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Multi Component Analyser

MCA 10 HWIR

Operation Manual

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Content

1 General

1.1 Information for operation manual

This operation manual contains the required information for intended use of the described product. It is firm part of the scope of supply, also if the possibility of separated order respectively delivery had been planned due to logistic reasons. By reasons of clarity it does not contain all details for all types of the described product and it cannot consider each possible case in operation with the product.

Read the operation manual completely and attentively. Observe the safety instructions and operation directions in this operation manual as well as the labelling at the device and the packaging. For later use keep the operation manual at a safe place.

If you should need further information or if problems should occur which are not described elaborately in this operation manual, please refer to Dr. Födisch Umweltmesstechnik AG (contact details: see cover inside).

For operation with the optional additional devices please read the technical documentations of the suppliers (see appendix). The contents are at responsibility of the respective manufacturers.

1.2 Intended use

The product described in this operation manual has been developed, manufactured, tested and documented in observation of the corresponding safety standards and has left the factory in safety-related correct and tested condition.

By observing the actions and safety instructions described for configuring, assembly, intended use and upkeep, there is no danger coming up by the product itself in normal case. The correct and safe operation presupposes furthermore the proper transport, professional storage, placement and assembly as well as careful operating and upkeep.

The multi component analyser MCA 10 HWIR serves the continuous emission measurement of pollutants in flue gas. It is applicable all-purpose for measurement of emissions, raw gases or processes. As system in regulatory and operational emission measurement systems it serves the exhaust concentration control in combustion plants with different types of fuel, thermal waste treatment, combustion optimisation or process management control.

To keep the correct condition of the device and to achieve a proper and safe operation it must solely be used in the way described by the manufacturer. Any kind of differing use as described in this operation manual is regarded as non-intended use and can result in personal or material damage.

Non-intended use results in termination of guarantee.

1.3 Warranty

The Dr. Födisch Umweltmesstechnik AG advises that the content of this operation manual is not part of a prior or present arrangement, commitment or legal relationship or that does not change these. All liabilities result from the respective sales contract which also contains the complete and solely legal warranty regulations. These contractual warranty terms are neither extended nor limited by the contents in this operation manual.

Rebuilding and modification at the product is not permitted. Any intervention into the device as well as any kind of non-intended use results in termination of guarantee. The manufacturer assumes no liability at all.

1.4 Standards and regulations

As far as possible, the harmonised European standards have been applied to specification and production of this device. If no harmonised European standards have been applied, the standards and regulations for the Federal Republic of Germany apply.

1.5 Declaration of conformity

The multi component analyser MCA 10 HWIR has a CE label. Therewith we declare that the device in its conception and design as well as in the execution put into circulation by us corresponds to the fundamental safety and health requirements.

NOTICE
On request the document of conformity declaration is placed at the disposal by Dr. Födisch Umweltmesstechnik AG (contact details: see cover inside).

2 Safety

The device must solely be operated in correct condition and in strict observation of the safety instructions.

Working at the device must solely be executed by qualified specialised personnel (see section 2.2 “Requirements for personnel”, page 11). Personal protective equipment according to the current legal accident prevention regulations must be worn.

Please read the safety instructions for the optional additional devices in the technical documentations of the suppliers (see appendix). The contents are at responsibility of the respective manufacturers.

2.1 Safety instructions

Safety instructions serve the prevention of hazards for life and health of users or upkeep personnel respectively for avoiding material damage. In this operation manual they are emphasised by the here defined signal terms. Furthermore, special safety instructions can be characterised by additional symbols.

2.1.1 General safety instructions

DANGER
Notes with signal word “DANGER” indicate possible hazards which cause personal damage in terms of death or most serious injury in case of non-observing the safety precautions.

WARNING
Notes with signal word “WARNING” indicate possible hazards which cause personal damage in terms of simple up to serious injury in case of non-observing the safety precautions.

CAUTION
Notes with signal word “CAUTION” indicate possible hazards which cause material damage in case of non-observing the safety precautions.

NOTICE
Notes with this indication describe helpful information and tips for operation with the product and serve the avoidance of failure.

2.1.2 Specific safety instructions

DANGER
Hazardous voltage!
Parts of the device can be energised with hazardous voltage.
Danger of electric shock.
Any work at the device must solely be executed by qualified personnel.

DANGER
Explosion hazard!
Personal damage in immediate surround as well as material damage at the device and its vicinity can be caused.
The device must not be operated in potentially explosive atmosphere.

DANGER
Poisonous substances!
Poisonous gases can cause serious health damage or death.
Irritating of eyes, skin or respiratory system organs can be caused.
Exhaust of the gas output must be conducted into an exhaust system.
The correct operation of ventilation in the analyser cabinet must be assured.

WARNING
Corrosive substances!
Irritating or corrosive gases or substances can cause chemical burn of body tissue and serious eye injury in case of contact.
In case of contact with skin or eyes the affected spots must be cleaned immediately!
Objects which have been contacted with irritating or corrosive gases or substances must be cleaned accurately.

WARNING
Hot surface!
Several device parts can develop high temperatures.
Burn of skin can be caused!
For protection against possible injury protective gloves must be worn.

2.1.3 Personal protective equipment

WEAR PROTECTIVE CLOTHING
For protection against injury at any kind of hazard protective clothing must be worn.

WEAR PROTECTIVE FOOTWEAR
For protection against possible injury protective footwear (e.g. safety shoes) must be worn.

WEAR PROTECTIVE GLOVES
For protection against possible injury at touching of device components protective gloves must be worn.

WEAR HEAD PROTECTION
For protection against possible injury by falling objects or bouncing hazard a head protection must be worn.

WEAR RESPIRATORY PROTECTION
For protection against possible suffocation hazard or injury of respiratory system organs by poisonous gases a respiratory protection must be worn.

WEAR EYE PROTECTION
For protection against possible eye irritation by corrosive gases or substances eye protection must be worn.

WEAR HEARING PROTECTION
For protection against possible hearing impairment by high noise level hearing protection must be worn.

2.2 Requirements for personnel

This operation manual is directed to technically qualified personnel which have been specially instructed or which possesses appropriate knowledge in the field of measuring, control and feedback control technology, called automation technology further on.

Qualified personnel are persons who

- are either familiar as configuring personnel with the safety concepts of automation technology
- or are instructed as operating personnel in operation with automation technology equipment and are acquainted with the contents of these instructions referring to operation
- or have been instructed as commissioning and/or service personnel to be qualified for repair of such automation technology equipment respectively who are authorised to energise, ground and tag circuits and devices/systems according to the standards of safety engineering.

The knowledge and the technically correct realisation of the safety instructions and operating directions described in this operation manual are the requirement for hazard-free assembly and commissioning as well as for safety at operation and upkeep. The specialised personnel must be familiar with the general risks and hazards and know and observe the respective safety precautions.

Unqualified interventions into the device or non-observance of the operation manual or of the affixed labels on the product can result in personal or material damage.

Any work at the device must solely be executed by qualified specialised personnel in observation of the corresponding regulations (central association of electrical engineering and industry).

2.3 Electrical power supply

DANGER
Hazardous voltage! Danger of electric shock.
Also when the device is switched off, there can be high voltage inside it.
Any work at the device must solely be executed by qualified personnel. The following requirements must be observed.

- Insulation: protection class I according to IEC 1010-1:1993
- Insulation co-ordination: overvoltage category II according to IEC 1010-1:1993
- Pollution: safe work of device in an area up to pollution degree 2 according to IEC 1010-1:1993 (light, normal pollution which can become conductive by occasional condensation)
- The power supply has to be installed and secured according to the corresponding legal safety regulations and prescriptions.
- The device must only be connected to the supply voltage designated on the type plate.
- A protective separation between primary and secondary circuit is generally ensured. Low voltage which is connected must also be generated by protective separation.
- Grounding contact:
  - The device must always be grounded. It has only to be operated at a power supply with grounding contact.
  - The grounding conductors in the device or the feeder must not be separated or removed.
  - The protection effect must not be abolished by an extension without grounding conductor. Every kind of interruption of the grounding conductor inside or outside of the device is hazardous and not permitted.
  - In the case of insufficient grounding or damaged grounding conductor the device must be shut down and secured against unauthorised or inadvertent activation.
- Fuses:
  - In the case of a required fuse change, only fuses must be used which are according to the old fuses in type and capacity.
  - Auxiliary fuses must not be used.
  - Fuse holders must not be shorted.
- Cables must be laid that an accident risk by tripping or getting caught is excluded.
- Covers:
  - The device must not be operated when covers or other parts have been removed, because current carrying parts are divested of covering in operation.
  - If not explicitly requested, work inside the device must not be executed.
  - Before opening the device it must be de-energised by exerting the pre-fuse.
  - If work at the opened device is necessary (adjustment, maintenance etc.), this work must only be executed by appropriate qualified personnel which is familiar with the hazard points and which has knowledge of avoiding hazards by proper safety precaution.

Electrical safety

If the electrical safety of the device is not given anymore, the device must be shut down and secured against unauthorised or inadvertent activation.

The electrical safety of the device is not given any more if it:

- has visible external damage
- does not work correctly anymore
- has been stored under impermissible or inappropriate conditions for any length of time
- has been encountered impermissible strain during transport

2.4 Gas supply

DANGER
Explosion hazard!
Personal damage in immediate surround as well as material damage at the device and its vicinity can be caused.
The device must not be operated in potentially explosive atmosphere.
Observe the safety instructions of the gas supplier.

DANGER
Poisonous substances!
Vapours and gases escaping from the cuvette are poisonous. Filters from cuvette, gas sample probe and pump can contain poisonous substances. Also leakage inside the analyser cabinet results in accumulation of poisonous or corrosive gases.
Serious health damage (e.g. irritation of eyes, skin or respiratory system organs) or death can be caused.
Exhaust of the gas output must be conducted into an exhaust system.
The correct operation of ventilation in the analyser cabinet must be assured.
Observe the safety instructions of the gas supplier.

WARNING
Corrosive substances!
Depending on the measuring gas incidental substances can be corrosive and/or poisonous.
Contact can cause chemical burn of body tissue and serious eye injury.
In case of contact with skin or eyes the affected spots must be cleaned immediately!
Objects which have been contacted with irritating or corrosive gases or substances must be cleaned accurately.

- The compressed-gas cylinders and equipment (gas bottles, valves, pipes, pressure reducer etc.) must be installed and operated according to the corresponding legal safety regulations and prescriptions.
- In the bottle room and near of compressed-gas cylinders naked light, fire, smoking and sparking are forbidden.
- Compressed-gas cylinders:
  - All compressed-gas cylinders must be positioned upright into steady mounted holders and secured against toppling by chains or rods.
  - The compressed-gas cylinders, theirs content and all continuative gas pipes must be designated clearly.
  - In case of storage in closed rooms sufficient ventilation must be ensured.
  - The compressed-gas cylinders must be kept away from heat sources and protected against direct solar radiation and temperature fluctuation.
- For every kind of gas solely the respective permissible pressure reducer must be used.
- Pressure gas hoses must be laid that an accident risk by tripping or getting caught is excluded. Likewise they must be protected against damage caused by falling objects and treading on.
- In case of standstill for any length of time the bleeder valves of the compressed-gas cylinders respectively of gas supply must be closed, the pressure inside the gas pipes to the device must be released and all valves must be closed.

2.5 Components

The device as well as the single components must only be operated as original variant. In case of exchanging single elements only the original parts of the manufacturer must be used. Components are configured device-specific and hence they are not interchangeable between different devices.

2.6 Electronic elements

Electrostatic discharges can cause damage at the electronic elements. The following precautions must be taken:

- Electronic elements must be stored in the original packaging directly until use.
- Electronic elements must be touched at housing. The contacts must not be touched.
- Electronic elements and conductor plates must be kept away from statically charged surfaces (PVC plastics, plastic bags etc.).
- Wear a special ESD wrist band or use a grounded, antistatic working surface.

2.7 Configuration settings

Changes of configuration can endanger the safety and function of the device. Configuration settings must solely be executed by an authorised service technician or by factory personnel of the manufacturer.

3 Basics

3.1 Photometry

The principle of the gas component measurement is based on the substance-specific extinction of infrared light. This is directed through the measuring gas whereat the lessening of the light intensity within the substance-specific absorption wave length is a degree for its concentration.

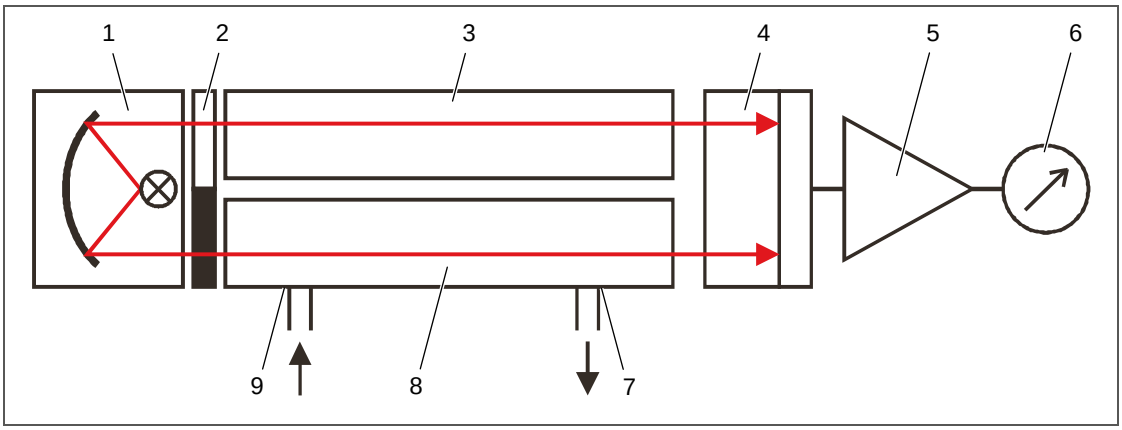


Fig. 1: Measuring technological implementation of photometry

1 Infrared emitting source
2 Aperture wheel
3 Comparison cuvette
4 Gas detector
5 Amplifier
6 Indicator
7 Test gas outlet
8 Measuring cuvette
9 Test gas inlet

The physical basis for photometric measurement is the Lambert-Beer's law.

$$E = \log\left(\frac{I_0}{I}\right) = e \cdot c \cdot d$$

E	Extinction
I_0	Intensity of emitted light
I	Intensity of received light
e	Extinctions coefficient
c	Concentration of the measured component
d	Transmitted wave length

For calculation of gas concentrations in the MCA 10 HWIR three different measuring methods are applied:

- Bi-frequency measuring method
- Gas filter correlation
- Oxygen measurement

3.1.1 Bi-frequency measuring method

At bi-frequency measuring method a measuring filter and subsequently a reference filter are directed into the light path. Thereby the transmission range of the measuring filter lies in the range of the absorption wave length of the measuring component. The transmission range of the reference filter lies in the spectral range outside of the absorption wave length of the measuring component. So the light intensities with and without gas influence can be determined successively.

Measurement of: NO_2, SO_2, HF, H_2O, CO_2

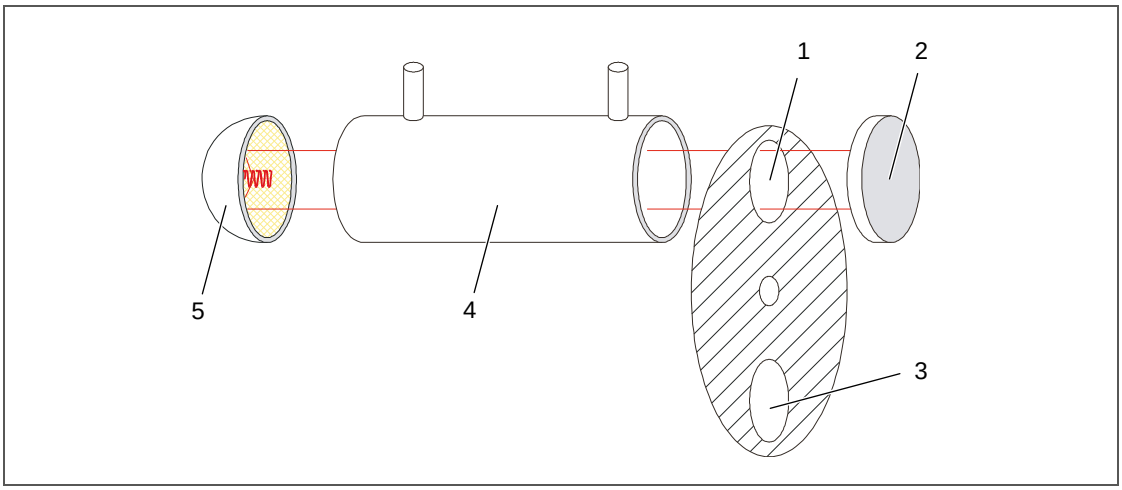


Fig. 2: Bi-frequency measuring method – scheme

1 Measuring filter
2 Receiver
3 Reference filter
4 Measuring cell (cuvette)
5 Light source

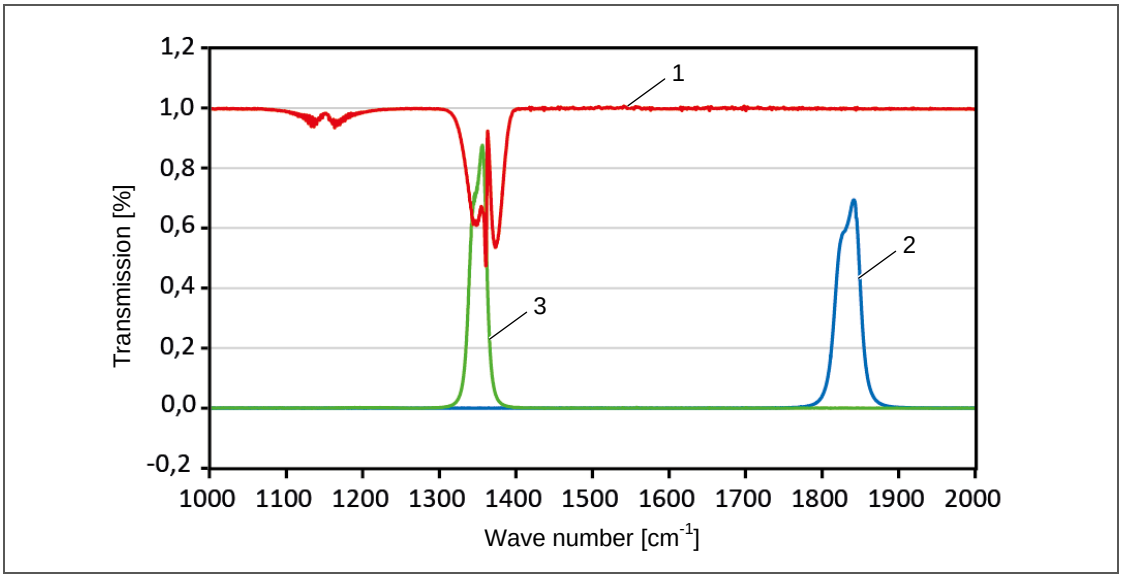


Fig. 3: Bi-frequency measuring method – spectrum

1 SO_2 band
2 Reference filter
3 Measuring filter

3.1.2 Gas filter correlation

At gas filter correlation the spectral sphere of action of the reference filter is identical with the one of the measuring gas filter. The reference filter position possesses an additional gas filter which is filled with a high concentration of the gas to be measured in order to reach the saturation of the infrared absorption. Thereby the substance-specific spectrum of the infrared light is almost completely faded out.

Measurement of: CO, NO, HCl, NH_3, N_2O, CH_4

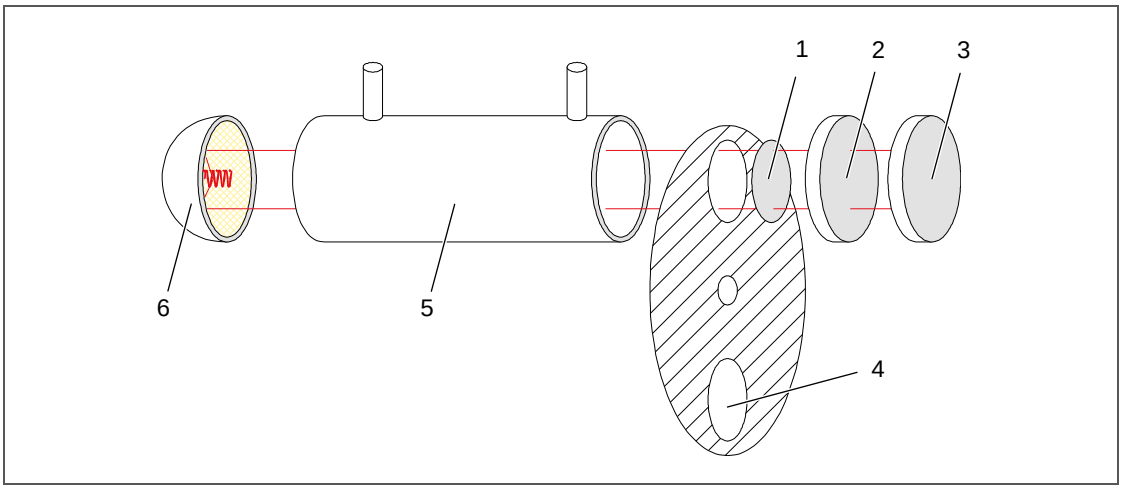


Fig. 4: Gas filter correlation – scheme

1 Gas filter
2 Interference filter
3 Receiver
4 Free aperture
5 Measuring cell (cuvette)
6 Light source

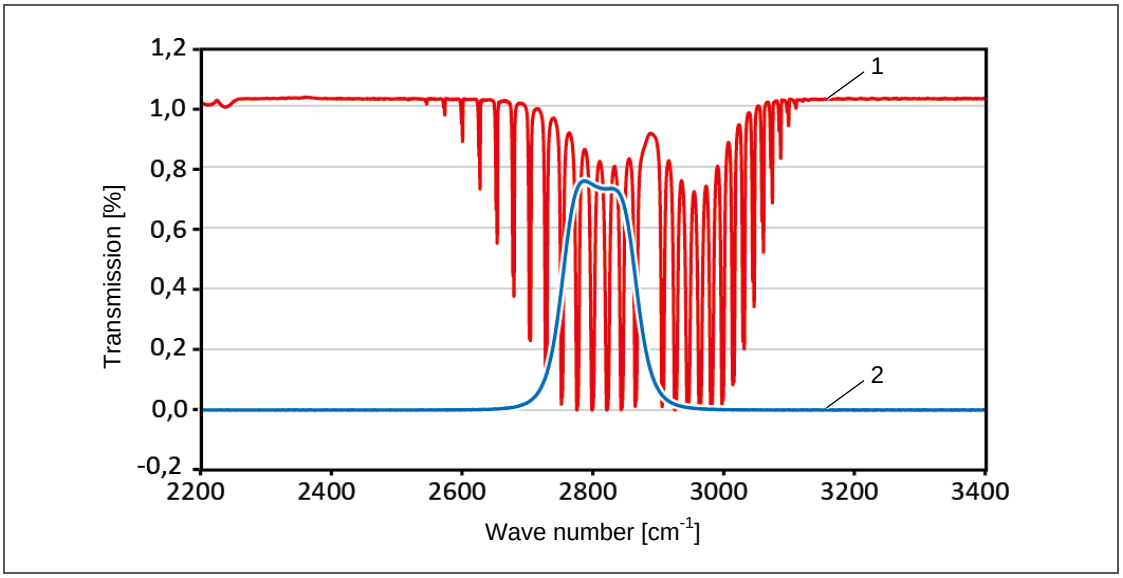


Fig. 5: Gas filter correlation – spectrum

1 HCl band
2 Interference filter

3.1.3 Oxygen measurement

The oxygen measurement is carried out by means of a zirconium dioxide cell. Inside the cell the measuring gas is separated from the reference gas (ambient air) via a zirconium membrane. Depending on the oxygen partial pressure the oxygen ions move through the membrane. This results in an electric potential difference.

The used oxygen sensor consists of a measuring cell and a pump cell which provides a constant oxygen concentration in the measuring cell. The thereby spent energy is a degree for the oxygen concentration.

Due to the proven proportionality of the signal to the concentration a steady exactness in all oxygen concentration ranges is ensured.

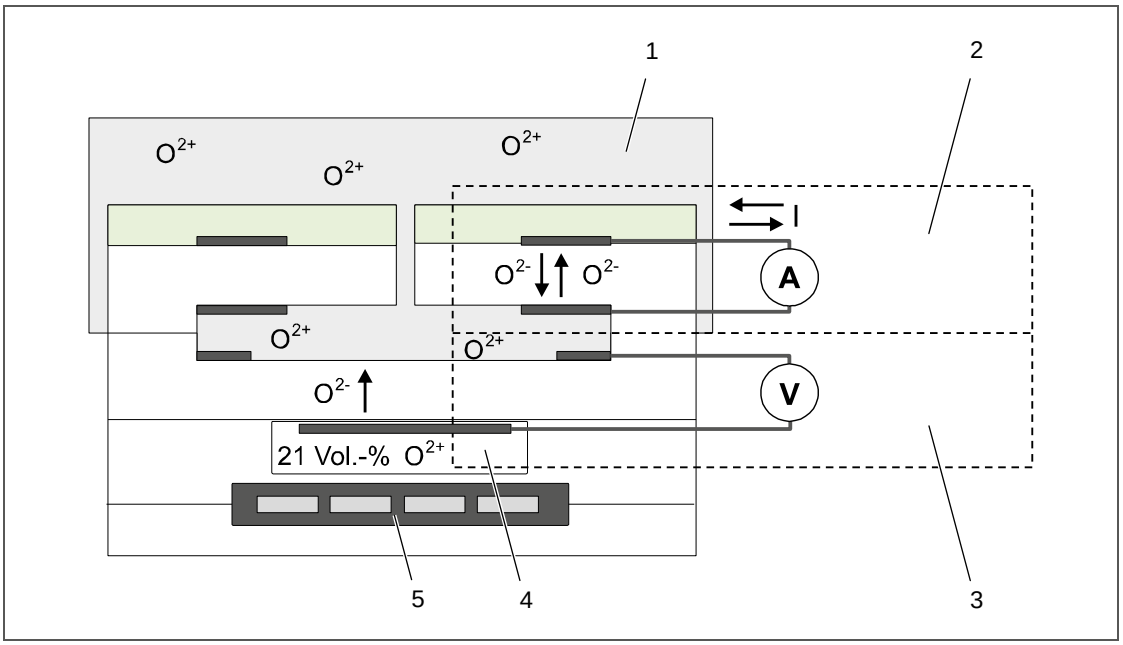


Fig. 6: Oxygen measurement – functional principle

1 Exhaust
2 Pump cell
3 Measuring cell
4 Reference medium
5 Heater

3.2 Compensation of measuring components

The following table shows the cross sensitivities of the single measuring components in correlation. In case of an existing cross sensitivity compensation is required.

Measuring component \ Cross sensitivity component	HF*	CO_2	HCl	H_2O	CH_4	CO	NO_2	SO_2	N_2O	NO	NH_3	O_2	TOC
HF*	-	●		●	●								
CO_2		-		●	●								
HCl		●	-	●	●								
H_2O		●		-	●								
CH_4		●		●	-								
CO		●		●		-							
NO_2				●	●		-			●			
SO_2		●		●	●			-		●			
N_2O		●		●		●			-	●			
NO		●		●						-			
NH_3		●		●							-		
O_2				●								-	
TOC								●					-

● compensation required

* not suitability tested according to DIN EN 15267-3; certified in compliance with MCERTS Performance Standards

Tab. 1: Compensation table

4 Functional description

The multi component analyser MCA 10 HWIR serves the continuous emission measurement of pollutants in flue gas (e.g. CO, NO, N_2O, NO_2, NH_3, CH_4, HCl, SO_2, HF; as system additionally TOC) and the measurement of CO_2, H_2O and O_2 as well as the continuous process control.

The device is applicable all-purpose for measurement of emissions, raw gases or processes. As system in regulatory and operational emission measurement systems, amongst others, it serves the:

- Exhaust concentration control in combustion plants with different types of fuel (oil, gas, coal, biomass, specified recovered fuels etc.)
- Thermal waste treatment
- Combustion optimisation
- Process management control

Application examples:

- Power plants
- Waste incineration plants
- Refineries
- Cement industry
- Industrial exhaust air
- Paper mills
- Glass industry
- Chemical industry

By the functional principle of the multi component analyser MCA 10 HWIR up to twelve infrared gas components can be detected simultaneously. Optionally, an oxygen measurement is possible by means of an oxygen sensor.

The optical bench for the measurement of the infrared components consists primarily of an infrared light source with chopper wheel, a measuring cell, a motor-driven filter wheel and a detector.

The infrared light source located in the emitter unit emits a wide-band light beam. This radiation is focused by a focussing mirror, modulated by the chopper wheel and transmitted into the measuring cell which is continuously streamed by the measuring gas.

The gas suction is carried out by a low-maintenance air-jet pump. Pressure sensors control the cuvette pressure and the suction-side injector pressure, so that all measuring values are standardised for pressure.

The reflexion of the infrared light starts at the couple-in area at the spherical mirror in the cuvette and is transmitted to the second mirror. By variable interreflections over the three mirrors in all, a path length up to 10 m can be achieved. Over the couple-out area at the spherical mirror the infrared radiation is directed out of the cuvette into the detector unit. There the filter wheel, a focussing mirror and the pyroelectric detector with its control electronics are located. The infrared radiation is transmitted through the measuring and reference filters located at the filter wheel and over the focussing mirror to the detector.

The positioning of the filter wheel is realised by a step motor and controlled continuously by an optical photo sensor. Thereby the arrangement of the filter wheel is depending on the type of the measured gas ingredients.

The multi component analyser MCA 10 HWIR evaluates internally all specification-depending required concentrations with all necessary compensations and standardisations. The mainboard is responsible for all tasks of photometer control, sensor evaluation, concentration calculation and interface communication. The measuring data is provided as Modbus protocol via the RS232 interface. Via USB interface the communication to an external PC is realised. There the visualisation and operating are executed by device-own user software.

The operating surface is designed for one-click operating via touch function without additional input acknowledgement. Optionally, the operating can be carried out by a connected mouse respectively a trackpad and a keyboard. All menus, messages and navigation fields are displayed as self-explanatory clear text. The menu navigation extends over several pages which can be navigated by clicking the buttons. Device parameters can be reviewed in the form of pop-up menus.

Optionally, the additional connections at the gas distribution block can be used for connection of external devices (e.g. Thermo-FID, HG measuring device).

5 Design

The MCA10 HWIR has a robust chassis design, where the photometer is structurally separated from the control electronics respectively computer electronics.

Device components at the top side:

- Gas suction and gas distribution
- Photometer (consisting of emitter unit, measuring cell and detector unit)
- Measuring relevant sensors
- Oxygen sensor (optional)

Device components at the bottom side:

- Power supply unit
- Mainboard

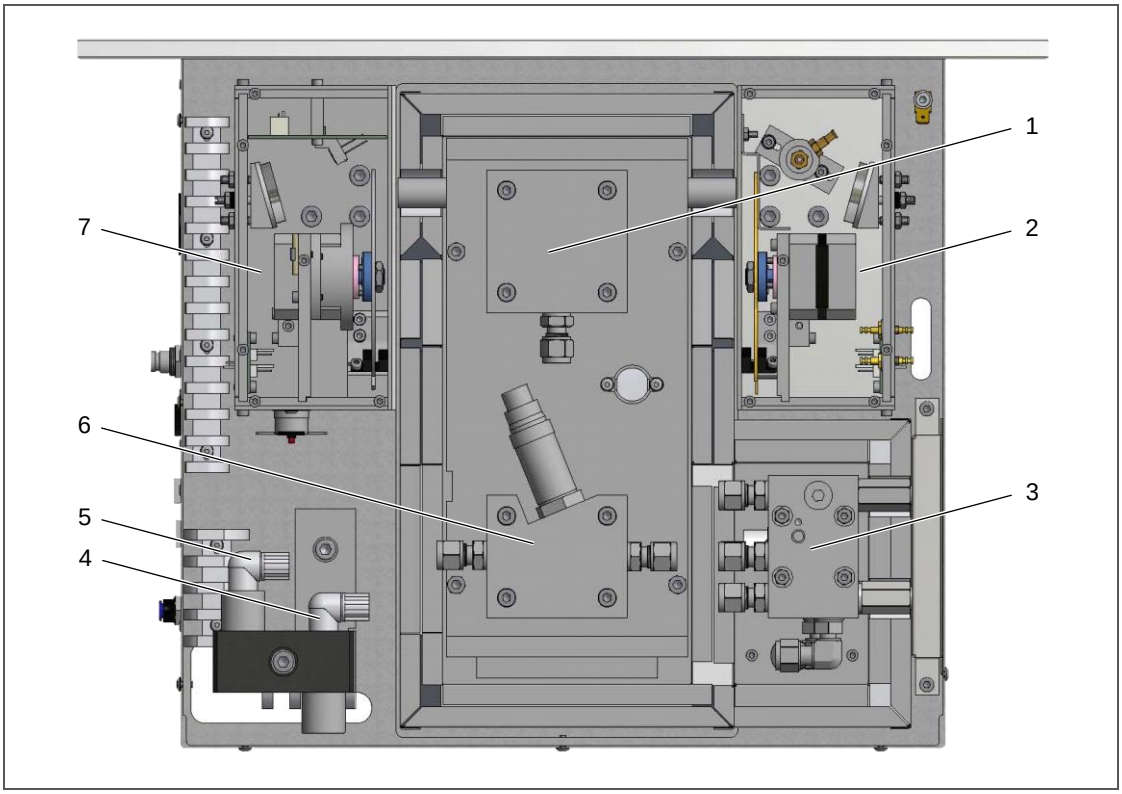


Fig. 7: Design of multi component analyser MCA 10 HWIR (top view)

1 Measuring cell
2 Emitter unit
3 Gas distribution block
4 Pressure sensor of injector
5 Pressure sensor of cuvette
6 Oxygen sensor
7 Detector unit

5.1 Emitter unit

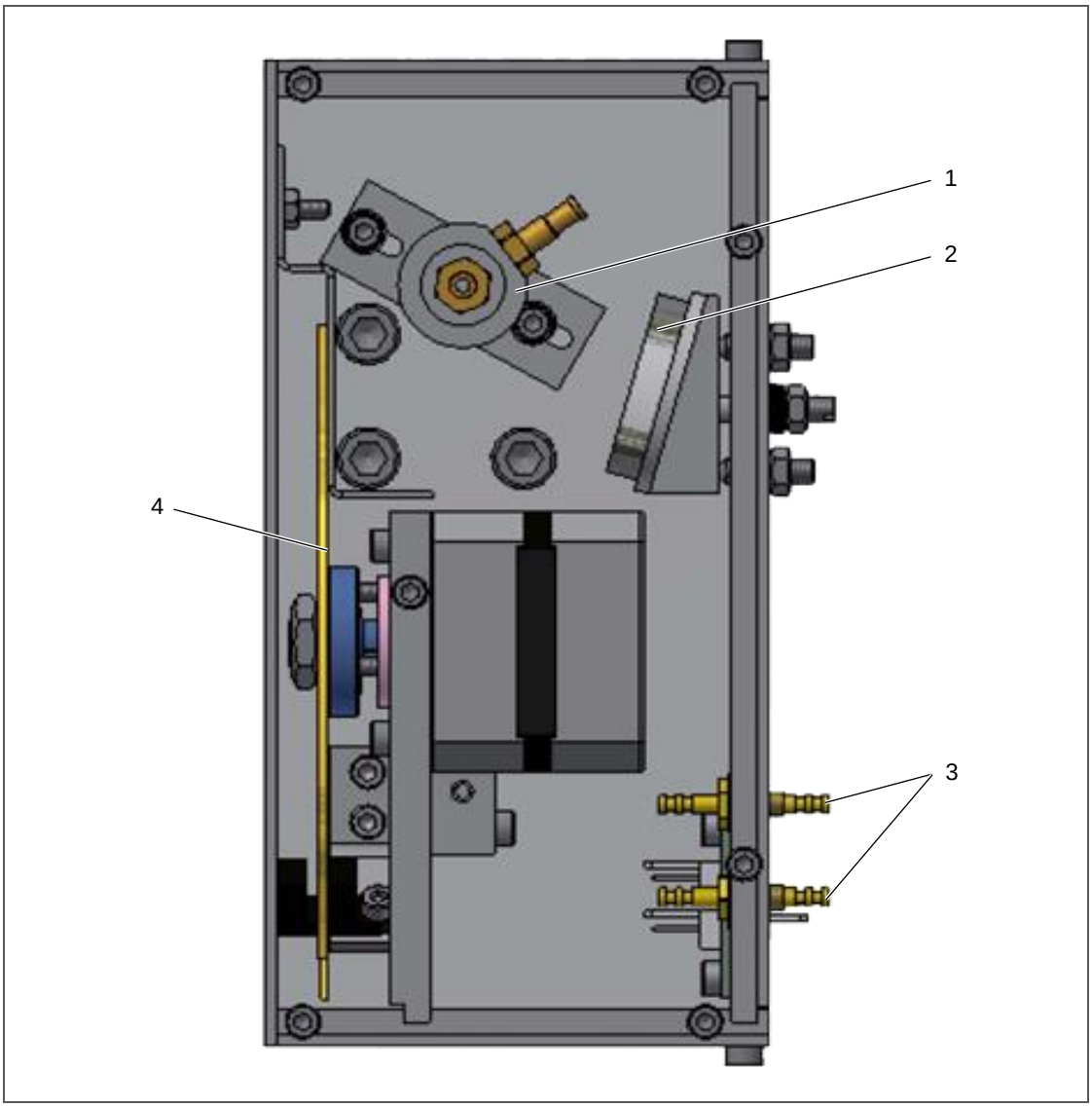


Fig. 8: Emitter unit

1 Infrared emitter
2 Focussing mirror
3 Connection for emitter and chopper wheel
4 Chopper wheel

5.2 Cuvette

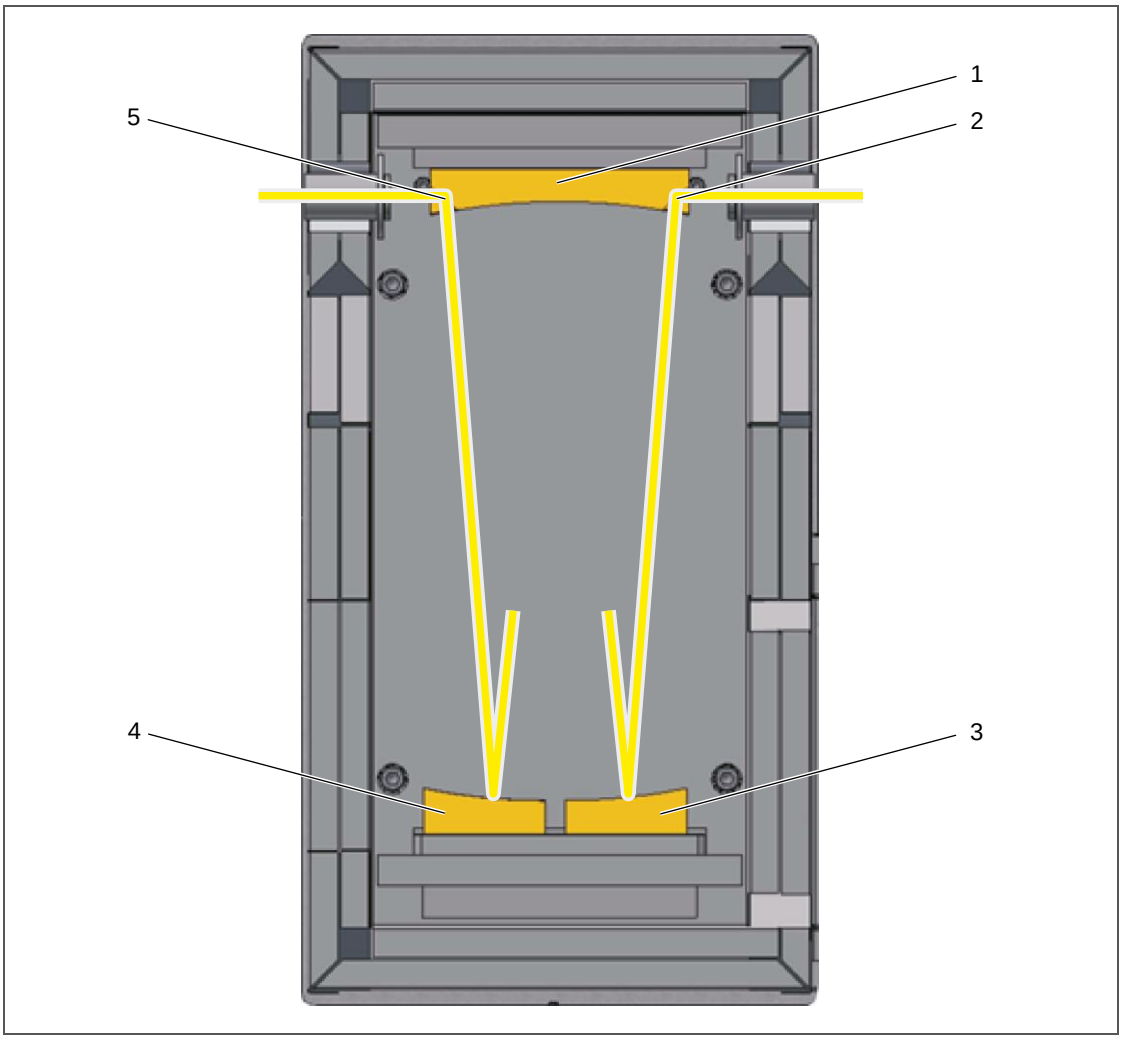


Fig. 9: Cuvette

1 Spherical mirror
2 Couple-in area
3 Mirror S2
4 Mirror S3
5 Couple-out area

5.3 Detector unit

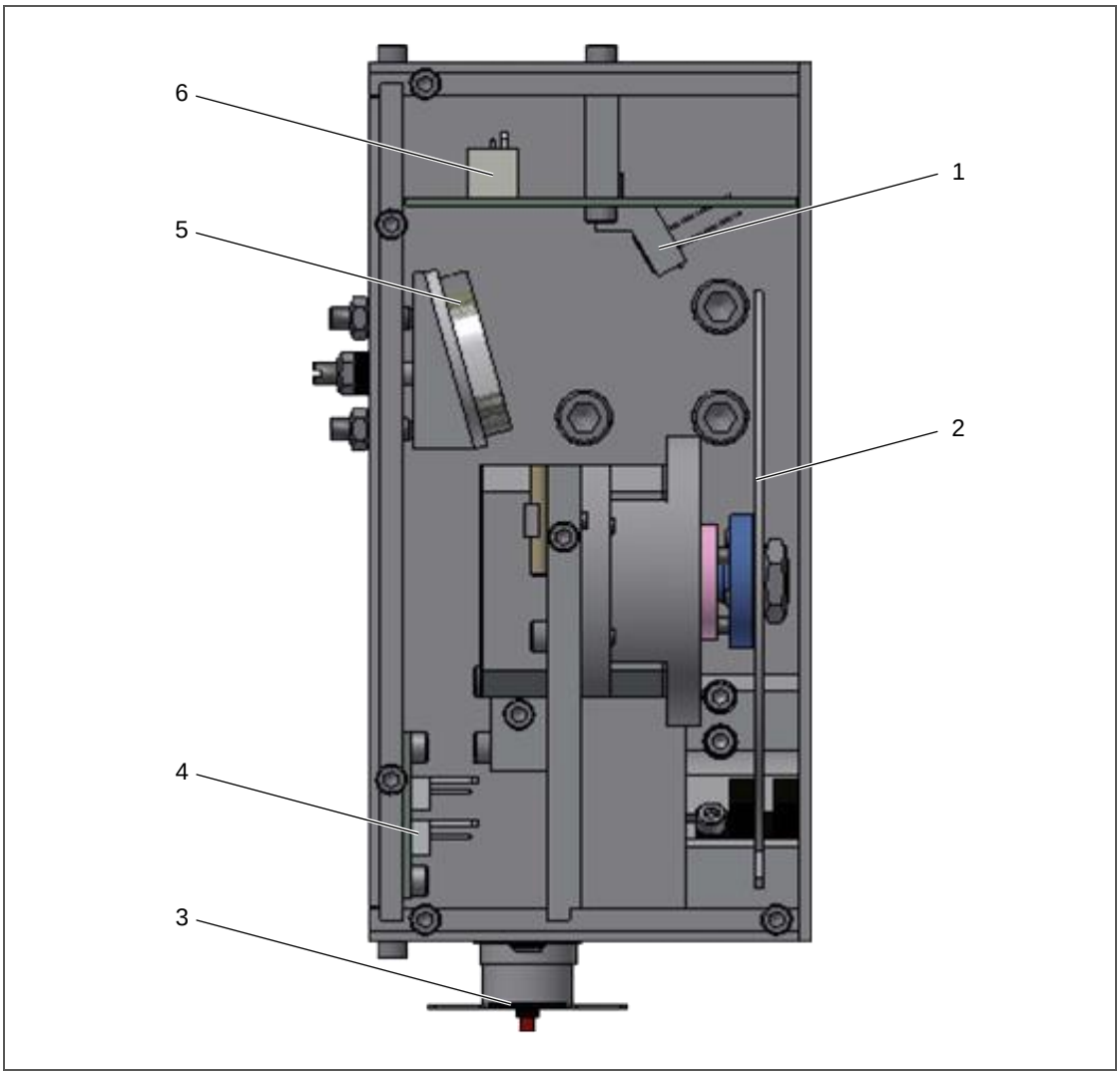


Fig. 10: Detector unit

1 Pyroelectric detector
2 Filter wheel with step motor
3 Over-temperature protection
4 Cable feedthrough
5 Focussing mirror
6 Detector board

NOTICE
The configuration of the filter wheel is in accordance to the device specification.

NOTICE
At a temperature of more than 70 °C the over-temperature protection interrupts the heater control.
If the internal temperature resistance displays more than 65 °C, the cuvette heater and the detector heater are set at a target value of 20 °C to avoid detector damages. A failure message is displayed.

5.4 Gas distribution block

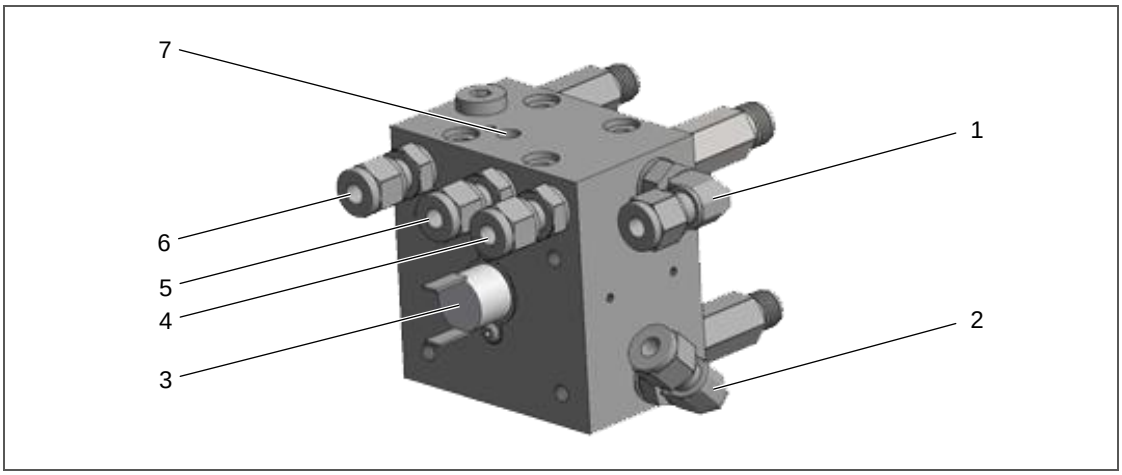


Fig. 11: Gas distribution block

1 Connection of pressure sensor S1
2 Internal connection to C2 (see Fig. 14, page 30)
3 Over-temperature protection
4 Internal connection to C6 (see Fig. 14, page 30)
5 Measuring gas cell outlet
6 Measuring gas cell inlet
7 Heater and temperature sensor

NOTICE
Connections at rear side of the gas distribution block:
See Fig. 15 “Connection assignment (view from right side)”, page 30.

The gas conveyance in the MCA10 HWIR is executed by an air-jet pump. This is arranged behind the exhaust connection at the gas distribution block.

NOTICE
The primary pressure of the forced air must be standard adjusted at 1 bar. Thereby a suction performance of 400 mbar will be reached.

5.5 Pressure and flow measurement

At the front of the left chassis side there are two absolute pressure sensors (4 and 5, Fig. 7) (0...1600 mbar). These measure the cuvette pressure and the suction-side injector pressure. By means of the sensors the analyser flow is controlled and all measuring values are standardised for pressure.

5.6 Oxygen sensor (optional)

The oxygen measurement takes place at exhaust side in the outlet block of the measuring cuvette. The oxygen sensor (6, Fig. 7) is attached above the measuring cuvette.

5.7 Mainboard

The mainboard is responsible for all tasks of photometer control, sensor evaluation, concentration calculation and interface communication.

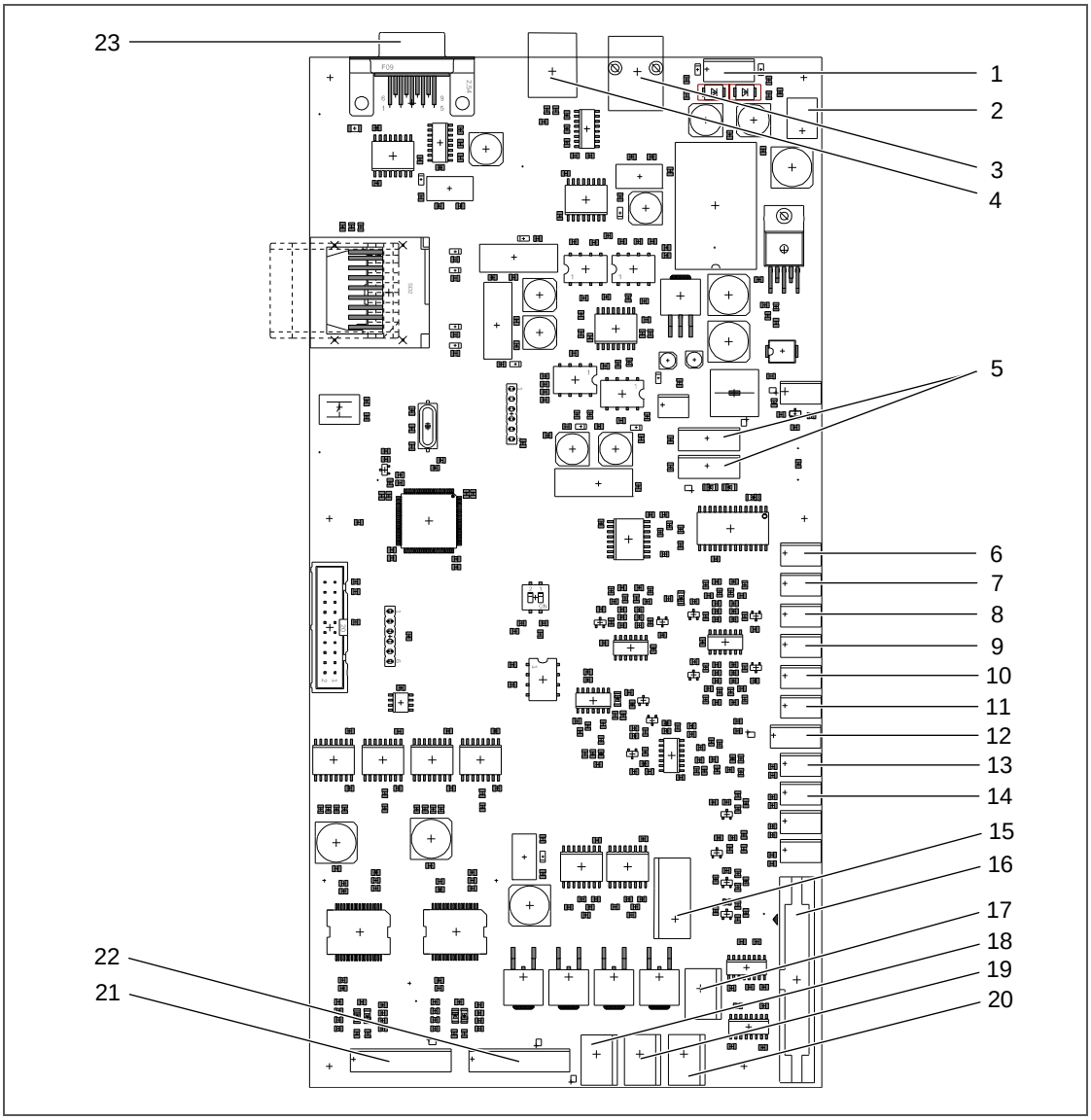


Fig. 12: Mainboard, connection plan

1 Power supply for detector
2 Power supply for Mainboard (10 V)
3 Service interface
4 USB interface (PC)
5 Power supply unit control
6 PT100 1 (detector, bottom)
7 PT100 2 (cuvette)
8 PT100 3 (detector, top)
9 PT100 4 (power supply unit)
10 PT100 5 (injector)
11 PT100 6 (free)
12 Oxygen sensor
13 Pressure of cuvette
14 Pressure of injector
15 Power supply (24 V)
16 Detector-board
17 Heater of injector
18 Heater of oxygen sensor
19 Heater of cuvette
20 Heater of detector
21 Filter wheel
22 Chopper wheel
23 RS232 interface (PLC)

5.8 Power supply unit

The power supply unit in the MCA10 HWIR consists of a solid aluminium case and is cooled via two fans. It is designed for a supply voltage of 110 V to 230 V, 50/60 Hz and provides all necessary voltage levels in the analyser.

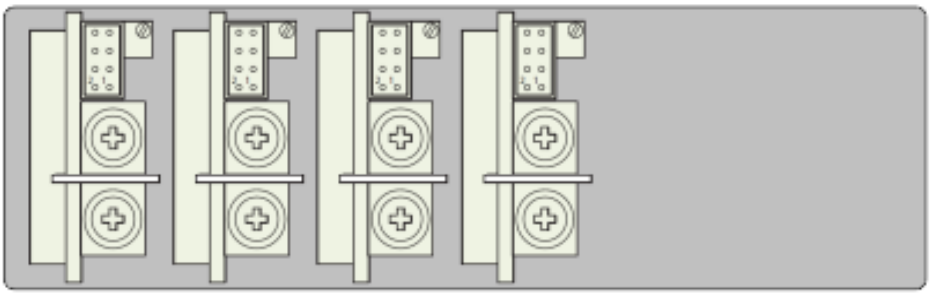


Fig. 13: Power supply unit, voltage levels

5.9 Interfaces

The following interfaces are located at the left side of the device:

- USB: communication to PC
- RS232: communication to cabinet control (PLC), provision of measuring data via Modbus protocol
- RJ-45: Service interface of factory

NOTICE
The precise protocol description of Modbus communication can be reviewed in the document “Description for digital interface - Modbus” (see appendix).

5.10 Connection assignment

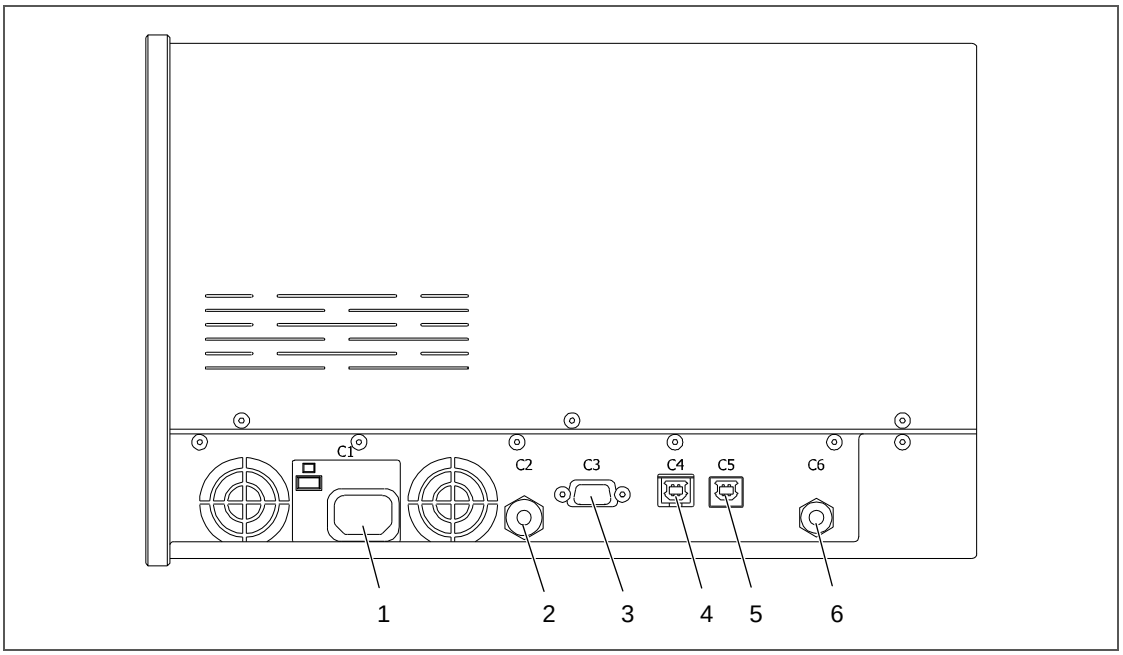


Fig. 14: Connection assignment (view from left side)

1 C1: Power supply (IEC)
2 C2: Test gas / zero gas (for 4/6-type hose)
3 C3: RS232 interface to PLC (D-sub, 9-pin)
4 C4: USB interface to PC (USB-B)
5 C5: Service interface Ethernet (RJ-45)
6 C6: Forced air connection (for 4/6-type hose)

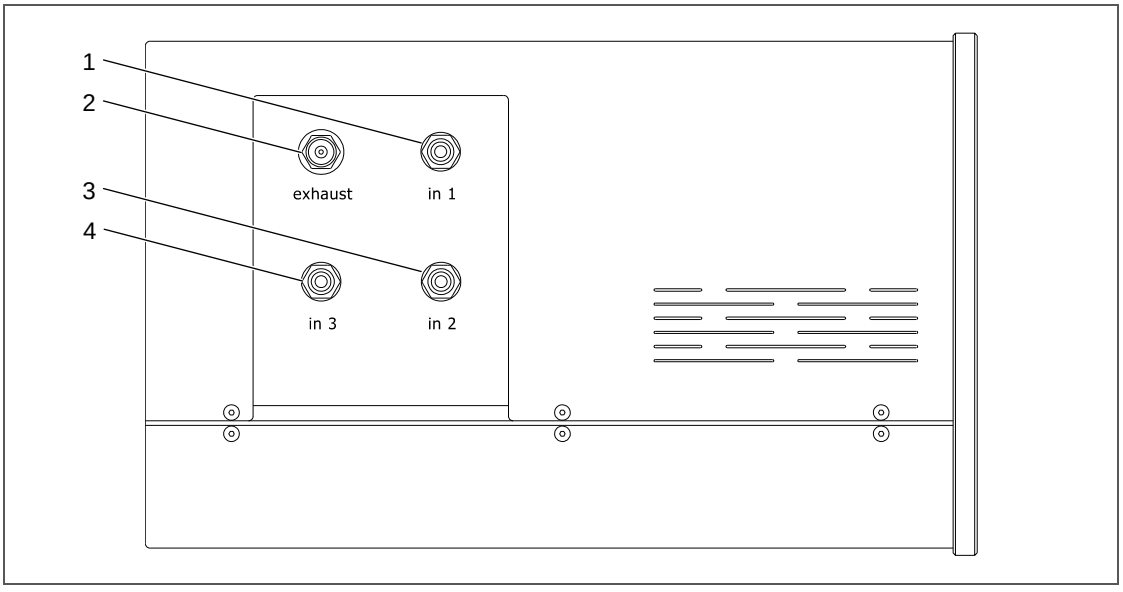


Fig. 15: Connection assignment (view from right side)

1 in 1: Measuring gas connection (suction-side measuring gas input)
2 exhaust: Exhaust connection (screwing-in injector)
3 in 2: Optional measuring gas distribution (suction-side measuring gas input)
4 in 3: Optional measuring gas distribution (suction-side measuring gas input)

(All connections with G ¼" for 6/8-type hose resp. tube)

5.11 System design (application example)

In conjunction with the MCA 10 HWIR the measuring device arises from the following main components:

- Infrared photometer (MCA 10 HWIR)
- Analyser cabinet, incl. control panel in the cabinet door
- Gas sample probe (optional device): connection of up to three heated gas sample probes with changeover via probe valve
- Heated measuring gas pipe
- Automatic test gas provision: up to ten test gases (single or multi gases)
- Gas return: PTFE exhaust pipe (optional: heated exhaust pipe)
- Optional system extensions:
  - Thermo-FID (mounting in analyser cabinet, control/visualisation via control panel integrated in the analyser cabinet)
  - Mercury measuring device (HG)

A possible design as a system with optional additional devices is shown in the following application example.

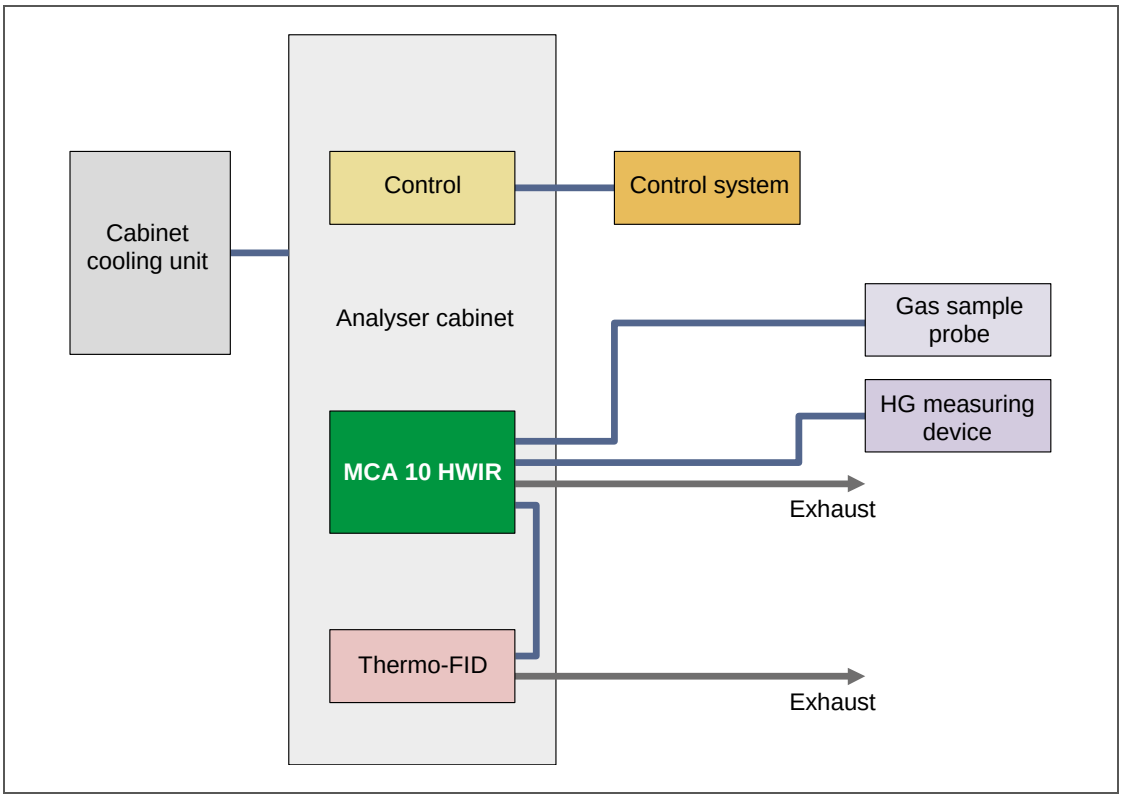


Fig. 16: System design (application example)

NOTICE
For precise design of optional additional devices please read the technical documentations of the suppliers (see appendix).
The contents are at responsibility of the respective manufacturers.

5.11.1 Gas circuit diagram

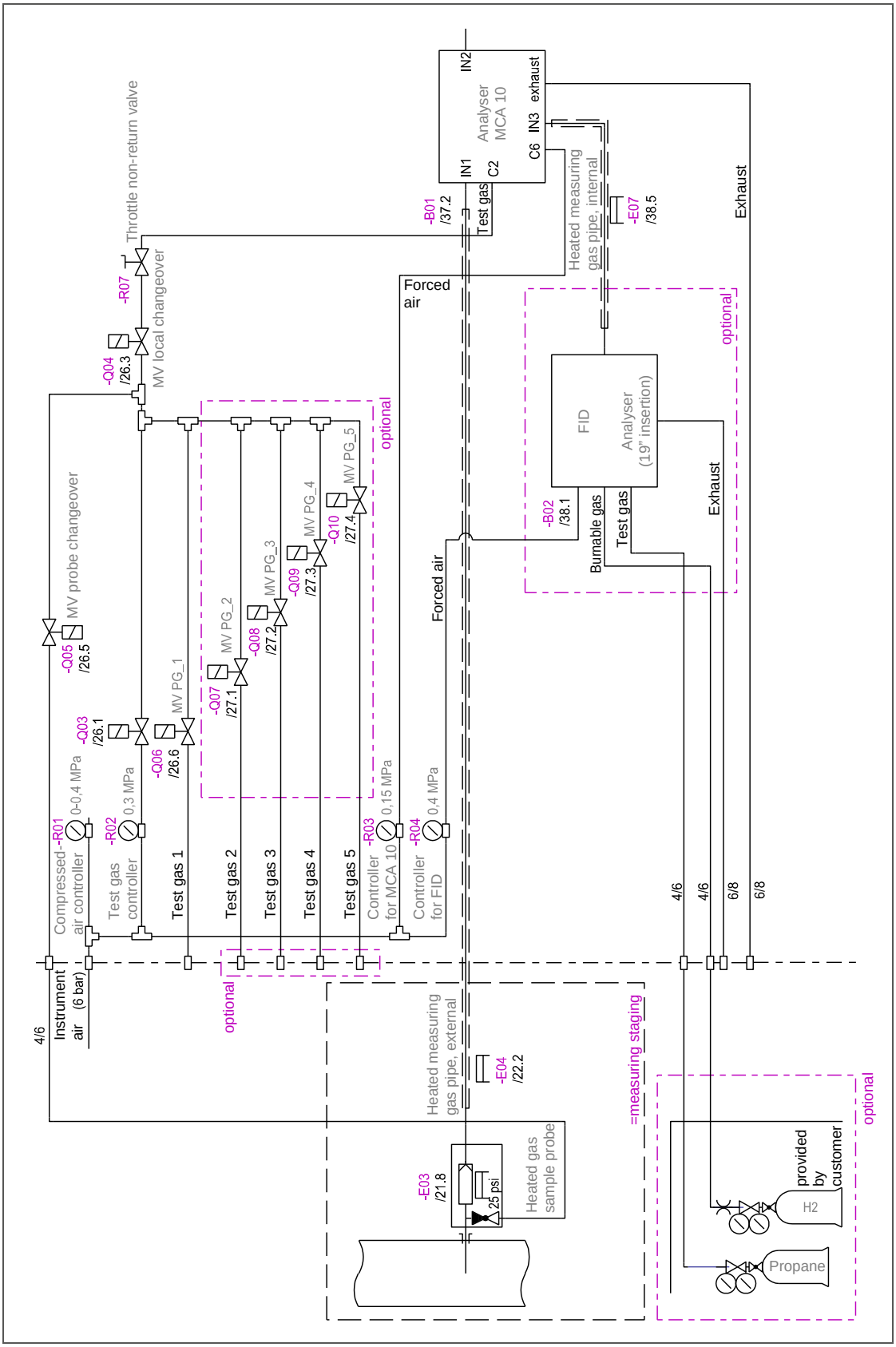


Fig. 17: Gas circuit diagram (application example)

The measuring gas conveyance is carried out by the air-jet pump integrated in the MCA 10 HWIR. Forced air of 1 to 4 bar is supplied to this pump. Up to three heated measuring gas pipes can be connected suction-side at the gas distribution block of the analyser module. The unused connections at the analyser will be sealed gas-tight. The exhaust is a mixture of forced air and sucked measuring gas and shows a large flow. The zero gas provision is standard conducted through the connection C2. Thereby the flow may be maximal 600 l/h.

5.11.2 Design of CPU components

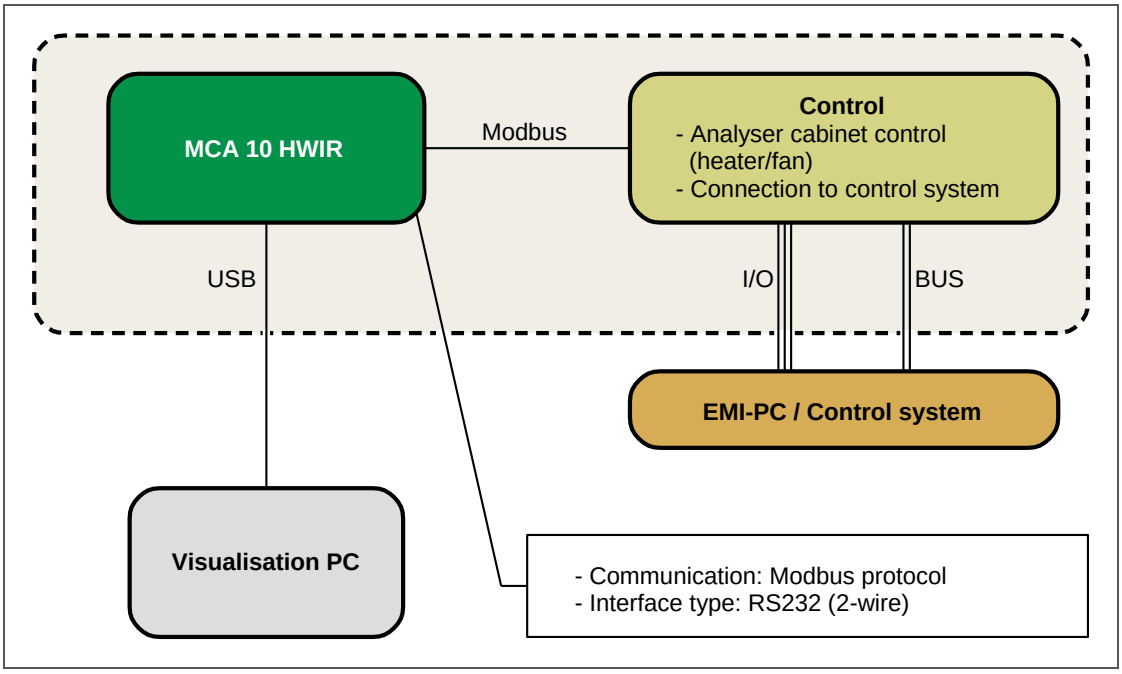


Fig. 18: Design of CPU components (application example)

The system design consists basically of three CPU components:

- Multi component analyser MCA 10 HWIR
- Visualisation PC with software “MCA10_HID”
- Control for analyser cabinet automation

The parameter set of the MCA10 HWIR contains information for all three components. The user software arranges the necessary synchronisation between PC and analyser. This synchronises itself automatically with the analyser cabinet control. At modification of parameters the complete parameter set is read from the MCA 10 HWIR. Thereby the synchronisation is ensured, so that all current data are transferred at later writing.

5.11.3 Signal plan

The following figure shows and describes the communication paths and tasks of the system components. The signal connection to the control system is solely done via the control unit of the analyser cabinet (PLC).

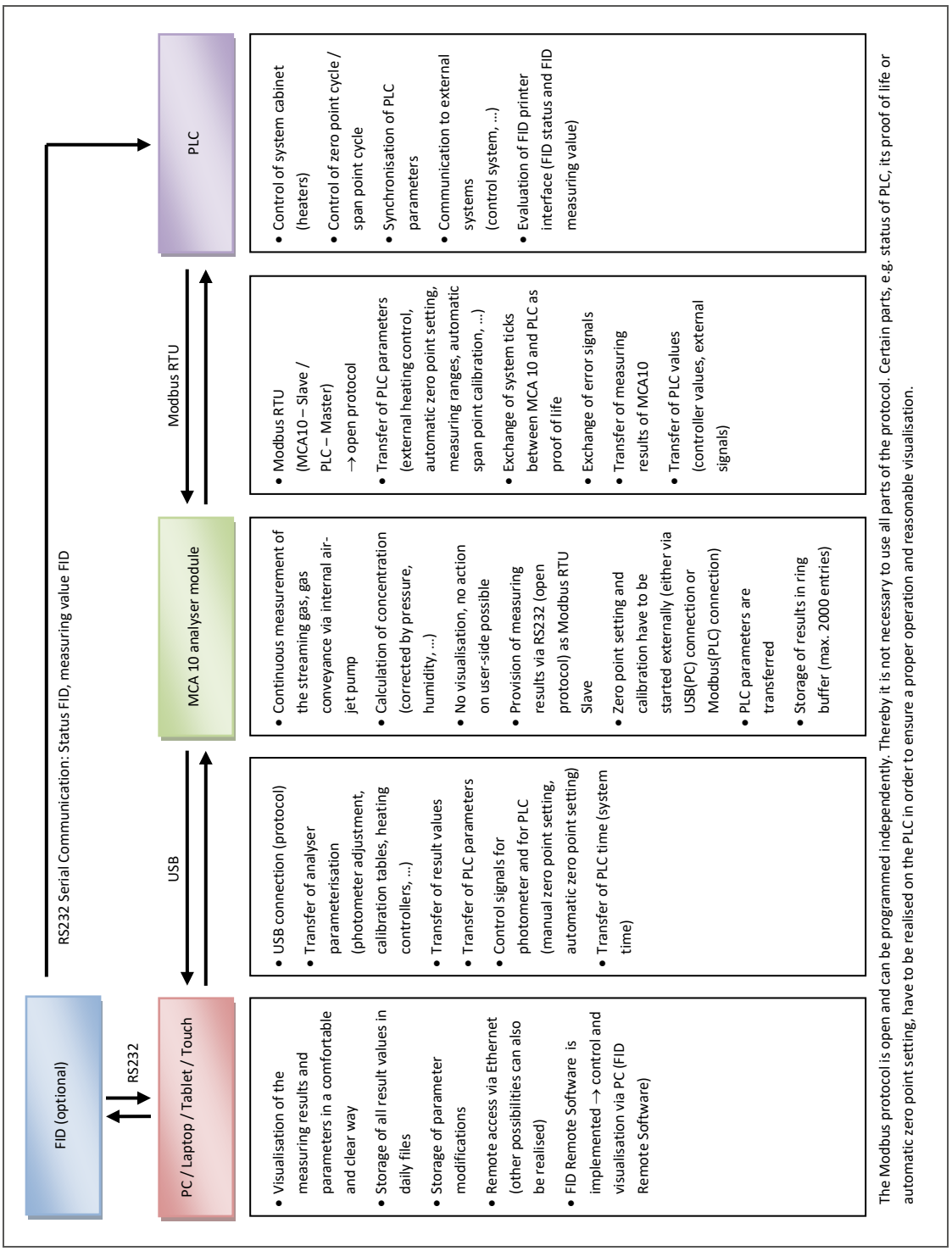


Fig. 19: Signal plan (application example)

6 Transport and scope of supply

6.1 Transport

The device is stored in a special handling case. This is generally secured against vibration at transport.

CAUTION
Through heavy percussion at transport (e.g. by falling) susceptible elements can be damaged.
Chose appropriate means of transport.

1. Check the device as well as the packaging material for transport damage.
2. Document possibly existing damage.

6.2 Scope of supply

According to the legal sales contract the respective scope of supply is specified in the shipping documents attached to the supply.

The scope of supply includes:

- 1 analyser module
- 1 operation manual
- 1 documentation CD for installation of the user software

NOTICE
Depending on purchase configuration deviations in technical design are possible, e.g. by analyser cabinet or optional additional devices.

1. Check the scope of supply for completeness and intactness.
2. Remove the packaging material.
3. Keep the packaging material for possible re-use.

7 Placement and mounting

7.1 Placement

CAUTION
The device must not be operated in potentially explosive atmosphere.

For correct operation of the multi component analyser MCA 10 HWIR the following ambient conditions apply:

- Ambient temperature: 25...35 °C (temperature stability max. 2 K/h)
- Relative humidity: max. 90% (non-condensing)
- Operation in rooms (outdoor operation not permissible)
- Protection against wetness
- Location free of percussion

7.2 Mounting

NOTICE
The mounting must be executed according to the delivered circuit diagram and gas circuit diagram.
Depending on application please observe the procedure in combination with the analyser cabinet respectively with optional additional devices if necessary (see appendix).

1. Insert the MCA10 HWIR horizontally into the mounting place and fix the device.

CAUTION
Insufficient ventilation can cause damage at the device.
Take care that the ventilation slots (also at bottom side of device) are not covered.

2. Connect the measuring gas pipe, the exhaust pipe and if necessary additional devices with the connections at the right device side (see Fig. 15, page 30).
   Furnish possibly non-used connections with seal caps.
3. Connect the forced air with connection C6 (6, Fig. 14, page 30) at the left device side.
4. Connect the communication cable to PC with connection C4 (4, Fig. 14).
5. Connect the power cord with connection C1 (1, Fig. 14).

7.3 Placement and mounting of additional devices

NOTICE
For placement and mounting of optional additional devices please read the technical documentations of the suppliers (see appendix).
The contents are at responsibility of the respective manufacturers.

8 Commissioning

DANGER
Hazardous voltage!
Parts of the device can be energised with hazardous voltage.
Danger of electric shock.
Any work at the device must solely be executed by qualified personnel.

DANGER
Poisonous substances!
Poisonous gases can cause serious health damage or death.
Irritating of eyes, skin or respiratory system organs can be caused.
Exhaust of the gas output must be conducted into an exhaust system.
The correct operation of ventilation in the analyser cabinet must be assured.

NOTICE
If the MCA 10 HWIR shall be commissioned again after storage, before commissioning it must stand unused at installation location at least one day under permissible ambient conditions.
Requirements for location: see section 7.1 “Placement”, page 37.

NOTICE
Depending on application please observe the procedure in combination with the analyser cabinet respectively with optional additional devices if necessary (see appendix).

8.1 Commissioning of MCA 10 HWIR

CAUTION
The device must be operated with compressed air. Permanent operation without compressed air can cause false measuring results or material damage.
If there is no possibility for compressed-air supply, the system must immediately be shut down.

1. Connect the power plug to the power supply.
2. Adjust the forced air to 1 bar.

CAUTION
The measuring medium must have atmospheric pressure (1013 mbar absolute).

3. Purge the device with instrument air.
4. Check the temperatures and the instrument air during the heat-up phase at regular intervals.
5. Wait until temperatures, pressures and regulation parameters are stable.
6. Carry out the zero point setting (see section 9.10 “Calibration”, page 59).

8.2 Test gas provision

WARNING
Hot surface!
The MCA 10 HWIR is standard heated to a temperature of 185 °C.
Burn hazard!
Personal protective equipment according to the current legal accident prevention regulations must be worn.

CAUTION
- Before test gas provision a stable zero point setting must have been carried out (control of drift correction values not more than 0.2 %/h).
- For zero point calibration of the oxygen sensor, solely nitrogen must be used.

To avoid damage at the measuring system and falsification of the measuring results, the following requirements must be observed at test gas provision via gas distribution block in the MCA 10 HWIR:

- cuvette pressure max. 1050 mbar
- constant pressure conditions during provision
- constant temperature conditions
- internal temperature controllers in steady state
- provision of test medium always via evaporator unit
- sensitivity tests as standard with a concentration of 80% of the measuring range

Provide test gas

1. Connect the pipes for test gas provision with the connections at the gas distribution block (“in 1”/“in 2”/“in 3”, see Fig. 15, page 30).
   Take care that the provision is carried out pressure-free (overflow method).
2. Furnish possibly non-used connections at the gas distribution block with seal caps.
3. Open the test gas supply.
4. Close the zero gas supply.
5. Wait until the settling time is over.
6. Read the measuring result from the connected visualisation PC.

To change into normal measuring operation after test gas provision, please proceed as follows:

1. Open the zero gas supply.
2. Purge the device with zero gas.
3. Close the test gas supply.
4. Remove the pipes of test gas provision from the connection at the gas distribution block.

8.3 Software installation

For installation of the PC software “MCA10_HID” of Dr. Födisch Umweltmesstechnik AG the following preconditions must be fulfilled:

- Communications cable between PC and MCA 10 HWIR connected (USB, connection C4)
- MCA 10 HWIR and PC switched on
- Preconditions for visualisation PC:
  - Operating system: Windows XP or higher
  - CPU: Pentium II or higher
  - Main memory: 500 MB
  - Read-only memory: 5 GB free memory for data storage
  - Interfaces: USB 2.0
  - Display screen: min. 1024 x 768 pixel

The user software “MCA10_HID” is stand-alone software and requires no installation routine before execution.

Install software

1. Insert the delivered documentation CD with user software into the PC.
2. Open the file “MCA10_HID.exe”.
   › The data is automatically read.

NOTICE
For uninstallation of no longer required user software displace the correspondent file into the recycle bin.

9 Operating

CAUTION

Incorrect operating can cause false measuring results, interferences in measuring process or material damage.
Basic requirement for safe operating is exact knowledge of the functioning of the MCA 10 HWIR and the complete system as well as knowledge of measuring method, windows-based applications and system-dependent details.
For operation with the software the instructions and calibration directions must be obeyed exactly. The respective setting possibilities as well as their effects and parameter limits have to be observed.
Operating must solely be executed by qualified personnel (see section 2.2 “Requirements for personnel”, page 11).

NOTICE

The user software “MCA10_HID” of Dr. Födisch Umweltmesstechnik AG must be on the intended visualisation PC.

The user software has the following functions:

- Visualisation of measuring results
- Modification of analyser parameters
- Control of complete system respectively of the analyser cabinet (if present)
- Saving of parameter data and measuring data on PC memory

NOTICE

The operating surface is designed for one-click operating without additional input acknowledgement.
To prevent incorrect operation, please avoid double-clicking. Extended setting possibilities as well as parameter modification get active by leaving the respective menu.
Observe the additionally shown info texts within the menus.

9.1 Display and operating elements

9.1.1 General screen design

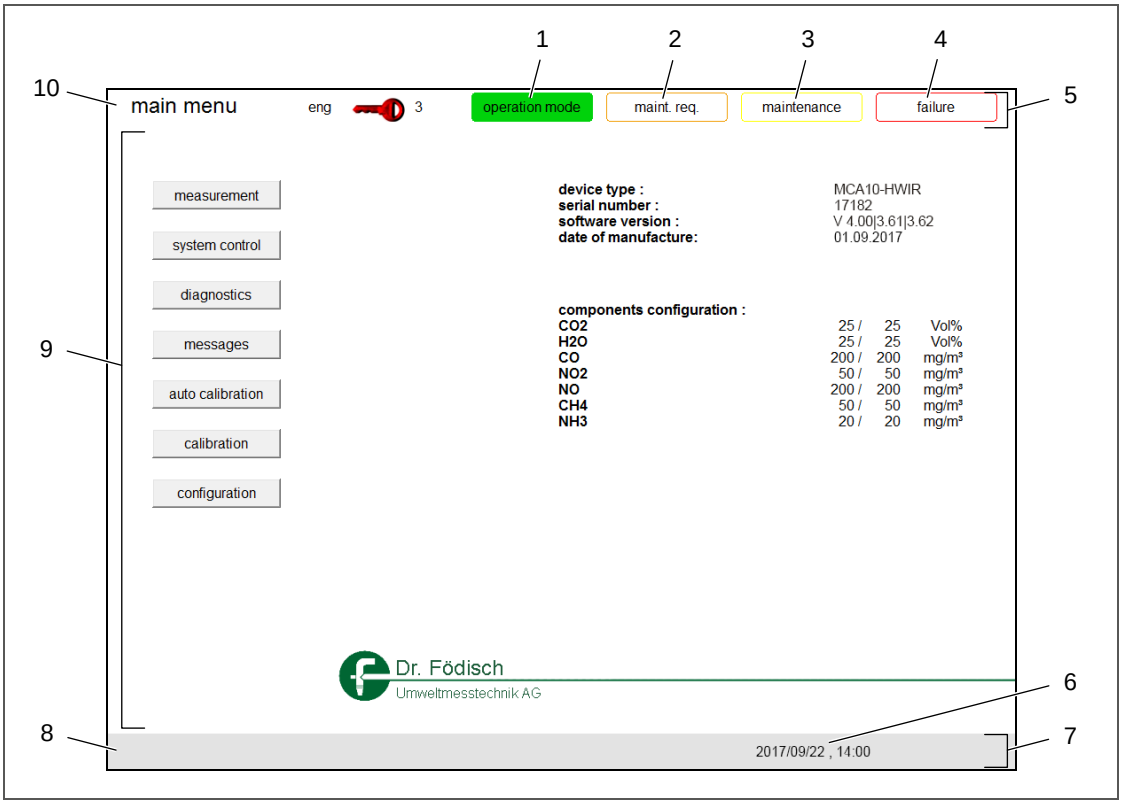


Fig. 20: General screen design (main menu for example)

1 Status information “operation mode”
2 Status information “maintenance requirement”
3 Status information “maintenance”
4 Status information “failure”
5 Upper status bar
6 Current date / current time
7 Lower status bar
8 Display for specific failure messages according to maintenance and communication status
9 Main area (menu content)
10 Display of currently selected menu

Status information

At the right side of the upper status bar the status information (1 to 4, Fig. 20) for operation, maintenance requirement, maintenance and failure is visualised. Depending on mode or possibly upcoming failure the respective field is coloured.

operation mode	The device is in operation mode. All values are within the normal range.
maint. req.	Maintenance is required. The list of the current messages has to be reviewed.
maintenance	The device is in maintenance mode. Modifications are active.
failure	A failure currently exists. The list of the current messages has to be reviewed.

Date and time

The current date and the current time (6, Fig. 20) are displayed at the right side of the lower status bar.

Display for specific failure messages according to maintenance and communication status

In case of an active maintenance or an upcoming failure of the communication status of the MCA 10 HWIR an additional message (8, Fig. 20) is displayed at the left side of the lower status bar. In normal operational state the display does not contain any messages.

Actually selected menu

The main area (9, Fig. 20) in the middle of the screen varies depending on the menu selection. The content of the currently selected menu is displayed. For orientation the name of the selected menu (10) is displayed at the left side of the upper status bar.

9.1.2 Display and operating elements within menus

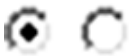
Info text

CAUTION
Text fields with the designation “info text” provide important notes for safe operating.
Read all displayed info texts attentively and observe them.

Selection list

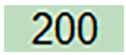
Selection lists serve the navigation within a selected menu. In a selection list several possibilities are available for menu display. By clicking the arrow symbol at the right side of the field a list with all possibilities opens. If the selection is adopted by another clicking within the list, the contents within the menu are adapted.

Selection field



Selection fields serve the assignment of a predefined function. For example, functions can be switched on/off or a specific function can be selected from several possibilities.

Input field



Fields for value input are coloured green. By clicking a pop-up window opens, in which set point values can be input and adopted.

Input window

By clicking an input field or for password input an input window opens. Values can be input and adopted/revoked by the numeral buttons.

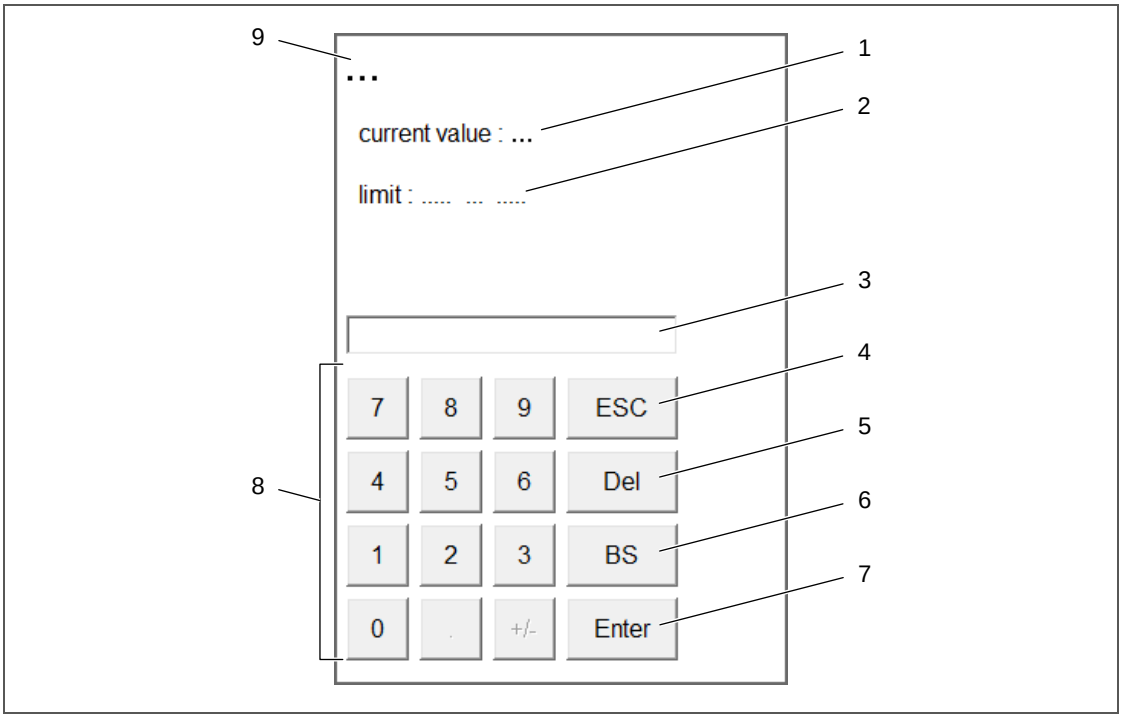


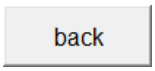
Fig. 21: Input window (pop-up window)

1 Current value
2 Min./max. input of limit value
3 Input field of new value
4 Button “ESC” (revoke input value)
5 Button “Del” (delete input value)
6 Button “BS” (delete last numeral of input value)
7 Button “Enter” (adopt input value)
8 Numeral buttons
9 Title/value name

Function button

By clicking a function button a function is carried out directly. The respective function is specified as clear text on the button.

Button “back”



The button “back” is located in all menu screens (except main menu) at the right side of the lower status bar. By clicking the button the main menu is selected again.

Arrow button

Arrow buttons signalise the availability of additional data. If in a menu more data is available as the screen is able to show, the next/last screen page can be selected by clicking an arrow button.

Besides, the buttons are used for going forward/back within the time line of a diagram.

9.1.3 Display “data transfer”

When data is interchanged between MCA 10 HWIR and PC, the display “data transfer” appears. Additionally, the progress of the transfer is displayed by a loading bar. The screen in the background fades for the respective duration.

CAUTION
During data transfer the USB connection must not be interrupted.

The data transfer between MCA 10 HWIR and PC serves the synchronisation of data and is started automatically.

An automatic data transfer is carried out at the following actions:

- Starting of the user software “MCA10_HID” (readout of the parameter storage of MCA 10 HWIR)
- Manual setting of span point for transfer of the new calculated calibration value (readout of the parameter storage of MCA 10 HWIR)
- Actualising of history (readout of the history storage at opening the menu)
- Configuration of parameters (readout of the parameter storage of MCA 10 HWIR at leaving the configuration menu)
- Change into service mode (readout of the parameter storage of MCA 10 HWIR)

9.2 Menu structure

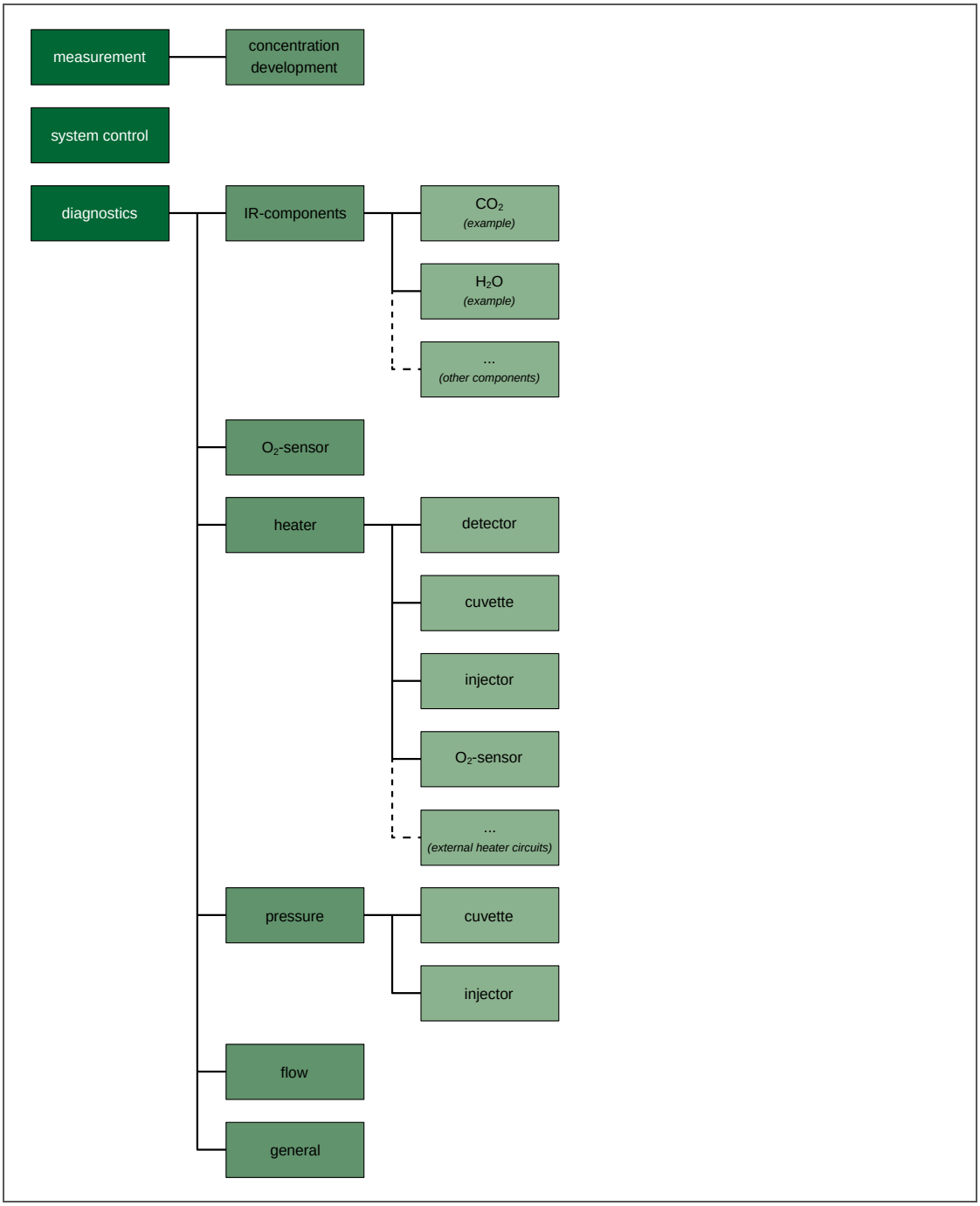


Fig. 22: Menu structure (1/3)

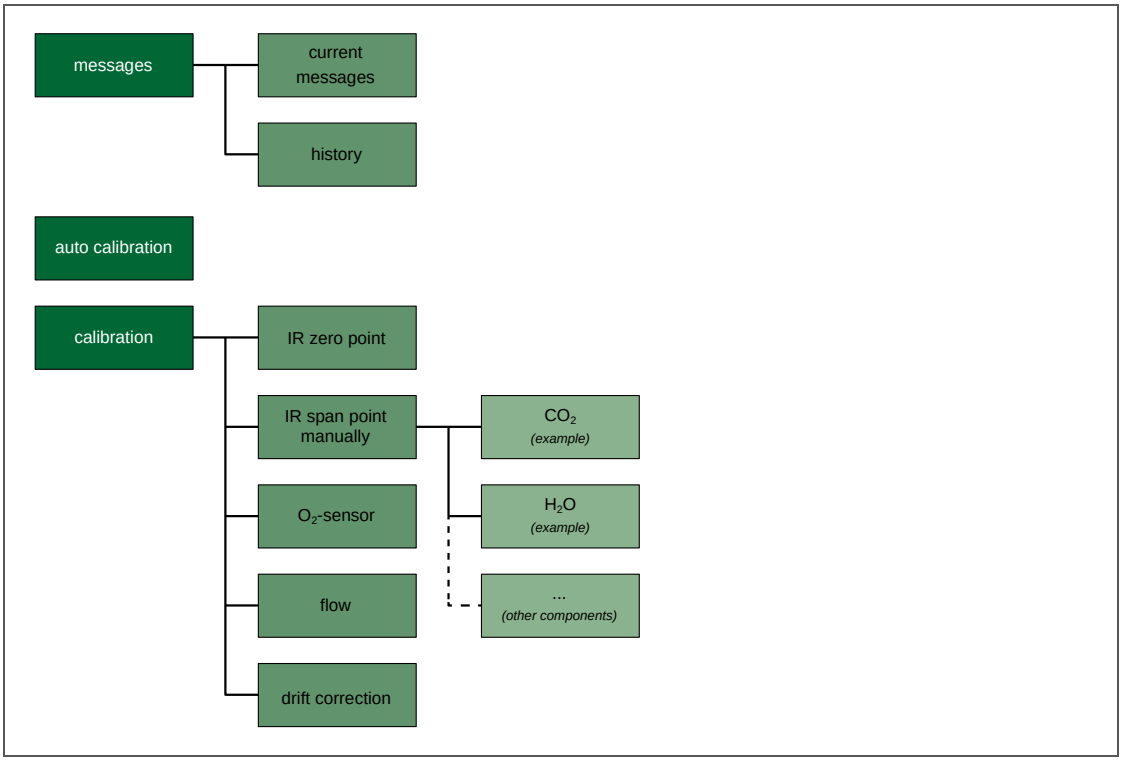


Fig. 23: Menu structure (2/3)

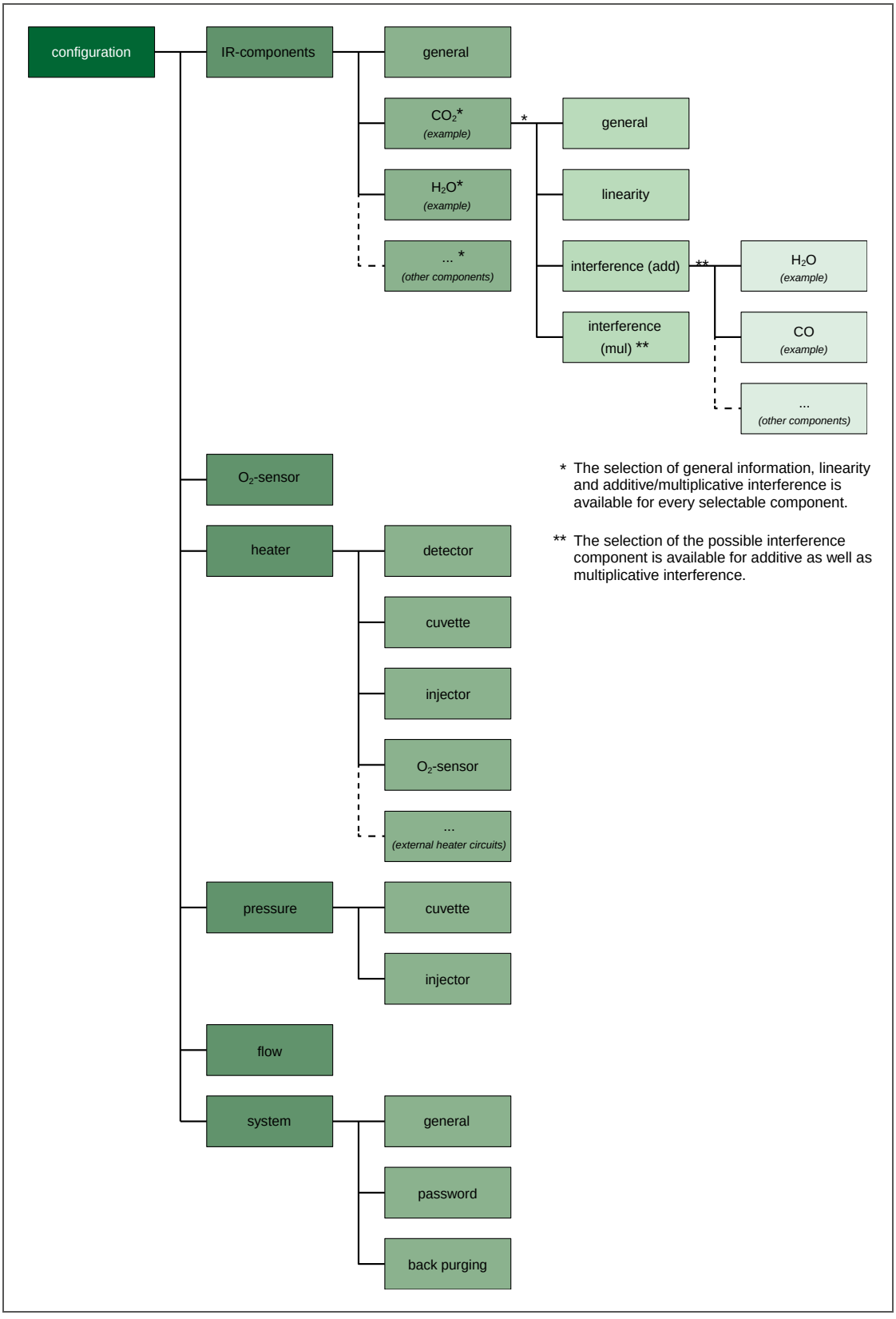


Fig. 24: Menu structure (3/3)

9.3 Password levels

For operating the user software of the MCA 10 HWIR four password levels are existing. As standard, these are configured as follows:

Password level	Access facilities
0	• View of all IR measuring values, diagnostic values and messages • Setting of maintenance mode • Provision of measuring gas, zero gas and test gas • Starting of auto calibration
1	- not existing - (The password is defined with the value “0”. After input the password level 0 is set automatically.)
2	• View of all IR measuring values, diagnostic values and messages • Setting of maintenance mode • Provision of measuring gas, zero gas and test gas • Starting of auto calibration • Manual calibration of IR measurement • Access to internal sensors
3	• All possibilities of password level 2 • Setting of all parameters • Access to calculation tables
4	- Service mode (unlimited access) - Notice: The access is exclusively reserved for authorised service personnel of Dr. Födisch Umweltmesstechnik AG.

Tab. 2: Password levels – standard

If for the password of password level 1 a different value than “0” is defined, specific access facilities apply for the password levels 0 and 1:

Password level	Access facilities
0	• View of all IR measuring values
1	• View of all IR measuring values, diagnostic values and messages • Setting of maintenance mode • Provision of measuring gas, zero gas and test gas • Starting of auto calibration
The access facilities of the password levels 2 to 4 remain unaffected by this.	

Tab. 3: Password levels – specific

NOTICE
Input password: see section 9.4.2, page 51.
Administrate passwords: see section 9.11 “Configuration”, page 64.

9.4 Main menu

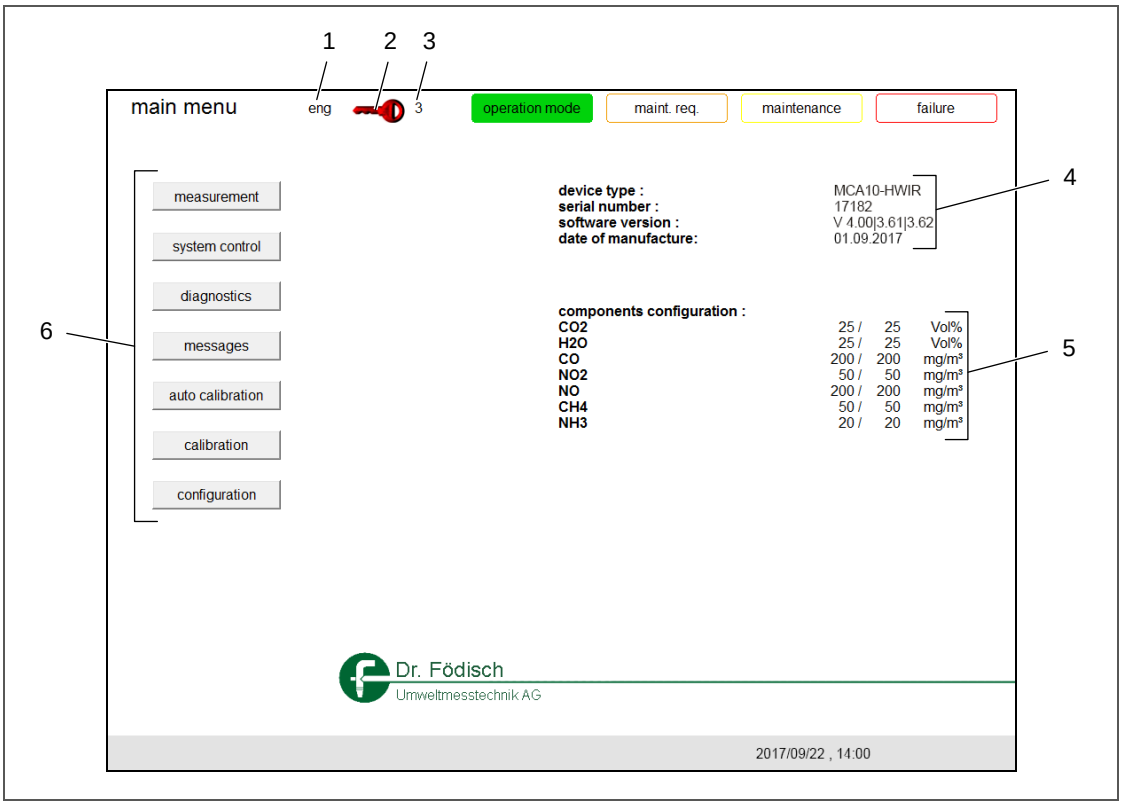


Fig. 25: Main menu

1 Language selection
2 Key symbol for password input
3 Display of currently selected password level
4 Device information
5 Display of component configuration
6 Menu buttons

Language selection

In the field “language selection” (1, Fig. 25) the acronym of the selected language is displayed.

Password levels and password input

In the field (3, Fig. 25) the currently selected password level is displayed. By clicking the key symbol (2) the respective password can be input.

Device information

In the area of device information (4, Fig. 25) device type, serial number, software version, date of manufacture and depending on configuration the next service date (settable in menu: configuration – system – general) are displayed.

NOTICE
The designation of the software version is subdivided into three parts and marked by lines. The designation of the separate software versions is due to the following:
PC | MCA | SPS

Display of component configuration

In the area of component configuration (5, Fig. 25) the measuring ranges of all measurable components are displayed.

Menu buttons

The menu buttons (6, Fig. 25) displayed in the main menu serve the navigation between the particular menus.

By clicking the menu buttons the respective screens can be selected:

- Measurement
- System control
- Diagnostics
- Messages
- Auto calibration
- Calibration (from password level 2)
- Configuration (from password level 3)
- Service mode (password level 4)

The currently selected menu is displayed at the left side of the upper status bar.

9.4.1 Change language

1. Select the main menu.
2. Click the acronym of the displayed language (1, Fig. 25).
   › The language setting changes automatically to the next language.

NOTICE
Depending on the device configuration the languages German (Deu) and English (eng) can be displayed.

9.4.2 Input password

1. Select the main menu.
2. Click the key symbol (2, Fig. 25).
   › An input window opens.
3. Input the password.
4. Acknowledge the input with “Enter”.
   › The password is adopted and the access to the respective level is enabled.

NOTICE
After 60 min without operating activity the menu is automatically reset to password level 0.

9.5 Measurement

In the menu “measurement” all measuring results of the IR components and the oxygen sensor are displayed as diagram.

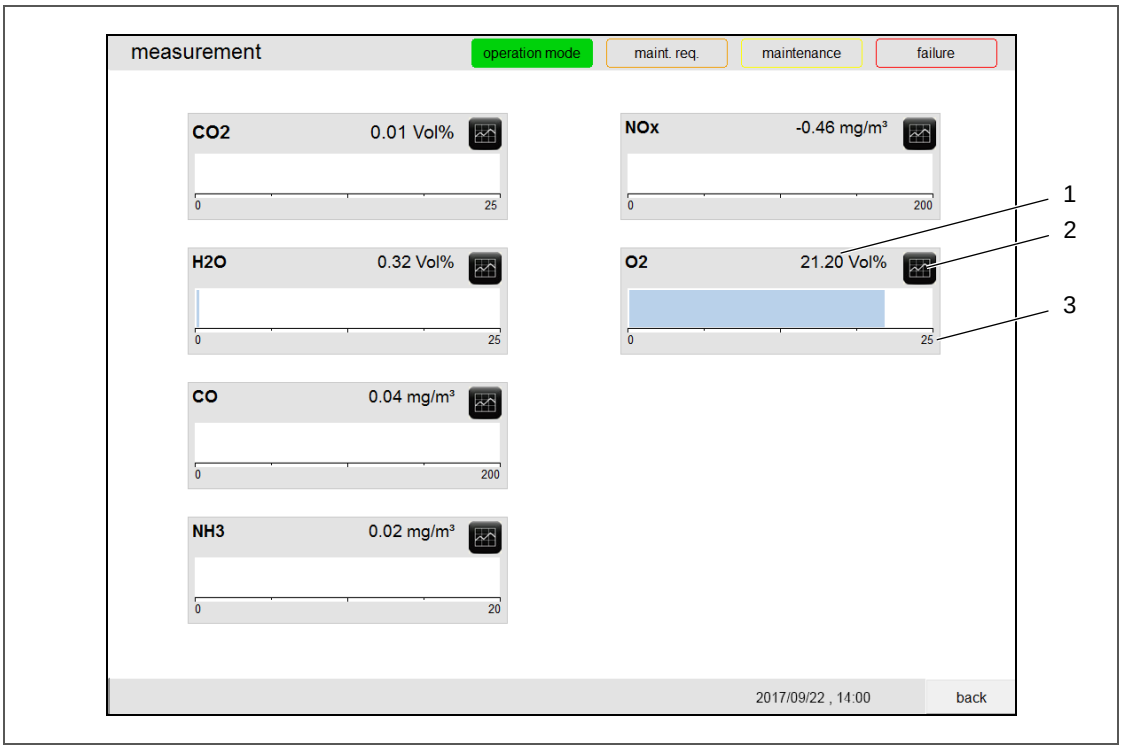


Fig. 26: Menu “measurement”

1 Current measuring value
2 Button “development”
3 Display of measuring range limit

The current measuring values of the respective components are displayed as value as well as in form of a bar diagram in relation to the upper measuring range limit.

NOTICE
If more than eight components are measured, an arrow button is displayed at the right side of the screen. By clicking the arrow button the next screen page is selected.

By clicking the button “development” (2, Fig. 26) the display of concentration development for the respective component is opened (see Fig. 27, page 53).

Concentration development

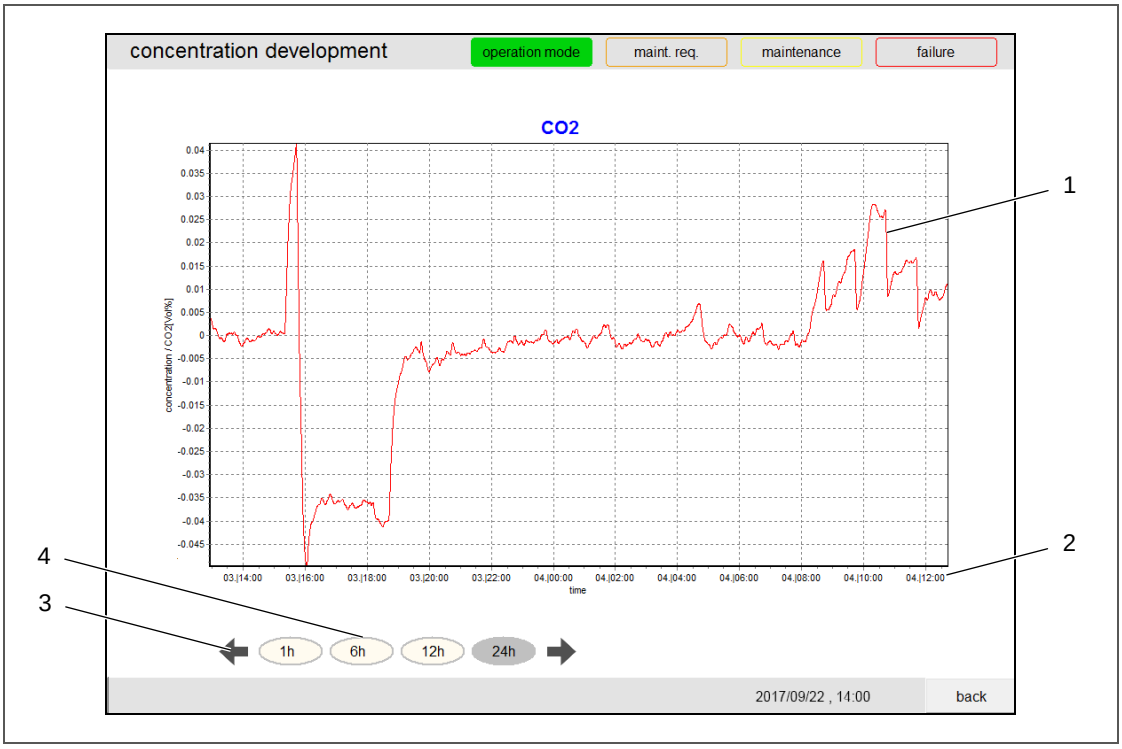


Fig. 27: Menu “measurement” – concentration development

1 Concentration development of the selected component
2 Display of day and time
3 Arrow buttons
4 Buttons for setting the displayed time period

According to the selected component the respective time development of the concentration is displayed on the screen.

As standard the last 24 hours are displayed. Alternatively, the time range can be changed to 1, 6 or 12 hours by clicking the respective button (4, Fig. 27). Thereby the scaling of the axes is carried out automatically.

The arrow buttons (3) serve going forward/back within the time axis. By clicking the display moves the half of the selected time range forward/back.

NOTICE
Through going forward/back within the time axis the automatic actualisation of the diagram is deactivated.
To reactivate the automatic actualisation, a click into the diagram must be done.

9.6 System control

NOTICE
The functions in the menu are only operative in connection with the complete system.

In the menu “system control” the maintenance switch of the complete system can be switched on/off. Besides, the selection between measuring gas, zero gas and optionally test gas is set.

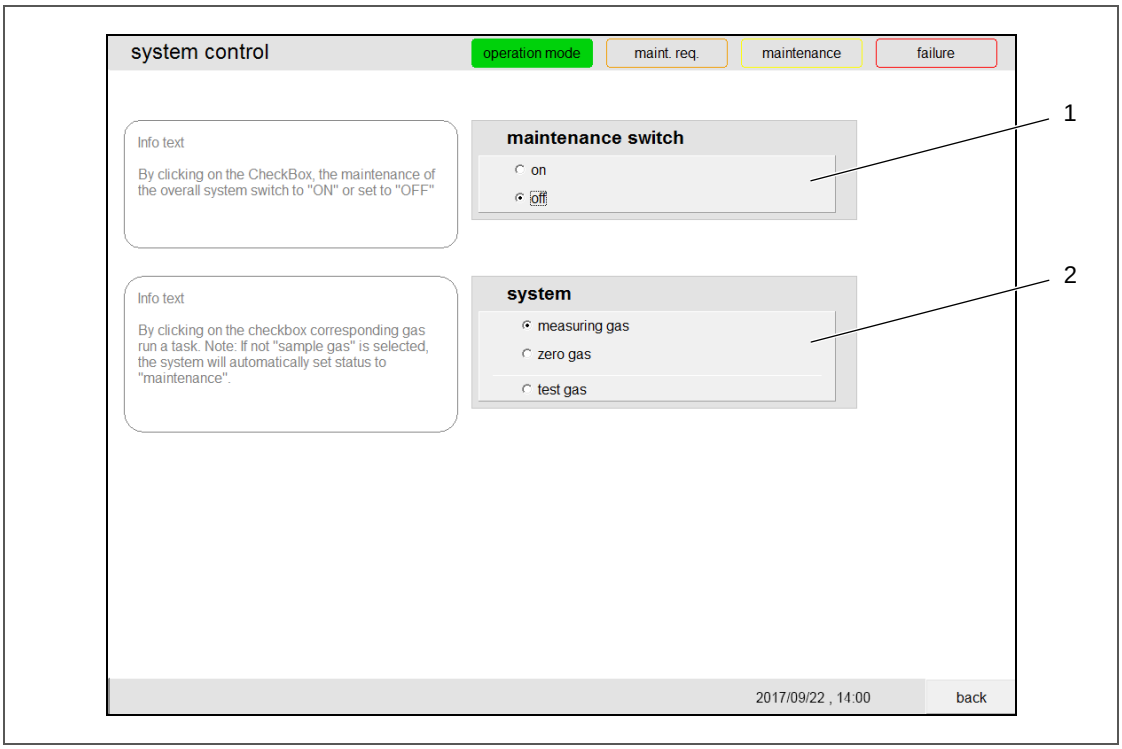


Fig. 28: Menu “system control”

1 Switching on/off the maintenance switch

2 Selection of measuring/zero/test gas

Maintenance switch

By clicking the respective selection field (1, Fig. 28) the maintenance mode is switched on/off.

System

By clicking the respective selection field (2, Fig. 28) the measuring/zero/test gas can be provided. The selection is also possible in case of an automatic test gas provision.

9.7 Diagnostics

In the menu “diagnostics” general system information as well as calculation relevant measuring values of IR components, oxygen sensor, heater circuits, pressure sensors and flow calculation are displayed.

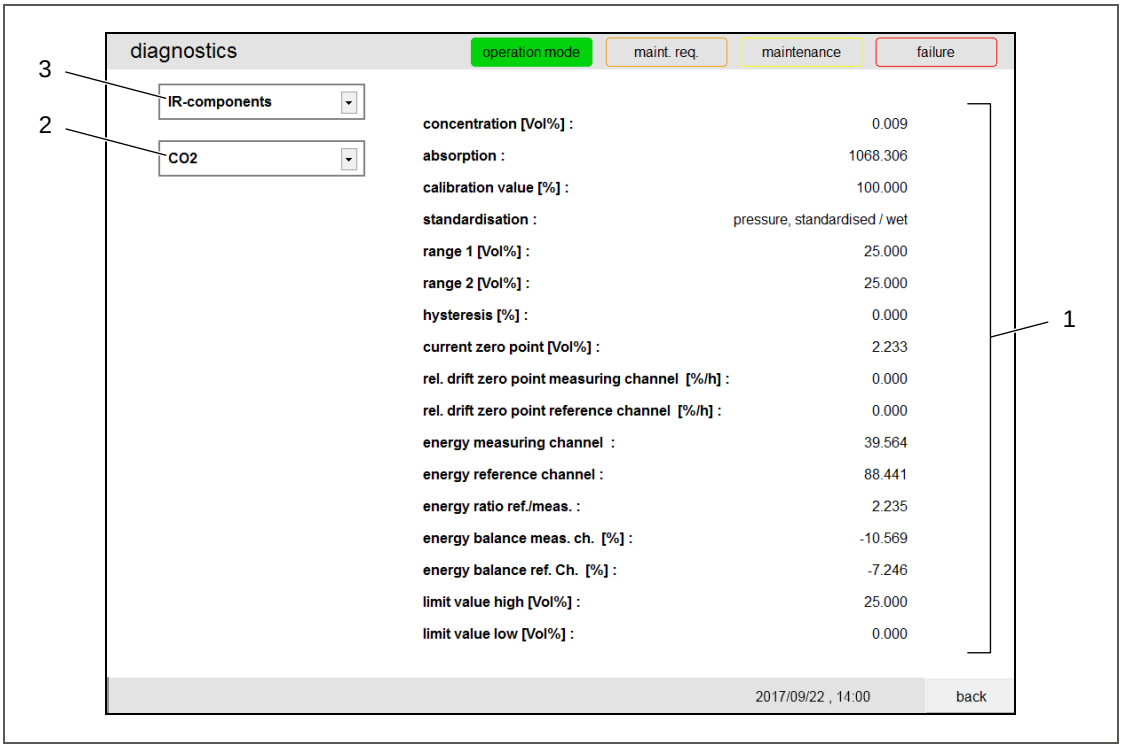


Fig. 29: Menu “diagnostics”

1 Display of all parameters (example - depending on selection)
2 Second selection list (depending on pre-selection)
3 First selection list

The selection of the information displayed in the menu is done by the selection lists.

The following values can be reviewed for diagnostics:

- IR-components
  (subordination of the second selection list: all components)
- O_2-sensor
- Heater
  (subordination of the second selection list: detector, cuvette, injector, O_2-sensor and external heater circuits (optional))
- Pressure
  (subordination of the second selection list: cuvette, injector)
- Flow (analyser flow)
- General

9.8 Messages

In the menu “messages” the current message list and the history storage can be reviewed. The selection of the information displayed in the menu is done by a selection list.

Current messages

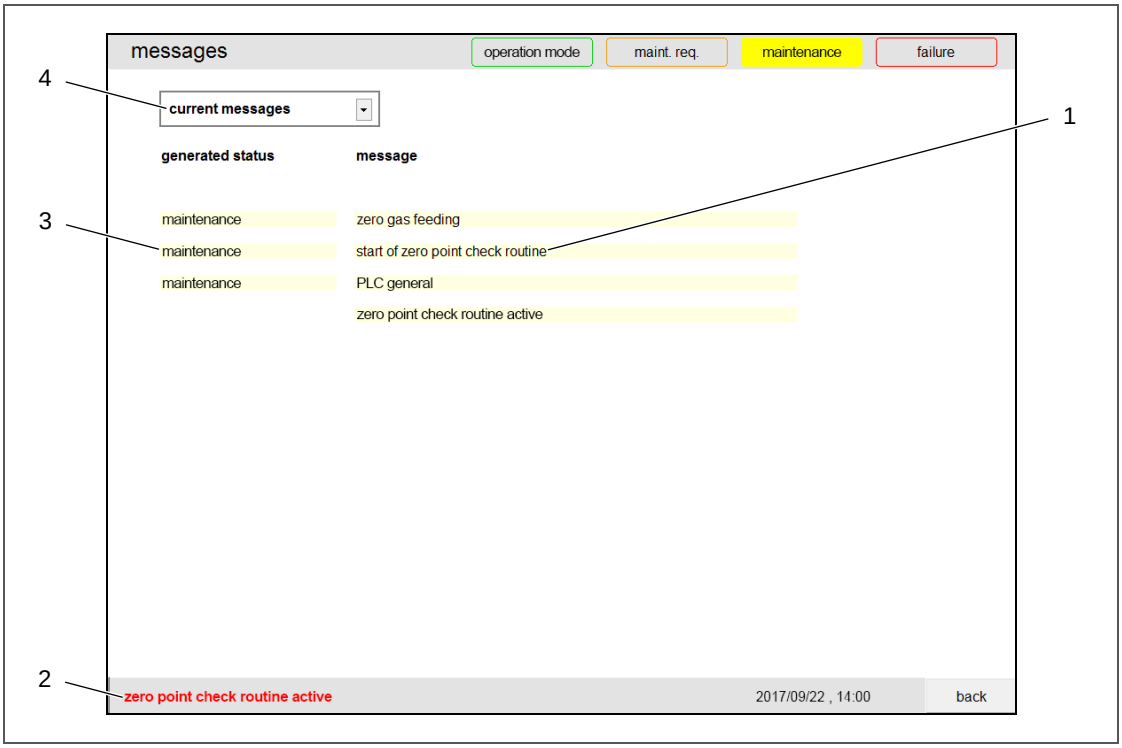


Fig. 30: Menu “messages” – current messages

1 Event characterisation
2 Additional message display
3 Generated status of event
4 Selection list

Messages are distinguished as follows:

- Info messages
- Maintenance requirement messages
- Maintenance messages
- Failure messages

In the menu all currently upcoming messages are listed. Therefor the generated status (3, Fig. 30; not in case of info messages) as well as the characterisation of the event (1) are displayed as clear text. The overview is actualised in the interval of one second.

Specific messages, e.g. an active zero point routine or a failure of the communication status, are additionally displayed in the lower status bar (2).

Under normal operation conditions there are no entries in the overview.

History

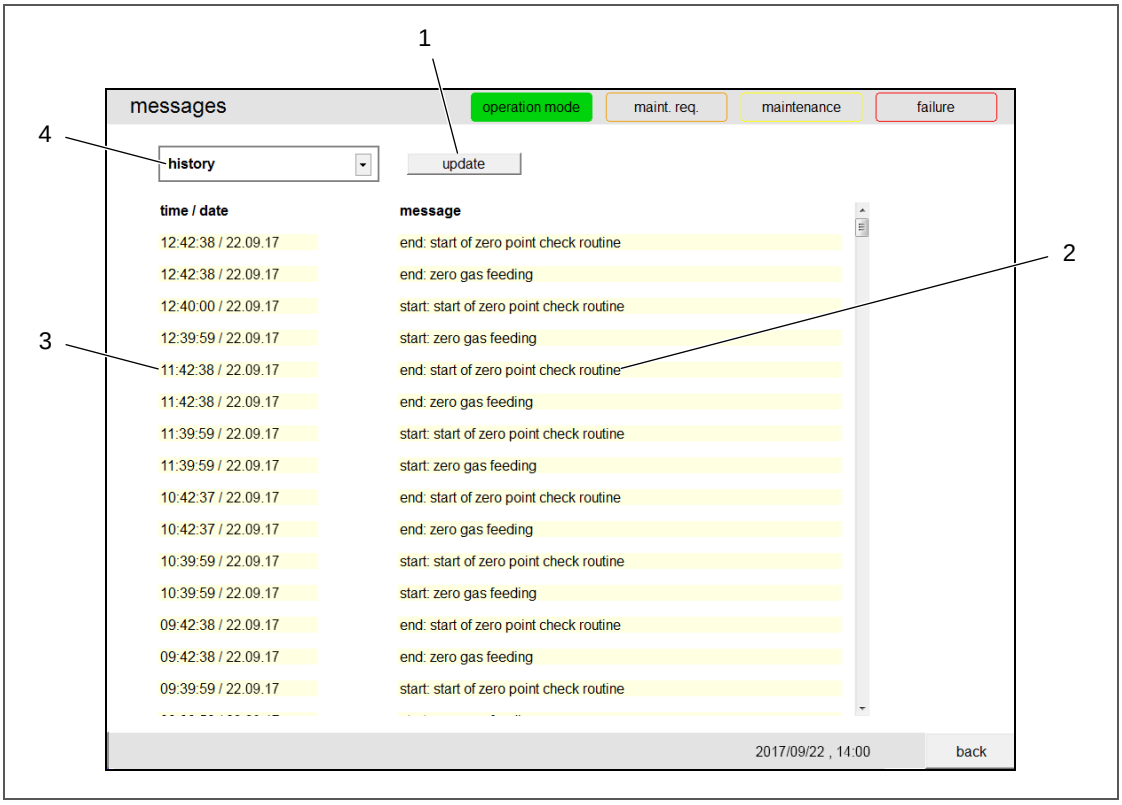


Fig. 31: Menu “messages” – history

1 Button “update”
2 Previous message with status characterisation
3 Time and date
4 Selection list

In the overview all previous messages are listed. Therefor time and date (3, Fig. 31) as well as the characterisation of the event (2) with determination of the status characterisation “start”/“end” are displayed.

The history storage provides the opportunity of up to 2000 entries.

NOTICE

- Date and time are only registered if the communication to the PLC with required timestamp is ensured.
- The actualisation of the history must be carried out manually by clicking the button “update” (1).

9.9 Auto calibration

NOTICE
The functions in the menu are only operative in connection with the complete system.

In the menu “auto calibration” the start of the automatic zero point setting can be triggered.

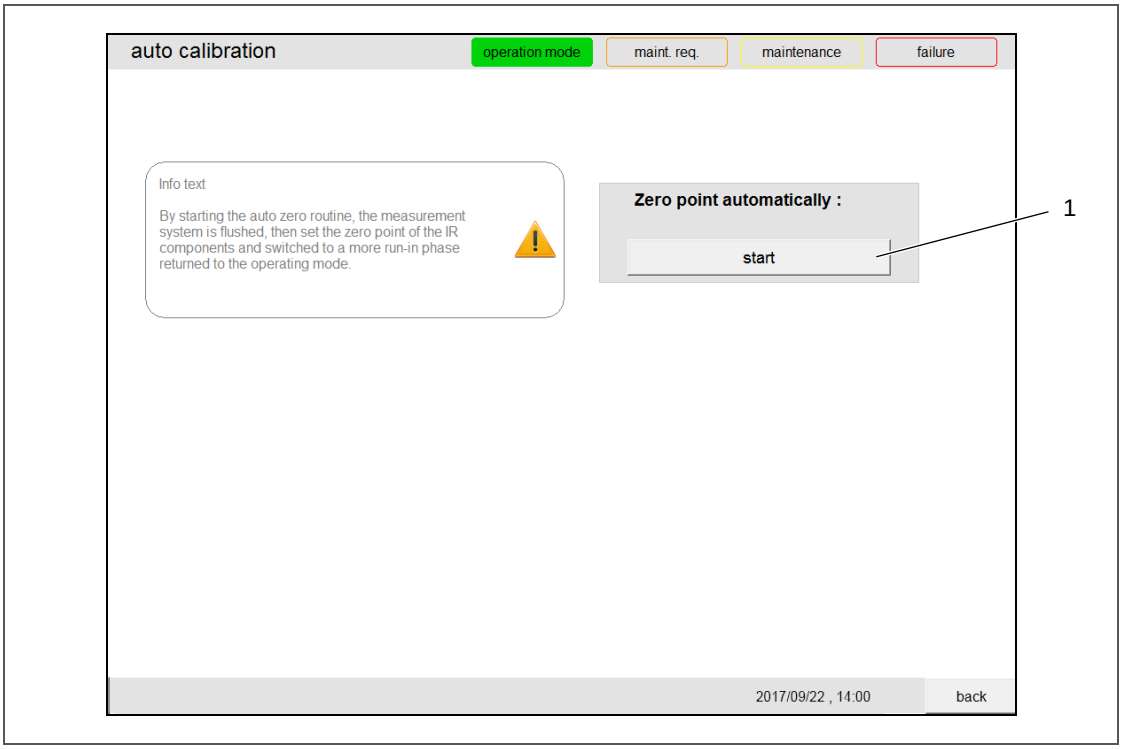


Fig. 32: Menu “auto calibration”

1 Button “start”

Zero point automatically

By clicking the button “start” (1, Fig. 32) an automatic zero point setting is carried out. Thereby the maintenance mode is activated. The complete system is purged and afterwards the zero point of the IR components is set. After another run-in period the system is switched back into operation mode.

Depending on configuration an additional calibration of the span point of the oxygen sensor is set to 20.95 vol. %.

9.10 Calibration

NOTICE
The screen is accessible only from password level 2.

In the menu “calibration” the settings for the calibration of IR components, oxygen sensor and flow measurement can be defined.

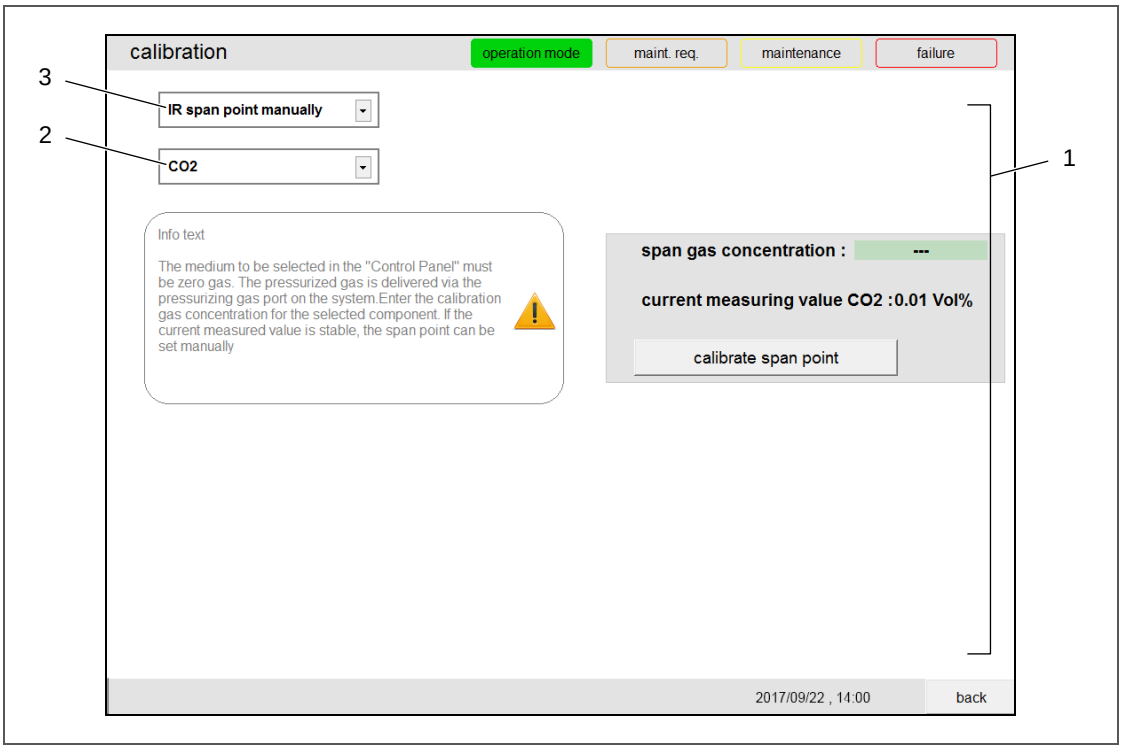


Fig. 33: Menu “calibration”

1 Display of menu content (example - depending on selection)
2 Second selection list (depending on pre-selection)
3 First selection list

The selection of the information displayed in the menu is done by the selection lists.

The following functions can be calibrated:

- IR zero point
- IR span point manually (subordination of the second selection list: all measurable components)
- IR span point automatically (optional)
- O_2-sensor
- Flow (analyser flow)
- Drift correction

IR zero point

NOTICE
The analyser must be purged with zero gas and must be stabilised.

At executing the function the zero point of all IR components is set to the current absorption value.

IR span point manually

NOTICE
The analyser must be purged with span gas and must be stabilised.

The calibration is carried out device-selective for the selected component (2, Fig. 33). At executing the function the new calibration value is automatically calculated and transferred.

CAUTION
During data transfer the USB connection must not be interrupted.

IR span point automatically (optional)

NOTICE
The selection of the function is only available if the according test gas option is existent.

The span point can be calibrated component-selective. At executing the function of automatic span point the control of the valves is carried out automatically. The time response can be set in the menu “configuration – IR-components – *component X* – general” (see section 9.11, page 62).

O_2-sensor

NOTICE
For the calibration of the O_2 sensor the following requirements apply:

- Zero point setting:
  The analyser must be purged with nitrogen (oxygen 0.0 vol. %) and must be stabilised.
- Span point setting:
  The analyser must be purged with zero gas and must be stabilised.

At executing the respective function the zero point respectively the span point of the O_2-sensor is calibrated.

Flow

At executing the respective function the zero point of the flow measurement is calibrated to the pressure difference between cuvette and injector, respectively the analyser flow is calibrated to the input span value.

Drift correction

At executing the function the drift value saved after a zero point setting is reset to zero.

9.11 Configuration

CAUTION
Changes of configuration affect the function of the device and the complete system seriously. Operating must solely be executed by specially trained qualified personnel.
The screen is accessible only from password level 3.

In the menu “configuration” all calculation-relevant and system-relevant parameters can be reviewed and modified within their limits.

All parameter changes get active only at returning to the main menu.

CAUTION
During data transfer the USB connection must not be interrupted.

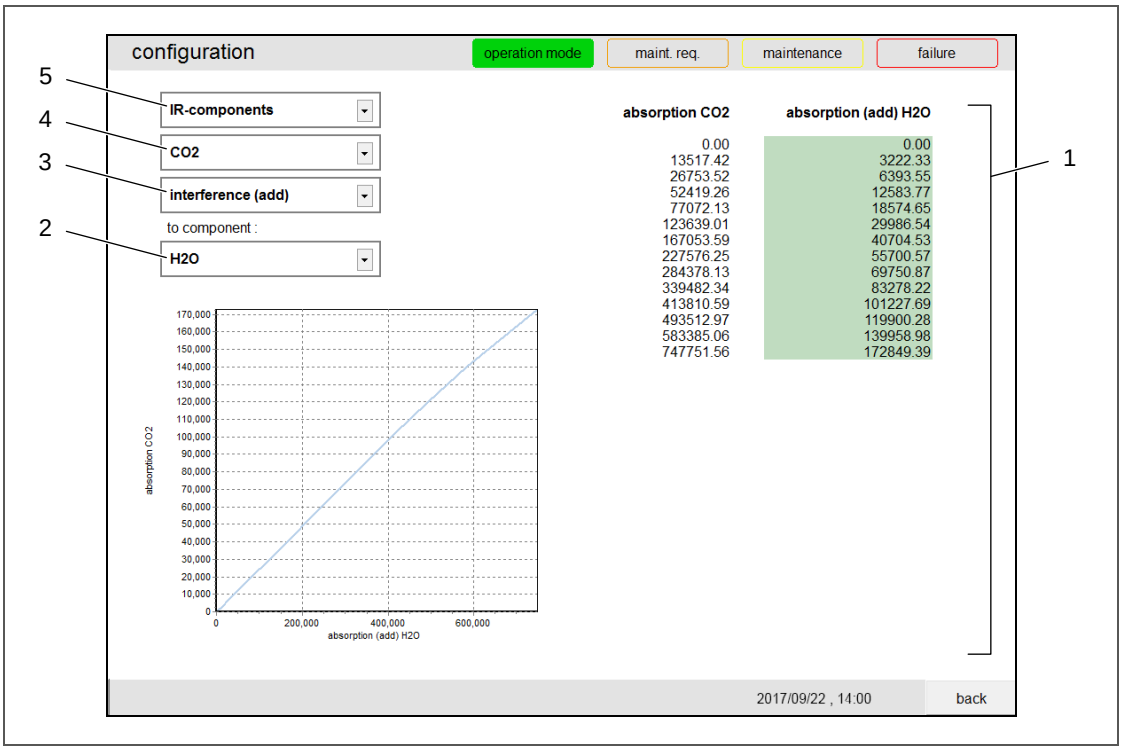


Fig. 34: Menu “configuration”

1 Display of menu content (example - depending on selection)
2 Fourth selection list *
3 Third selection list *
4 Second selection list *
5 First selection list

* depending on pre-selection

The selection of the information displayed in the menu is done by the selection lists.

The following values can be configured:

- IR-components
  (subordination of the second selection list: all measurable components)
- O_2-sensor
- Heater
  (subordination of the second selection list: detector, cuvette, injector, O_2-sensor and external heater circuits (optional))
- Pressure
  (subordination of the second selection list: cuvette, injector)
- Flow (analyser flow)
- System
  (subordination of the second selection list: general, password, back purging)

IR-components

Via the menu the parameters of all measurable components can be reviewed and modified.

For every component another selection list (3, Fig. 34) is available. By this the menu can be adapted by the selection of the following possibilities:

- General
- Linearity
- Interference (add)
- Interference (mul)

In case of selecting interference the respective component, which shall be compared, can be selected by a fourth selection list (2, Fig. 34). Then the table of cross sensitivity (interference) is adaptable in the menu.

O_2-sensor

Via the menu the parameters of the O_2 sensor can be reviewed and modified.

Heater

Depending on the setting in the second selection list, parameters of the heaters of detector, cuvette, injector, O_2 sensor and external heater circuits (optional) can be reviewed and modified via the menu.

Pressure

Depending on the setting in the second selection list, parameters of the pressure of cuvette and injector can be reviewed and modified via the menu.

Flow

Via the menu the parameters of the analyser flow can be reviewed and modified.

System

General

Via the menu the general settings, e.g. for date and time, zero point and service alarm, can be made.

Password

Via the menu the passwords can be administered to restrict the access facilities to the password levels.

1. Select password level 3.
2. Select menu “configuration”.
3. Select “system” in the first selection list.
4. Select “password” in the second selection list.
5. Click into the input field of the password which shall be changed.
   › An input window opens.
6. Input the new password and acknowledge the input with “Enter”.
   › The new password is adopted and immediately effective.

Back purging

Via the menu the parameters for back purging can be reviewed and modified.

9.12 Service mode

NOTICE
The service mode enables unlimited access which is exclusively reserved for authorised service personnel of Dr. Födisch Umweltmesstechnik AG.
The screen is accessible only for password level 4.

10 Maintenance/Upkeep

NOTICE
The provision of guarantee items requires an execution of maintenance in due form.
Any work at the device must solely be executed by qualified personnel.
Executed maintenance/upkeep work must be documented according to the legal regulations.

The maintenance work has the following target:

- Preservation of measurement precision
- Warranty of operational safety
- Increment of service life

The following maintenance/upkeep work must be executed:

Component	Action	Maintenance interval
Injector screwing-in	Exchange	6 months
Sinter metal filter of cuvette	Exchange	12 months
Gaskets at cuvette inlet block	Exchange	12 months
Screwing-in with nozzle at gas distribution block	Exchange	24 months

Tab. 4: Maintenance/upkeep work

10.1 Exchange injector screwing-in

WARNING
Hot surface!
Several device parts can develop high temperatures.
Burn hazard!
Personal protective equipment according to the current legal accident prevention regulations must be worn.

1. Purge the device with zero gas for 10 min.
2. Remove the exhaust pipe from the device (connection “exhaust”).
3. Unscrew the injector screwing-in with the aid of special tool and remove the gasket.
4. Attach the new gasket to the injector and screw it in.
5. Connect the exhaust pipe with the connection “exhaust” at the device.
6. Check the device for leak tightness.

10.2 Exchange sinter metal filter of cuvette / exchange gaskets at cuvette inlet block

DANGER
Hazardous voltage!
Parts of the device can be energised with hazardous voltage.
Danger of electric shock.
Any work at the device must solely be executed by qualified personnel.

WARNING
Hot surface!
Several device parts can develop high temperatures.
Burn hazard!
Personal protective equipment according to the current legal accident prevention regulations must be worn.

1. Purge the device with zero gas for 10 min.
2. Disconnect the device from power supply.
3. Release the screws at the upper device cover and take the cover off.
4. Release the four hexagon socket-head screws at the cuvette isolation box and open it.
5. Release the four hexagon socket-head screws at the cuvette inlet block.
6. Disconnect the 4/6-type pipe from injector block.
7. Release the circlip with the aid of pincers.
8. Dismount the sinter metal filter and the gaskets.
9. Mount the new sinter metal filter and the new gaskets.
10. Replace the gaskets of the cuvette inlet block with new gaskets.
11. Fix the circlip.

12. Connect the 4/6-type pipe with the injector block.
13. Screw the four hexagon socket-head screws with the cuvette inlet block.
14. Close the cuvette isolation box and screw it with the four hexagon socket-head screws.
15. Put the upper device cover onto the device and screw it.
16. Check the device for leak tightness.
17. Connect the device to the power supply.

10.3 Exchange screwing-in with nozzle at gas distribution block

1. Purge the device with zero gas for 10 min.
2. Disconnect the device from power supply.
3. Release the screws at the upper device cover and take the cover off.
4. Release the four hexagon socket-head screws at the cuvette isolation box and open it.
5. Disconnect the PTFE hose from the screwing-in.
6. Dismount the screwing-in with nozzle.
7. Mount the new screwing-in with nozzle.
8. Connect the PTFE hose with the screwing-in.
9. Close the cuvette isolation box and screw it with the four hexagon socket-head screws.
10. Put the upper device cover onto the device and screw it.
11. Check the device for leak tightness.
12. Connect the device to the power supply.

11 Error search and failure clearance

11.1 Service qualification of the specialised personnel

CAUTION
Failure clearance must be executed by qualified personnel under strict observation of the specified service qualification.
Persons without required service qualification are not authorised to carry out the respective actions for clearance of error or failure causes and act illegally. Non-observance can result in personal and/or material damage. The manufacturer assumes no liability at all.

The levels of the service qualification for authorisation of error/failure clearance are as follows:

Level	Service qualification
1	The executive personnel are specialised personnel of the system that possess knowledge of the system and process measuring and control technology and that have been instructed on location in operation with the device and the complete system. The here specified specialised personnel must solely execute actions which are characterised in the sections 11.2.1 to 11.2.4 with the level 1.
2	The executive personnel are specialised personnel of the system that possess knowledge and skills of the level 1 and additionally special knowledge of operation with the device and the complete system which empowers to basic service activities. For service qualification the executive specialised personnel must have a certificate of participation in the training “Basic service activity”. The here specified specialised personnel must solely execute actions which are characterised in the sections 11.2.1 to 11.2.4 with the levels 1 and 2.
3	The executive personnel are specialised personnel of the system that possess knowledge and skills of the levels 1 and 2 and additionally special knowledge of operation with the device and the complete system which empowers to advanced service activities. For service qualification the executive specialised personnel must have a certificate of participation in the training “Advanced service activity”. The here specified specialised personnel is allowed to execute all actions which are specified in the sections 11.2.1 to 11.2.4.

Tab. 5: Service qualification of the specialised personnel

CAUTION
Actions for failure clearance which exceed the service qualification of the trained qualified personnel of level 3 must solely be executed by service personnel of Dr. Födisch Umweltmesstechnik AG.

11.2 Displaying of current messages and clearing of failures

Messages and alarms regarding error state can be displayed by a connected visualisation PC with installed user software.

Upcoming failure and errors are signalised by the status information on operating surface (“maint. req.”, “maintenance”, “failure”) and can be reviewed via menu (see section 9.8 “Messages”, page 56).

In case of a system application, current failure messages according to communication status of MCA 10 HWIR and PLC are additionally displayed in the lower status bar on the screen.

1. Select menu “messages” on operating surface.
2. Select “current messages” in the selection list.
   › On screen all currently upcoming messages are displayed.
3. Check all messages which are designated with “maint. req.”, “maintenance” or “failure” in the column “generated status”.

NOTICE
Info messages, e.g. for failure of communication status, are only displayed in the lower status bar. They are not signalised by any status information.
In the message list no generated status is defined.

4. Compare the respective message with the tables specified in the following sections:
   › Failure (see section 11.2.1, page 70)
   › Maintenance (see section 11.2.2, page 79)
   › Maintenance requirement (see section 11.2.3, page 81)
   › Info message (see section 11.2.4, page 88)

CAUTION
Failure clearance must be executed by qualified personnel.
Observe the required levels for service qualification (see section 11.1, page 68).

5. Depending on your service qualification, carry out the actions for failure clearance for the respective message, if applicable.
   › As soon as the cause of error/failure is eliminated, the corresponding message in the menu disappears after approx. 2 min.
6. Check the error/failure message for disappearance.

NOTICE
In case of upcoming errors or failure which cannot be eliminated, please refer to Dr. Födisch Umweltmesstechnik AG (contact details: see cover inside).

11.2.1 Messages “failure”

Failure		
Message	**Cause**	**Action**
air conditioner	run-in phase is not finished	1 Close the cabinet door. Wait until the system has thermally stabilised. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	failure at air conditioning unit	3 Check the message display at the air conditioning unit. If applicable, eliminate the respective cause of error/failure. For that purpose, read the technical documentation of the supplier (see appendix).
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
analyser	several failure messages pertaining to the analyser are occurring (superordinate message)	1 Select the menu “messages” with the selection list “current messages” on the operating surface (see section 9.8 “Messages”, page 56). Check all messages which are designated with “failure” in the column “generated status” and compare these with the quoted messages here in this table. Depending on your service qualification, carry out the actions for failure clearance for the respective messages, if applicable.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
analyser flow underrun	deposit respectively cross-section constriction in the region of the probe	2 Exchange the probe filter. Check the connecting pieces.
	deposit respectively cross-section constriction in the region of the exhaust pipe	2 Clean the exhaust pipe.
	injector performance too low	2 Exchange the injector screwing-in (see section 10.1, page 66).
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	cuvette inlet filter is clogged	3 Exchange the cuvette inlet filter.
	faulty flow measurement	3 Calibrate the flow measurement via the menu of the operating surface (see section 9.10 “Calibration”, page 59).
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.

Failure		
Message	**Cause**	**Action**
cabinet ventilator	run-in phase is not finished	1 Close the cabinet door. Wait until the system has thermally stabilised. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	failure at air conditioning unit	1 Check the message display at the air conditioning unit. If applicable, eliminate the respective cause of error/failure. For that purpose, read the technical documentation of the supplier (see appendix).
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
chopper wheel failure	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
chopper wheel initialization failed	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
communication	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
communication MCA - PLC	PLC in programming mode (“PROG.”)	2 Switch the DIP switch at the control unit in the system cabinet to “RUN”.
	unconnected or defect connection cable between MCA 10 HWIR and PLC	2 Check the connection cable between MCA 10 HWIR and PLC. Exchange it, if necessary.
condensate tank	full condensate tank	1 Empty the condensate tank.
	defect level sensor	3 Check the function of the level sensor. Exchange it, if necessary.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
cuvette pressure limit exceeded	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
detector ad-converter limit exceeded	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
detector initialization failed	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
external components	failure at external measuring device	1 Check the message display at the external measuring device. If applicable, eliminate the respective cause of error/failure. For that purpose, read the technical documentation of the supplier (see appendix).
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
FID	failure at FID	3 Select the menu “FID control” on the operating surface of the MCA 10 HWIR. Check the message display of the FID. If applicable, eliminate the respective cause of error/failure. For that purpose, read the technical documentation of the supplier (see appendix).
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.

Failure		
Message	**Cause**	**Action**
FID watchdog	unconnected or defect connection cable between PLC and FID	3 Check the connection cable between PLC and FID. Exchange it, if necessary.
	failure at internal communication of FID	3 Carry out a reset of the FID and wait until the system has stabilised. For that purpose, read the technical documentation of the supplier (see appendix).
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
filter wheel failure	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
filter wheel initialization failed	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
general PLC	several failure messages pertaining to the PLC are occurring (superordinate message)	1 Select the menu “messages” with the selection list “current messages” on the operating surface (see section 9.8 “Messages”, page 56). Check all messages which are designated with “failure” in the column “generated status” and compare these with the quoted messages here in this table. Depending on your service qualification, carry out the actions for failure clearance for the respective messages, if applicable.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
heating cuvette hardware failure	temporary occurring failure message (without relevance)	1 Wait until the message has disappeared.
	permanently occurring failure message	Contact Dr. Födisch Umweltmesstechnik AG.
heating detector hardware failure	temporary occurring failure message (without relevance)	1 Wait until the message has disappeared.
	permanently occurring failure message	Contact Dr. Födisch Umweltmesstechnik AG.
heating injector hardware failure	temporary occurring failure message (without relevance)	1 Wait until the message has disappeared.
	permanently occurring failure message	Contact Dr. Födisch Umweltmesstechnik AG.
heating O2 sensor hardware failure	temporary occurring failure message (without relevance)	1 Wait until the message has disappeared.
	permanently occurring failure message	Contact Dr. Födisch Umweltmesstechnik AG.
heating option intern hardware failure	temporary occurring failure message (without relevance)	1 Wait until the message has disappeared.
	permanently occurring failure message	Contact Dr. Födisch Umweltmesstechnik AG.

Failure		
Message	**Cause**	**Action**
initialisation chopper wheel	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
initialisation detector	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
initialisation filter wheel	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
initialisation mainboard flash	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
injector pressure limit exceeded	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
O2 sensor limit exceeded	heat-up phase is not finished	1 Wait until the current value of the cuvette temperature has reached more than 80% of the nominal value (see section 9.7 “Diagnostics”, page 55). As soon as the current value is more than 80%, wait until the heat-up phase of the oxygen sensor is finished. Check the temperature at regular intervals.
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	controller error	3 Carry out a reset of the analyser (see section 12.1 “Shutdown”, page 89 and section 8.1 “Commissioning of MCA 10 HWIR”, page 38). Wait until the heat-up phase is finished.
	defect oxygen sensor	3 Exchange the oxygen sensor.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
sample probe	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
software test	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
temperature analyser	several failure messages pertaining to the analyser temperatures are occurring (superordinate message)	1 Select the menu “messages” with the selection list “current messages” on the operating surface (see section 9.8 “Messages”, page 56). Check all messages which are designated with “failure” in the column “generated status” and compare these with the quoted messages here in this table. Depending on your service qualification, carry out the actions for failure clearance for the respective messages, if applicable.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.

Failure		
Message	**Cause**	**Action**
temperature cabinet / option	heat-up phase is not finished	1 Wait until the heat-up phase of the analyser cabinet is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect electric connections	3 Check the electric connections of heater and temperature sensor.
	defect cabinet heater	3 Exchange the cabinet heater.
	defect temperature sensor	3 Exchange the temperature sensor.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
temperature cuvette overrun	heat-up phase is not finished	1 Wait until the heat-up phase of the analyser is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect cuvette heater	3 Exchange the cuvette heater.
	defect temperature sensor	3 Exchange the temperature sensor.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
temperature cuvette underrun	heat-up phase is not finished	1 Wait until the heat-up phase of the analyser is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect cuvette heater	3 Exchange the cuvette heater.
	defect temperature sensor	3 Exchange the temperature sensor.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
temperature detector overrun	faulty climatisation	2 Check the status display of the cabinet air conditioning.
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect detector heater	3 Exchange the detector heater.
	defect temperature sensor	3 Exchange the temperature sensor.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.

Failure		
Message	**Cause**	**Action**
temperature detector underrun	heat-up phase is not finished	1 Wait until the heat-up phase of the analyser is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	ambient temperature is too low	1 Close the cabinet door. Wait until the heat-up phase of the analyser is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect detector heater	3 Exchange the detector heater.
	defect temperature sensor	3 Exchange the temperature sensor.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
temperature electronic/ cabinet overrun	ambient temperature is instable	1 Close the cabinet door. Wait until the heat-up phase of the analyser is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect temperature sensor	3 Exchange the temperature sensor.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
temperature electronic/ cabinet underrun	ambient temperature is instable	1 Close the cabinet door. Wait until the heat-up phase of the analyser is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect temperature sensor	3 Exchange the temperature sensor.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.

Failure		
Message	**Cause**	**Action**
temperature exhaust line	heat-up phase is not finished	1 Wait until the heat-up phase of the exhaust pipe is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect electric connections	3 Check the electric connections of heater and temperature sensor.
	defect heater of the exhaust pipe	3 Exchange the exhaust pipe.
	defect temperature sensor	3 Exchange the exhaust pipe.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
temperature external sample line	heat-up phase is not finished	1 Wait until the heat-up phase of the measuring gas pipe is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect electric connections	3 Check the electric connections of heater and temperature sensor.
	defect heater of the measuring gas pipe	3 Exchange the measuring gas pipe.
	defect temperature sensor	3 Exchange the measuring gas pipe.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
temperature injector overrun	heat-up phase is not finished	1 Wait until the heat-up phase of the analyser is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect injector heater	3 Exchange the injector heater.
	defect temperature sensor	3 Exchange the temperature sensor.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.

Failure		
Message	**Cause**	**Action**
temperature injector underrun	heat-up phase is not finished	1 Wait until the heat-up phase of the analyser is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	deposit respectively cross-section constriction in the region of the exhaust pipe	2 Clean the exhaust pipe.
	deposit respectively cross-section constriction in the region of the injector	2 Exchange the injector.
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	zero gas rate too high	3 Regulate the zero gas rate to the system-specific nominal value (reviewable in the system-specific supplementary sheet for MCA 10 HWIR).
	defect injector heater	3 Exchange the injector heater.
	defect temperature sensor	3 Exchange the temperature sensor.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
temperature internal sample line	heat-up phase is not finished	1 Wait until the heat-up phase of the measuring gas pipe is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect electric connections	3 Check the electric connections of heater and temperature sensor.
	defect heater of the measuring gas pipe	3 Exchange the measuring gas pipe.
	defect temperature sensor	3 Exchange the measuring gas pipe.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
temperature O2 sensor overrun	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect oxygen sensor	3 Exchange the oxygen sensor.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.

Failure		
Message	**Cause**	**Action**
temperature O2 sensor underrun	heat-up phase is not finished	1 Wait until the heat-up phase of the analyser is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect oxygen sensor	3 Exchange the oxygen sensor.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
temperature sample line	heat-up phase is not finished	1 Wait until the heat-up phase of the measuring gas pipe is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect electric connections	3 Check the electric connections of heater and temperature sensor.
	defect heater of the measuring gas pipe	3 Exchange the measuring gas pipe.
	defect temperature sensor	3 Exchange the measuring gas pipe.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
temperature sample probe	heat-up phase is not finished	1 Wait until the heat-up phase of the probe is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	faulty probe isolation	1 Check if the probe cover is correctly mounted.
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect electric connections	3 Check the electric connections of heater and temperature sensor.
	defect probe heater	3 Exchange the probe heater.
	defect temperature sensor	3 Exchange the temperature sensor.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.

Tab. 6: Error search and failure clearance – Messages “failure”

11.2.2 Messages “maintenance”

Maintenance		
Message	**Cause**	**Action**
a/o testmode active	simulation value of a component is active	3 Check the simulation values of the components. If necessary, set these via the menu of the operating surface to “0” (see section 9.11 “Configuration”, page 62).
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
analyser	several maintenance messages pertaining to the analyser are occurring (superordinate message)	1 Select the menu “messages” with the selection list “current messages” on the operating surface (see section 9.8 “Messages”, page 56). Check all messages which are designated with “maintenance” in the column “generated status” and compare these with the quoted messages here in this table. Depending on your service qualification, carry out the actions for failure clearance for the respective messages, if applicable.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
back purging / line switching	back purging respectively line switching is active	1 Wait until the back purging respectively the line switching after the changeover of the measuring point is finished.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
external components	maintenance at external measuring device	1 Check the message display at the external measuring device. If applicable, eliminate the respective cause of error/failure. For that purpose, read the technical documentation of the supplier (see appendix).
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
FID	zero point routine or span point routine of the FID is active	1 Wait until the zero point routine is finished.
	maintenance at FID	3 Select the menu “FID control” on the operating surface of the MCA 10 HWIR. Check the message display of the FID. If applicable, eliminate the respective cause of error/failure. For that purpose, read the technical documentation of the supplier (see appendix).
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.

Maintenance		
Message	**Cause**	**Action**
general PLC	several maintenance messages pertaining to the PLC are occurring (superordinate message)	1 Select the menu “messages” with the selection list “current messages” on the operating surface (see section 9.8 “Messages”, page 56). Check all messages which are designated with “maintenance” in the column “generated status” and compare these with the quoted messages here in this table. Depending on your service qualification, carry out the actions for failure clearance for the respective messages, if applicable.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
maintenance switch set	maintenance switch of the system is set	1 Set the maintenance switch via the menu of the operating surface to “off” (see section 9.6 “System control”, page 54).
testgas connected	system is set to test gas	1 Set the system via the menu of the operating surface to “measuring gas” (see section 9.6 “System control”, page 54).
zero point routine running	zero point routine is active	1 Wait until the automatic zero point routine is finished.
zerogas connected	system is set to zero gas	1 Set the system via the menu of the operating surface to “measuring gas” (see section 9.6 “System control”, page 54).

Tab. 7: Error search and failure clearance – Messages “maintenance”

11.2.3 Messages “maint. req.”

Maint. req.		
Message	**Cause**	**Action**
analyser	several maintenance requirement messages pertaining to the analyser are occurring (superordinate message)	1 Select the menu “messages” with the selection list “current messages” on the operating surface (see section 9.8 “Messages”, page 56). Check all messages which are designated with “maint. req.” in the column “generated status” and compare these with the quoted messages here in this table. Depending on your service qualification, carry out the actions for failure clearance for the respective messages, if applicable.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
analyser flow underrun	deposit respectively cross-section constriction in the region of the probe	2 Exchange the probe filter. Check the connecting pieces.
	deposit respectively cross-section constriction in the region of the exhaust pipe	2 Clean the exhaust pipe.
	injector performance too low	2 Exchange the injector screwing-in (see section 10.1, page 66).
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	cuvette inlet filter is clogged	3 Exchange the cuvette inlet filter.
	faulty flow measurement	3 Calibrate the flow measurement via the menu of the operating surface (see section 9.10 “Calibration”, page 59).
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
condensate tank	full condensate tank	1 Empty the condensate tank.
	defect level sensor	3 Check the function of the level sensor. Exchange it, if necessary.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
external components	maintenance requirement at external measuring device	1 Check the message display at the external measuring device. If applicable, eliminate the respective cause of error/failure. For that purpose, read the technical documentation of the supplier (see appendix).
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
FID	maintenance requirement at FID	3 Select the menu “FID control” on the operating surface of the MCA 10 HWIR. Check the message display of the FID. If applicable, eliminate the respective cause of error/failure. For that purpose, read the technical documentation of the supplier (see appendix).
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.

Maint. req.		
Message	**Cause**	**Action**
flow probe 1	flow at measuring point 1 is under limit value	1 Check and clean the measuring point 1.
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
flow probe 2	flow at measuring point 2 is under limit value	1 Check and clean the measuring point 2.
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
general PLC	several maintenance requirement messages pertaining to the PLC are occurring (superordinate message)	1 Select the menu “messages” with the selection list “current messages” on the operating surface (see section 9.8 “Messages”, page 56). Check all messages which are designated with “maint. req.” in the column “generated status” and compare these with the quoted messages here in this table. Depending on your service qualification, carry out the actions for failure clearance for the respective messages, if applicable.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
PLC battery empty	flat or empty buffer battery of the control unit	3 Exchange the buffer battery of the control unit.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
pressure cuvette limit exceeded	deposit respectively cross-section constriction in the region of the exhaust pipe	3 Check the exhaust pipe. Clean the exhaust pipe respectively exchange it, if necessary.
	deposit respectively cross-section constriction in the region of the injector	3 Check the injector. Clean the injector respectively exchange it, if necessary.
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
pressure injector limit exceeded	deposit respectively cross-section constriction in the region of the exhaust pipe	3 Check the exhaust pipe. Clean the exhaust pipe respectively exchange it, if necessary.
	deposit respectively cross-section constriction in the region of the injector	3 Check the injector. Clean the injector respectively exchange it, if necessary.
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.

Maint. req.		
Message	**Cause**	**Action**
ratio flow P1/P2 high	flow at measuring point 2 is too low	1 Check and clean the measuring point 2.
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
ratio flow P1/P2 low	flow at measuring point 1 is too low	1 Check and clean the measuring point 1.
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
servicetime interval overrun	deadline of service date is exceeded	Contact Dr. Födisch Umweltmesstechnik AG.
software test	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
temperature cuvette overrun	heat-up phase is not finished	1 Wait until the heat-up phase of the analyser is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect cuvette heater	3 Exchange the cuvette heater.
	defect temperature sensor	3 Exchange the temperature sensor.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
temperature cuvette underrun	heat-up phase is not finished	1 Wait until the heat-up phase of the analyser is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect cuvette heater	3 Exchange the cuvette heater.
	defect temperature sensor	3 Exchange the temperature sensor.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.

Maint. req.		
Message	**Cause**	**Action**
temperature detector overrun	faulty climatisation	2 Check the message display at the air conditioning unit. If applicable, eliminate the respective cause of error/failure. For that purpose, read the technical documentation of the supplier (see appendix).
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect detector heater	3 Exchange the detector heater.
	defect temperature sensor	3 Exchange the temperature sensor.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
temperature detector underrun	heat-up phase is not finished	1 Wait until the heat-up phase of the analyser is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	ambient temperature is too low	1 Close the cabinet door. Wait until the heat-up phase of the analyser is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect detector heater	3 Exchange the detector heater.
	defect temperature sensor	3 Exchange the temperature sensor.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
temperature electronic/ cabinet overrun	ambient temperature is instable	1 Close the cabinet door. Wait until the heat-up phase of the analyser is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect temperature sensor	3 Exchange the temperature sensor.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.

Maint. req.		
Message	**Cause**	**Action**
temperature electronic/ cabinet underrun	ambient temperature is instable	1 Close the cabinet door. Wait until the heat-up phase of the analyser is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect temperature sensor	3 Exchange the temperature sensor.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
temperature exhaust line	heat-up phase is not finished	1 Wait until the heat-up phase of the exhaust pipe is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect electric connections	3 Check the electric connections of heater and temperature sensor.
	defect heater of the exhaust pipe	3 Exchange the exhaust pipe.
	defect temperature sensor	3 Exchange the exhaust pipe.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
temperature external sample line	heat-up phase is not finished	1 Wait until the heat-up phase of the measuring gas pipe is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect electric connections	3 Check the electric connections of heater and temperature sensor.
	defect heater of the measuring gas pipe	3 Exchange the measuring gas pipe.
	defect temperature sensor	3 Exchange the measuring gas pipe.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.

Maint. req.		
Message	**Cause**	**Action**
temperature injector overrun	heat-up phase is not finished	1 Wait until the heat-up phase of the analyser is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect injector heater	3 Exchange the injector heater.
	defect temperature sensor	3 Exchange the temperature sensor.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
temperature injector underrun	heat-up phase is not finished	1 Wait until the heat-up phase of the analyser is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	deposit respectively cross-section constriction in the region of the exhaust pipe	2 Clean the exhaust pipe.
	deposit respectively cross-section constriction in the region of the injector	2 Exchange the injector.
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	zero gas rate too high	3 Regulate the zero gas rate to the system-specific nominal value (reviewable in the system-specific supplementary sheet for MCA 10 HWIR).
	defect injector heater	3 Exchange the injector heater.
	defect temperature sensor	3 Exchange the temperature sensor.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
temperature internal sample line	heat-up phase is not finished	1 Wait until the heat-up phase of the measuring gas pipe is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect electric connections	3 Check the electric connections of heater and temperature sensor.
	defect heater of the measuring gas pipe	3 Exchange the measuring gas pipe.
	defect temperature sensor	3 Exchange the measuring gas pipe.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.

Maint. req.		
Message	**Cause**	**Action**
temperature O2 sensor overrun	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect oxygen sensor	3 Exchange the oxygen sensor.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
temperature O2 sensor underrun	heat-up phase is not finished	1 Wait until the heat-up phase of the analyser is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect oxygen sensor	3 Exchange the oxygen sensor.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
temperature sample line option	heat-up phase is not finished	1 Wait until the heat-up phase of the measuring gas pipe is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect electric connections	3 Check the electric connections of heater and temperature sensor.
	defect heater of the measuring gas pipe	3 Exchange the measuring gas pipe.
	defect temperature sensor	3 Exchange the measuring gas pipe.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
temperature sample probe	heat-up phase is not finished	1 Wait until the heat-up phase of the probe is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	faulty probe isolation	1 Check if the probe cover is correctly mounted.
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect electric connections	3 Check the electric connections of heater and temperature sensor.
	defect probe heater	3 Exchange the probe heater.
	defect temperature sensor	3 Exchange the temperature sensor.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.

Maint. req.		
Message	**Cause**	**Action**
temperature sample probe option	heat-up phase is not finished	1 Wait until the heat-up phase of the probe is finished. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55).
	faulty probe isolation	1 Check if the probe cover is correctly mounted.
	parameters or limit values faulty	3 Check the parameter settings in the menu of the operating surface (see section 9.11 “Configuration”, page 62). Correct these, if necessary.
	defect electric connections	3 Check the electric connections of heater and temperature sensor.
	defect probe heater	3 Exchange the probe heater.
	defect temperature sensor	3 Exchange the temperature sensor.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.
zero drift component ...	instability during zero point setting	1 Close the cabinet door. Wait until the system has thermally stabilised. Check the temperature at regular intervals in the menu of the operating surface (see section 9.7 “Diagnostics”, page 55). Carry out an automatic zero point setting (see section 9.9 “Auto calibration”, page 58). Wait until this setting has finished. After finishing the automatic zero point setting, wait min. 1 h and repeat the process, if necessary.
	pollution of instrument air	2 Clean respectively exchange the filters of the compressed-air cleaning system.
	water ingress in the instrument air	3 Check the pressured-air system for condensate formation. Remove possibly existing condensate.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.

Tab. 8: Error search and failure clearance – Messages “maint. req.”

11.2.4 Info message

Message	Cause	Action
MCA not connected	temporary communication loss	1 Wait until the connection is re-connected automatically and the message has disappeared.
	unconnected or defect connection cable between visualisation PC and MCA 10 HWIR	2 Check the connection cable between visualisation PC and MCA 10 HWIR. Exchange it, if necessary.
	miscellaneous	Contact Dr. Födisch Umweltmesstechnik AG.

Tab. 9: Error search and failure clearance – Info message

12 Shutdown and Disposal

12.1 Shutdown

DANGER
Hazardous voltage!
Parts of the device can be energised with hazardous voltage.
Danger of electric shock.
Any work at the device must solely be executed by qualified personnel.

WARNING
Corrosive substances!
Depending on the measuring gas incidental substances can be corrosive and/or poisonous.
Contact can cause chemical burn of body tissue and serious eye injury.
Personal protective equipment according to the current legal accident prevention regulations must be worn.

WARNING
Hot surface!
Several device parts can develop high temperatures.
Burn hazard!
Before working at the device it must be cooled down.

NOTICE
Please observe the procedure in combination with the analyser cabinet respectively with optional additional devices if necessary.

1. Purge the device with zero gas for min. 30 min.
2. Disconnect the measuring gas pipe from gas sampling. Therefor shut the valves at the gas bottles.
3. Disconnect the power plug from power supply.

12.2 Disassembling

NOTICE
Please observe the procedure in combination with the analyser cabinet respectively with optional additional devices if necessary.

1. Disconnect the power cord from the device.
2. Disconnect the communication cable of PC from the device.
3. Disconnect the forced air pipe from the device.
4. Disconnect the measuring gas pipe and the exhaust pipe from the device.
5. If necessary, disconnect optional additional devices from the connections at the device.
6. Release the screws at the mounting plate and remove the device from the mounting place.
7. Store all pipes safe and care for correct storage of the device.

12.3 Storage

For correct storage of the multi component analyser MCA 10 HWIR the following ambient conditions apply:

- Ambient temperature: 0 ... 50 °C
- Relative humidity: max. 90% (non-condensing)
- Storage in rooms (outdoor storage not permissible)
- Protection against wetness
- Location free of percussion

12.4 Disposal

NOTICE
The disposal must be executed according to the country-specific legal environmental protection regulations. The device must be treated as hazardous waste.

13 Technical data

13.1 Multi component analyser MCA 10 HWIR

Multi component analyser MCA 10 HWIR	
Insulation	protection class I according to IEC 1010-1:1993
Insulation co-ordination	overvoltage category II according to IEC 1010-1:1993
Protection degree	IP40
Pollution	pollution degree 2 according to IEC 1010-1:1993
Ambient conditions: • Ambient temperature for operation • Ambient temperature for storage • Relative humidity	 25...35 °C (temperature stability max. 2 K/h) 0 ... 50 °C max. 90% (non-condensing)
Power consumption	350 W
Power supply	110 V to 230 V, 50/60 Hz
Compressed-air supply	4...6 bar
Compressed-air consumption	approx. 1 m³/h (dependent on application)
Calibration	• zero point: automatically with instrument air • span point: with test gas, optional: automatically
Measuring method	bi-frequency measuring method, gas filter correlation, oxygen measurement
Number of measuring components	max. 12 infrared components (dependent on application) and oxygen
Measuring ranges	2 per measuring component
Detection limit	< 2% of the respective measuring range
Air pressure correction	yes
Correction of cross sensitivity (interference)	additive, multiplicative
Drift correction of zero point	automatically
Sensitivity correction	with test gas, once in 6 months (sensitivity tests as standard with a concentration of 80% of the measuring range)
Standardisation	dry, wet
Gas conveyance	air-jet pump
Forced air supply	1...4 bar depending on flow rate

Multi component analyser MCA 10 HWIR	
Operating	PC connection via USB
Interfaces	2 x RS 232, USB
Software versions [PC/MCA10/PLC]	4.00/3.61/3.62

Tab. 10: Technical data – Multi component analyser MCA 10 HWIR

Photometer	
Spectral range	1 ... 16 µm
Supply voltage of emitter unit	10 V
Gas line, heated	continuous to 200 °C, standard 185 °C, higher possible
Path length of measuring cell	adjustable 2...10 m
Dead volume of measuring cell	1 l
Particle filter	2 µm

Tab. 11: Technical data – Photometer

13.2 Measuring ranges of MCA 10 HWIR

For measurement of the various gas concentrations the MCA 10 HWIR is tested regarding the following measuring ranges:

Component	Certification range	Measuring range 2	Measuring range 3
CO	0...75 mg/m³	0...300 mg/m³	0...5000 mg/m³
CO_2	0...25 vol. %	0...50 vol. %	-
NO	0...80 mg/m³	0...400 mg/m³	0...3000 mg/m³
NO_2	0...50 mg/m³	0...500 mg/m³	-
N_2O	0...50 mg/m³	0...3000 mg/m³	-
NH_3	0...10 mg/m³	0…50 mg/m³	0…500 mg/m³
SO_2	0...75 mg/m³	0...300 mg/m³	0...2500 mg/m³
HCl	0...15 mg/m³	0...90 mg/m³	0...5000 mg/m³
HF*	-	0...20 mg/m³	-
H_2O	0...40 vol. %	-	-
CH_4	0...50 mg/m³	0...500 mg/m³	-
TOC	0...15 mg/m³	0...30 mg/m³	0…500 mg/m³
O_2	0...25 vol. %	-	-

* not suitability tested according to DIN EN 15267-3; certified in compliance with MCERTS Performance Standards

Tab. 12: Measuring ranges of MCA 10 HWIR

14 Spare and wear parts

For placing a purchase order of spare and wear parts please refer to Dr. Födisch Umweltmesstechnik AG (contact details: see cover inside).

Element/Component	Item number
BaF_2 window 15x2 mm	ETLD 242
BaF_2 window 20x1 mm	ETLA 304
Blank plug	ETLD 325
Bulkhead plug connector	ETLA 1121
Bulkhead screwing	ETLD 163
Cable for detector board power supply	ETLD 27
Cable for mainboard power supply 10 V	ETLD 261
Cable for mainboard power supply 24 V	ETLD 265
Cable for PT100 detector box	ETLD 210
Cable for PT100 heating cuvette	ETLD 254
Cable for PT100 of gas distribution block	ETLD 193
Cable loom for heating of cuvette	ETLD 253
Cable loom for heating of detector box	ETLD 208
Cable loom for heating of gas distribution block	ETLD 192
Cable of signal transmission for detector box to mainboard	ETLD 26
Chopper motor with intermediate plate for emitter box	ETLD 200
Chopper wheel	ETLA 276
Collet chuck	ETLD 32
Connection board	ETLD 81
Control cable for power supply unit of mainboard	ETLD 266
Control cable for stepper motor of detector box	ETLD 30
Control cable for stepper motor of emitter box	ETLD 29
Cuvette	ETLD 19
Detector board	ETLD 118
Detector box	ETLD 18
Elbow screwing	ETLA 690
Elbow screwing of pressure sensor	ETLD 154
Emitter box	ETLD 17
Fan for power supply unit	ETLD 467

Element/Component	Item number
Fuses T 10 A	ETLD 152
Gas distribution block	ETLD 7
Gas inlet	ETLD 249
Gas outlet	ETLD 250
Injector for gas distribution block	ETLD 21
IR emitter	ETLD 70
Isolation box of cuvette	ETLD 15
Isolation boxes of gas distribution block	ETLD 16
Light barrier of detector box	ETLD 213
Light barrier of emitter box	ETLD 199
Locking ring	ETLD 240
Locking screw of gas distribution block	ETLD 161
Mainboard	ETLD 149
Mirror set of cuvette	ETLA 934
Nozzle of gas distribution block	ETLD 160
O-ring of gas outlet	ETLD 252
O-rings of gas inlet	ETLD 251
Over-temperature protection	ETLA 113
Oxygen sensor	ETLD 258
PE cable for board of housing	ETLD 31
PE cable for top of main carrier	ETLD 28
Power supply unit	ETLD 185
Pressure sensor	ETLD 159
PT100 for intermediate plate of detector box	ETLD 219
PT100 for mainboard	ETLD 227
PTFE hose 100 mm	ETLD 328
PTFE hose 1200 mm	ETLD 330
PTFE hose 146 mm	ETLD 327
PTFE hose 240 mm	ETLD 329
PTFE hose 4/6	ETLD 75
PTFE hose 46 mm	ETLD 326
PTFE hose 560 mm	ETLD 331
Screw-in connection with gasket	ETLD 322

Element/Component	Item number
Screw-in connection with gasket for gas distribution block	ETLD 139
Sealing set for cuvette	ETLD 248
Side panel 1 of emitter with BaF_2 window	ETLD 346
Side panel 2 of detector with BaF_2 window	ETLD 211
Sinter metal filter	ETLD 239
Sinter metal filter (set), gilded	ETLD 540
Slot bracket	ETLD 147
Spacer for cuvette	ETLD 77
Stepper motor for chopper wheel	ETLD 432
Stepper motor for filter wheel	ETLD 359
Stepper motor with intermediate plate for detector box	ETLD 215
Stud bolt for gas distribution block	ETLD 43
Thermo switch	ETLA 264
Touch pen	ETLD 632
Window holder	ETLD 80

Tab. 13: Spare and wear parts – Multi component analyser MCA 10 HWIR

15 System application with analyser cabinet

NOTICE
This chapter describes the general system connection by the analyser cabinet.
For operation with the optional additional devices please read the technical documentations of the suppliers (see appendix). The contents are at responsibility of the respective manufacturers.
Application examples for system design: see section 5.11, page 31.

15.1 Design of analyser cabinet

The analyser cabinet is an air-conditioned steel sheet cabinet. The complete electrics/electronics, feeding, voltage distribution, signal processing and PLC as well as a pressured air distribution are located inside. The multi component analyser MCA 10 HWIR is mounted rear at the mounting plate. In the steel sheet door the control panel with touch surface is generally located. Optionally, a Thermo-FID can be mounted into the analyser cabinet (see appendix).

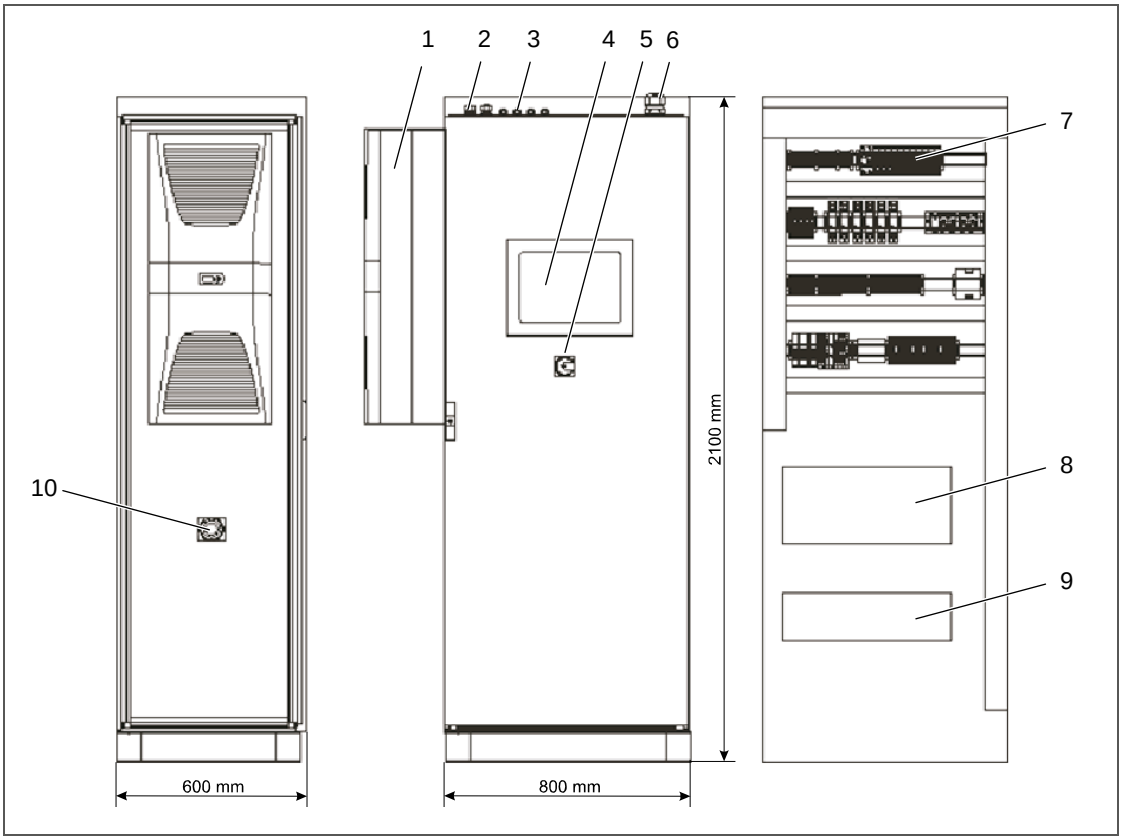


Fig. 35: Design of analyser cabinet (Application example)

1 Air conditioners
2 Feedthrough for power supply
3 Feedthrough for peripheral connections
4 Control panel (touch screen)
5 Master switch
6 Feedthrough for measuring gas pipe
7 Control
8 MCA 10 HWIR
9 Thermo-FID (optional)
10 Service aperture

15.2 Transport of analyser cabinet

The analyser cabinet is transported separately from the multi component analyser MCA 10 HWIR.

The analyser cabinet is delivered upright-standing on a stillage. The transport can be carried out in miscellaneous way:

- by lifting the stillage with the aid of a forklift
- by gibbeting at hoisting lugs at the top side of analyser cabinet

DANGER
Heavy load! At transport the analyser cabinet may topple or fall.
Risk of injury!
Remain aloof from floating load. Wear personal protective equipment.
Chose appropriate means of transport with sufficient load-bearing capacity.
Safeguard the analyser cabinet against toppling or falling.
Avoid heavy shocks and percussion at transport.

CAUTION
Risk of incorrect attaching.
The hoisting lugs mounted at the analyser cabinet are solely appropriate for vertical forces. Gibbeting at only one load hook causes damage.
One vertical load-bearing rope/chain with load hook must be provided for every hoisting lug.
Consider the barycentre of analyser cabinet when lifting.

1. Check the analyser cabinet as well as the packaging material for transport damage.
2. Document possibly existing damage.
3. Remove the packaging material.
4. Keep the packaging material for possible re-use.

15.3 Placement and Mounting

15.3.1 Placement

For correct operation the following conditions apply:

- Ambience:
  - Ambient temperature: 5 ... 40 °C
  - Relative humidity: max. 90% (non-condensing)
  - Operation in rooms (outdoor operation not permissible)
  - Protection against wetness
- Bottom ground:
  - solid and plane
  - carrying capacity: min. 500 kg/m²
  - securing of safe standing of the analyser cabinet including possible additional equipment
- Location free of percussion
- Distance between air conditioners and wall: min. 20 cm
  (air inlets and air outlets must not be covered)

Placing of analyser cabinet

1. Lift the analyser cabinet to the installation location and put it down at the footprints carefully.
2. Remove all means of transport (ropes, chains etc.) and hoisting lugs if necessary.
3. Align the analyser cabinet with the aid of a spirit level.
4. Tighten the analyser cabinet at the wall/ground.

15.3.2 Mounting

1. Lay the measuring gas pipe.
2. Connect the heater of the measuring gas pipe and the temperature sensor to the power supply (circuit diagrams: see appendix).
3. Mount the probe (circuit diagrams: see appendix).
4. Connect the probe heater to the power supply.
5. Connect the measuring gas pipe with the probe.
6. Lay the exhaust pipe.
7. If necessary, connect the heater of the exhaust pipe to the power supply (circuit diagrams: see appendix).
8. Insert the MCA10 HWIR horizontally into the analyser cabinet and fix the device at the mounting plate of the analyser cabinet.

CAUTION
Insufficient ventilation can cause damage at the device.
Take care that the ventilation slots are not covered.

9. Execute the following work at the MCA 10 HWIR:
   a) Connect the measuring gas pipe, the exhaust pipe and if necessary additional devices with the connections at the right device side (see Fig. 15, page 30).
   Furnish possibly non-used connections with seal caps.
   b) Connect the forced air pipe with connection C6 (6, Fig. 14, page 30) at the left device side.
   c) Connect the communication cable to PLC with connection C3 (3, Fig. 14).
   d) Connect the communication cable to PC with connection C4 (4, Fig. 14).
   e) Connect the power cord with connection C1 (1, Fig. 14) and with the terminal strip in the analyser cabinet.
10. If necessary, connect optional additional devices of the system (circuit diagrams: see appendix).

NOTICE
At locations with temperatures below 20 °C, an analyser cabinet heater must be installed for temperature stabilisation, so that the analyser cabinet is tempered constantly to min. 22 °C.

11. Connect the signal connection to the control system.
12. Connect the power plug of the analyser cabinet to the power supply.

15.4 Commissioning

DANGER
Hazardous voltage!
Parts of the device can be energised with hazardous voltage.
Danger of electric shock.
Any work at the device must solely be executed by qualified personnel.

NOTICE
If the MCA 10 HWIR shall be commissioned again after storage, before commissioning it must stand unused at installation location at least one day under permissible ambient conditions.
Requirements for location: see section 15.3.1 “Placement”, page 99.

1. Switch on the power supply by the master switch at the analyser cabinet.
2. Provide the relevant gases. Therefor open the valves at the gas bottles.
3. Adjust the forced air to 1 bar.

CAUTION
The measuring medium must have atmospheric pressure (1013 mbar absolute).

4. Purge the device with instrument air.
5. Check the temperatures and the instrument air during the heat-up phase at regular intervals.
6. Wait until temperatures, pressures and regulation parameters are stable.
7. Carry out the zero point setting:
   - Manual zero point setting (see section 9.10 “Calibration”, page 59).
   - Automatic zero point setting (see section 15.5, page 102)

15.5 Automatic zero point setting via “Thermocal”

NOTICE
In case of intensely fluctuating ambient temperature the zero point position must be corrected. Via function “Thermocal” the new zero point setting is executed automatically (max. once in 2 hours).

If the deviation of electronics temperature of the MCA 10 HWIR from the last automatic zero point setting until the current time is larger than 2.0 K, the function “Thermocal” is triggered. Thereby the MCA 10 HWIR is purged with instrument air with a delay of two hours and the zero point is set. The function “Thermocal” happens in maintenance mode.

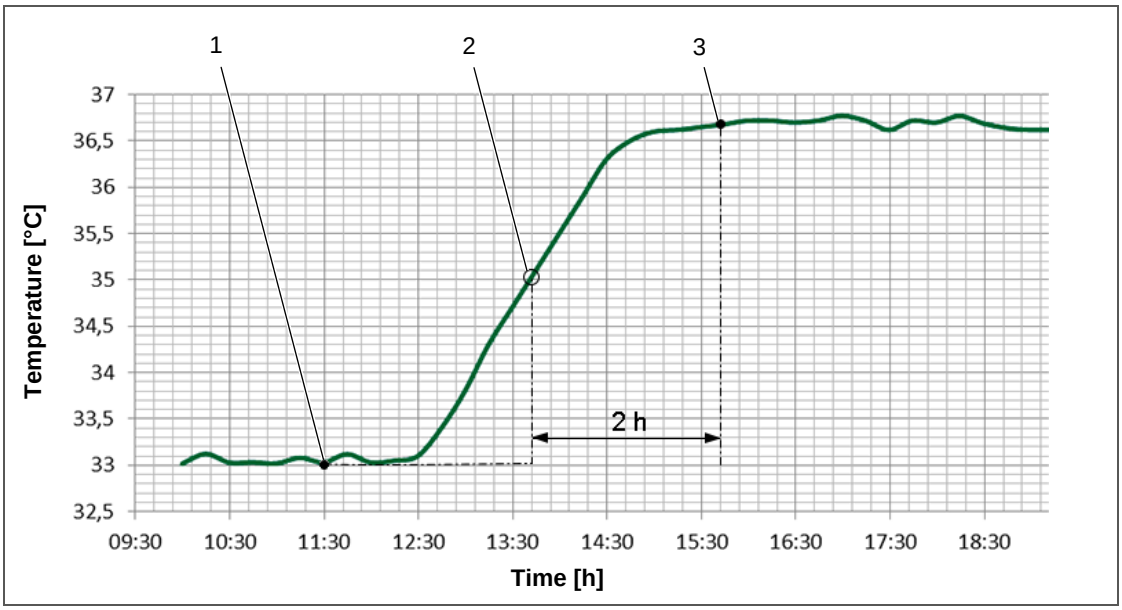


Fig. 36: Function “Thermocal”

1 Automatic zero point
2 Leaving of the limit of 2 K
3 “Thermocal” zero point

15.6 Test gas provision

The test gas provision can be carried out locally via the gas distribution block at the MCA 10 HWIR or by overflow process via gas sample probe.

NOTICE
Generally, a test gas provision via gas sample probe is recommended.

Within the scope of QAL3 tests the provision method must be kept according to component specification. Hence the method of test gas provision must be defined at the beginning of a QAL3 examination and must be adopted unmodified during the series of tests.

CAUTION
- Before test gas provision a stable zero point setting must have been carried out (control of drift correction values not more than 0.2 %/h).
- To keep the climatic conditions constant, the cabinet door must be closed during the complete test gas provision.
- For zero point calibration of the oxygen sensor, solely nitrogen must be used.

CAUTION
Conversion-active components!
Interactions with probe parts and the filter element can be caused.
In case of dry test gas provision of HCl, NH_3, HF and NO_2 a local test gas provision is recommended.

15.6.1 Local test gas provision at MCA 10 HWIR

(See section 8.2 “Test gas provision”, page 39)

15.6.2 Test gas provision via gas sample probe (optional)

NOTICE
For operation with the gas sample probe please read the technical documentation of the supplier (see appendix). The contents are at responsibility of the manufacturer.

WARNING
Hot surface!
The gas sample probe is standard heated to a temperature of 185 °C.
Burn hazard!
Personal protective equipment according to the current legal accident prevention regulations must be worn.

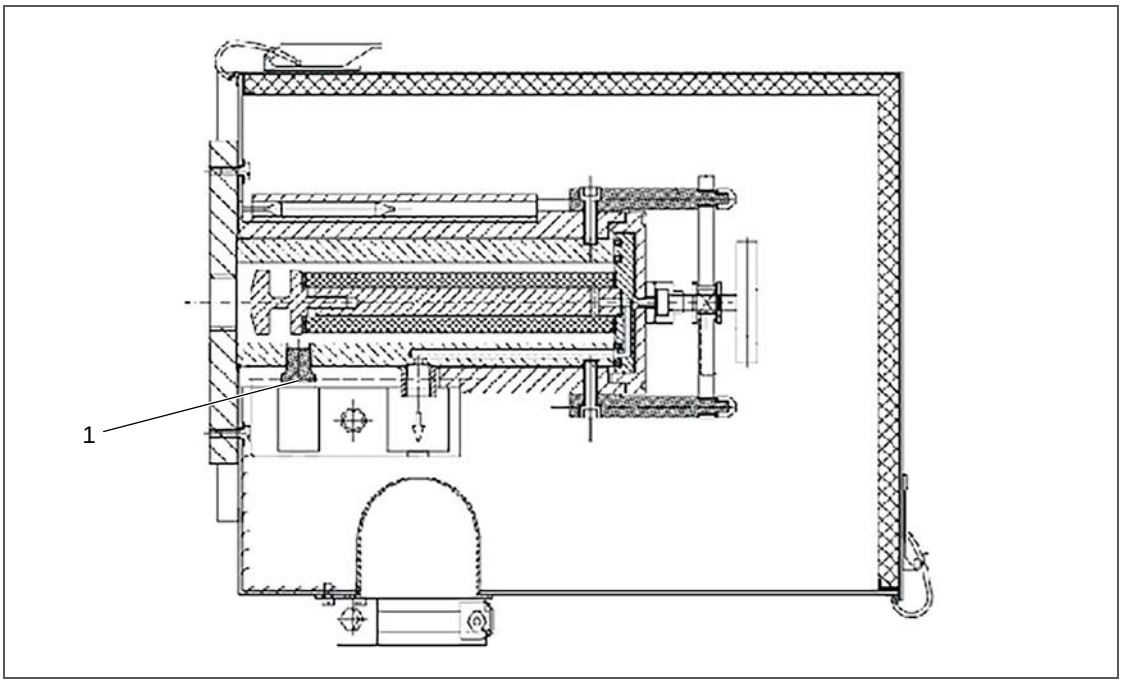


Fig. 37: Test gas provision via gas sample probe

1 Test gas connection

Provide test gas

1. Switch the system into maintenance mode by the maintenance switch at the analyser cabinet.
2. Connect the pipes for test gas provision with the test gas connection (1, Fig. 37).
3. Open the test gas supply.
4. To open the throttle non-return valve safe, adjust the primary pressure to 3 bar.
5. To avoid damage at the measuring device, limit the flow rate of the medium to min. 600 l/h and max. 1000l/h.
   › Excessive medium is conducted into the canal.
6. Wait until the settling time is over.
7. Read the measuring result from the connected visualisation PC.

To change into normal measuring operation after test gas provision, please proceed as follows:

1. Close the test gas supply.
2. Remove the pipes of test gas provision from the test gas connection (1, Fig. 37).
3. Switch the system into operation mode by the maintenance switch at the analyser cabinet.

15.7 Maintenance/Upkeep

NOTICE
The provision of guarantee items requires an execution of maintenance in due form.

The maintenance work has the following target:

- Preservation of measurement precision
- Warranty of operational safety
- Increment of service life

The following maintenance/upkeep work must be executed:

Component	Action	Maintenance interval
MCA 10 HWIR	see chapter 10, page 65	
Exhaust pipe	Cleaning	as required
Air conditioning unit	Cleaning	as required
Gas sample probe:		
• Internal filter	Exchange	4 months
• Gaskets	Exchange	4 months
• Flange gasket	Exchange	12 months

Tab. 14: Maintenance/upkeep works – system

NOTICE
For maintenance and upkeep of optional additional devices please read the technical documentations of the suppliers (see appendix).
The contents are at responsibility of the respective manufacturers.

15.8 Error search and failure clearance

NOTICE
Error search and failure clearance for the system are carried out according to the MCA 10 HWIR (see chapter 11, page 68).

15.9 Shutdown and disposal

15.9.1 Shutdown

DANGER
Hazardous voltage!
Parts of the device can be energised with hazardous voltage.
Danger of electric shock.
Any work at the device must solely be executed by qualified personnel.

WARNING
Corrosive substances!
Depending on the measuring gas incidental substances can be corrosive and/or poisonous.
Contact can cause chemical burn of body tissue and serious eye injury.
Personal protective equipment according to the current legal accident prevention regulations must be worn.

WARNING
Hot surface!
Several device parts can develop high temperatures.
Burn hazard!
Before working at the device it must be cooled down.

1. Purge the MCA 10 HWIR with zero gas for min. 30 min.
2. Disconnect the measuring gas pipe from gas sampling. Therefor shut the valves at the gas bottles.
3. Switch off the compressed-air supply of the analyser cabinet.
4. Switch off the power supply by the master switch at the analyser cabinet.
   › The MCA 10 HWIR, the air conditioner of the analyser cabinet and if necessary connected optional additional devices are switched off automatically.

15.9.2 Disassembling

1. Disconnect the power plug of the analyser cabinet from power supply.
2. Disconnect the signal connection from the control system.
3. Execute the following work at the MCA 10 HWIR:
   a) Disconnect the power cord of the MCA 10 HWIR from the terminal strip in the analyser cabinet.
   b) Disconnect the communication cables of PLC and PC from the device.
   c) Disconnect the forced air pipe from the device.
   d) Disconnect the measuring gas pipe and the exhaust pipe from the device.
4. If necessary, disconnect optional additional devices from the system.
5. Release the tightening of the analyser cabinet from the wall/ground.
6. Release the screws at the mounting plate of the MCA 10 HWIR and remove the device from the analyser cabinet.
7. If necessary, disconnect the heater of the exhaust pipe from the power supply.
8. Disconnect the measuring gas pipe from the probe.
9. Disconnect the probe heater from the power supply.
10. Dismount the probe.
11. Disconnect the heater of the measuring gas pipe and the temperature sensor from the power supply.
12. Store all pipes safe and care for correct storage of all system components.

15.9.3 Storage

For correct storage the following conditions apply:

- Ambience:
  - Ambient temperature: 0 ... 50 °C
  - Relative humidity: max. 90% (non-condensing)
  - Storage in rooms (outdoor storage not permissible)
  - Protection against wetness
- Solid and plane bottom ground
- Location free of percussion

15.9.4 Disposal

NOTICE
The disposal must be executed according to the country-specific legal environmental protection regulations. The device must be treated as hazardous waste.

15.10 Technical data

System	
Insulation	Protection class I acc. to IEC 1010-1:1993
Insulation co-ordination	Overvoltage category II according to IEC 1010-1:1993
Protection degree	IP 54
Pollution	Pollution degree 2 according to IEC 1010-1:1993
Ambient conditions: • Ambient temperature for operation • Ambient temperature for storage • Relative humidity	 5 ... 40 °C 0 ... 50 °C max. 90% (non-condensing)
Power supply	400 V / 50 Hz, 4000 W (analyser cabinet, air conditioner, probe) + 100 W/m measuring gas pipe
Compressed-air supply	4...6 bar
Compressed-air consumption	Approx. 1 m³/h (dependent on application)
Calibration	• Zero point: automatically with instrument air • Span point: with test gas, optional: automatically
Interfaces	Analogue outputs, Modbus, Profibus, further on request
Remote control	Ethernet
Analogue outputs	Max. 24 x 4 ... 20 mA
Digital outputs	Failure, maintenance, maintenance requirement, measuring range switch-over, other
Inputs	For analogue and digital signals

Tab. 15: Technical data – System

Analyser cabinet	
Dimensions	2100 mm x 800 mm x 600 mm (H x W x D)
Material	Steel sheet
Weight	Approx. 200 ... 300 kg (depending on fitments)
Colour	RAL 7035 (light grey)
Operating unit	Control panel with touch surface

Tab. 16: Technical data – Analyser cabinet

15.11 Spare and wear parts

For placing a purchase order of spare and wear parts please refer to Dr. Födisch Umweltmesstechnik AG (contact details: see cover inside).

Element/Component	Item number
2-way solenoid valve	ETLD 608
2-way solenoid valve, normally closed	ETLD 318
2-way solenoid valve, normally open	ETLD 319
Air conditioner	ETLA 469
Analogue extension module for PLC	ETLA 1038
Analogue input for PT100 for PLC	ETLA 1039
Battery for FP Sigma	ETLA 1041
Bulkhead screwing, straight, stainless steel	ETLA 1356
Bulkhead screwing, straight, stainless steel	ETLA 482
Cabinet heating	ETLD 264
Communication cassette COM4	ETLA 1037
Compressed-air station	ETLD 138
Compressed-air station, common supply block	ETLD 136
Compressed-air station, end block at left site	ETLD 134
Compressed-air station, end block at right site	ETLD 135
Condensate tank with level sensor	ETLD 344
Connector block module PLC	ETLA 1165
Coupling relay	ETLA 437
CPU for PLC/cabinet	ETLA 1036
Digital output expansion for PLC	ETLA 1040
Elbow screwing with plug connector	ETLD 321
Fine dosing valve	ETLA 481
Locking screw M63x1.5	ETLA 187
Multiple-port plate	ETLD 316
Null modem cable	ETLD 349
Pass element	ETLD 353
PLC	ETLD 324
PLC programming cable for PC	ETLA 598
Plug connector screwing with hexagon socket	ETLD 315

Element/Component	Item number
Power supply unit 24 V, 120 W	ETLA 1052
Power supply unit 24 V, 60 W	ETLA 1051
Pressure regulator	ETLD 133
Rack assembly set	ETLD 137
Ribbon cable	ETLA 1042
Screw-in adapter	ETLA 713
Sealing set for solenoid valve station	ETLD 465
Solenoid valve station	ETLD 323
Throttle non-return valve	ETLD 320
Thyristor power switch	ETLA 634
Touch panel	ETLD 498 / ETLD 52
USB cable	ETLD 350

Tab. 17: Spare and wear parts – System / Analyser cabinet

16 Index

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