 9		Light barrier (chopper)

15.1.2 Oxygen Measurement without IR channel

X 5	Oxygen sensor [at electrochemical measurement: PCB OXS (cable P1, 5 - pin connector)]
X 7	Temperature sensor [at electrochemical measurement: PCB OXS (cable P1, 2 - pin connector)]

15.1.3 IR - / Oxygen Measurement combined

X 2		Chopper
X 3	(4/5)	Light source channel 2
X 5		Oxygen - Sensor
X 6		IR - detector (channel 2)
X 7		Temperature sensor (chopper)
X 9		Light barrier (chopper)

15.2 Plug Pin Allocation OXS (electrochemical oxygen measurement only)

Pin - base P2	Oxygen sensor
Cable P1, 5 - pin connector	PCB BKS, X 5 (sensor signal)
Cable P1, 2 - pin connector	PCB BKS, X 7 (temperature sensor) (not used for combination with IR measurement)

View A: PCB OXS assembled, horizontal projection

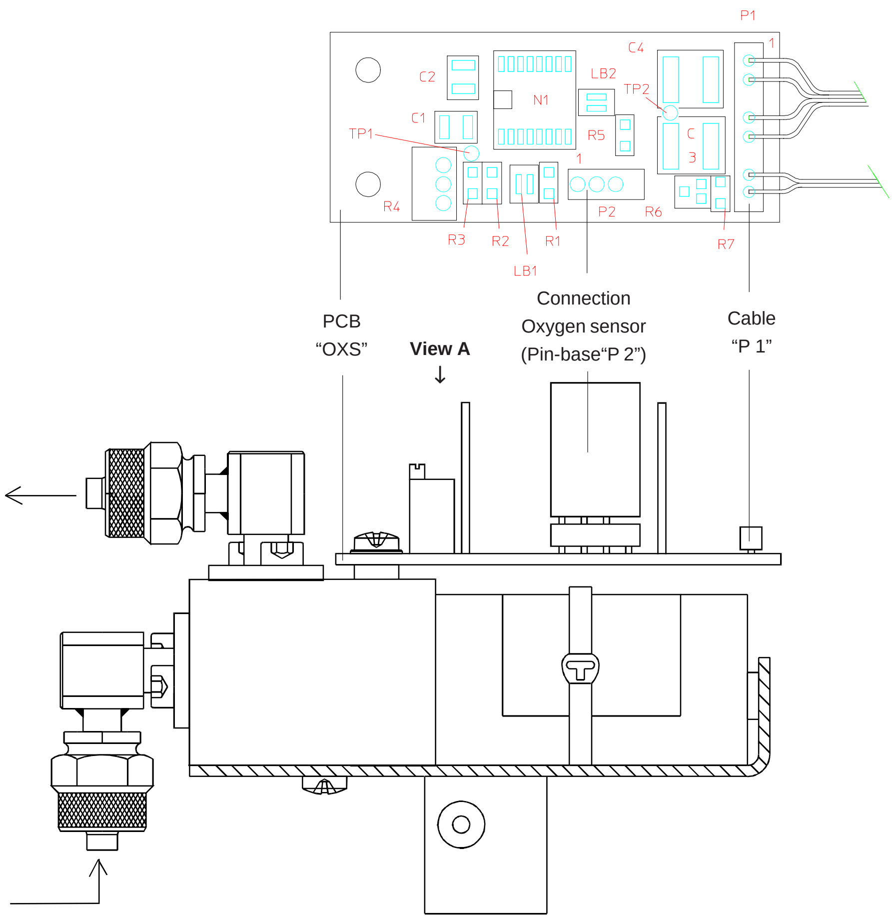


Fig. 15-1: PCB "OXS"

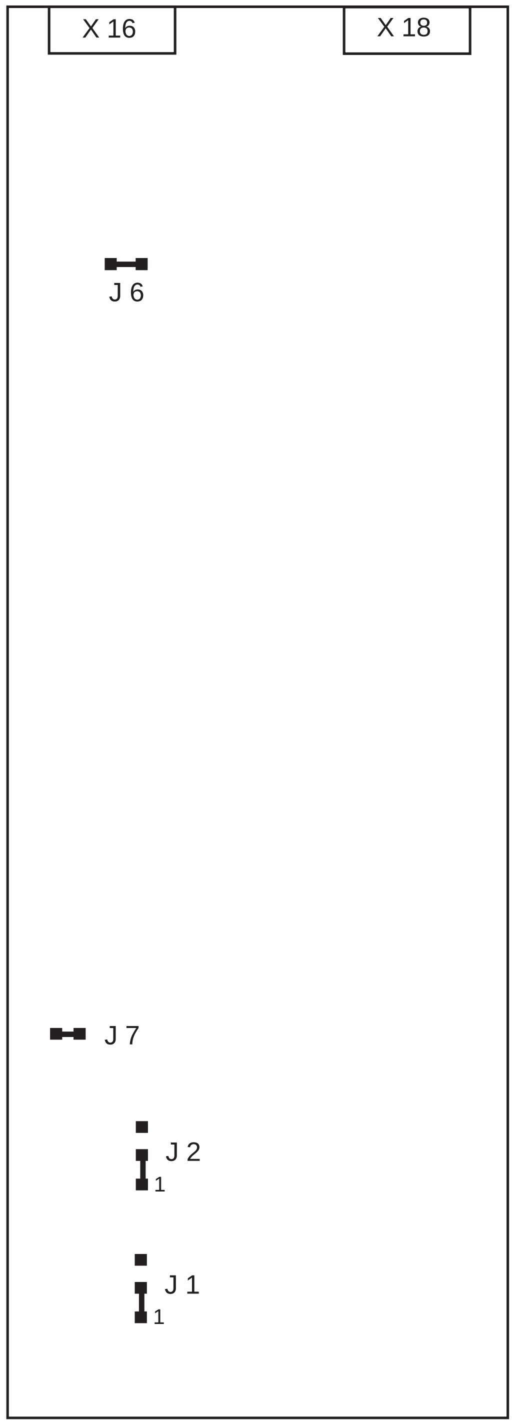
16. Jumper Allocation of BKS

J 1 A/D - Conversion - Start channel 1

J 2 A/D - Conversion- Start channel 2
(open for 1 - channel analyzer)

J 6 Watchdog signal

J 7 Buffer Battery

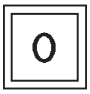


Frontplatte

Maintenance

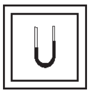
In general only the gas conditionning hardware will require maintenance; the analyzer itself requires very little maintenance.

The following checks are recommended for maintenance of the proper operation of the analyzer.



Check and adjust zero-level: weekly

Check and adjust span: weekly



Perform leak testing: 6 times annually.

The maintenance frequencies stated above are presented as guidelines only; maintenance operations may be required more or less frequently, depending upon usage and site conditions.

19. Fine Dust View Filter (Option)

The optional fine dust filter (see Fig. A-1) should be checked at intervals appropriate to the type of processing involved. If the filter element shows contamination, the element should be immediately replaced with a new unit.

To avoid a danger to the operators by explosive, toxic or unhealthy gas components, first purge the gas lines with ambient air or nitrogen (N_2) before cleaning or exchange parts of the gas paths.

❍ Removal of the glass filter bowl and unscrew the mounting bracket (switch off optional gas sampling pump before).

❍ Replace contaminated filter element, using only **new** units (Order - No.: 42 707 676). Dispose of contaminated filter elements in accordance with applicable regulations.

Filter elements are single - use disposable items !
Do not clean and replace used filter elements; use new replacements only !

❍ Reinstall mounting bracket and close filter with the glass bowl (see Fig. 19-1).

❍ Perform a leak testing (see Item 20.)

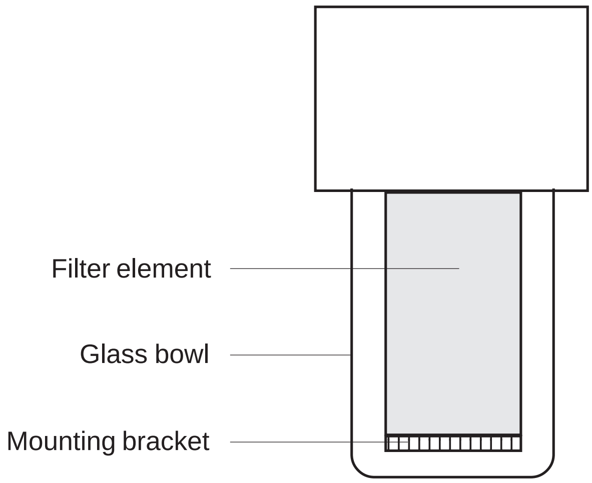


Fig. 19-1: Fine Dust View Filter

20. Leak Testing

Testing for gas leakage should be performed at bimonthly intervals and always immediately after any repair or replacement of gas - line components is performed. The test procedure is as follows:

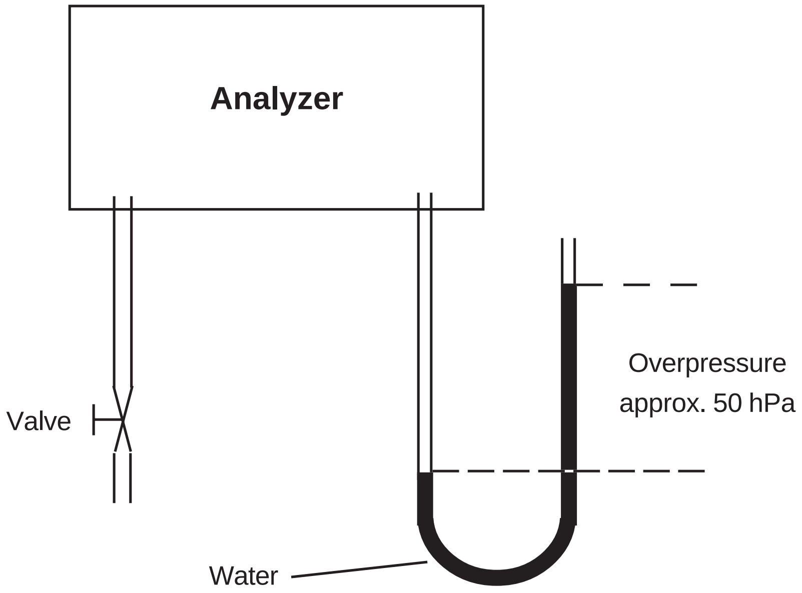


Fig. 20-1: Leak Testing with an U - Tube - Manometer

- Install a water - filled U - tube manometer at the sample gas outlet;

- Install a shut-off valve at the sample gas inlet.
  Admit air into the instrument at the shut-off valve until the entire analyzer is subjected to an overpressure of 50 hPa (approximately 500 mm water column; see Fig. 20-1).

Close the shut-off valve and verify that following a brief period required for pressure equilibrium, that the height of the water column does not drop over a period of about 5 minutes.
Any external devices, such as sample gas cooling hardware, dust filters etc., should be checked in the course of leak testing.

Overpressure max. 500 hPa !
For analyzers with parallel gas paths the leakage check must be performed for each gas path separately !

21. Housing

21.1 Cleaning of Housing Outside

For cleaning housing outside, you need a soft, fluff free cloth and all purpose detergent.

❍ Disconnect all voltage supplies.

To avoid a danger to the operators by explosive, toxic or unhealthy gas components, first purge the gas lines with ambient air or nitrogen (N_2) before cleaning or exchange parts of the gas paths.

If it is necessary to disconnect the gas connections, the gas line fittings of the analyzer have to be closed with PVC-caps before cleaning !

❍ Moisten of the soft, fluff free cloth with the cleaning solution
(mixture of 3 parts water, 1 part all purpose detergent max.).

Be sure to use a moisted, but not wet, cloth only !
Be sure, that non liquid can drop into the housing inside !

❍ Cleaning of the housing outside with the moisted cloth.

❍ If required, rub off the housing with a dry cloth afterwards.

21.2 Opening the Housing

The housing must be opened for checking the electrical connections and for replacement or cleaning of any of the components of the analyzer.

Be sure to observe Item 5. of the safety measures !

21.2.1 Housing Cover

❍ Disconnect all voltage supplies.

❍ Unscrew fastening screws for rack mounting / front frame if necessary (Fig. A-1). Remove analyzer out of rack or remove the front mounting frame and carrying strap to rear.

❍ Unscrew the respective fastening screws at both housing sides (Fig. 21-1)

❍ Remove the respective housing top cover panel.

Closing of the housing is performed in reverse order.

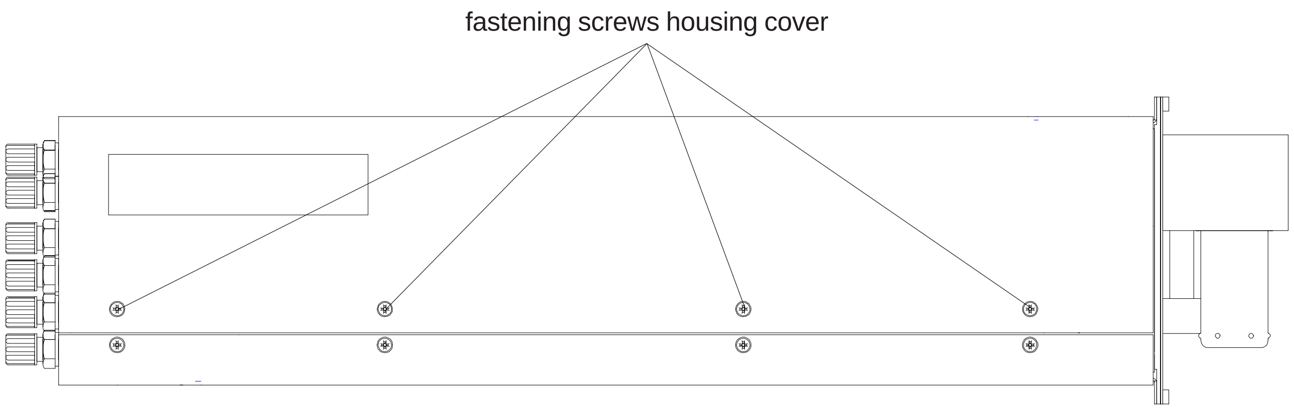


Fig. 21-1: BINOS® 100 2M
(Fastening screws housing cover)

21.2.2 Front Panel

- ❍ Opening housing cover (Item 21.2.1).
- ❍ Unscrew the 6 fastening screws at both housing sides (Fig. 21-2)
- ❍ Remove front panel to the front carefully.

> The optional components fine dust filter and flow meter are mounted at front panel (see Fig. A-1 and Fig. 1-1) !

Closing of the housing is performed in reverse order..

> Do not squeeze gas lines !

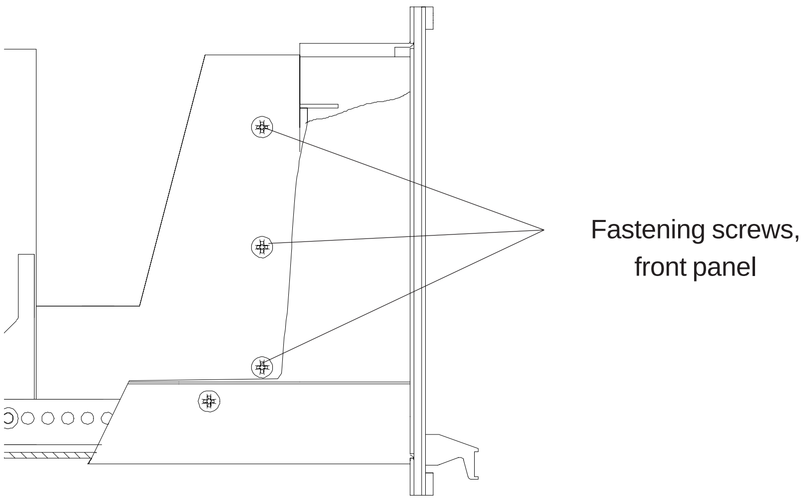


Fig. 21-2: BINOS® 100 2M
(Fastening screws front panel, viewed without options filter and flow sensor)

22. Replacement and Cleaning of Photometric Components

22.1 Removal of the Photometer Assembly

- Open the analyzer housing (cf. Section 21).

- Disconnect all electrical connections between photometer assembly and electronic unit and remove all gas lines from the photometer assembly.

  - *Only analyzers with gas detector:*
    Remove preamplifier (Fig. 2-2, Item 5) from holding device (Fig. 2-2, Item 4).

- Remove the two screws shown in Fig. 22-1 as Item 1.

- Remove the photometer assembly from the analyzer housing as a unit.

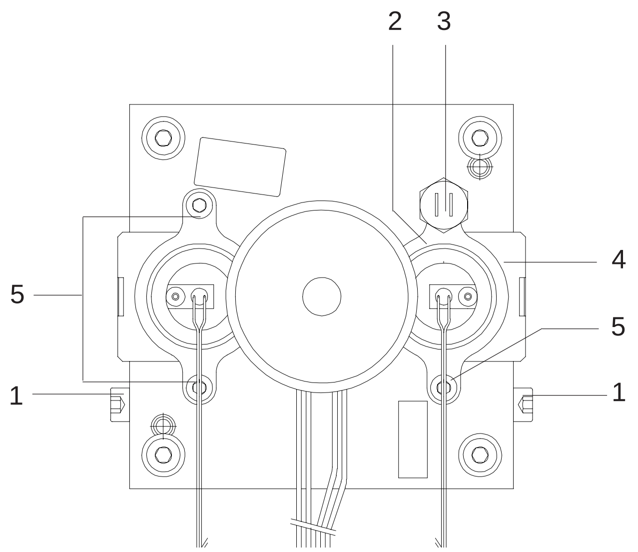


Fig. 22-1: Analyzer Photometer Assembly
(2 - channel IR - analyzer, viewed from the front panel side)

1 Fastening screw, photometer assembly mounting bracket
2 Light source with mounting flange
3 Temperature sensor
4 Zero - level adjustment baffle (not for sealed version)
5 Light source mounting screw

22.2 Light Source Replacement

- Open the analyzer housing (cf. Section 21).
- Remove the photometer assembly out of analyzer housing (see Section 22.1).
- Remove the two light source mounting screws (shown in Fig. 22-1 as Item 5) or the temperature sensor (shown in Fig. 22-1 as Item 3) resp.
- Remove the light source together with its mounting flange.
- Remove the mounting flange from the light source and position it on the new light source.
  - *For sealed version with pyroelectrical detector only:*
    Remove the tight baffle (zero - level adjustment baffle) from the light source and position it in the new light source.
  - *For sealed version only:*
    Place the O - rings on the adapter cell and filter cell.
- Insert the new light source and flange in the same position as the old one.
- Insert and tighten the two light source mounting screws (shown in Fig. 22-1 as Item 5) or the temperature sensor (shown in Fig. 22-1 as Item 3) resp.

Then:

- Replace the photometer assembly (see Section 22.4).
- Perform the physical zeroing procedure (see Section 22.5).

22.3 Cleaning of Analysis Cells and Windows

22.3.1 Removal of Analysis Cells

- ❍ Open the analyzer housing (cf. Section 21).
- ❍ Remove the photometer assembly out of analyzer housing (see Section 22-1).

a) For analysis cells of lengths 1 mm and 7 mm

- ❍ Remove the clamp (Fig. 22-2, Item 2).
- ❍ Remove the clamping collar and the filter cell with signal detector assembly.

b) For analysis cells of lengths 50 mm - 200 mm:

- ❍ Remove the clamp (Fig. 22-2, Item 3).
- ❍ Remove the filter cell with signal detector assembly.
- ❍ Remove the mounting screws shown in Fig. 22-2, Item 4.
- ❍ Remove the analysis cell body from the chopper housing.

Only analyzers with gas detector:

- ❍ Remove preamplifier from analysis cell

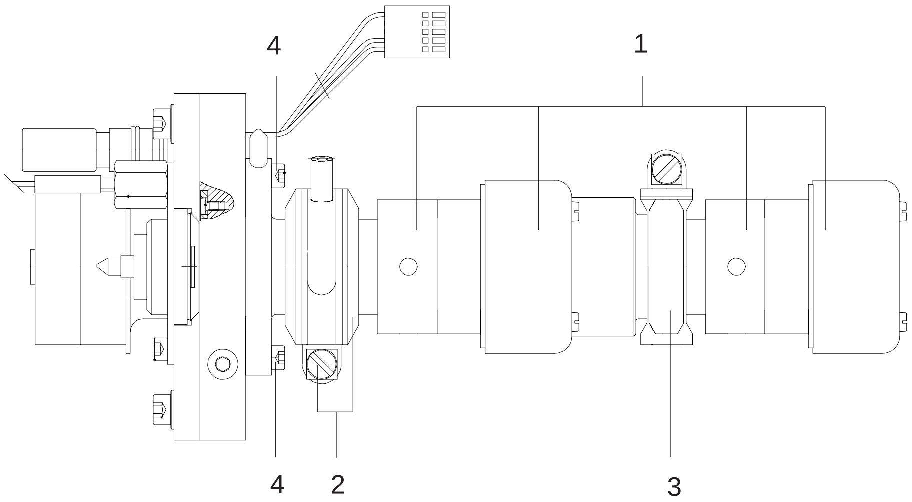


Fig. 22-2: Photometer Assembly (2 - channel photometer, side view)

1 Filter cell with signal detector assembly
2 Clamp with clamping collar
3 Clamp
4 Mounting screws for analysis cells of lengths 50 - 200 mm

22.3.2 Cleaning

a) Windows

The shielding windows (on the filter cell, chopper housing and the adapter cell resp. analysis cell) may be cleaned with a soft, lint - free cloth.

Use a highly volatile alcohol for the cleaning procedure.

To remove any lint and dust particles remaining, blow off the cleaned components with nitrogen (N_2).

b) non-divided analysis cells

The analysis cell may be cleaned with a soft, lint - free cloth.

Use a highly volatile alcohol for the cleaning procedure.

To remove any lint and dust particles remaining, blow off analysis cell with nitrogen (N_2).

c) divided analysis cells

If deposits are visible in the analysis cell, these can be removed with suitable solvents e. g. acetone or spirit. Then the analysis cell is to be flushed with an alcohol which evaporates easily and dried by blowing nitrogen (N_2).

! Maxi. pressure in analysis cell 1.500 hPa !

22.3.3 Reinstalling of Analysis Cells

a) For analysis cells of lengths 1 mm and 7 mm

- ❍ Place the O - rings on the adapter cell and filter cell.
- ❍ Fit the components together.
- ❍ Install the clamping collars with the clamp and tighten.

b) Analysis cells of lengths 50 mm - 200 mm:

- ❍ Place the O - ring on the chopper housing side of the cell body.
- ❍ Position the cell body in place and fasten using the two mounting screws (Fig. 22-2, Item 4).
- ❍ Place the O - ring on the filter cell.
- ❍ Fit the filter cell on the cell body.
- ❍ Install the clamp and tighten.

Only analyzer with gas detector:

- ❍ Assembly preamplifier to analysis cell

Then:

- ❍ Replace the photometer assembly (see Section 22.4).

22.4 Reinstalling of the Photometer Assembly

- Insert the photometer assembly into the analyzer housing and fasten in position using the mounting bracket screws (Fig. 22-1, Item 1).
    - *Only analyzers with gas detector:*
      Insert preamplifier (Fig. 2-2, Item 5) to holding device (Fig. 2-2, Item 4).
- Reconnect all gas lines to the assembly.
- Reconnect all electrical connections between the photometer assembly and the electronic unit (see Section 15.).
- Perform a leakage test (see Section 20).
- Perform the physical zeroing procedure (see Section 22.5).

22.5 Physical Zeroing

Adjustment of the physical zero - level will only be required if a light source, a filter cell, or an analysis cell have been replaced or repositionned.

! Be sure to observe the safety measures !

Needed for the adjustment are a digital voltmeter (DVM) with a range of 2 VDC and a 3 mm hexagon wrench SW 3.

- Switch on the analyzer (cf. Section 6.).
- Admit zero gas to the analyzer.
- Connect the DVM to the measuring points:

X 25 and X 28	(⊥) for	channel 1 (IR - measurement only).
X 27 and X 28	(⊥) for	channel 1 (Combined Oxygen - / IR - measurement). channel 2 (IR - measurement only).

22.5.1 Standard - Photometer (not sealed version)

- Slightly loosen the light source mounting screws (shown in Fig. 22-1 as Item 5) or the temperature sensor (shown in Fig. 22-1 as Item 3) resp. for channel 1 or channel 2.
- Set the zero - level precisely to 0 V (± 100 mV) by turning the corresponding light source. If the turning of the light source is not sufficient, the zero point can be adjusted by sliding the zero - level adjustment baffle (Fig. 22-1, item 4).
- Tighten the light source mounting screws (shown in Fig. 22-1 as Item 5) or the temperature sensor (shown in Fig. 22-1 as Item 3) resp. for channel 1 or channel 2.

When the physical zeroing has been correctly set, perform an electrical zeroing (see Section 9.).

22.5.2 Sealed Photometer (Option)

❍ Slightly loosen the light source mounting screws (shown in Fig. 22-1 as Item 5) or the temperature sensor (shown in Fig. 22-1 as Item 3) resp. for channel 1 or channel 2.

❍ Set the zero - level precisely to 0 V (± 100 mV) by turning the corresponding light source.

> ❍ *For photometer with pyroelectrical detector only:*
> To facilitate the physical zero - level adjustment, there is built in one of three different tight baffles (zero - level adjustment baffle) into the light source.
> For simply exchange the baffle is hold in the source via a magnet.
> If the turning of the light source is not sufficient, another tight baffle (zero - level adjustment baffle) is to position in the light source (see item 22-2).

❍ Tighten the light source mounting screws (shown in Fig. 22-1 as Item 5) or the temperature sensor (shown in Fig. 22-1 as Item 3) resp. for channel 1 or channel 2.

When the physical zeroing has been correctly set, perform an electrical zeroing (see Section 9.).

23. Check / Replacement of electrochemical Oxygen Sensor

Through measuring principle the oxygen sensor will have only a limited life time.

The life time of the oxygen sensor is dependent on the sensor itself and on the measured oxygen concentration and is calculated as follows:

$$\text{life time} = \frac{\text{sensor time (hours)}}{O_2 \text{ - concentration (\%)}}$$

The so-called “sensor time” (operation without oxygen at 20 °C) is

approx. 900.000 hours for sensor with a response time of about 12 s
approx. 450.000 hours for sensor with a response time of about 6 s

The sensors will have the following life time at approx. 21 % Oxygen and 20 °C :

approx. 42.857 hours (approx. 5 years) for sensor with a response time of about 12 s
approx. 21.428 hours (approx. 2.5 years) for sensor with a response time of about 6 s

Note !
The values stated above are presented as guidelines only. The values are depending on operation temperatures (the result of higher temperatures, for example 40 °C, could be the half life time) and measured concentrations.

Note !
Depending on measuring principle the electrochemical O_2-cell needs a minimum internal consumption of oxygen. Admit cells continuously with sample gas of low grade oxygen concentration or with oxygenfree sample gas could result a reversible detuning of O_2-sensitivity. The output signal will become instabil.
For correct measurement the cells have to admit with a O_2 concentration of at least 2 Vol.-%.
We recommend to use the cells in intervall measurement (purge cells with conditioned ambient air at measurement breaks).
If it is necessary to interrupt oxygen supply for several hours or days, the cell have to regenerate (admit cell for about one day with ambient air). Temporary flushing with nitrogen (N_2) for less than 1 h (e.g. analyzer zeroing) will have no influence to measuring value.
For analyzers with electrochemical O_2-cellpurge all gas lines of analyzer with conditioned ambient air first before closing the gas line fittings for transport or depositing the analyzer.

23.1 Check of the Sensor

Exchange the sensor, if the voltage is less than 70 % of the initially output voltage.

The check requires a digital voltmeter (DVM) with a range of 2 V DC.

❍ Opening housing (see 21.).

❍ Switch On the analyzer (see Section 6.).

❍ Admit ambient air to the analyzer (approx. 21 Vol. - O_2).

❍ Connect the DVM to the measuring points

Tp 1 (Signal) and Tp 2 (⊥) of the PCB OXS, mounted directly at the connection block (Fig. 23-1, see also Fig. 23-2, 1-1 and 1-2).

The measuring signal should be into a range of 700 mV DC to 1000 mV DC.

Note !
If the measuring value is lower than 700 mV at gas flow with ambient air, the sensor is consumed. Exchange the sensor.

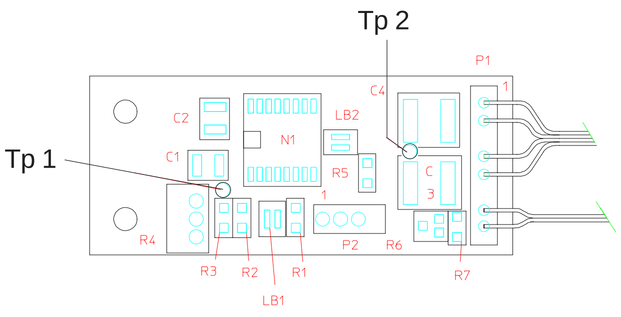


Fig. 23-1: PCB “OXS”, assembled, horizontal projection

23.2 Replacement of the Sensor

Be sure to observe the safety measures !

23.2.1 Removal of the Sensor

a) Oxygen Measurement without IR - channel

❍ Open the analyzer housing (see Section 21.).

❍ Disconnect all electrical connections between the PCBs OXS and BKS (X5, X6 and X7, see Item 15.).

❍ Remove all gas lines from the sensors.

❍ Unscrew both allen screws (fastening screws, see Fig. 23-2).

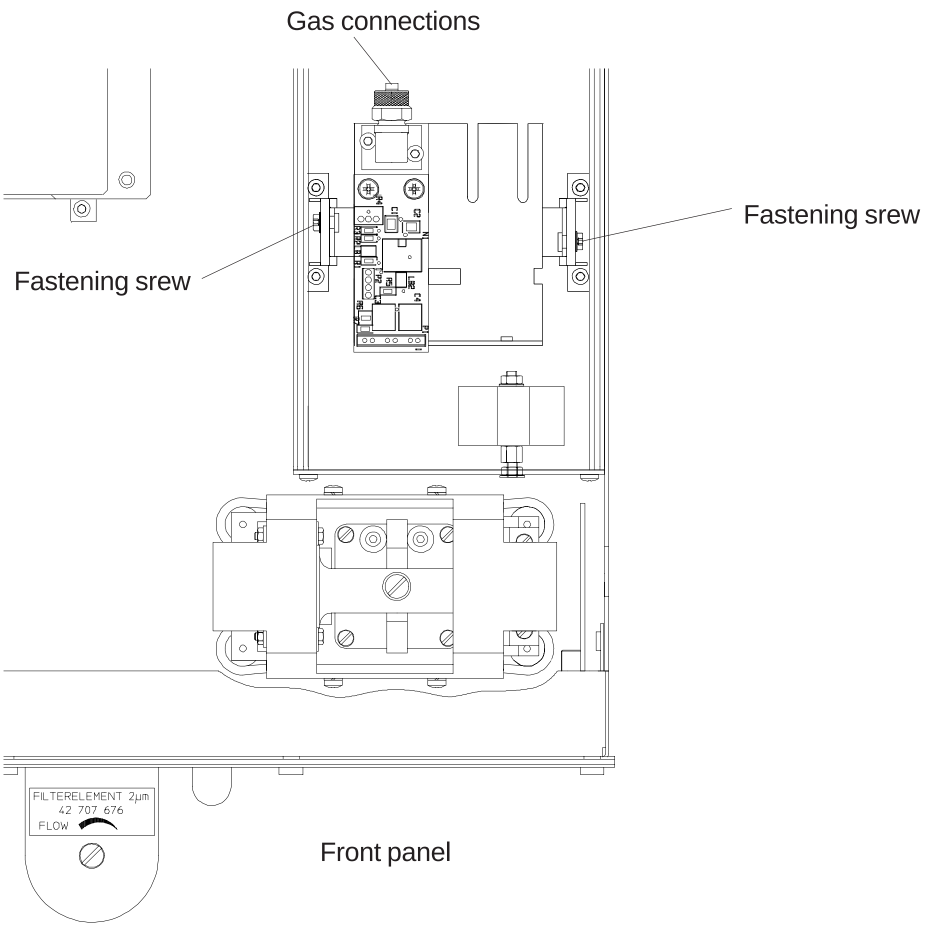


Fig. 23-2: Inside View BINOS® 100 2M
(Oxygen Measurement without IR - channel)

❍ Remove the complete support (see Fig. 23-1) to the top of the analyzer.

❍ Disconnect the connector for the sensor from “P2” of circuit board “OXS” (see Fig. 23-5).

❍ The cable clamp (see Fig. 23-3) is to cut through.

❍ Unscrew both fastening screws for the fitting (phillips screws, see Fig. 23-3).

❍ Remove the fitting including the sensor (see Fig. 23-3).

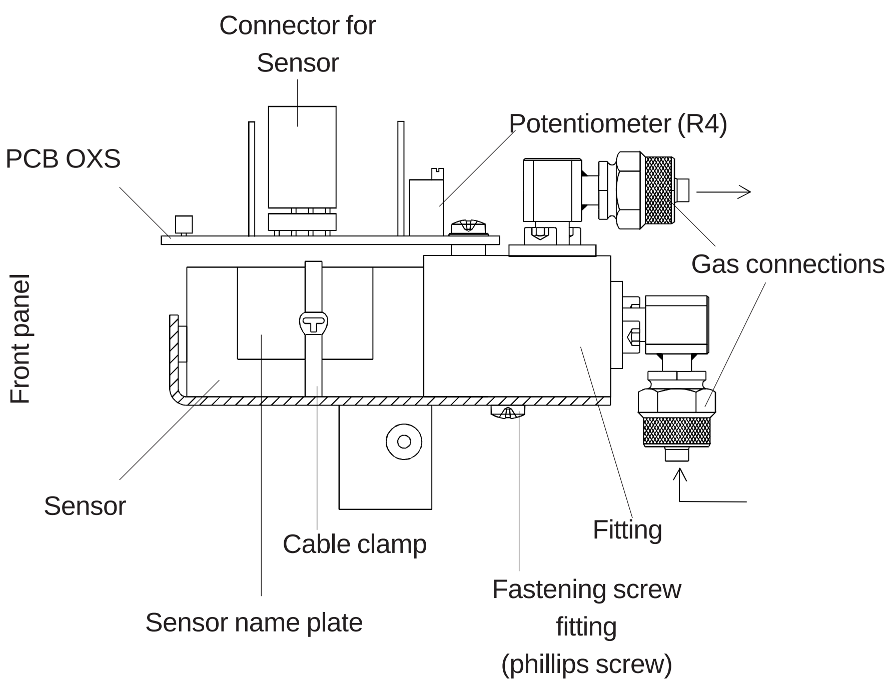


Fig. 23-3: Sensor support BINOS® 100 2M
(Oxygen Measurement without IR - channel)

b) IR - / Oxygen Measurement combined

❍ Open the analyzer housing (see Section 21.).

❍ Disconnect the connector for the sensor from “P2” of circuit board “OXS” (see Fig. 23-5).

❍ Unscrew both fastening screws for the fitting (see Fig. 23-4) and remove the fitting completely with the sensor.

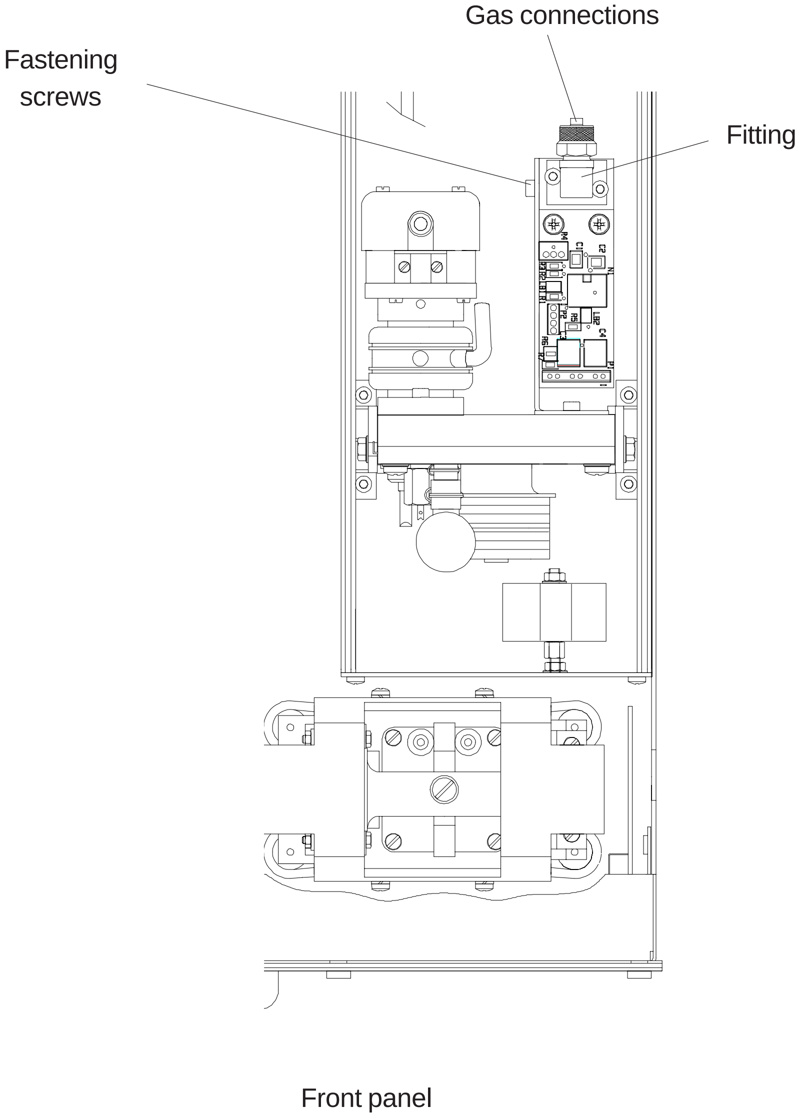


Fig. 23-4: Inside View BINOS® 100 2M
(combined IR-/ Oxygen Measurement)

23.2.2 Exchange of the Sensor

❍ Take the consumed sensor out of the fitting.

❍ Take off the stopper from new sensor and fit in the new sensor into the fitting, so that the name plate is at the top of the sensor.

❍ Close the spent sensor with the stopper and send it immediately to our factory.

23.2.3 Reinstalling of the Sensor

a) Oxygen Measurement without IR - channel

❍ Put the fitting with the (new) sensor onto the support, move to the stop and screw with the two fastening screws (phillips screws, see Fig. 23-3)

❍ Fix the sensor with a cable clamp at the support (see Fig. 23-3).

❍ Connect the connector for the sensor to "P2" of circuit board "OXS" (see Fig. 23-5 / Item 15.).

❍ Insert the complete support (see Fig. 23-3) into the analyzer and screw with the two allen screws (fastening screws, see Fig. 23-2).

❍ Reconnect all gas lines to the fittings (see Fig. 23-2 and Fig. 23-3).
Do not interchange gas inlets and gas outlets.

❍ Reconnect all electrical connections between OXS and BKS (X5 and X7, see 15.).

❍ Perform a leakage test (see Section 20.) and set the sensor (see Section 23.2.4).

b) IR - / Oxygen Measurement combined

❍ Put the fitting with the (new) sensor onto the support, move to the stop and screw with the two fastening screws (see Fig. 23-4)

❍ Connect the connector for the sensor to "P2" of circuit board "OXS" (see Fig. 23-5 / Item 15.).

❍ Perform a leakage test (see Section 20.) and set the sensor (see Section 23.2.4).

23.2.4 Basic conditions for the Oxygen Sensor

❍ Admit ambient air for the analyzer (approx. 21 Vol. - O_2) and switch on (see Section 6.).

❍ Connect the DVM to the measuring points

Tp 1 (Signal) and Tp 2 (⊥) of the PCB OXS, mounted directly at the connection block (Fig. 23-1, see also Fig. 23-2, 1-1 and 1-2).

❍ Set the signal to 1000 mV DC (± 5 mV) with potentiometer R4 (Fig. 23-5) of the corresponding circuit board “OXS”.

Note !
It is not allowed to change this setting for this sensor again !

❍ Switch off the analyzer and close the analyzer housing (see 21.).
Built-in the module into platform if necessary.

❍ A complete re-calibration of the instrument must be performed after a sensor - replacement.

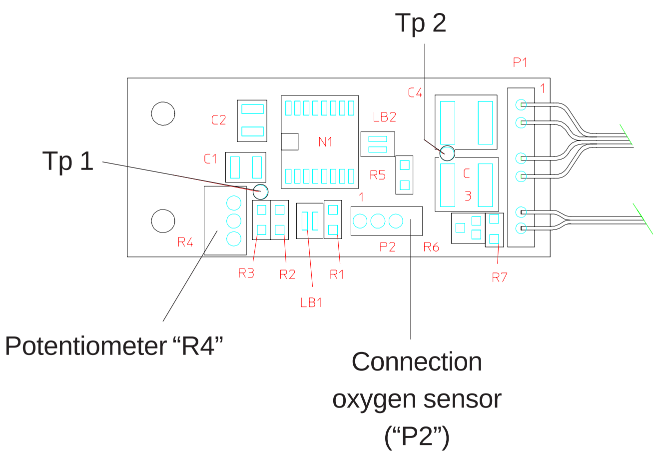


Fig. 23-5: PCB “OXS”, assembled, horizontal projection

24. Technical Data

Certifications	CE EN 50081-1, EN 50082-2, EN 61010-1
(not for TC)	NAMUR, CSA NRTL/C, N96, INTERTest SYSTEMS iS International Conformance
Suitability tests	TÜV Nord mbH, report-No.: 95CU054/B, TÜV Bavaria, report-No.: 1563793, Carbon monoxide (CO): TI Air, 13th BImSchV Oxygen (O_2): TI Air, 13th BImSchV, 17th BImSchV DMT: 0-80 Vol.-% CO_2 / CH_4 0-200 ppm / 0-10 Vol.-% CO, 0-10 Vol.-% O_2 IBS/PFG-No. 41300392NIII/41300292NIII

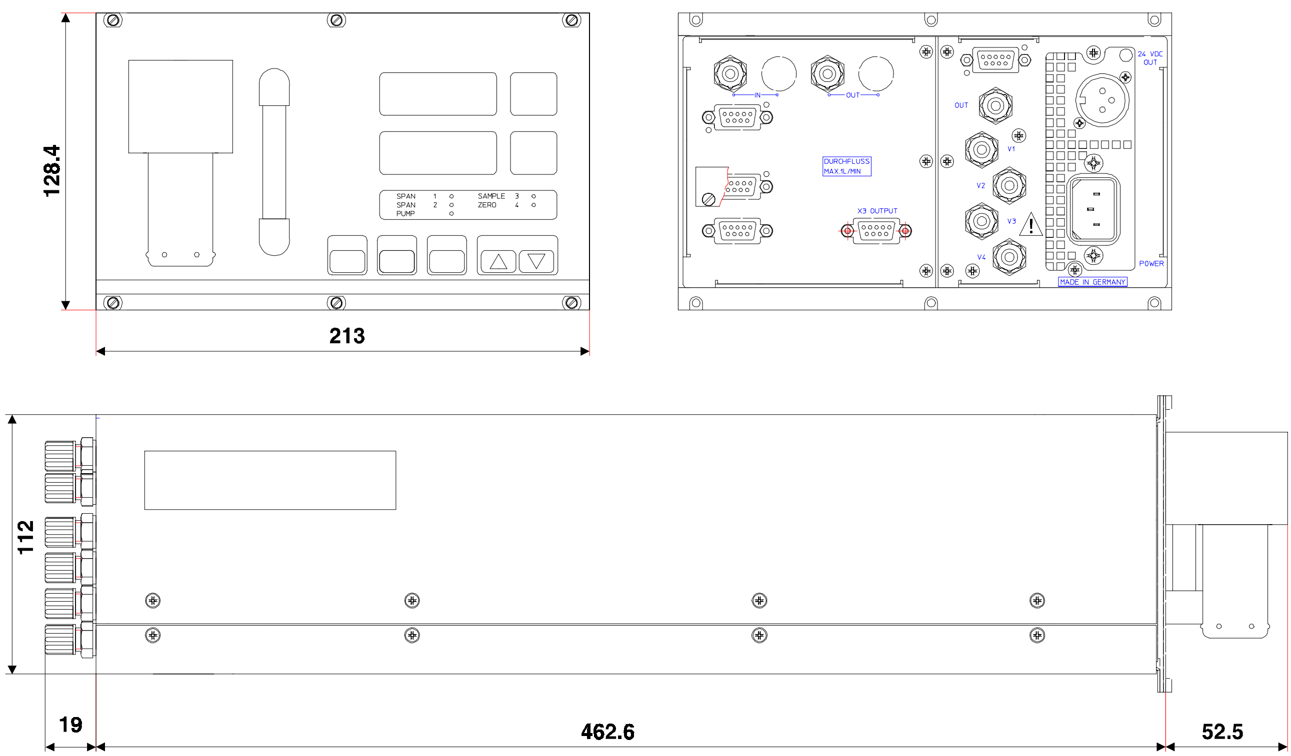


Fig. 24-1: Dimensional sketch BINOS® 100 2M (dimensions iin [mm])

24.1 Housing

Gas connections	Standard 6/4 mm PVDF additional fittings on request
Dimensions	1/2 19" housing, 3 HU [see dimensional sketch (Fig. 24-1)]
Weight (depending on configuration)	approx. 12 kg
Protection class	IP 20 (according to DIN standard 40050)
Permissible ambient temperature	+ 5 °C to + 40 °C (higher ambient temperatures (45 °C) on request)
Humidity (non condensing)	< 90 % rel. humidity at + 20 °C < 70 % rel. humidity at + 40 °C
Rain, drop / splash water	The analyzer must not be exposed to rain or drop/splash water
Explosive atmosphere	The analyzer must not be operated in explosive atmosphere without supplementary protective measures
Altitude	0-2000 m (above sea level)

24.2 Options

Pressure sensor	Measuring range 800 - 1,100 hPa
Fine dust filter	Filter material PTFE, Pore size approx. 2 µm
Sample gas pump	Pumping rate max. 2.5 l/min. Suction pressure min. 900 hPa Lifetime max. 5,000 hours

24.3 Signal Inputs / Outputs, Interfaces

2 analog outputs per channel [(optically isolated), offset (begin of range) and end of range are free programmable]	0 - 10 V and 0 - 20 mA ($R_B \leq 500\ \Omega$) or 2 - 10 V and 4 - 20 mA ($R_B \leq 500\ \Omega$), adjustable via keyboard
Option:	0 (0.2) - 1 V and 0 (4) - 20 mA ($R_B \leq 500\ \Omega$)
8 digital outputs, parallel (optically isolated)	2 threshold contacts per channel, Sample gas valve, Zero gas valve, Span gas valve 1, Span gas valve 2 (dual channel only) “Open Collector”, max. 30 V DC / 30 mA
serial interface (Option, optically isolated)	RS 232 C or RS 485 (2 or 4 wire support)
3 output relays (Option)	“Measure/Calibration” / “Failure Analyzer” / “NN” “non-voltage carrying contacts” max. 30 V / 1 A / 30 W
3 analog inputs (Option for TC), for electronic cross compensation of up to 3 interfering components (external signals)	0 - 10 V, 0 - 20 mA, 2 - 10 V, 4 - 20 mA, 0 - 1 V or 0.2 - 1 V

24.4 General Specifications

Measuring components	see order confirmation
Measuring ranges	
NDIR	see order confirmation
paramagnetic oxygen sensor (PO_2)	0 - 5 % to 0 - 100 % O_2 or
	0 - 2 % to 0 - 25 % O_2
	0 - 1 % to 0 - 10 % O_2 *)
electrochemical oxygen sensor (EO_2)	0 - 5 % O_2 to 0 - 25 % O_2 **)
thermal conductivity (TC)	0 - 5 to 0 - 100 % H_2
	0 - 2 % H_2 *)
	0 - 10 to 0 - 100 % He
	0 - 50 to 0 - 100 % Ar
	0 - 30 to 0 - 100 % CO_2

*) on request, non-standard specifications
**) higher measuring ranges reduce sensor lifetime

Cross sensitivities

electrochemical oxygen measurement: Not for use with sample gases containing FCHC´s !

paramagnetic oxygen measurement

100 % Gas	zero-level effect % O_2
N_2	0,00
CO_2	- 0,27
H_2	+ 0,24
Ar	- 0,22
Ne	+ 0,13
He	+ 0,30
CO	+ 0,01
CH_4	- 0,20
C_2H_6	- 0,46
C_2H_4	- 0,26
C_3H_8	- 0,86
C_3H_6	- 0,55
NO	+ 43,0
NO_2	+ 28,0
N_2O	- 0,20

Table 1	NDIR	oxygen sensor	thermal conductivity sensor
Detection limit	≤ 1 % [1) 4)]	≤ 1 % [1) 4)]	≤ 2 % [1) 4)]
Linearity	≤ 1 % [1) 4)]	≤ 1 % [1) 4)]	≤ 1 % [1) 4)]
Zero-point drift	≤ 2 % per week [1) 4)]	≤ 2 % per week [1) 4)]	≤ 2 % per week [1) 4)]
Span (sensitivity) drift	≤ 1 % per week [1) 4)]	≤ 1 % per week [1)]	≤ 2 % per week [1) 4)]
Repeatability	≤ 1 % [1) 4)]	≤ 1 % [1) 4)]	≤ 1 % [1) 4)]
Response time (t_{90}), electronically	2 - 60 s	2 - 60 s	2 - 60 s
Total response time (t_{90})	< 5 s [3)]	< 5 s [3) 5)] approx. 12 s [3) 6)]	3 s < t_{90} < 20 s [3) 7)]
Permissible gas flow	0.2 - 1.5 l/min	0.2 - 1.0 l/min [5)] 0.2 - 1.5 l/min [6)]	0.2 - 1.5 l/min (constant flow)
Influence of gas flow		≤ 1 % [1) 4)]	
Permissible pressure	≤ 1,500 hPa abs.	atm. pressure [5)] ≤ 1,500 hPa abs. [6)]	≤ 1,500 hPa abs.
Influence of pressure			
(at constant temperature)	≤ 0.10 % per hPa [2)] (≤ 0.15 % per hPa for CO_2) [2)]	≤ 0.10 % per hPa [2)]	≤ 0.10 % per hPa [2)]
(with pressure compensation) [8)]	≤ 0.01 % per hPa [2)] (≤ 0.015 % per hPa for CO_2) [2)]	≤ 0.01 % per hPa [2)]	≤ 0.01 % per hPa [2)]
Influence of temperature (pressure constant)			
- on zero point	≤ 1 % per 10 K [1)]	≤ 1 % per 10 K [1)]	≤ 1 % per 10 K in 1 h [1)]
- on span (sensitivity)	± 5 % (+5 to +40 °C) [1) 9)]	≤ 1 % per 10 K [1)]	≤ 1 % per 10 K in 1 h [1)]
Thermostat Control	none	approx. 55 °C [5) 10)] none [6)]	approx. 75 °C [10)]
Heating-up time	approx. 15 to 50 minutes [11)]	approx. 50 minutes [5)] < NDIR channel	approx. 50 minutes

1) related to full scale at system parameter
END = final value set in our factory and OFS = 0
2) related to measuring value
3) from analyzer gas inlet at gas flow of approx. 1.0 l/min. (electrical = 2 s)
4) constant pressure and temperature
5) paramagnetic oxygen measurement (PO_2)
6) electrochemical oxygen measurement (EO_2)
7) depending on sensor postioning
8) optional pressure sensor is required
9) starting from +20 °C (to +5 °C or to + 40 °C)
10) sensor / cell only
11) dependent on integrated photometer bench

24.5 Voltage Supply

Internal power supply	UPS 01 T
Input	plug
Nominal voltage	230 / 120 V ac, 50 / 60 Hz
Input voltage	196–264 V ac and 93–132 V ac, 47-63 Hz with autoranging
Input power	max. 240 VA
Fuses (UPS internal)	T3.15A/250V (2 pcs.)
Output voltage	24 V dc / max. 5.0 A
Output power	max. 120 VA
Output to external consumers	3-poliger XLR- Flange (female)
Available power consumption to external consumers	max. 2.0 A

24.5.1 Electrical Safety

Over-voltage category	II
Pollution degree	2
Safety Class	1
all I/O´s	SELV voltage optically isolated to electrical supply

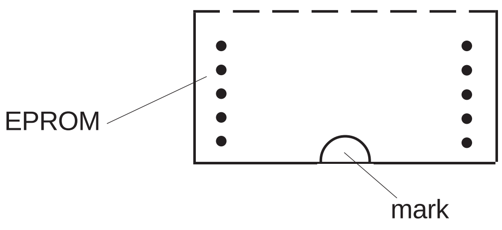
25. Replacing the EPROM

The EPROM may be readily replaced, either by a new unit when faulty, or by another which has been reprogrammed with an alternative program.

The EPROM - replacement procedure is as follows:

- ❍ Disconnect the analyzer from the source of electric power.
- ❍ Open the housing (see Section 21.).
- ❍ Remove jumper J7 (for the battery buffering; see the section 16.).
- ❍ Withdraw EPROM (section 15.).

Correctly orient the EPROM with respect to its socket before re-insertion.



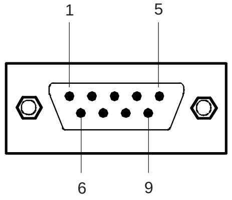
The EPROM will be inserted correctly, if the mark is shown to the front panel.

- ❍ Insert the EPROM.
- ❍ Reconnect jumper J7 (see the section 16.).
- ❍ Reconnect the instrument to the source of electric power and switch it on [see Section 6. (the displays must show a flushing "batt.")].

All data will now have been restored to default values. All user and application data, such as system parameters, limit - point values etc., must now be re-entered.

A complete re-calibration of the instrument (see Section 9.) must be performed after an EPROM - replacement.

Frontview of Connectors

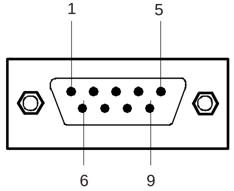


Plug X 3
9 - pin Sub. min. D

Digital Outputs (optically isolated)
"Open Collector": max. 30 V DC / 30 mA

Pin	Assignment
1	Limit channel 2 max.
2	Limit channel 2 min.
3	Limit channel 1 max.
4	Limit channel 1 min.
5	⊥
6	(Valve control span gas 2)
7	(Valve control span gas 1)
8	(Valve control zero gas)
9	(Valve control sample gas)

ME



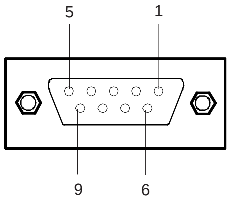
Plug X 1 (Option)
9 - pin Sub. min. D

Option "Output Relays"
("non-voltage-carrying contacts", max. 30 V / 1 A / 30 W)

Pin	Assignment
1	OK / Failure (NO)
2	OK / Failure (NC)
3	Measure / Calibration (NC)
4	Measure / Calibration (NO)
5	not used (NC)
6	OK / Failure (Common)
7	Measure/Calibration (Common)
8	not used (Common)
9	not used (NO)

ME

[NO = Normally OPEN]
[NC = Normally CLOSED]



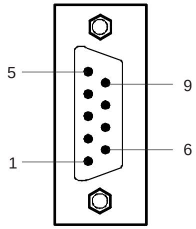
Socket X 2
9 - pin Sub. min. D

Analog Outputs (optically isolated)

Pin	Assignment
1	⊥ (V DC)
2	0(2)-10 Vdc [Option: 0(0.2)-1 Vdc], ch. 1
3	0(4)-20 mA, channel 1 ($R_B \leq 500\ \Omega$)
4	0(2)-10 Vdc [Option: 0(0.2)-1 Vdc], ch. 2
5	0(4)-20 mA, channel 2 ($R_B \leq 500\ \Omega$)
6	⊥ (mA)
7	⊥ (mA)
8	⊥ (mA)
9	⊥ (mA)

ME

Analog Signal Inputs (max. 3, Cross Compensation)



Plug CROSS. COMP. (Option)
9 - pin Sub. min. D

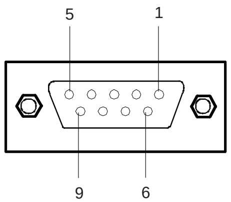
Pin	Assignment
1	interfering gas 1
2	interfering gas 1
3	interfering gas 2
4	interfering gas 2
5	not used
6	interfering gas 3
7	(GND) interfering gas 3
8	not used
9	not used

ME

24 V DC out
(max. 2 A, see technical data)

(shield) 1 3 2

Pin 1:	ME
Pin 2:	+ 24 V DC
Pin 3:	0 V DC (GND)
shield:	housing flange



X 4 (Option)
9 - pin Sub. min. D

Option RS 232 C Interface (optically isolated)

Pin	Assignment
1	GND
2	RxD
3	TxD
4	not used
5	GND
6	not used
7	not used
8	not used
9	not used

ME

Option RS 485 Interface (optically isolated)

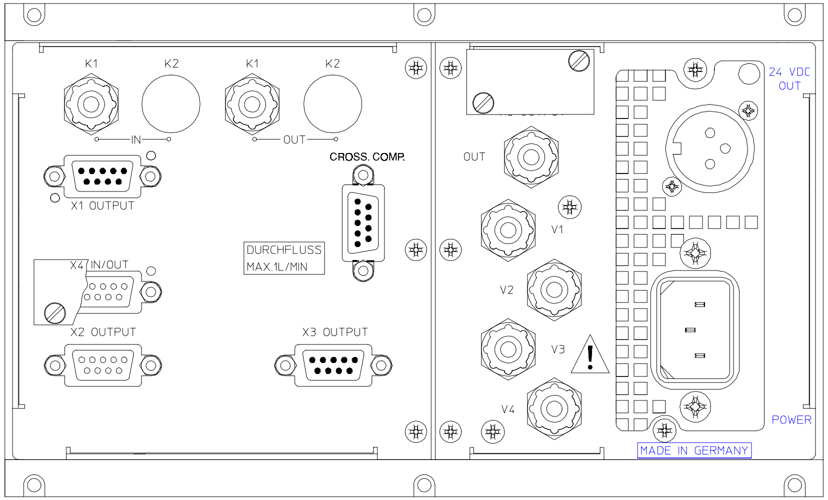
Pin	Assignment
1	GND
2	RxD-
3	RxD+
4	TxD+
5	TxD-
6	not used
7	not used
8	not used
9	not used

ME

N
PE
L

Nominal voltage:
110-120/210-240 V AC, 50/60 Hz, 2/1 A

Input voltage:
93-132 and 196-264 V AC, 47-63 Hz



Rear Panel BINOS® 100 2M

X 1: Option “Output Relays”
(Sub.-min. D, 9 pin. plug)

X 2: Analog Outputs
(Sub.-min. D, 9 pin socket)

X 3: Digital Outputs
(Sub.-min. D, 9 pin plug)

X 4: Option “Interface” RS 232 C / RS 485
(Sub.-min. D, 9 pin socket)

Connection Cable POWER (230/120 V ac)
Order-No.: 03 861 008

Connection Cable 24 V dc
cable length approx. 1000 mm
one elbow socket, one straight plug,
Order-No.: CH 000 088

optionally terminal strip adaptors:

9-pin. sub.-min. D - socket to terminal strip
Order-No.: 00 019 494

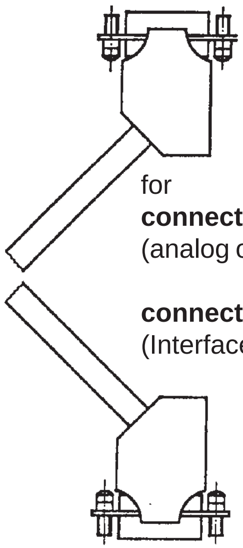
9-pin. sub.-min. D - plug to terminal strip
Order-No.: 90 002 986

Combination of Cable / terminal strip adaptors:

combination of 43 008 001 and 00 019 494
Order-No.: NGA 000 59

combination of 43 008 006 and 90 002 986
Order-No.: NGA 000 62

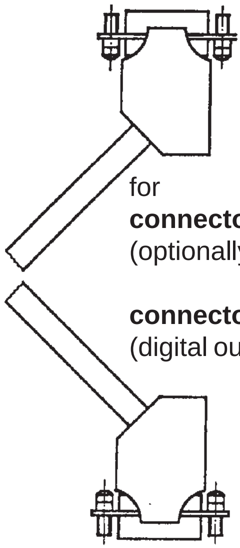
optionally Connection Cable
cable length approx. 2,0 m / double sided **plug**
Order-No.: 43 008 001



for
connector X 2
(analog outputs)

connector “X 4” (Option)
(Interface RS 232 C / RS 485)

optionally Connection Cable
cable length approx. 2,0 m / double sided **socket**
Order-No.: 43 008 006



for
connector X 1 (Option)
(optionally status signals)

connector X 3
(digital outputs)

connector CROSS: COMP:
(analog inputs)

Be sure to observe the safety measures !

29. Failure Check List

If there should be an error at the analyzer, please look for this failure check list, before establish in contact with us.
If you are send us the analyzer for removal of faults, enclose a copy of this list please.
This informations could simplify our trouble shooting and can lead to cost reduction.
It is possible to mark divers items with a cross.

Serial. - No.: ________________________________

Measuring range / gas channel 1: ____________________ channel 2: ____________________

Software - Version - No.: ________________________

1.	No Display (defective)	❑
2.	BATT. is flushing	❑
3.	E 11 is flushing	❑
4.	E 12 is flushing	❑
5.	E 14 is flushing	❑
6.	E 16 is flushing	❑
7.	E 17 is flushing	❑
8.	E 18 is flushing	❑
9.	E 19 is flushing	❑
10.	E 20 is flushing	❑
11.	E 21 is flushing	❑
12.	E 22 is flushing	❑
13.	E 27 is flushing	❑
14.	E 37 is flushing	❑
15.	E 38 is flushing	❑
16.	E 39 is flushing	❑

17.	Analog Output absent	Ch1 ❑	CH2 ❑
18.	Fluctuating display without error	CH1 ❑	CH2 ❑
19.	Response - time to long	CH1 ❑	CH2 ❑
20.	Chopper has loud noise		❑
21.	Measuring values to high	CH1 ❑	CH2 ❑
22.	Measuring values to low	CH1 ❑	CH2 ❑
23.	Misalignment Display/Analog output	CH1 ❑	CH2 ❑
24.	Limiting values function incorrect	CH1 ❑	CH2 ❑
25.	Adjustment not possible	CH1 ❑	CH2 ❑
26.	Analyzer drift	CH1 ❑	CH2 ❑
27.	Transverse sensitivity to high	CH1 ❑	CH2 ❑
28.	Contamination of analyzer	CH1 ❑	CH2 ❑
29.	Condensation	CH1 ❑	CH2 ❑
30.	Overhaul complete analyzer with cost estimate		❑
31.	Removal of failures with cost estimate		❑
32.	Removal of failures without cost estimate		❑

Further tests of electronics (see section 14):

33. Supply voltage + 6 V incorrect ❑

34 Reference voltage positive incorrect ❑

35 Reference voltage negative incorrect ❑

36. Motor drive incorrect ❑

37. Light barrier signal incorrect ❑

38. Temperature sensor incorrect ❑

39. Supply voltage + 18 V incorrect ❑

40. Analog preamplifiering incorrect ❑

41. You are satisfied with our services rendered ? Yes ❑ No ❑
(If no, give us a short comment please)

Comment or further failure description: ______________________________

____

____

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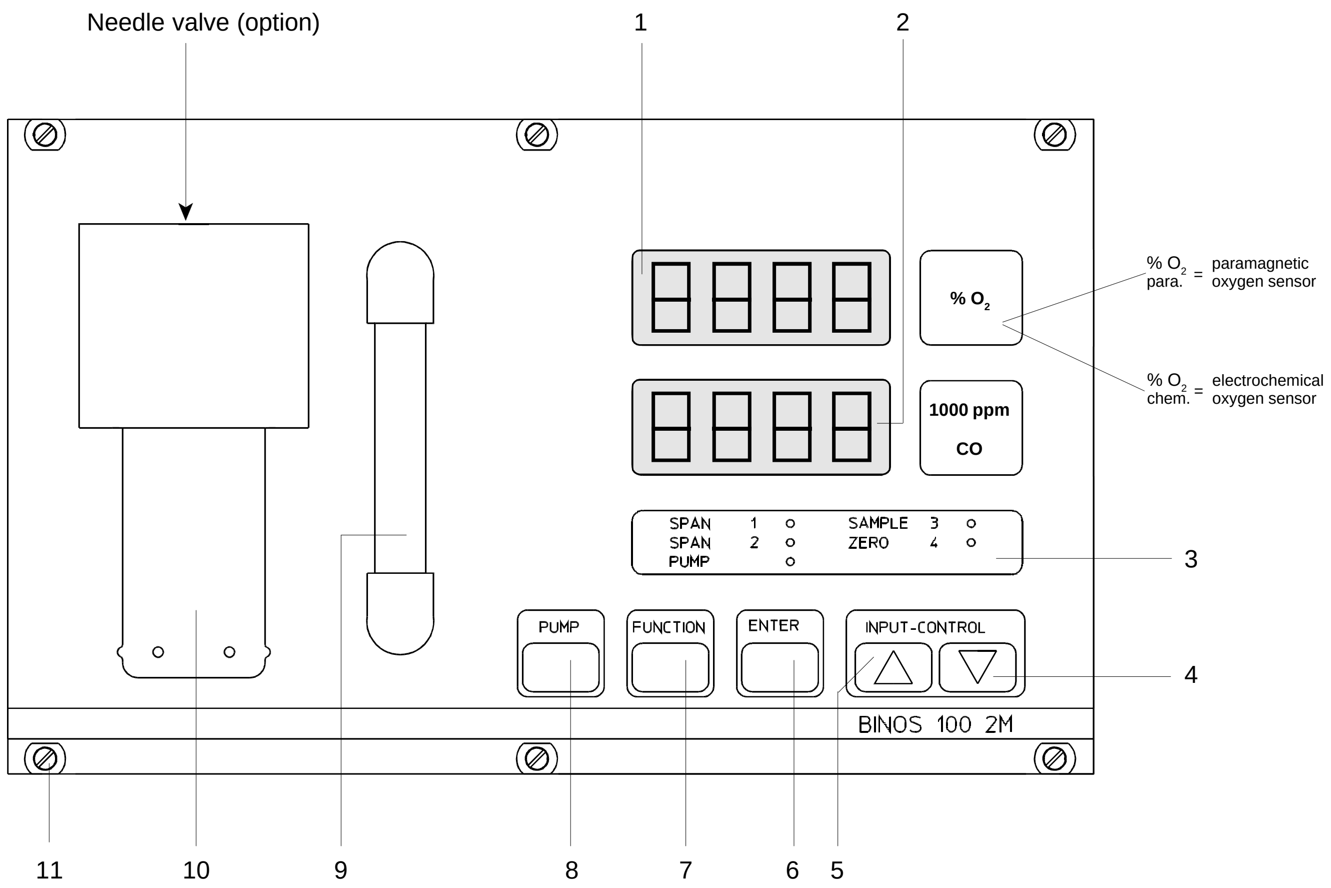

Fig. A-1: BINOS® 100 2M, front view

1	LED display (channel 1)
2	LED display (channel 2)
3	Funktion LED for options "Solenoid Valves / Gas Sampling Pump"
4	Input setting control key **DOWN**
5	Input setting control key **UP**
6	**ENTER** key
7	**FUNCTION key**
8	Key for option “Gas Sampling Pump”
9	Flow meter (option)
10	Fine dust view filter with needle valve (option)
11	Fastening screws for the carrying strap bracket or rack mounting purposes

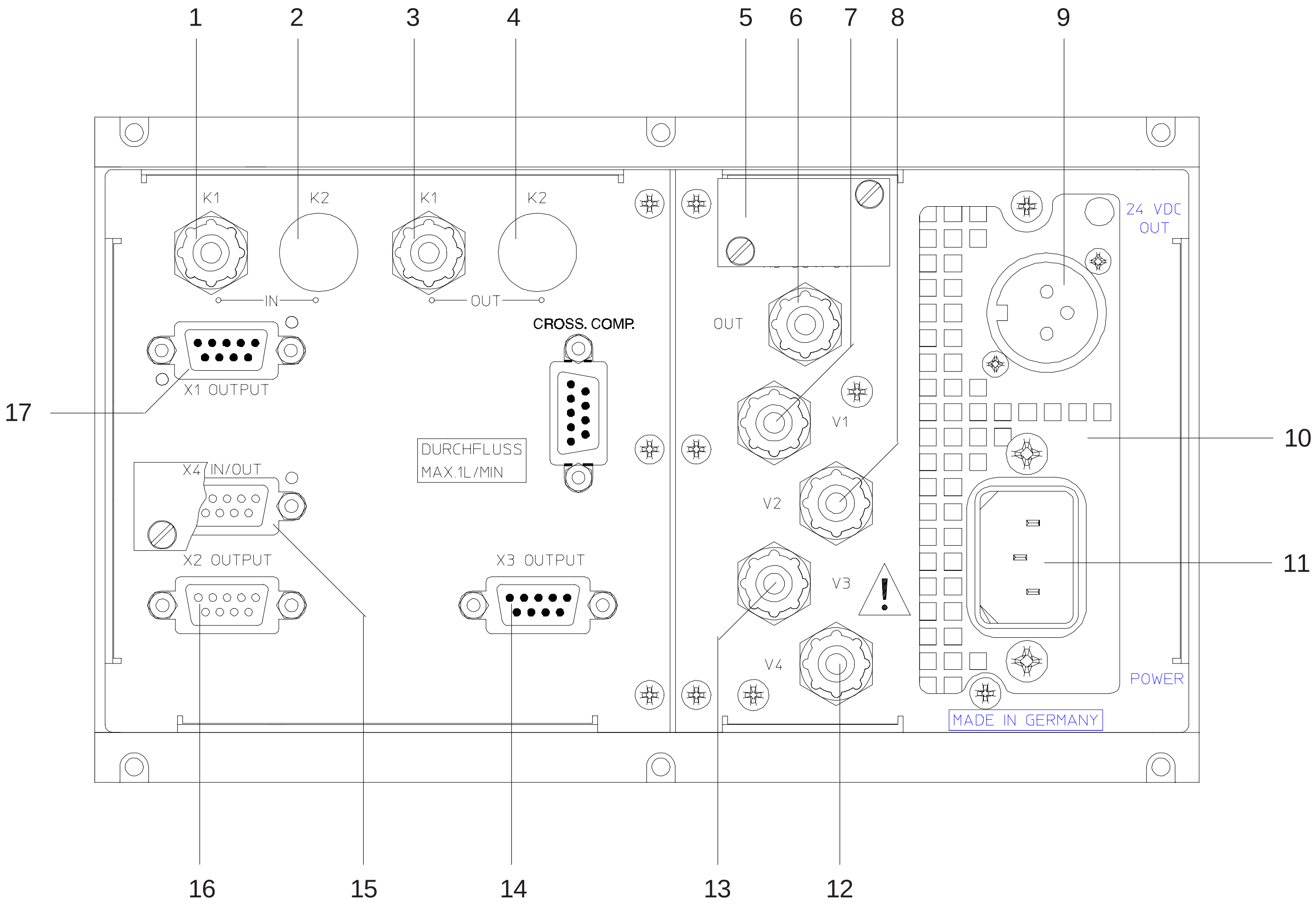

Fig. A-2: BINOS® 100 2M, Rear view with all options

1	**Gas inlet line fitting**
2	2nd gas inlet line fitting (option)
3	**Gas inlet line fitting**
4	2nd gas outlet line fitting (option)
5	Open
6	“Solenoid valves” (option): common gas outlet line fitting
7	“Solenoid valves” (option): Test gas inlet 1
8	“Solenoid valves” (option): Test gas inlet 2
9	24 VDC output (max. 30 / 60 W, see technical data)
10	Power supply [UPS 01 T (Universal Power Supply)]
11	Plug **Power Supply** (Mains line)
12	“Solenoid valves” (option): Zero gas inlet
13	“Solenoid valves” (option): Sample gas inlet
14	Plug **Digital Outputs** (threshold contacts)
15	Mating socket **Serial Interface** [RS 232 C / 485] (option)
16	Mating socket **Analog Signal Outputs**
17	Plug **Output Relays** (option)