PROCESS ANALYSERS AG

QuickTOC purity

TOC-ANALYSIS

# User Manual

**Document QuickTOC® purity**
**Rev 04E3920 - 09/2020**
**Software Version: 4.4**

LAR Process Analysers AG
Neuköllnische Allee 134
D - 12057 Berlin
www.lar.com

Email service@lar.com
Telephone +49 30 278958-55
Fax +49 30 278958-706

# CONTENTS

## Certificates

# Certificate

Standard **ISO 9001:2015**

Certificate Registr. No. **01 100 5122**

Certificate Holder:

**LAR Process Analysers AG**
Neuköllnische Allee 134
D - 12057 Berlin

Scope: Development, production, distribution and technical support of measurement-instruments for environmental and process analysis

Proof has been furnished by means of an audit that the requirements of ISO 9001:2015 are met.

Validity: The certificate is valid from 2017-05-24 until 2020-05-18.
First certification 1998

2017-05-24

TÜV Rheinland Cert GmbH
Am Grauen Stein · 51105 Köln

www.tuv.com

DAkkS Deutsche Akkreditierungsstelle D-ZM-16031-01-00

TÜVRheinland®
Precisely Right.

# 1 General Information

Read the manual at hand carefully prior to using the analyser.
Keep the manual in a place near the analyser for further reference.
The improper usage of the analyser may void the warranty.

The following symbols are used in this operating manual to highlight instructions:


Notice


Warning


Danger

## 1.1 Safety Notes


Danger

The general codes for working with chemicals and electrical equipment must be observed while using the analyser.
The voltage specified on the nameplate of the analyser must match that of your power supply.
Bear in mind the hazards potentially emanating from the different waters.
Use protective gloves and goggles as required.
The analyser must be switched off before working on live parts.
For safety reasons, the rear part of the analyser may only be opened by authorised personnel.
When work is carried out in the front part of the enclosure, you must ensure that the analyser is in Offline mode.
If faults occur when the analyser is running which you cannot rectify yourself, please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 257).

## 1.2 Safety Symbols

For your safety, the following symbols are attached to the analyser. Observe the symbols when working on the analyser.

Mandatory:

Refer to manual

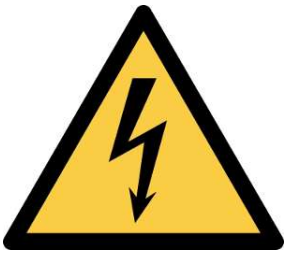
Use goggles

Use gloves

Warning:

Hot surfaces

Corrosive agents



Electric hazard

Prohibition:

Keep out

# 2 Operating Principle of the Analyser

The online measurement system determines the corresponding parameters using the high temperature method at 1,200°C according to the following measurement methods:
:

- TOC-Difference Method: TC, TIC, TOC (in accordance with DIN EN 1484:1997 and US-EPA 415.2)
- TOC-Direct Method: NPOC (in accordance with DIN EN 1484:1997 and US-EPA 415.2)
- TConly Method: TC (in accordance with DIN EN 1484:1997 and US-EPA 415.2)

## 2.1 TOC Measurement

### 2.1.1 The Sum Parameter TOC

The TOC (Total Organic Carbon), in addition to COD (chemical oxygen demand) and BOD (biochemical oxygen demand), is an important sum parameter for assessing the organic load of water. Because all organic carbon compounds are read and specified as mass carbon (unit: mg/l C), the TOC is a precisely definable, absolute parameter, and can be directly measured. Other parameters are always stated in relation to the TOC. Their interrelations and respective meanings are shown below:

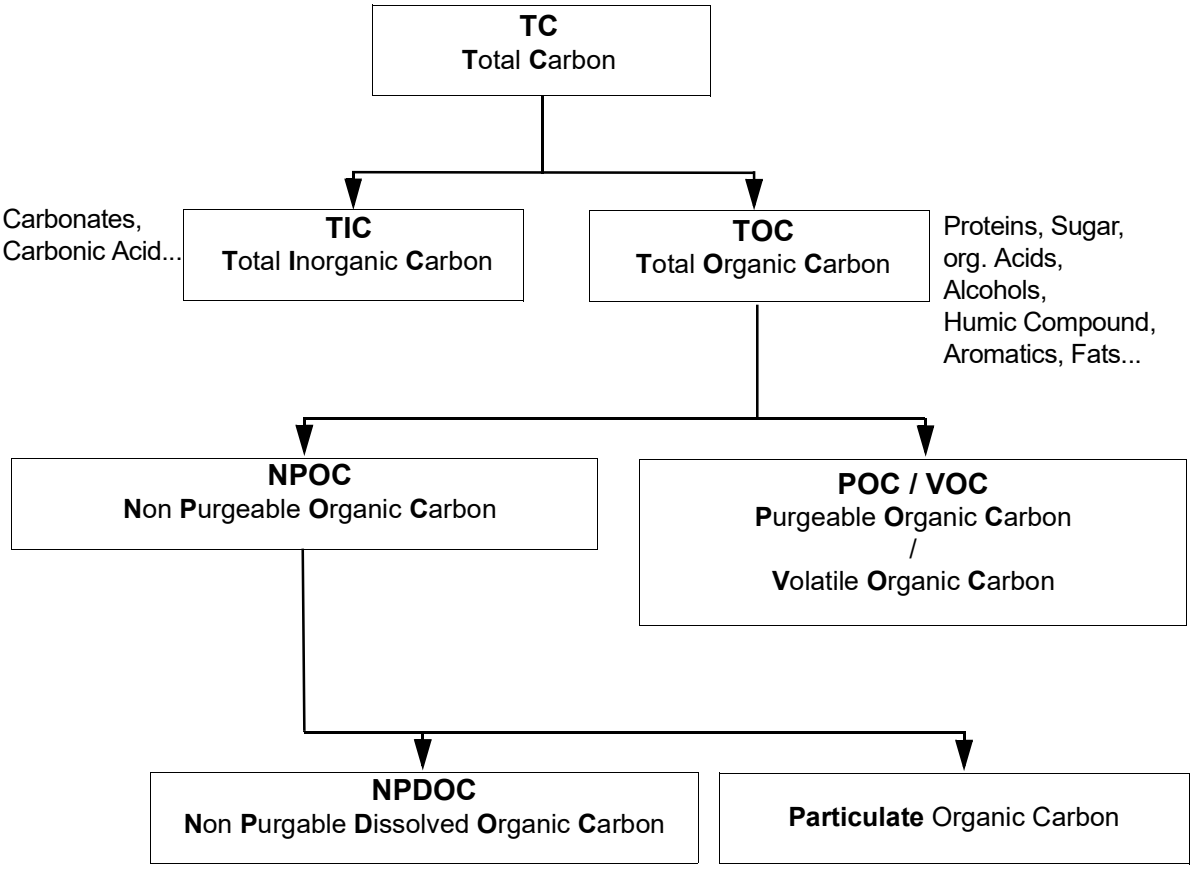



*Fig. 1: Sum parameters of organic compounds*

The basis of all TOC measurement methods is oxidation - normally using thermal or wet chemical oxidation of organically-ligated carbon to carbon dioxide ($CO_2$). The $CO_2$ produced is detected and deter-

mined quantitatively.

### 2.1.2 High Temperature Method at 1,200°C

In the ceramic furnace without catalyst the carbon compounds are reliably oxydized at a combustion temperature of 1,200°C. This high temperature method does not require a filtration. The NDIR detector (Non-Dispersive Infrared) detects the $CO_2$ contents of the sample. If required, the samples can be homogenised and be measured with all particles contained within, allowing for measurement of the TRUE TOC.

### 2.1.3 High Temperature Method vs. Wet Chemical Method

High temperature methods (as well as wet chemical methods, such as the UV persulphate method) are used to determine the TOC. The advantages of the high temperature method compared to the wet chemical UV persulphate method is described in the European Norm EN 1484:1997:

“Devices which determine the TOC with the UV persulphate method are not appropriate for media containing suspended and turbided solids”.

Furthermore, Wei reports in the “Proceedings of the Water Quality Technology Conference (1998, Paper 2-E2)“ that the UV persulphate method can show TOC values between 30 and 50% lower than with the high temperature method, while the values measured can have a 23% higher variance. It is for these reasons that the high temperature method is the more common method in waste water analysis. For this reason, it is also used in the QuickTOC®$_{purity}$.

### 2.1.4 The Measurement Principle of the TOC-Difference Method

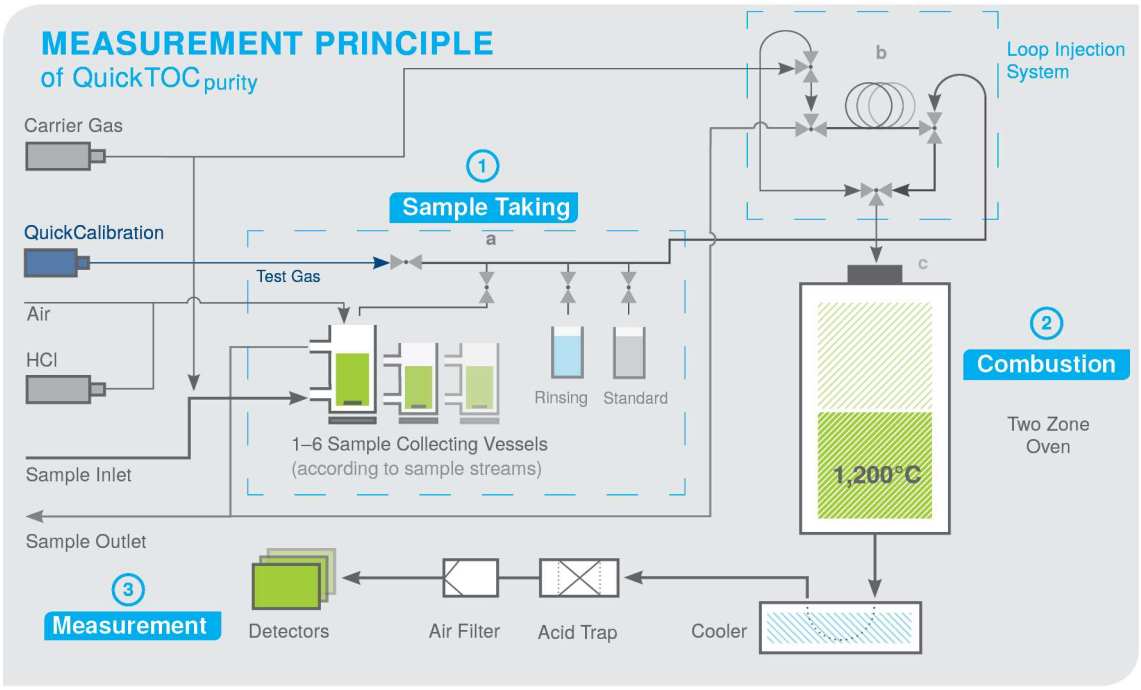



*Fig. 2: Measurement Principle of the TOC-Difference Method*

#### 2.1.4.1 Proceeding

First, the sample is transferred into the sample vessel via the inlet. From here, the sample is injected by the injection system into the ceramic furnace.

The sample oxidises completely to $CO_2$ at 1,200°C in the ceramic furnace. After the oxidation a carrier gas, which flows continuously through the ceramic furnace, transports the measurement gas to a cooler.

The water vapour produced by oxidation is condensed out by the cooler, and remaining corrosive. Combustion gases are cleaned by the filters. The $CO_2$ concentration is determined in the NDIR detector displayed as TC.

Now the TIC is analysed. For this, the same sample is taken by the injection system from the sample vessel and injected into the TIC reactor.

Inside the TIC reactor, the inorganic substances are expelled from the sample as $CO_2$ by introducing an acid solution and aeration. Then the produced $CO_2$-gas is condensed out again by the cooler, and the gas produced is cleaned by filters and routed to the NDIR detector, which determines the TIC.

Once the TC and TIC are determined, the TOC is calculated using the following formula:

$$\underline{TOC = TC - TIC\ [mg/l\ C]}$$

#### 2.1.4.2 Advantages

In this method, no volatile organic components (POC / VOC) are expelled from the sample. Because all particles can be measured, all of the TOC remains in the sample - meaning the TRUE TOC is measured in this method. The considerably greater precision of the result has meant the TOC difference method applied in the analyser has established itself in waste water analytics. This means the analyser allows

for speedy and accurate analyses of the

- TOC
- TIC
- TC

parameters in consideration of the POC / VOC.

Summing up the advantages of the TOC-Difference Method:

- Quick measurement results are available in under 3 minutes.
- For the Multi-Stream-Measurement, no additional of measurement time in needed, enabling sample concentrations to be determined quicker overall.
- The entire TOC is determined (no loss of purgeable/volatile organics).
- High precision of result.

## 2.1.5 The Measurement Principle of the TOC-Direct Method (NPOC-Method)

### 2.1.5.1 Proceeding

In the TOC direct method, the sample is first acidified externally with a strongly diluted hydrochloric acid or with a acidic carrier gas before it is moved into the sample vessel (see . There, $CO_2$-free air (carrier gas) continually flows through the sample. Because of the low pH value (< 2), the anorganics are removed from the sample and drained off. At the end of this process, the sample only contains the NPOC (Non Purgeable Organic Carbon).

In the next step, the injection system transfers the sample from the sample vessel to the ceramic furnace, which then completely oxidises to $CO_2$ at 1,200°C.

The water vapour produced by oxidation is condensated out by a cooler, and remaining corrosive combustion gasses are then cleaned by the filters. Then the $CO_2$ concentration is determined in a NDIR detector and output as the TOC.

### 2.1.5.2 Advantages

The direct method is recommended for determining the TOC when the concentration of the anorganic carbon is considerably greater than the concentration of the organic carbon. Furthermore, the direct method is recommended when it is known that the sample contains hardly any volatile carbon, and thus cannot be lost during the purging process:

$$TOC = NPOC + POC/VOC$$

$$(POC/VOC = 0)$$

$$TOC = NPOC + 0$$

$$\underline{TOC = NPOC\ [mg/l\ C]}$$

Summing up the advantages of the TOC-Direct Method:

- Quick measurement results are available under 90 seconds after stripping.
- For the Multi-Stream-Measurement, there is no addition of measurement times, enabling sample concentrations to be determined quicker overall.
- Prevention of impurities from organic substances in the sample vessel, and possibly in the sample tubes, because adding acid has a kind of cleaning effect.

- Lower consumption of reagents (1% HCl). Only 5 to 6 litres are used in six weeks at measurement frequency of 12 minutes.

Notice

Depending on the application, hydrochloric acid concentrations between 3 % and 5 % can be used.

Please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 245) before using other concentrations.

## 2.1.6 The Measurement Principle of the TConly Method

### 2.1.6.1 Proceeding

First, the sample is transferred into the sample vessel via the inlet by the help of a peristaltic pump, before the sample is injected into the ceramic furnace via the injection system.

The sample oxidises completely to $CO_2$ at 1,200°C in the ceramic furnace. After the oxidation a carrier gas, which flows continuously through the ceramic furnace, transports the measurement gas to a cooler.

The water vapour produced by oxidation is condensated out by the cooler, and remaining corrosive combustion gasses are then cleaned by the filters. Then the $CO_2$ concentration is determined in a NDIR detector and output as the TC.

### 2.1.6.2 Advantages

The TC only method is the correct choice when the concentration of the organic carbon is considerably greater that the concentration of the anorganic carbon, especially when the anorganic fraction can be neglected as a result (TIC < 5% of the TC):

$$TOC = TC - TIC$$

$$(TIC <<< TOC)$$

$$TOC = TC - (\sim 0)$$

$$\underline{TOC = TC\ [mg/l\ C]}$$

Summing up the advantages of the TConly Method:

- Measurement results are available in under 90 seconds.
- For the Multi-Stream-Measurement, there is no addition of measurement times, enabling sample concentrations to be determined quicker overall.
- Reagents and acids are not required.
- Overhead for care and maintenance is very low.

### 2.1.7 Measurement Ranges of the QuickTOC® purity

The analyser can be deployed in several measurement ranges (application-specific). The measurement ranges are shown in the table below

*Table 1: Overview of the Measuring Ranges for TOC and TC Measurements*

| Measuring Range |
|---|
| 0,1 - 20 mg/l (ppm) |
| 0,5 - 50 mg/l (ppm) |
| 2 - 200 mg/l (ppm) |
| 5 - 1.000 mg/l (ppm) |
| 10 - 2.000 µg/l (ppb) |

*Table 2: Overview of the Measuring Ranges for $TN_b$ Measurements*

| Measuring Range |
|---|
| 0,1 - 50 mg/l (ppm) |
| 10 - 200 mg/l (ppm) |

# 3 Product

This chapter gives an overview of the analyser and its components.

## 3.1 Scope of Delivery

The analyser „QuickTOC® purity“, associated individual parts and any required operating material are delivered in a sturdy wooden crate.

The contents consists of:

- Analyser „QuickTOC® purity“
- User Manual „QuickTOC® purity“
- Case with
  - Reactor foor
  - Injection port
  - Furnace head
  - Reactor
  - Tube cassettes
  - Vessels
  - Operating material
  - Data stick
- Accessories (optional) (see Chapter 9 from page 135)

## 3.2 Identification plate

On the side of the housing is a nameplate with name of the analyser, serial number, year built, mains voltage, power consumption, further technical data and the contact address of LAR

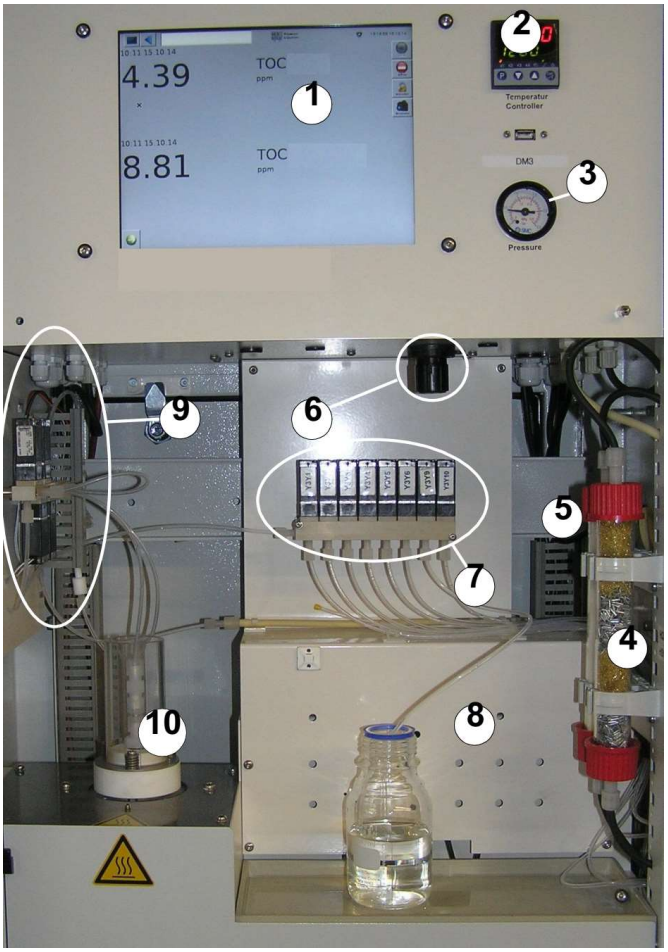

*Fig. 3: Identification plate (Example)*

## 3.3 Construction of the Analyser

### 3.3.1 Front View

User interface

Analyser




**1** Touchscreen
**2** Temperature regulator (Actual/Target)
**3** Pressure display of carrier gas prepressure
**4** Quartz wool filter
**5** Pressure regulatorl
**6** Valve block for samples
**7** Calibration vessel
**8** Sample vessel
**9** Injection block and furnace
**10** Injection unit with needle

*Fig. 4: Front view of the analyser (open) (Example: 6 sample streams, TOC direct method)*

Danger

Danger of Burns!

The area around the injection block and the furnace system (**9**) is hot during operation.

Use heat-resistant gloves when working on the injection block or the furnace system.

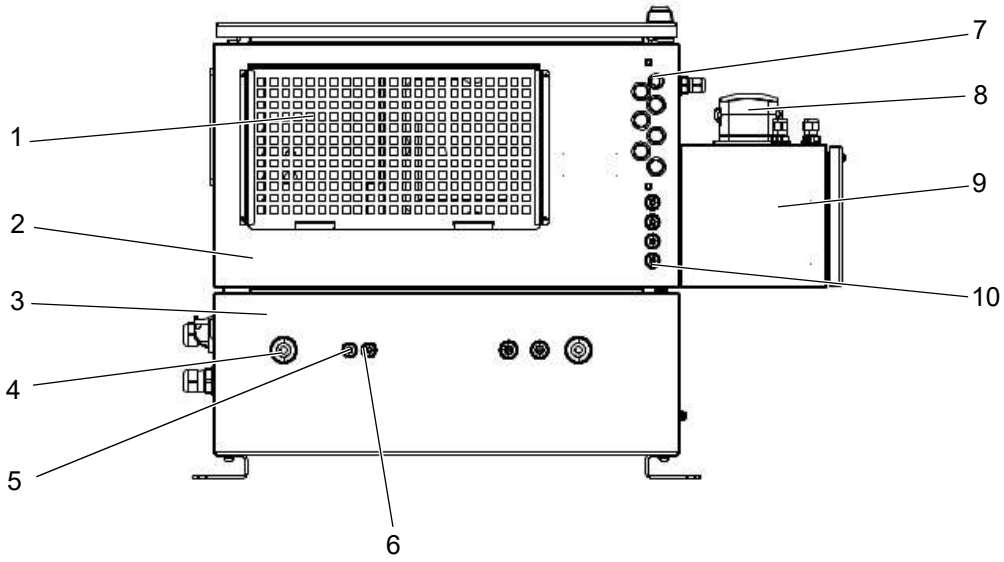
Notice

A system key is included for peronell with authorisation.
Unauthorised personell are not permitted to open the front door of the housing.

Notice

Depending on the method of measurement and the number of samples, there is an additional cabinet on the right side of the analyser with pumps for transporting the samples to the analyser.

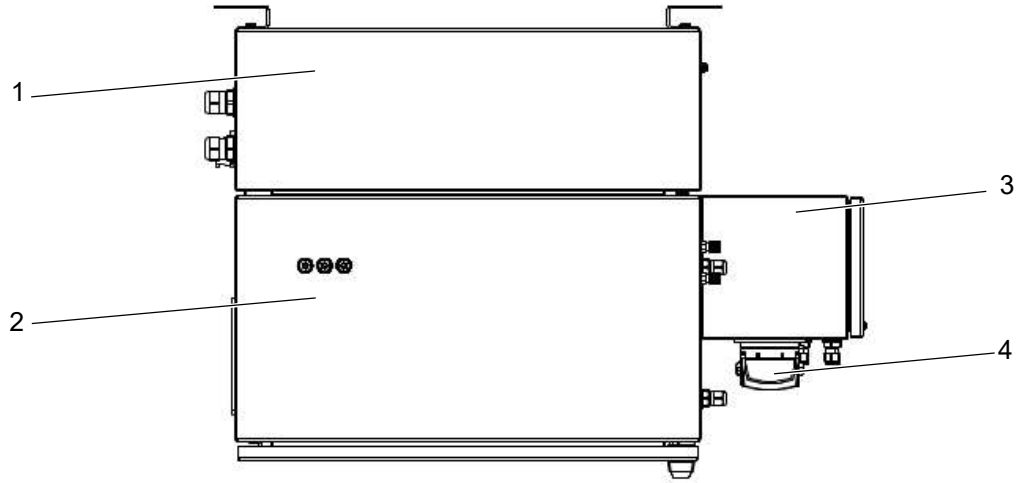
### 3.3.2 Bottom View




**1** Ventilation
**2** Front Casing
**3** Rear Casing
**4** Power supply
**5** Power Supply for Air Recurculation/ Permeation
**6** Carrier Gas Inlet
**7** Outlet for samples, Condensate, Acid and Rinsing Solution
**8** Pump
**9** Pump Casing
**10** Inlet for Rinsing Solution, Acid and Carrier Gas

*Fig. 5: Bottom View of the Analyser*

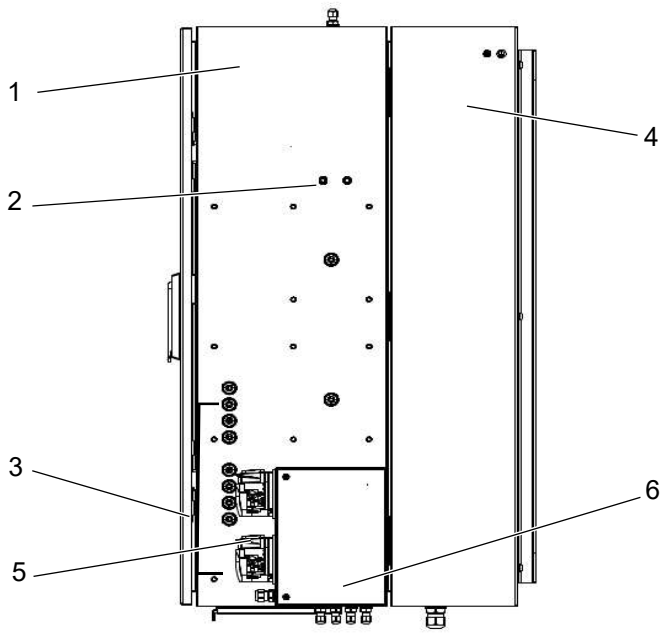
### 3.3.3 Top View




**1** Rear Casing
**2** Front Casing
**3** Pump Casing
**4** Pump

*Fig. 6: Upper View of the Analyser*

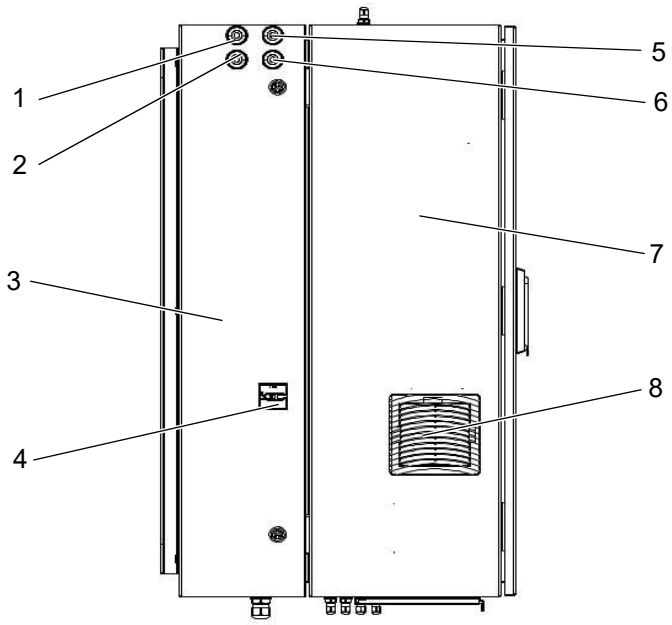
### 3.3.4 Right side




**1** Front Casing
**2** Carrier Gas Outlet
**3** sample Tube Inlet
**4** Rear Casing
**5** Pump
**6** Pump Casing

*Fig. 7: Right View of the Analyser*

### 3.3.5 Left side




**1** Relay In
**2** Digital In
**3** Rear Casing
**4** Main Switch
**5** RS232 Interface In
**6** Analog In
**7** Front Casing
**8** Ventilation

*Fig. 8: Left View of the Analyser*

## 3.4 Components of the Analyser

To provide you with an overview of the components fitted, this section explains the most important components, and their positions and functions in the analyser.

### 3.4.1 Pump System

Depending on the number of sample streams and the selected measurement method, the number of pumps, pump type, and position of the pumps may vary within the analyser (installed inside or outside).

Notice

The analyser is equipped with a tube cassette pump fitted with five tube cassettes at the factory. This tube cassette pump is used to drain the condensate and, when using the TOC difference method, to transport the required acid to and from the TIC reactor.

### 3.4.1.1 Tube Cassette Pump

The tube cassette pump (Fig. 9) is used for different applications within the analyser and depends on the selected measurement method.

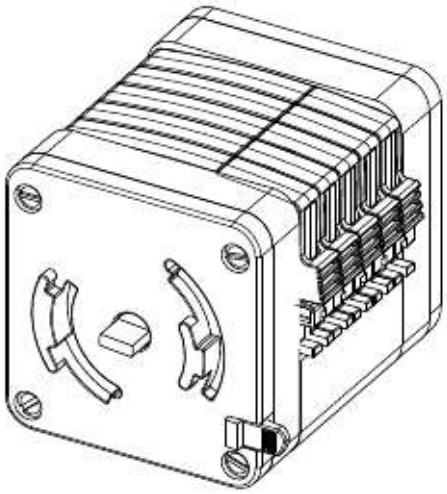


*Fig. 9: Tube cassette pump with five tube cassettes*

| | |
|---|---|
| Danger | **Danger of crushing**<br>During operation, the rollers of the tube cassette pump are in motion.<br>Do not reach into the working area of the tube cassette pump during operation. |

### 3.4.1.2 Tubes (for the Tube Cassette Pump)

The tubes (3) for the tube cassette pump (2) have three colour-coded-stoppers (1). The three stoppers enable uniform spanning of the tube at all times - which has a positive effect on reproducibility of the flow rate. The colour coding also gives reliable identification of the tube dimension. The flow rates of the individual tubes depend on their internal diameters.

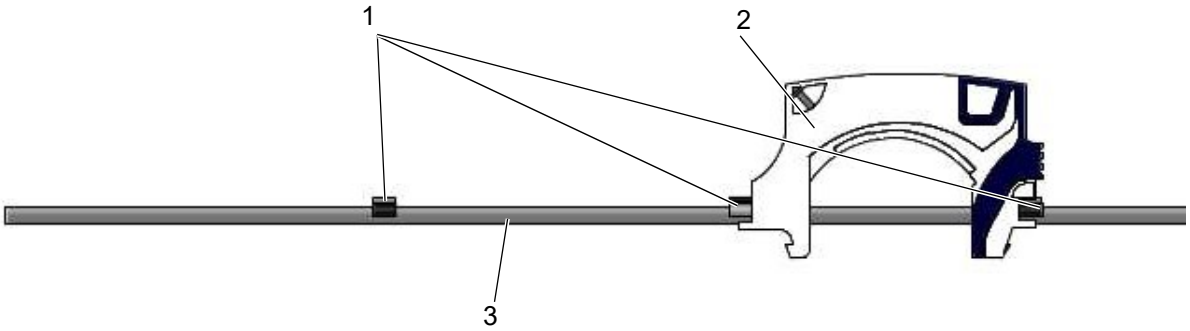



*Fig. 10: Tube for the tube cassette pump (example)*

### 3.4.1.3 Sample Pump

The sample pump (Fig. 11) is used to transport the sample(s) for the TOC-difference and TConly methods. The number of sample pumps depends on the number of sample streams.

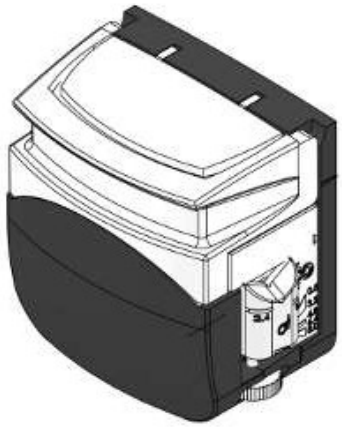


*Fig. 11: Head of the sample pump (closed)*

Danger

**Danger of crushing**

During operation, the rollers of the tube cassette pump are in motion.

Do not reach into the working area of the tube cassette pump during operation.

### 3.4.2 Glass Components

The following glass components are installed in the analyser. The number of glass components can vary depending on the number of sample streams and the measurement method:

#### 3.4.2.1 Calibration Vessel

The calibration vessel (**1**) is located in the main casing.


*Fig. 12: Calibration Vessel*

### 3.4.2.2 Sample Vessels

The sample vessels (**2**) with the corresponding sample pumps (**3**) are located in the additional cabinet.

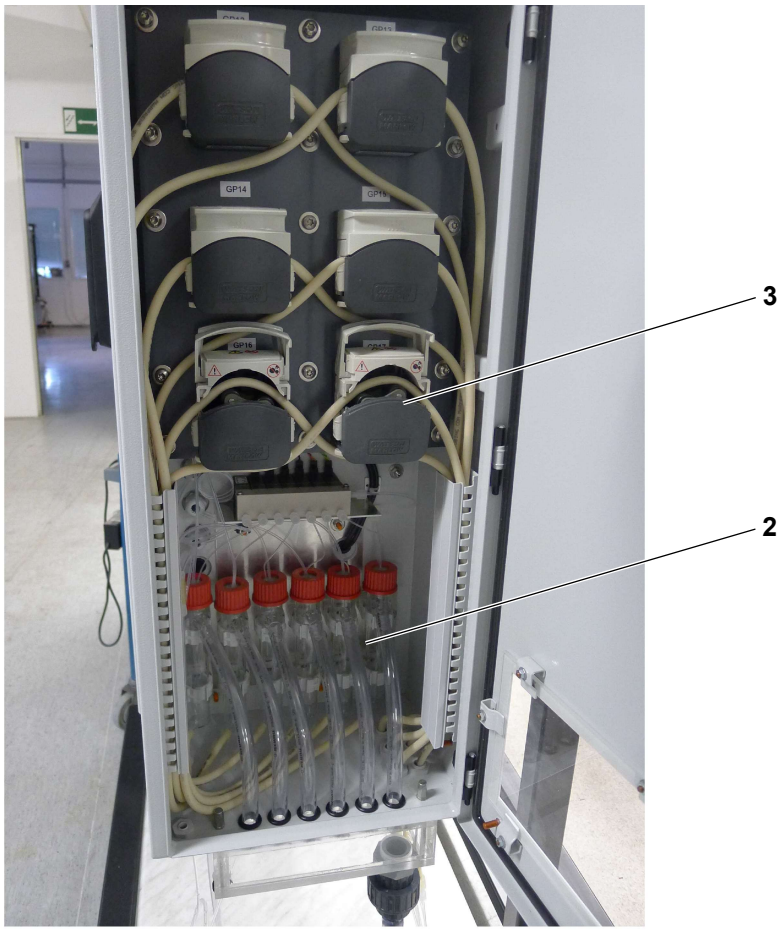



*Abb. 13: sample vessels in the additional cabinet (Example: 6 sample streams)*

### 3.4.2.3 Gas Acidification (only for QuickTOC$_{purity}$ 1E0)

In order to prevent possible contamination of the sample by carbon in the NPOC measuring method, an acid safety vessel is used for the sample acidification. The acid safety vessel is operated with the original HCl bottle (**1**) from Merck with 25% hydrochloric acid (HCl) The acidic safety vessel is equipped with a condensate separator (**2**). For the procedure of the measuring method see Chapter 2.1.5 on page 9.

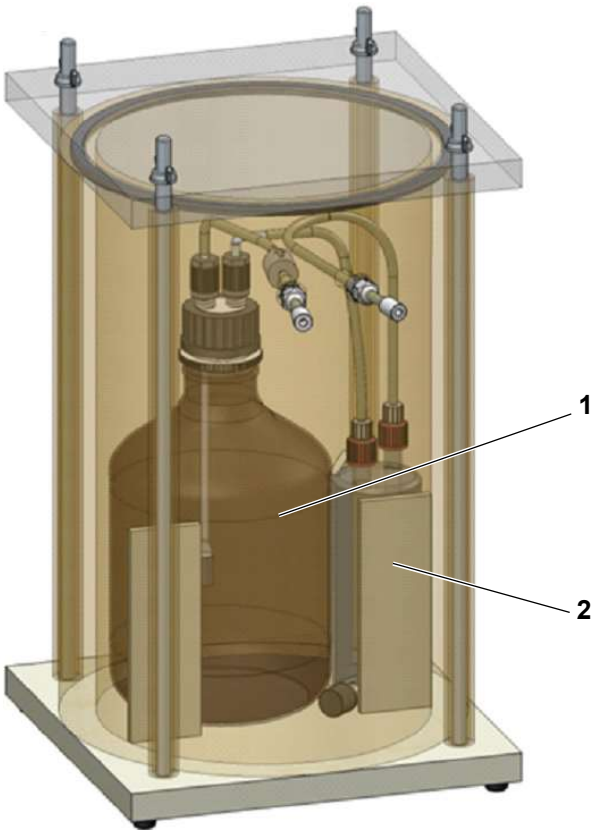



*Fig. 14: Gas acidification with acid safety vessel*

For the tubing connection of the gas acidification see *Chapter 12.4 on page 184.*

**Notice**

The gas acidification is included only in the QuickTOCpurity 1E0.

**Installation On-Site**

The gas acidification (**3**) is placed on the floor under, or in proximity, of the analyser (**4**).

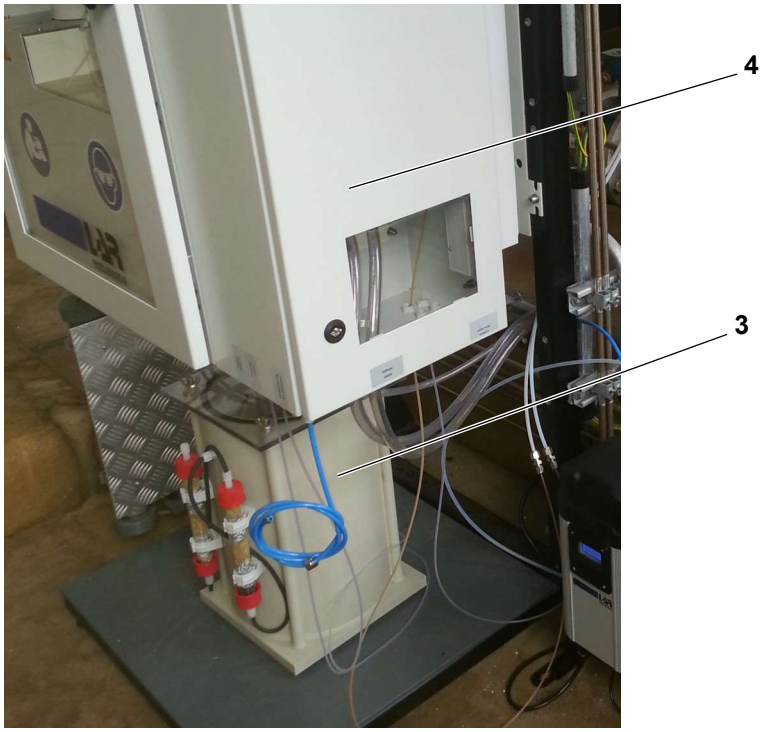
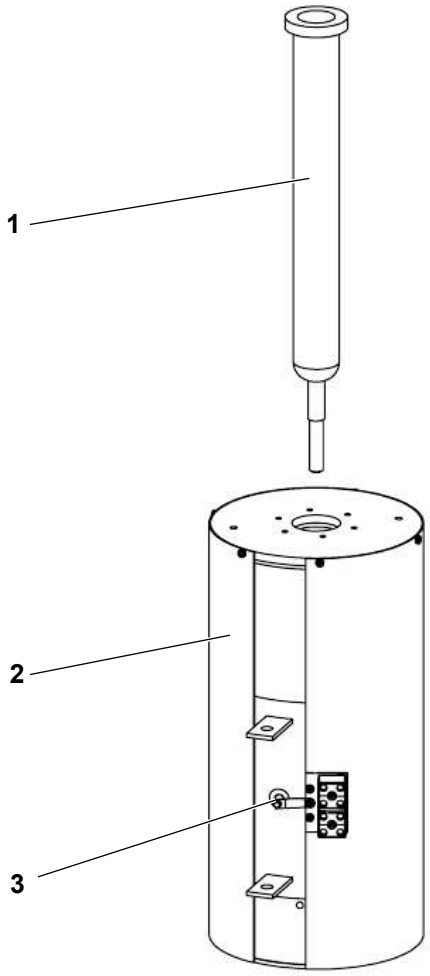



*Fig. 15: Installation on-site for the gas acidification*

### 3.4.3 Ceramic Furnace

The catalyst-free ceramic furnace is the heart of the analyser. In it, all carbon compounds are reliably oxidised at 1,200°C, enabling a complete analysis of the sample. Absolute safety is guaranteed in every environment despite the high temperatures.

*Fig. 16: Furnace head*




**1** Ceramic reactor pipe
**2** Furnace
**3** Thermocouple

*Fig. 17: Ceramic Furnace*

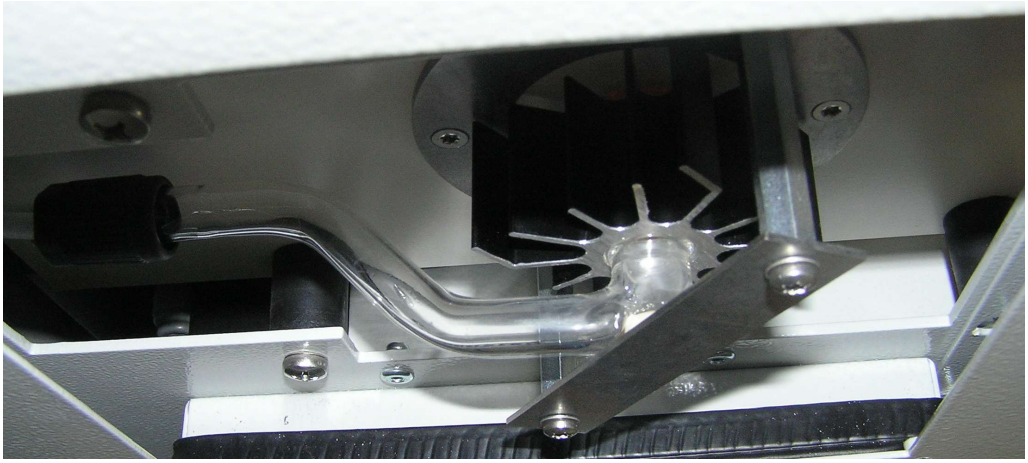


*Fig. 18: Reactor foot*

### 3.4.4 Connections

Danger

Danger of burns

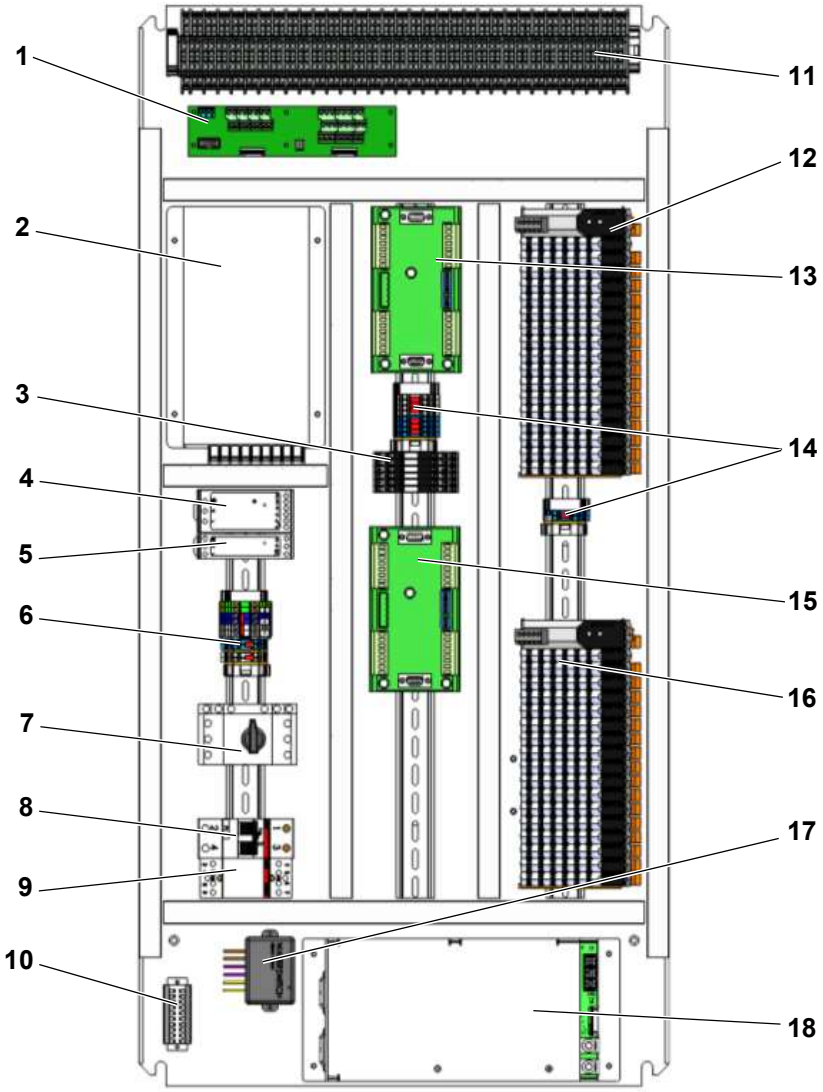
During operation, the furnace is extremely hot.

Use heat-proof gloves when working on the furnace system.

**Notice**

A mains cable is not included in the delivery. This must be provided by the user.

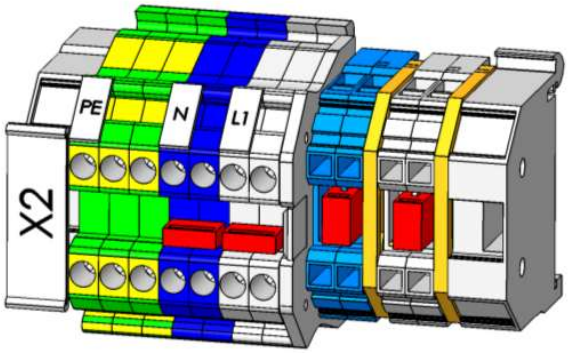
The analyser has different ports and connections. These are explained below.




**1** TRC-Board (RS232 Serial Interface, Relays, Digital Inputs)
**2** Switching power supply(24 V / 13 A)
**3** Relaiys for sample pump
**4** Switching power supply 12 V
**5** Switching power supply (5 V)
**6** Mains connector
**7** Motor circuit breaker (for analysers with EX-Zone housing)
**8** Main fuse (8 A)
**9** Furnace contactor
**10** Connection Terminal for Ambient Air Preparation Unit (24 V/DC)
**11** Connection Terminals for Analog Outputs (X101)
**12** Analog output node
**13** Digital Node for Sample Stream 1 and 2
**14** Through terminals
**15** Digital Node for Multi-Stream-Analyser
**16** Analog output node
**17** Water Detector(for analysers with EX-Zone housing)
**18** Switching Power Supply of the furnace

*Fig. 19: Installation plate with maximum placement*

### 3.4.4.1 Power Supply




PE (green): Protective conductor
N (blue): Neutral
L (gray): Conductor

*Fig. 20: Connection to power supply*

| | |
|---|---|
| Warning | Warning of improper electrical connection<br>The analyser may be damaged if it is connected to a local power supply not specified on the type plate.<br>Before switching on the analyser, check that the local voltage supply matches that on the rating plate.<br>If this power supply is not available, contact LAR Technical Support.<br>Do not switch on the analyser without a LAR-authorized technician before using it for the first time, as this will void the warranty of your analyser! |

| | |
|---|---|
| Warning | Warning about improper commissioning<br>The analyser may be damaged if improperly put into operation.<br>Do not switch on the analyser without a LAR-authorized technician before using it for the first time, as this will void the warranty of your analyser! |

## 3.4.5 Electronic Connections (Digital and Analog Connections)

Notice

De-energize the analyser before beginning to cabling the system.

### 3.4.5.1 Connections on the TRC-Board

The analyser is equipped with a TRC board for connection to external devices or to a process control system. It is located on the upper left side of the mounting plate in the rear housing (Abb. 18, Seite 30). Open the rear housing door to gain access to the TRC board.

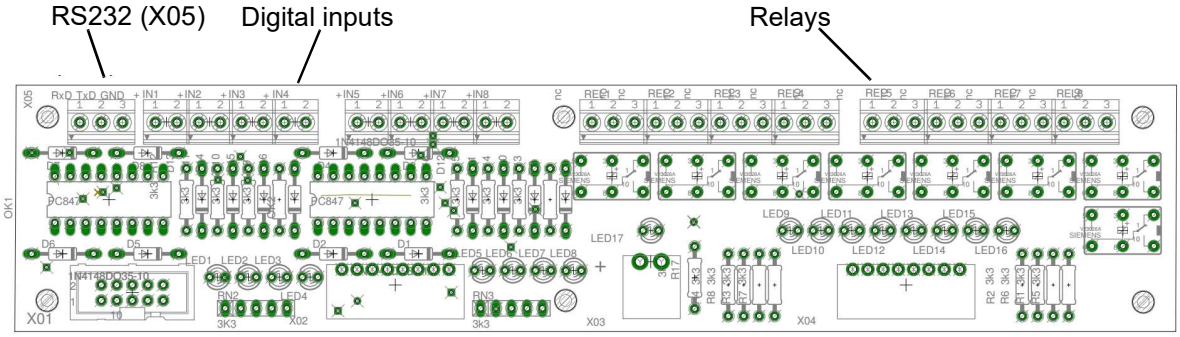



*Fig. 21: TRC-Board (complete)*

The TRC board has the following connections

- 1x RS 232 interface
- 8x Digital inputs
- 8x Relays

Notice

For connecting the signal cables to the TRC board, use a cable cross-section of 1.5 $mm^2$ = cable diameter of 1.4 mm.

| Connection | Function | Usage |
|---|---|---|
| **RS232 (X05)** | | |
| 1 | RXD | used by operator and LAR technical support |
| 2 | TXD | used by operator and LAR technical support |
| 3 | GND | used by operator and LAR technical support |
| **Digital inputs (24 V)** | | |
| 1+ | IN1 | remote control for stream 1 |
| 2- | IN1 | |
| 1+ | IN2 | remote control for stream 2 |
| 2- | IN2 | |
| 1+ | IN3 | Hold |
| 2- | IN3 | |
| 1+ | IN4 | remote control for stream 3 |
| 2- | IN4 | |
| 1+ | IN5 | remote control for stream 4 |
| 2- | IN5 | |
| 1+ | IN6 | remote control for stream 5 |
| 2- | IN6 | |
| 1+ | IN7 | remote control for stream 6 |
| 2- | IN7 | |
| 1+ | IN8 | Start gas validation |
| 2- | IN8 | |
| 1+ | IN8 | unused |
| 2- | IN8 | |
| **Relays** | | |
| 1 | nc break | programmable |
| | com | |
| | no make | |
| 2 | nc break | programmable |
| | com | |
| | no make | |
| 3 | nc break | programmable |
| | com | |
| | no make | |
| 4 | nc break | programmable |
| | com | |
| | no make | |
| 5 | nc break | programmable |
| | com | |
| | no make | |
| 6 | nc break | programmable |
| | com | |
| | no make | |
| 7 | nc break | programmable |
| | com | |
| | no make | |
| 8 | nc break | programmable |
| | com | |
| | no make | |

*Fig. 22: TRC-Board (RS 232 serial interface, digital inputs relays)*

### 3.4.5.2 RS232 Serial Interface

The serial RS232 interface can be used to transfer the current data to a remote computer unit that is connected to the analyser via an RS232 cable. The pin assignment of the interface is shown in Fig. 20, page 32. Set the serial interface parameters on your computer as follows:

*Tabelle 3: Serial interface parameters*

| | |
|---|---|
| Baud rate | 9600 Bd |
| Parity | non |
| Data bits | 8 |
| Stop bits | 1 |
| Protocol | Xon / Xoff |

*Example:*

If you send the letter D, the analyser will reply with the transmission of the current data in the following format:

Date; time; measured value display1; measured value display2; ... last measured value display; respective status

Formats:

- Date; time: dd.mm.yyyy-hh:mm:ss
- Display measured values: @@@@@@.@@ (six digits before and two digits after the comma, not used digits are displayed as „Zero“)
- Status (Example): "Errors = (E1835_E1836)" ; "Limits = (L1_max LV1_max)" ; "Status = (M1)" (Underscore = blank space)

Various activities are listed in the status string. The maximum length of the transmitted string is 4095 characters.

### 3.4.5.3 Digital Inputs

The analyser can be controlled via the digital inputs. This option allows e.g. to start only one measurement if a sample is present. The necessary input signals (0 - 24 VDC) must be provided by the user:

*Tabelle 4: Digital input of the applied DC voltage*

| Digital Input 1, 2, 4, 5, 6, 7 (Sample Measurement) | |
|---|---|
| 0 - 3 V | no changes |
| 12 - 24 V | Measurement |
| | |
| Digital input 3 (General Stop of the Analyser) | |
| 0 - 3 V | no changes |
| 12 - 24 V | measurement is stopped |

Notice

The digital inputs are assigned to the corresponding sample streams. For an overview see Fig. 20.

### 3.4.5.4 Relays

The analyser has 8 isolated relays (switch contacts). These are capable of switching external circuits up to 24 V DC / AC with 1 A and can be assigned by the user in the operating software. The relays can be programmed as normally open and normally closed (settings in the software, default is normally open). See Chapter 7.2.6 from page 82).

### 3.4.5.5 Analog Outputs

The maximum load for the isolated 0 / 4-20 mA current loops is 500 ohms. The type of analogue output (0-20 mA or 4-20 mA current loop) can be set in the software. If the output is set to 4 - 20 mA, a so-called "live zero feature" can be set in the operating software. This means that instrument errors are output at 0 mA. The conditions of the error display can be programmed individually in the operating software.
The analyser mounting plate (Fig. 17, page 29) contains the X101 terminal strip for the analog outputs (Fig. 21, page 34). The individual terminals of X101 are labeled. The first digit stands for the sample flow (PS) and the second for the outgoing parameter.

Warning

**Damage to the analyser due to current or voltage at analog outputs!**

At the analog outputs of the analyser neither current nor voltage must be applied actively. The LAR analysers only output different currents in mA.

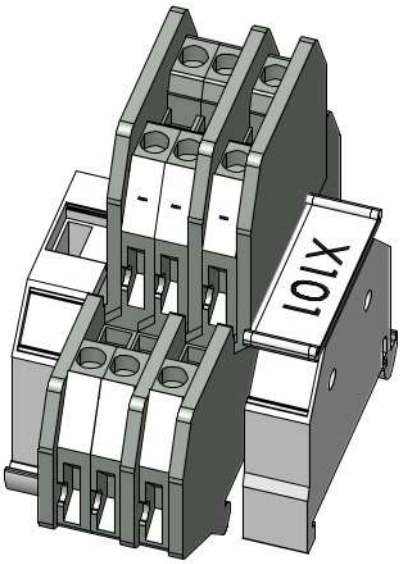



*Fig. 23: Analog outputs*

**Notice**

Note that the terminal diagram (Fig. 22, page 35 to Fig. 24, page 37) is designed as an example for the maximum configuration (6 sample streams) and that the analyser ordered by you corresponds to your configuration.
The relays and analog outputs can be programmed individually by LAR Technical Support (Chapter 15.1 on page 187) during commissioning.

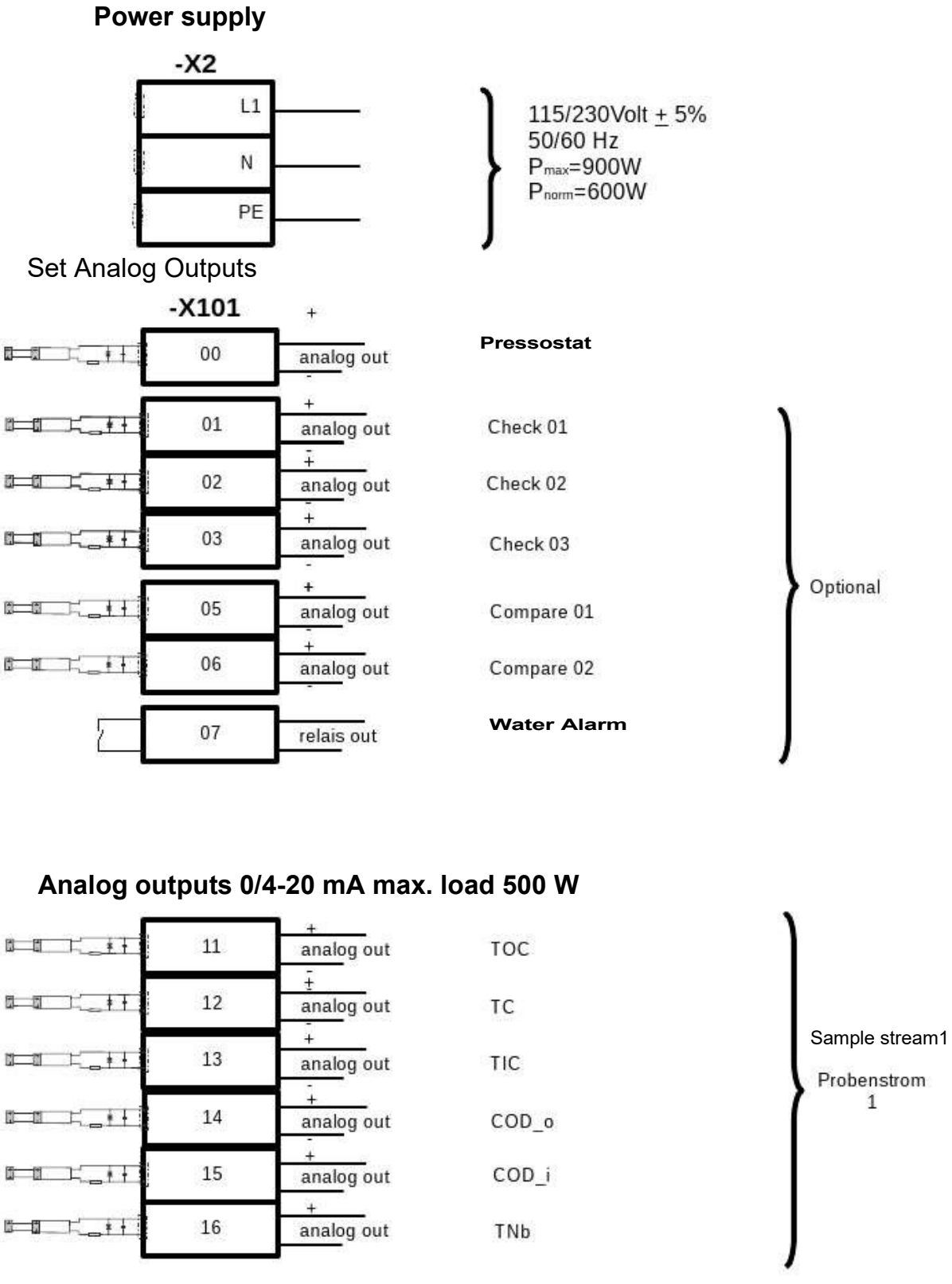



*Fig. 24: Terminal plan (part I) - Power supply, fixed analogue outputs, programmable analogue outputs*

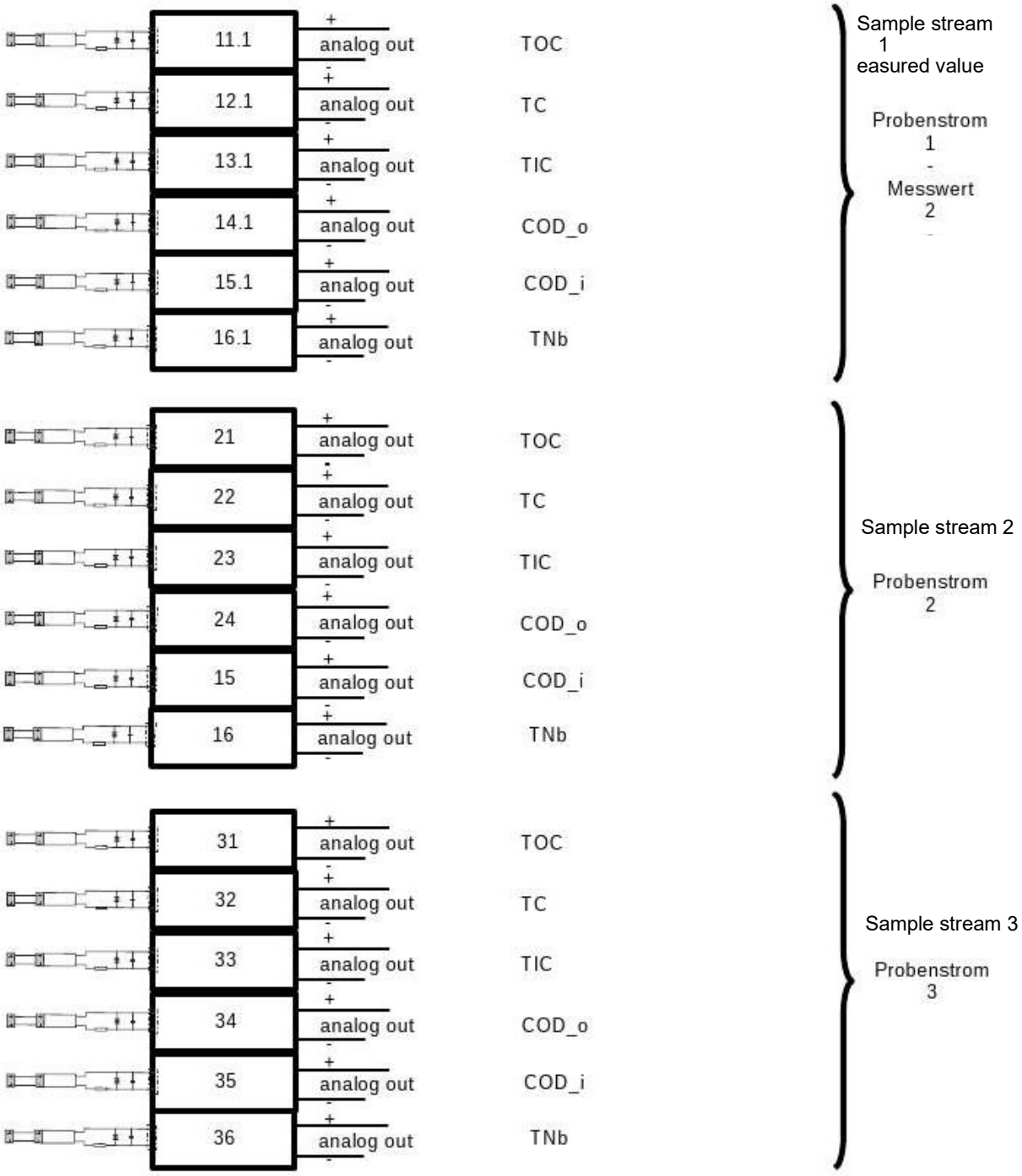



*Fig. 25: Terminal plan (part II) - Programmable analogue outputs*

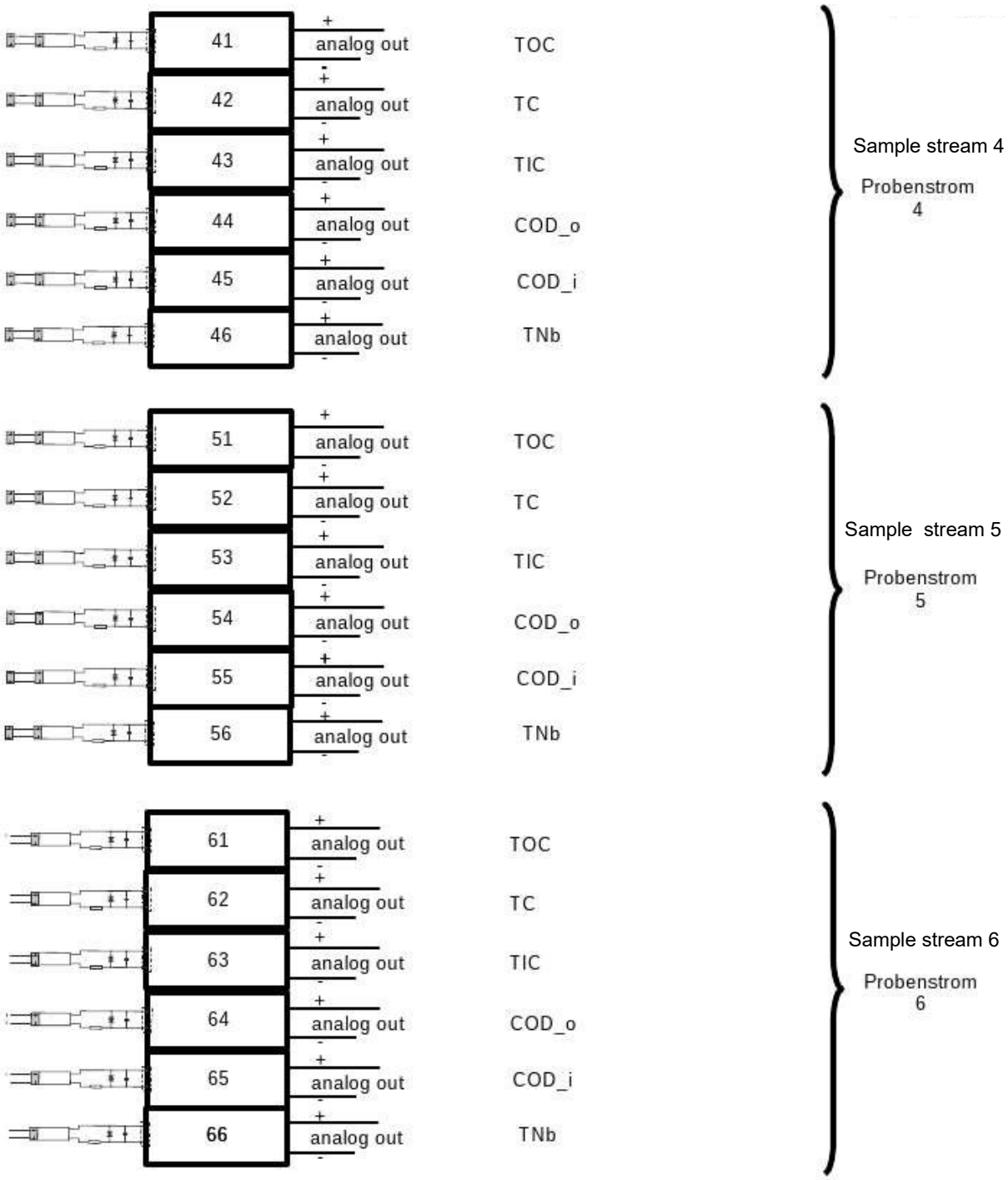



*Fig. 26: Terminal plan (part III) - Programmable analogue outputs*

### 3.4.6 Carrier Gas

The carrier gas supplied to the measuring system must be CO2-free, as it carries the CO2 produced during the oxidation of the sample to the detector. The carrier gas must be supplied with a pre-pressure of 3.5 to 4 bar.

The carrier gas must be free of:

- $CO_2$
- Carbon
- Dust
- Water
- Oil

Notice

If you do not have the option to provide a carrier gas with the necessary specifications, you can optionally order recirculation air conditioning and / or permeation from **LAR**.
For information on air conditioning, see Chapter 9.3 on page 139.
If you have any questions, contact the LAR sales department (Chapter 15.1 on page 187)

# 4 Installation

The following chapter will give you instructions for installing the analyser. The following installation procedure serves as overview. Perform the installation correctly and log the installation process that you should perform and log correctly.

## 4.1 Installation Procedure

The installation procedure is divided into the installation of the analyser and the installation of optional accessories to the analyser.

### 4.1.1 Installation of the Analyser

1. Site selection (Chapter 4.2 on page 41)
2. Analyser Set-Up (Chapter 4.3 on page 42)
3. Provide Carrier Gas (Chapter 4.4 from page 44)
4. Provide sample inlet and drain (Chapter 4.5 on page 44)
5. Connect the Signal Cables (Chapter 4.6 on page 44)
6. Provide Rinsing Solution (Chapter 4.7 on page 45)
7. Provide Acid Solutions (Chapter 4.8 on page 45)
8. Provide Calibration Standards (Chapter 4.9 on page 46)

*Tabelle 5: Installation protocol for the analyser*

| Task | Criteria | OK | Comment |
|---|---|---|---|
| Ensure Environment Conditions | • Dry and frost-proof<br>• Temperature: 5°C - 35 °C<br>• Rel. humidity: < 80%<br>• No direct exposure to sunlight<br>• No aggressive environment<br>• No aggressive sample contents | ☐ | |
| Mounting and Installation of the Analyser on Site | • Wall mounting:<br>*Free space (W x H x D)*<br>*approx.* 1.430 x 1.760 x 1.190 mm | ☐ | |
| | • Mounting rack:<br>*Free space (W x H x D)*<br>*approx.* 1.500 x 2.000 x 1.420 mm | ☐ | |
| Provide Carrrier Gas | • Free of $CO_2$, Carbon, Dust, Water und Oil<br>• Pre pressure 3,5 - 4 bar<br>• Available in the direct vicinity | ☐ | |
| Provide Sample Inlet | • Depressurised<br>• Available in the direct vicinity | ☐ | |
| Provide Drain | • Depressurised<br>• Available in the direct vicinity | ☐ | |
| Provide Power Supply | • Mains voltage correct<br>• Power cable on power supply connected | ☐ | |
| Install Signal Connections | • Serial interface connected<br>• Digital Inputs connected<br>• Analog Outputs connected<br>• Relays connected | ☐ | |
| Provide Rinsing Water | • Rinsing water provided | ☐ | |
| Provide Acid Solution | • Acid solution provided | ☐ | |
| Provide Calibration Standards | • Calibration Standard provided | ☐ | |
| Date: | | Signature: | |

*Tabelle 6: Installation protocol for accessories*

| Task | Criteria | OK | Note |
|---|---|---|---|
| Installation of the reagent cabinet | • Mounting on the LAR mounting rack / placed underneath the analyser | ☐ | |
| Installation der Umluftaufbereitung | • An der Wand / am LAR-Montagegestell montiert oder unterhalb des Analysators aufgestellt | ☐ | |
| Installation des FlowSampler® | • FlowSampler® an der Wand rechts neben dem Analysator montiert | ☐ | |
| Installation des $CO_2$-Removers | • An der Wand montiert oder unterhalb des Analysators aufgestellt | ☐ | |
| Date: | | Signature: | |

## 4.2 Site Selection - Ambient Conditions

**The following ambient conditions apply for choosing the analyser location:**

- Dry and frost-proof
- Allowed temperature ranget 5°C - 35°C
- Max. relative humidity 80%
- No direct exposure to sunlight
- No aggressive environment for housing type IP54
- Mains voltage 115/230 V at 50/60 Hz, 16 A fusing (K-characteristics)

**Warning**

**Warning of incorrect electric connections**

The analyser may be damaged if it is not connected to the mains matching the data stated on the nameplate.

Before the analyser is switched on, a check must be run on whether the local voltage supply matches that on the nameplate.

If this power supply is not available, please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 245).

Do not switch the analyser on before using it for the first time without the presence of a technician authorised by LAR - otherwise this voids the warranty of your analyser.

## 4.3 Analyser Set-Up

The analyser is mounted either to a wall or on the LAR mounting rack.

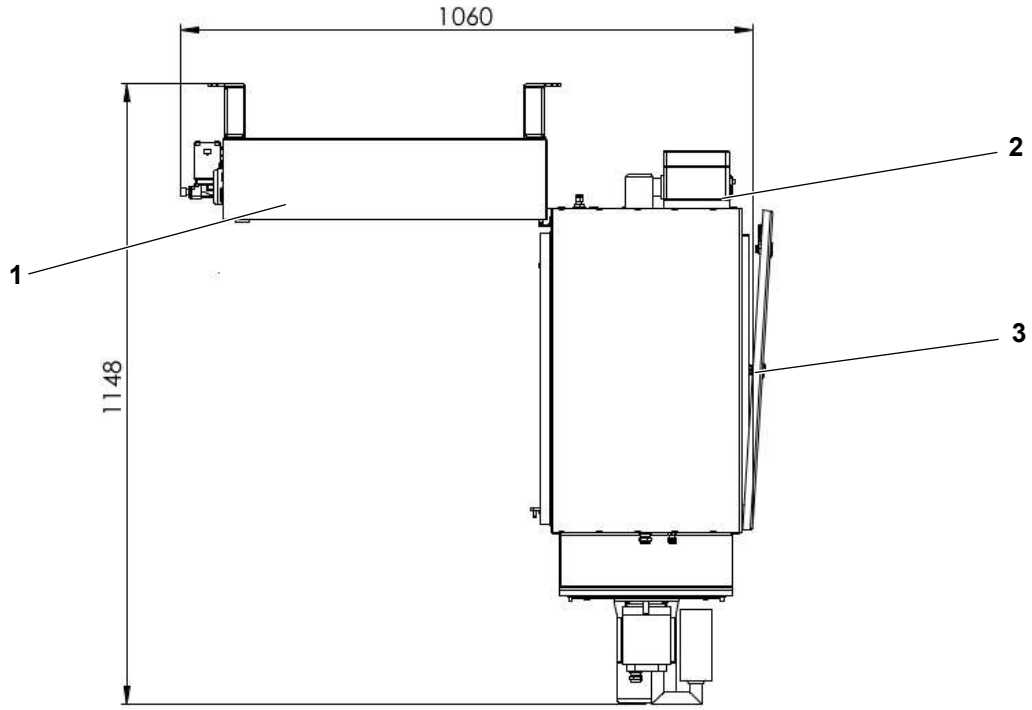
**Notice**

LAR Technical Support does not carry out any construction work.
The analyzer and options must be installed by the user before commissioning the analyser.

### 4.3.1 Maximum Swing-Open

**Notice**

For all mounting variants, a distance to the side and opposite walls must be maintained so that the analyser can be swung open.

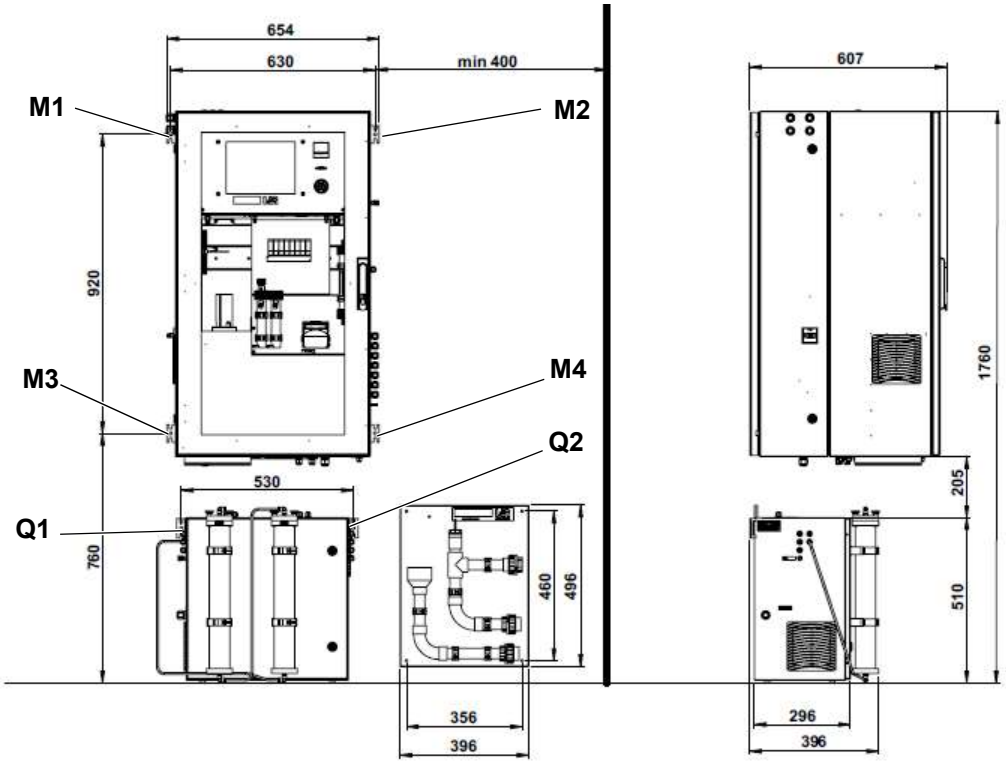



1 Rear Casing
2. Front Casing
3. Analyser Door

*Fig. 25: Maximum swing-open*

### 4.3.2 Wall Mounting

The following installation dimensions must be taken into account:
At least 1.430 x 1.760 x 1.210 mm (W x H x D)




M1 - M4: Mounting Points for Analyser
Q1 - Q2: Mounting Points for Air Recirculation

*Fig. 26: Wall mounting for QuickTOC® purity with Air Recirculation and FlowSampler® (Example: TC-only, 1 sample stream)*

**Warning**

**Improper installation!**

Improper installation can damage the analyser or cause it to not work properly!

A distance to the side and opposite walls must be maintained so that the analyser can be swung open!

Note the condition of the wall to which the analyser is to be mounted. The wall should have the strength of a concrete wall, but gas concrete walls are unsuitable!

Use all brackets of the analyser for the assembly!

Make sure that the analyser is aligned horizontally.

Use e.g. a spirit level.

**Notice**

If the condition of the wall does not meet the requirements, mount the analyser on the mounting rack.

Information on mounting the analyzer on the mounting frame can be found in Chapter 9.5 on page 170.

## 4.4 Carrier Gas and Rinsing Gas

For the operation of the analyser, a carrier gas is required with the following specifications.

**Ensure that he carrier gas is:**

- free of $CO_2$, carbon, dust, water and oil
- pre-pressurized to 2 - 5 bar
- dew point max -5 °C
- provided in the direct vicinity of the analyser

**Notice**

If you do not have the opportunity to supply a carrier gas with the required specifications, you can optionally order the recirculation and / or permeation from LAR.

For information on recirculation, see chapter Chapter 9.3 from page 197.

If you have any questions, contact the sales department of LAR (Chapter 15.1 on page 269).

## 4.5 Sample Inlet and Drain

Please ensure that sample inlet and drain are depressurised and available in the direct vicinity of the analyser.

### 4.5.1 Pressurized Sample Inlet

#### 4.5.1.1 NPOC Measuring Method

The sample is fed with a 4.8 x 1.6 Maprene tube for each sample stream. In the case of single-channel devices, the Maprene hose is fed directly into the analyser. In the case of multi-channel devices, the hoses are guided from the outside into the additional housing, which is located on the side of the analyser.

#### 4.5.1.2 TOC-Difference Method and TC-only Method

The sample is fed with a 1.6 x 0.8 PFA tube for each sample stream. In the case of single-channel devices, the PFA hose is led directly into the analyser. In the case of multi-channel devices, the hoses are fed into the additional housing from the outside.

## 4.6 Signal connections

The analyser has different digital connections. The signal lines can be connected by you on the installation plate in the rear part of the housing, and be programmed by **your local partner** or the **Technical Support of LAR** as part of initial start-up.

Signal lines to be connected:

- RS232 serial interface to a computer unit via an RS232 cable (Chapter 3.4.5.2 on page 22)
- Digital Inputs (Chapter 3.4.5.3 on page 22)

- Relays (Chapter 3.4.5.4 on page 23)
- Analog Outputs (Chapter 3.4.5.5 on page 23)

**Warning**

**Warning of incorrect electric connections**

The analyser may be damaged if it is not connected to the mains matching the data stated on the nameplate.

Before the analyser is switched on, a check must be run on whether the local voltage supply matches that on the nameplate.

If this power supply is not available, please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 245).

Do not switch the analyser on before using it for the first time without the presence of a technician authorised by LAR - otherwise this voids the warranty of your analyser.

**Warning**

**Warning of incorrect setting-up**

The analyser may be damaged if it is not connected to the mains matching the data stated on the nameplate.

Do not switch the analyser on before using it for the first time without the presence of a technician authorised by LAR - otherwise this voids the warranty of your analyser.

**Notice**

Disconnect the analyser from electric power prior to cabling the system.

## 4.7 Rinsing Water

Rinsing Water (provided by the operator) used for rinsing the injection needle is required for Start-Up. See Chapter 6.1.2 on page 55.

## 4.8 Provide Acid Solution (TOC-Direct and TOC-Difference Method)

For the usage of the analyser with the TOC-Direct or TOC-Difference Method, an acid solution for stripping out inorganic carbon compounds (TIC) must be provided. See Chapter 6.1.3 on page 56 for the TOC-Difference Method or the Chapter 6.1.4 on page 56 for the TOC-Direct Method.

**Notice**

For the start-up, please use an acid solution which is not older than five days.

It is best to keep canisters in the Reagent Cabinet (see Chapter 9 from page 169).

## 4.9 Provide Calibration Standards

A calibration standard must be provided by the operator to calibrate the analyser. See Chapter 6.2 from page 57.

**Warning**

**Warning of improper storage**

The calibration standard must be stored in a cool place (such as a refigerator).

For the start-up, please use a calibration standard not older than five days.

**Notice**

Certified calibration standards can be sourced directly from LAR to minimise overhead.

For more information please contact the **Sales Department of LAR** (Chapter 15 on page 245).

# 5 Start-up

This section provides all information about the start-up of the analyser. The following start-up procedure serves as an overview. The start-up must be carried out properly and documented by Technical Support of LAR or by another person authorised by LAR.


Warning

**Warning of improper start-up**

Do not switch on the analyser before start-up without having completed the installation (described in the previous chapter) and without the presence of a technician authorised by LAR - because this voids the warranty of your analyser.

## 5.1 Procedure

The start-up procedure is divided into start-up of the analyser and start-up of accessories.

### 5.1.1 Start-Up of the Analyser

1. Checking the Pre-fusing (Chapter 5.2 on page 48)
2. Checking the mounting plate (Chapter 5.3 on page 48)
3. Removing the transportation locks (Chapter 5.4 on page 48)
4. Aligning the voltage (Chapter 5.5 on page 50)
5. Switching on the fuses (Chapter 5.6 on page 50)
6. Filling and installing the reactor pipe (Chapter 5.7 on page 50)
7. Completing the furnace system (Chapter 5.8 on page 53)
8. Installing the pump tubes (Chapter 5.9 on page 55)
9. Tubing the analyser (Chapter 5.10 on page 57)
10. Rinsing the injection system and the sample tubes (Chapter 5.12 on page 57)
11. Customizing application-specific settings (Chapter 5.13 on page 58)
12. Checking status parameters (Chapter 5.14 on page 58)
13. Performing a calibration (Chapter 5.15 on page 58), if need be, performing a second calibration.

*Tabelle 7: Start-up protocoll for the analyser*

| Task | Criteria | OK | Comment |
|---|---|---|---|
| Checking the Pre-fusing | • Pre-Fuse is installed correctly | ☐ | |
| Checking the Mounting plate | • Components are fixed | ☐ | |
| Removing the transportation locks | • Furnace Transport Screw is removed | ☐ | |
| Aligning the voltage | • Voltage is correct | ☐ | |
| Switching on the fuses | • Fuse Lock is removed<br>• All Fuses are switched on | ☐ | |
| Filling and installing the reactor pipe | • Reactor Pipe is filled<br>• Reactor Pipe is installed | ☐ | |
| Date: | Signature: | | |

| Task | Criteria | OK | Comment |
|---|---|---|---|
| Completing the Furnace System | • Furnace Head is installed<br>• Injection Port is installed<br>• Reactor Foot is installed | ☐ | |
| Installing the pump tubes | • Pump tubes are installed | ☐ | |
| Tubing of the Analyser | • Tubing is performed like in Flow Diagram<br>• Tubes are hand-screwed onto the screwed joints | ☐ | |
| Rinsing the Injection System and Sample Tubes | • Injection System and Sample Tubes are rinsed | ☐ | |
| Customizing application-specific settings | • Hardware and Parameter Settings are set | ☐ | |
| Checking Status Parameters | • Carrier Gas IN / OUT: approx. 30 l/h (High Salt: approx. 20 l/h)<br>• Humidity: Actual < Target<br>• Gas Pressure: Actual < Target<br>• Zero Signal: 0 - 0.1 FSR | ☐ | |
| Perfoming a Calibration | • Analyser is calibrated | ☐ | |
| If need be, perfoming a second Calibration | • Analyser is calibrated | ☐ | |
| Date: | Signature: | | |

## 5.2 Checking the Pre-Fusing

Before start-up can begin, it is important to ensure that correct pre-fusing has been installed at the operator.

## 5.3 Checking the Installation Plate

Before start-up can be performed, it is important to ensure that no components have become loose or suffered damage during transit. The housing and the components on the installation plate in the rear part of the housing (Fig. 14, page 18) must also be checked.

## 5.4 Removing Transport Locks

Transport locks are affixed to safeguard the analyser and its components during transport. They must be removed before the analyser is used.

**Furnace Transport Screw**

Notice

Transport locks can also be affixed to accessories and options.

Information to remove transportation locks of accessories and options can be found in Chapter 9 from page 169.

For transportation, the furnace is secured with a bolt and a spacer sleeve, which must be removed for

operation.
Proceed as follows:

1. Open the furnace door in the analyser.
2. Use the screwdriver to remove the transport bolt (**1**) for the furnace.
3. Remove the spacer sleeve (**2**).
4. Close the furnace door of the analyser.

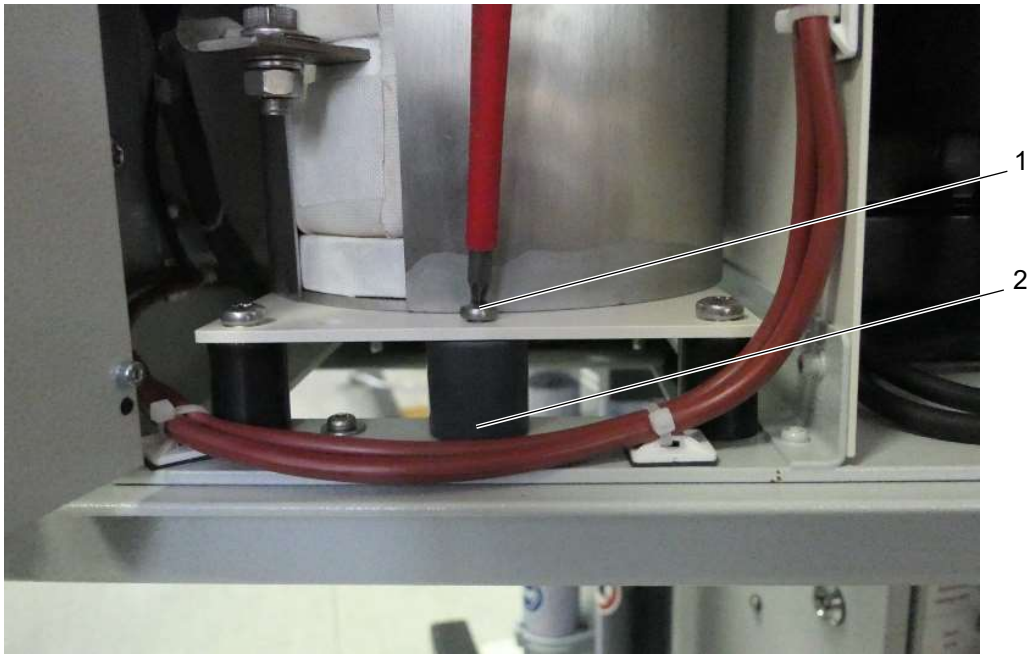



*Fig. 27: Removing the transport locks of the furnace*

## 5.5 Aligning the Voltage

1. Check the power supply.
2. Compare the mains voltage with that specified on the analyser (Fig. 3, page 14) ab.

## 5.6 Switching on the Pre-Fusing

In order to switch the analyser on, the lock on the automatic circuit breaker must be removed and the fuses must be switched on.

Proceed as follows:

1. Open the rear part of the housing to access the mounting plate (Fig. 14, page 18).
2. Open the yellow lock (**1**) by pulling it forwards.
3. Use your finger and thumb to press in the metal clip, and remove the lock (**1**).
4. Switch all fuses on.
5. Close the rear part of the housing.

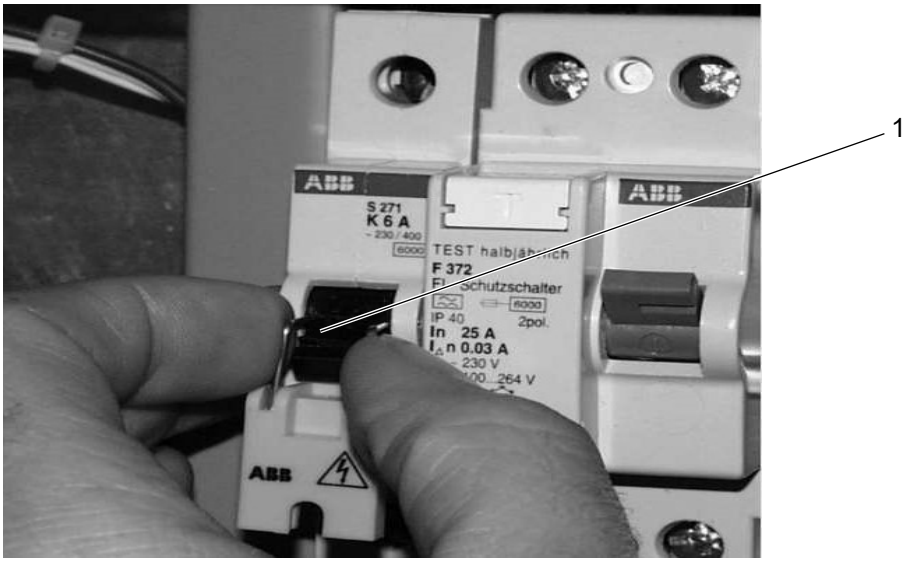



*Fig. 28: Remove the safety clip of the Pre-fusing*

## 5.7 Filling and Installing the Reactor Pipe

Warning

**Warning of damage to the analyser**
The analyser may suffer irreparable damage if operated with an unfilled reactor pipe or without a reactor pipe.
Fill the reactor pipe and install the reactor pipe in the furnace before operating the analyser.

Some components of the furnace system are packed individually for safety during transit. These components must be fitted in the furnace.

Remove the following components from the packaging:

- Reactor Pipe
- Protective Pipe
- Ceramic Sieve
- Ceramic Balls
- Green Protective Seal

Assembly of the Reactor Pipe:

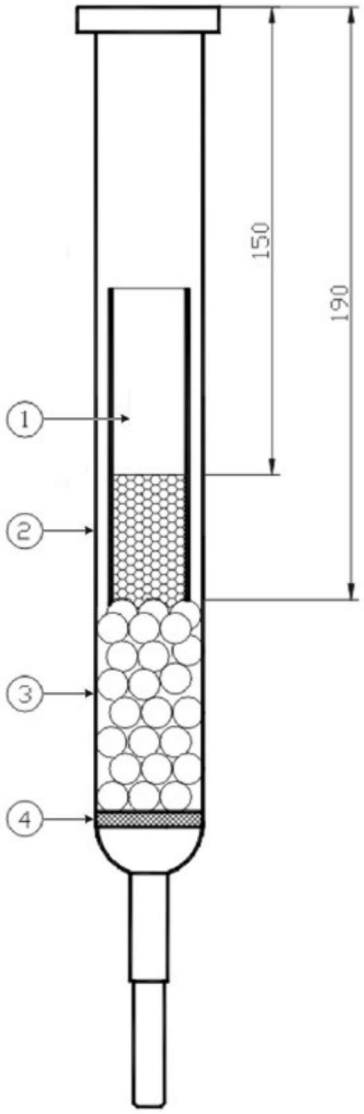



*Fig. 29: Reactor pipe filling*

Proceed as follows:

1. Place the ceramic sieve (**4**) on the taper of the reactor tube. Make sure that the ceramic sieve rests horizontally.
2. Fill 7 mm of the ceramic balls (**3**) to the height of 190 mm from the top of the reactor tube.
3. Fill 3.5 - 4.5 mm of the ceramic balls (**2**) up to a height of 150 mm from the top of the reactor tube.
4. Insert the short protective tube (**1**).

Warning

**Damage due to improper filling**

Incorrect filling of the reactor pipe can damage the reactor pipe.

Use a funnel to fill the ceramic balls so that the ceramic balls do not fall between the reactor pipe and the protective pipe.

Any deviations from the standard filling should be discussed in advance with LAR Technical Support (Chapter 15.1 on page 187) or with a service partne authorized by LAR.

Notice

As our research and development progresses, we encourage you to stay in touch with your **LAR** contact to stay up-to-date with any additions.

## 5.8 Completing the Furnace

Install the furnace system as shown in Fig. 30, page 53 and Fig. 31, page 54.

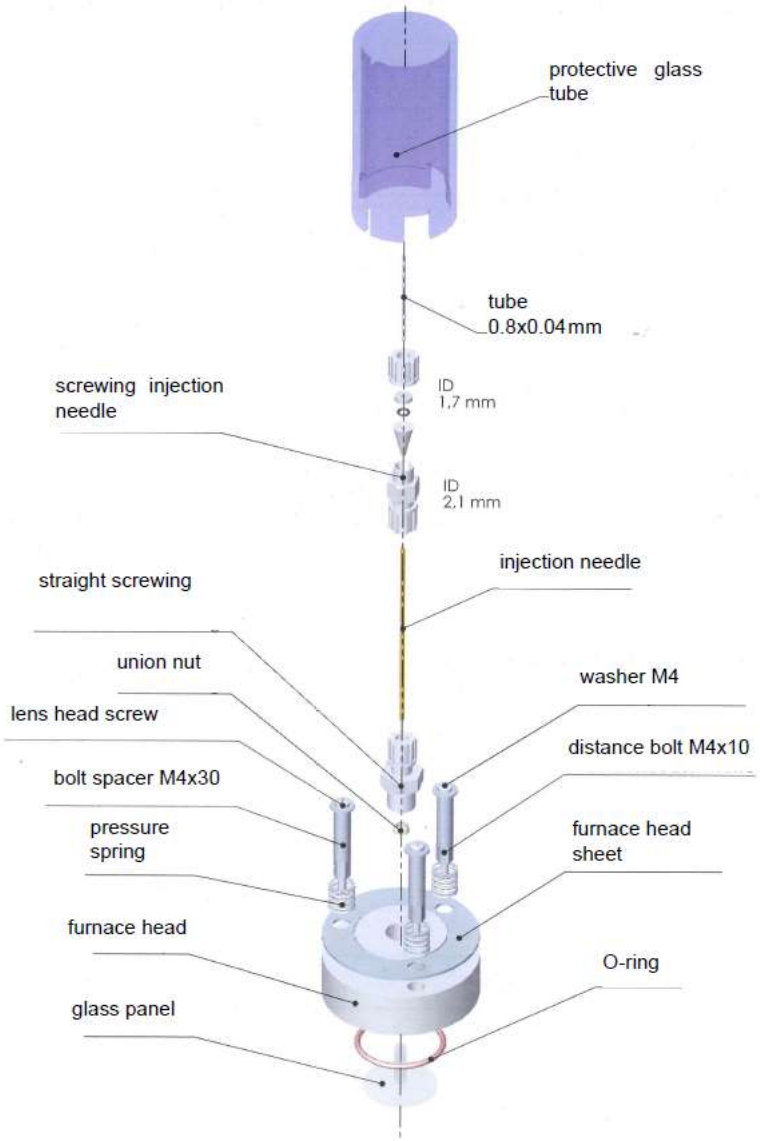



*Fig. 30: Assembly of the reactor head*

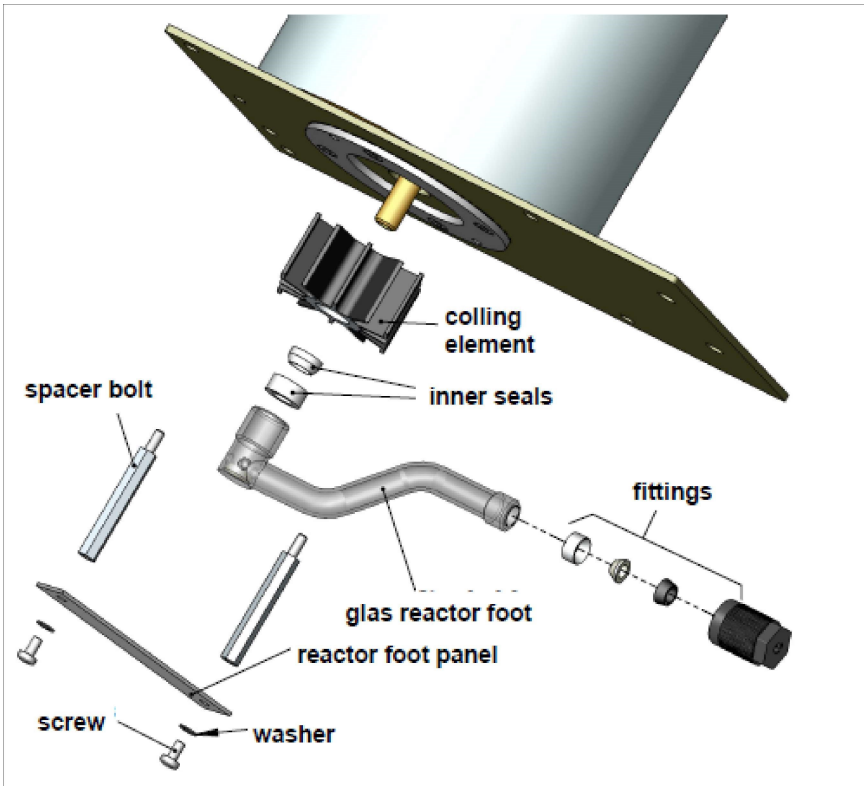



*Fig. 31: Assembly of the reactor foot*

Notice

Mount the reactor foot when the furnace has reached a temperature of approx. 800° C. The high temperature simplifies the assembly of the reactor bottom.

## 5.9 Installation of the Pump Tubes

### 5.9.1 Installation of the tubes into the Tube Cassette Pump

In order to pump the solutions, the tubes must be placed into the tube cassette pump correctly.

Proceed as follows:

1. Use the overview to localise all tube cassette pumps (Tab. 2, page 13).
2. Place the tube into the cassette between two of the coloured stoppers with the marking facing upwards.
3. Apply silicone oil to the tube.
4. Place the cassette onto the pulley head of the pump until a click is heard.
5. Proceed in the same way with other cassettes on the tube cassette pump and other tube cassette pumps..

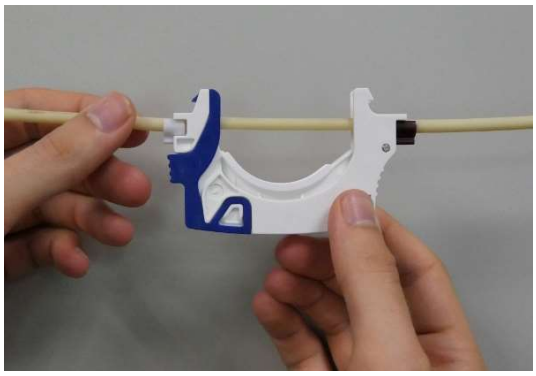


*Fig. 32: Insert tube (Example)*

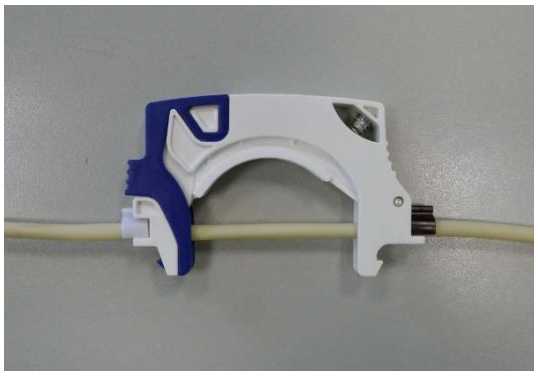


*Fig. 33: Cassette with Fixing Flap (Example)*

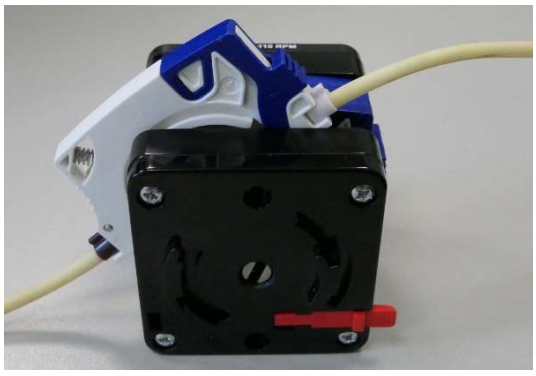


*Fig. 34: Mounting the Tube Cassette (Example)*

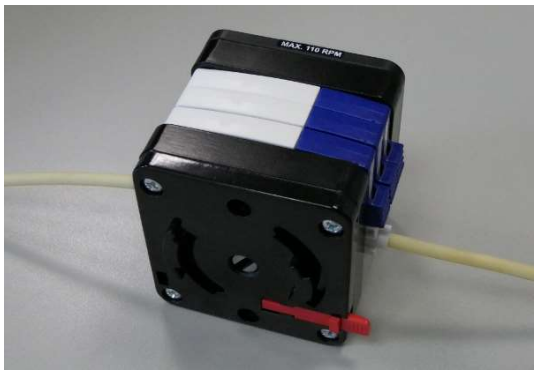


*Fig. 35: Schlauchkassette auf Pumpe (Example)*

Notice

Hoses with three color code stoppers can be used longer by pushing them forward. The service life of a hose is thereby doubled.

To ensure long life and good performance of the pump tubing, use only original **LAR** pump tubing.

### 5.9.2 Installation of the Tubes into the Sample Pump

In order to pump the samples, the tubes must be placed correctly into the sample pump.

Proceed as follows:

1. Locate all sample pumps by using Tab. 2, page 24.
2. Open the upper lid (**1**) of the sample pump.
3. Place the tube (**2**) close to the roller (**3**).
4. Pay attention not to twist the tube (**2**).
5. Pull the tube (**2**) down on both sides to make sure that the tube (**2**) is in both sides of the guide (**4**).
6. Select the value according to the diameter of the used tubing (**2**) by means of the adjustment wheels (**5**). The value can bei either 3,2 mm or 4,8 mm.
7. Close the upper lid (**1**) of the sample pump.
8. Proceed analogously with the other pump tubings and sample pumps.

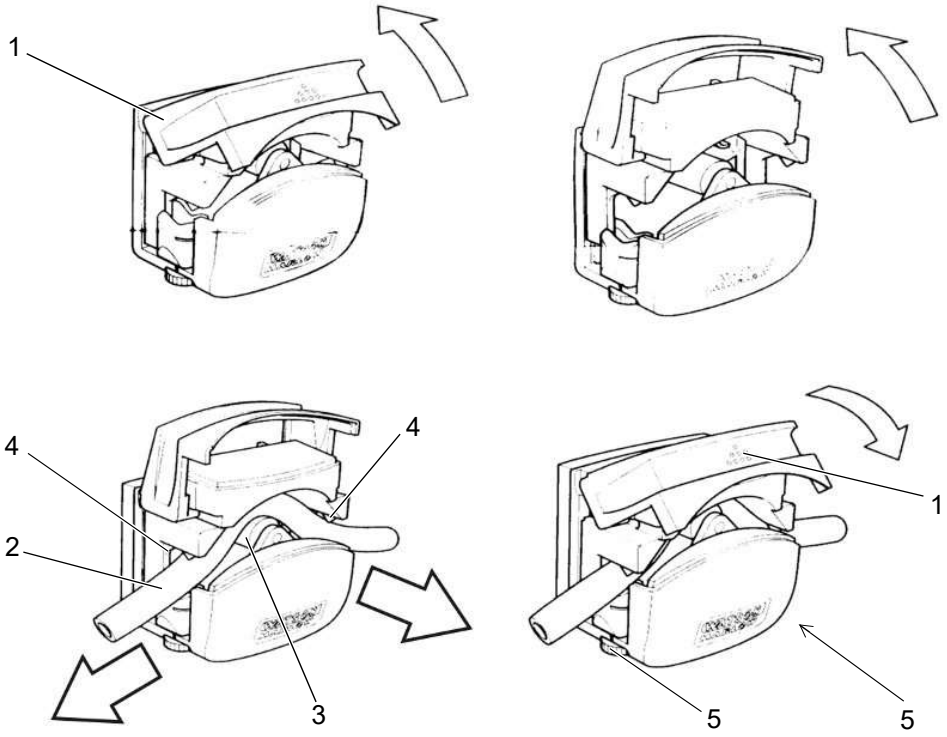



*Fig. 36: Installation of the Tubes into the Sample Pump*

## 5.10 Analyser Tubing

Inside the analyser, samples, reagents and the carrier gas are transported from one component to the next. Different tubes are used for this, which must be connected properly to the components.

Notice

For tubing of your analyser, follow the flow diagram for your configuration (Chapter 12 from page 217).

Ensure for tubing that

- tubes are in perfect condition (e.g. no kinks)
- routing diagram is observed depending on configuration
- tubes are hand-screwed onto the screwed joints
- drain is depressurisedf

## 5.11 Switch on the Analyser

The analyser is switched on for the first time by Technical Support of LAR or by a person authorised by LAR.

Preconditions:

- Completion of installations (Chapter 4 from page 29)
- Removal of transport locks (Chapter 5.4 from page 48)
- Switch-on of internal fuses (Chapter 5.6 on page 50)
- Filling and installation of the reactor pipe (Chapter 5.7 from page 50)

Warning

**Warning of warranty void**
The warranty of the analyser may be void if the analyser has been improperly installed prior to initial use!

Turn on the analyser after proper installation by a person authorized by **LAR**.

Notice

Fault message “E1820 - Furnace temperature not reached” is shown when the system is switched on. This message disappears once the furnace has reached the required temperature. It does not need to be confirmed in the log book.

## 5.12 Rinse the Injection System und Sample Tubes

Notice

Before the first measurement, the injection system and sample tubes must be rinsed.

Proceed as follows:

1. Switch to the “Service Action” display (Chapter 7.2.11 from page 86).

2. Rinse the injection system using the “Rinse injection system” function.
3. Rinse the sample tubes using the “Rinse sample tubes” function.

## 5.13 Costumisation of Application-Specific Settings

Application-specific hardware and parameter changes can be set.

Change the following settings:

- Measurement Parameters (Chapter 7.2.2 from page 68)
- Measurement Channels (Chapter 7.2.7 on page 82)
- Relays (Chapter 7.2.5 from page 79)
- Analog Outputs (Chapter 7.2.19 on page 104)

## 5.14 Checking Status Parameters

The status parameters on the Status screen must be checked to ensure perfect operation of the analyser. Use for the check the start-up log (Tab. 7, page 47), in which all relevant status parameters are recorded with associated status information permitted. The status parameters are on the “Status screen” display (Chapter 7.2.10 from page 85).


Notice

If a status parameter differs from the status, contact the **LAR** Technical Support (Chapter 15.1 on page 267).

## 5.15 Perform a Calibration

Before the measurements can be started, the analyser must undergo application-specific calibration. A 2-point or multi-point calibration can be used here (Chapter 7.2.3 from page 71).


Notice

The calibration standards provided by the user are a prerequisite for calibration (Chapter 6.2 from page 84).

# 6 Reagents and Calibration Standards

Deionised water, rinsing water, calibration standards (and possibly acid solutions) are required for the analyser measurement mode. This section shows how you can prepare the calibration standards and solutions yourself.


Warning

**Harmful Chemicals**

Observe the safety rules for the preparation of chemical solutions.

Follow the instructions for setting up the solutions.

## 6.1 Reagents


Notice

You can prepare the necessary stock solutions yourself or order them from LAR. When ordering solutions, please bear in mind the supplier specifications for shelf life and storage conditions.

### 6.1.1 Deionised Water for Calibration Standards

Deionised Water is required to make the calibration standards. It should contain a low fraction of carbon and nitrogen compounds. The purity of the deionised water is dependent on the working range set.

*Table 8: Purity Grades of the Deionised Water for TOC Measurement*

| Working Range [mg/l C] | Maximum Permitted C-Concentration [mg/l C] |
|---|---|
| < 2 | 0.1 |
| < 10 | 0.3 |
| 10 – 100 | 0.5 |
| > 100 | 1.0 |

*Tabelle 9: Purity Grades of the Deionised Water for COD Measurement*

| Working Range [mg/l COD] | Maximum Permitted C-Concentration [mg/l COD] |
|---|---|
| < 25 | 1,0 |
| 25 - 250 | 2,0 |
| > 250 | 3,0 |

### 6.1.2 Rinsing Water

Deionised water is required to rinse the injection needle. The amount is dependent on the measurement frequency set and the number of sample streams. The conductivity of the deionised water must be between 1µS/cm and 10µS/cm, and the maximum permitted concentration for TC may not exceed 1 mg/l.

Proceed as follows:

1. Fill a 5 l graduated flask with 5 litres of deionised water.
2. Add 1 ml of 85% phosphoric acid ($H_3PO_4$).
3. Degas the rinsing water using underpressure or put it into an ultrasonic bath for five minutes.
4. Keep the rinsing water underneath the analyser (e.g. in the Reagent Cabinet or Ambient Air Preparation Unit).

### 6.1.3 Phosphoric Acid ($H_3PO_4$) for TOC-Difference Method

1% phosphoric acid ($H_3PO_4$) is used for the outgassing or elimination of inorganic carbon compounds (TIC), such as carbonate. The low pH value converts the ligated $CO_2$ (e.g. carbonate) into gas phase, which is then gassed out of the liquid and can be determined.

Proceed as follows:

1. Fill a 5 l graduated flask with 4 litres of deionised water.
2. Add 58 ml of an 85% phosphoric acid ($H_3PO_4$).
3. Fill the graduated flask up to 5 l with deionised water.
4. Add 1 g of copper sulphate ($CuSO_4 * 5H_2O$) to the solution to prevent bacteria forming.
5. Keep the phosphoric acid solution underneath the analyser (e.g. in the Reagent Cabinet or Ambient Air Preparation Unit).

Notice

Biological deposits can form in the stripping vessel for strongly biological samples. A sulphuric acid ($H_2SO_4$) should be used here instead of the phosphoric acid ($H_3PO_4$) for determination of the TIC.

Please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 245) before using another acid.

### 6.1.4 Gas Measurement and Gas Calibration

The injection system must be cleaned before performing a gas calibration. Proceed as follows:

1. Set the connected test gas with which the injection loop is to be purged under "Measurement parameters" in the sub-item "Gas measurement".
2. Optionally, a cleaning cycle with carrier gas can be carried out. The injection block is switched on and off several times; Due to the pressure fluctuations that occur, remaining liquid drops are transported out of the injection loop.
3. A waiting period of three minutes ensures that any liquid droplets injected do not affect the detector zero line.

After the waiting period, the fully automatic gas calibration begins. The entire calibration runs fully automatically - regardless of the number of calibration points. The gas calibration is carried out with the previously selected settings. The measurement begins with the zero point detection of the detector, followed by the injection process. The valves Y4Y5 and Y4Y6 are switched and the test gas flows through the injection loop for the set filling time. Now the injection block switches and the loop content is injected into the oven. This process is repeated according to the number of injections for this calibration point

**Notice**

For each calibration point, five measurements are carried out - analogous to calibration with liquid standards.

After the calibration has been completed, an outlier correction is carried out.

After the analyser has been calibrated with test gas, the measured value for the online measurement and the individual measurement is calculated as follows:
The measured signal areas are normalized to a single injection of the injection loop. Since the gas calibration is an addition calibration, the signal area is divided by the number of injections that are necessary for the set injection volume of the sample stream.

Proceed as follows:
1. Use test gas with 450 ppm CO2 in nitrogen grade 5.0. Test gas cylinders with a capacity of 10 l are available commercially.
2. Set the pressure reducer to 1 bar. This pressure is then reduced to 400 mbar within the measuring device.
3. Calibrate the analyzer with this test gas using an adjustable multi-point calibration.
4. The first calibration point corresponds to approx. 241 ppb TOC, the second 482, etc. since the sample loop is injected several times.

### 6.1.5 Gas Validation

Gas validation is used to check the sensitivity of the detector. The resulting measured value corresponds to the measured value for the individual injection if the detector is functioning properly during gas calibration.
The gas validation is only possible for the first sample stream and only in online mode. In order to use the function, another channel for sample stream 1 must be created. For further information please contact the technical support of LAR (Chapter 15.1 on page 199).

The procedure is analogous to a measurement in gas calibration, after a flush of the injection loop with test gas has been carried out. In addition, the injection volume of the first sample stream is used and the current calibration is applied to the signal area for the first sample stream, which is irrelevant due to the normalization for the measured value.

Gas validation is carried out using the "Single measurement" function. The calibration parameters of the

first sample stream are used.

**Notice**

**Calibration Gas Consumption**

For two calibration points with 5 single measurements each the consumption of gas is approx. 3 liters.

If you have connected test gas permanently, remote gas validations and remote checks can be carried out. To do this, control the gas validation / check via the digital input DIGITAL IN 8. The measurement result is output via an analog output.

**Notice**

For gas validation, a channel for gas verification must be set in "Names & Units".
With Dig. 8 - longer signal - the measurement is started.

The result is the concentration of the test gas converted into TOC.

Example:
450 ppm CO2 in nitrogen = approx. 241 ppb TOC.

### 6.1.6 Hydrochloric Acid (HCl) for TOC-Direct Method (NPOC-Method)

1% hydrochloric acid (HCl) is used for the outgassing or elimination of inorganic carbon compounds (TIC), such as carbonate. The low pH value converts the ligated $CO_2$ (e.g. carbonate) into gas phase, which is then gassed out of the liquid and can be determined.

Proceed as follows:

1. Fill a 5 l graduated flask with 4 litres of deionised water.
2. Add 200 ml of a 25% hydrochloric acid (HCl).
3. Fill the graduated flask up to 5 l with deionised water.
4. Keep the hydrochloric acid solution underneath the analyser (e.g. in the Reagent Cabinet or Ambient Air Preparation Unit).

Notice

Hydrochloric acid concentrations between 3 and 5% can also be used depending on the application.

Please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 245) before using another concentration.

### 6.1.7 Calibration Standards - TOC-Difference Method

This section explains how you can prepare the calibration standards for the TOC-Difference Method.

First, a stock solution needs to be prepared which can then be diluted to obtain the required calibration standard concentration.

Notice

To minimise mistakes, LAR always recommends using the stock solution as the initial solution for dilutions.

The stock solution and its diluitions can be used as a calibration standard.

#### 6.1.7.1 Stock Solution - TOC-Difference Method

This section shows how to prepare a stock solution for TOC-Difference Method analogous to DIN EN 1484:1987.

Chemicals required:

- 6.382 g Potassium hydrogen phthalate ($C_8H_5KO_4$) p.a. dried for 2 hours at 105°C
- 4.415 g Sodium carbonate ($Na_2CO_3$) dired for 1 hour at 185°C
- 3.500 g Sodium hydrogen carbonate ($NaHCO_3$) dried for at least 24 hours in the exsiccator with silica gel

Proceed as follows:

1. Dissolve the weighted sample of each of the three substances in a 1,000 ml graduated flask in 700 ml of deionised water.
2. Fill the 1,000 ml graduated flask up to the mark with deionised water.

The concentration of this stock solution is:

- TC (Total Carbon) = 4,000 mg/l C
- TIC (Total Inorganic Carbon) = 1,000 mg/l C
- TOC (Total Organic Carbon) = 3,000 mg/l C

Warning

The stock solution can be kept in a sealed glass bottle for about four weeks at a temperature of 4°C.

Please note that the pipetting accuracy can be negatively impacted when the stock solution is diluted.

### 6.1.7.2 Dilution of the Stock Solution - TOC-Difference Method

Because the analysers work in different working ranges, the following three stock solution dilutions are listed. These dilutions enable calibration standards to be made which have a lower concentration than listed in the table below.

Proceed as follows:

1. Take a 500 ml/2,000 ml graduated flask.
2. Fill the dilution amount specified in the table into the graduated flask.
3. Fill the graduated flask with deionised water up to the 500 ml/2,000 ml mark.

*Table 10: Dilution of the Stock Solution (TOC-Difference Method)*

| | Amount Stock Solution : Deionised Water | Stock Solution to Deionised Water | TC [mg/l C] | TIC [mg/l C] | TOC [mg/l C] |
|---|---|---|---|---|---|
| Dilution I | 1 : 10 | 50 ml to 500 ml | 400 | 100 | 300 |
| Dilution II | 1 : 40 | 12.5 ml to 500 ml | 100 | 25 | 75 |
| Dilution III | 1 : 800 | 2.5 ml to 2,000 ml | 5 | 1.25 | 3.75 |

The calibration standard can be diluted further after the stock solution is diluted:

1. Take a 100 ml graduated flask.
2. Fill the dilution amount specified in the table into the graduated flask.
3. Fill the graduated flask with deionised water up to the 100 ml mark.

*Table 11: Dilution of the Calibration Standards (TOC-Difference Method)*

| TC [mg/l C] | TIC [mg/l C] | Dilution | Amount Dilution | TOC [mg/l C] |
|---|---|---|---|---|
| 360 | 90 | I | 90 ml | 270 |
| 300 | 75 | I | 75 ml | 225 |
| 280 | 70 | I | 70 ml | 210 |
| 200 | 50 | I | 50 ml | 150 |
| 120 | 30 | I | 30 ml | 90 |
| 50 | 12.5 | II | 50 ml | 37.5 |
| 40 | 10 | II | 40 ml | 30 |
| 20 | 5 | II | 20 ml | 15 |
| 10 | 2.5 | II | 10 ml | 7.5 |
| 2 | 0.5 | III | 40 ml | 1.5 |
| 1 | 0.25 | III | 20 ml | 0.75 |
| 0.5 | 0.125 | III | 10 ml | 0.375 |
| 0.2 | 0.05 | III | 4 ml | 0.15 |
| 0.1 | 0.025 | III | 2 ml | 0.075 |

Notice

The calibration standards can be kept in a sealed glass bottle for about one week at a temperature of 4°C.

### 6.1.8 Calibration Standards - TOC-Direct Method / TConly Method

This section explains how you can prepare the calibration standards for the TOC-Direct Method and TConly Method yourself.

First, a stock solution needs to be prepared which can then be diluted to arrive at the calibration standard concentration required.

Notice

To minimise mistakes, LAR always recommends using the stock solution as the initial solution for dilutions.

The stock solution can be used as a calibration standard.

The stock solution dilutions can be used as a calibration standard.

#### 6.1.8.1 Stock Solution - TOC-Direct Method / TConly Method

This section shows how to prepare a stock solution for TOC-Direct Method and TConly Method analogous to DIN EN 1484:1987.

Chemicals required:

- 2.125 g Potassium hydrogen phthalate ($C_8H_5KO_4$) p.a. dried for 2 hours at 105°C

Proceed as follows:

1. Dissolve the weighted sample of each of the three substances in a 1,000 ml graduated flask in 700 ml of deionised water.
2. Fill the 1,000 ml graduated flask up to the mark with deionised water.

The concentration of this stock solution is:

- TOC (Total Organic Carbon) = 1,000 mg/l C

Warning

The stock solution can be kept in a sealed glass bottle for about four weeks at a temperature of 4°C.

Please note that the pipetting accuracy can be negatively impacted when the stock solution is diluted.

### 6.1.8.2 Dilution of the Stock Solution - TOC-Direct Method / TConly Method

Because the analysers work in different working ranges, the following four stock solution dilutions are listed. These dilutions enable calibration standards to be made which have a lower concentration than listed in the table below.

Proceed as follows:

1. Take a 500 ml/1,000 ml graduated flask.
2. Fill the dilution amount specified in the table into the graduated flask.
3. Fill the graduated flask with deionised water up to the 500 ml/1,000 ml mark.

*Table 12: Dilution of the Stock Solution (TOC-Direct Method and TConly Method)*

| | Amount Stock Solution : Dionised Water | Stock Solution to Deionised Water | TOC [mg/l C] Amount |
|---|---|---|---|
| Dilution I | 1 : 2 | 250 ml to 500 ml | 500 |
| Dilution II | 1 : 10 | 50 ml to 500 ml | 100 |
| Dilution III | 1 : 20 | 25 ml to 500 ml | 50 |
| Dilution IV | 1 : 1,000 | 1 ml to 1,000 ml | 1 |

The calibration standard can be diluted further after the stock solution is diluted:

1. Take a 100 ml graduated flask.
1. Fill the dilution amount specified in the table into the graduated flask.
1. Fill the graduated flask with deionised water up to the 100 ml mark.

*Table 13: Dilution of the Calibration Standards (TOC-Direct Method and TConly Method)*

| TOC [mg/l C] | Dilution | Amount Dilution |
|---|---|---|
| 375 | I | 75 ml |
| 250 | I | 50 ml |
| 125 | I | 25 ml |
| 50 | II | 50 ml |
| 40 | II | 40 ml |
| 20 | II | 20 ml |
| 10 | II | 10 ml |
| 5 | II | 5 ml |
| 25 | III | 50 ml |
| 5 | III | 10 ml |
| 2.5 | III | 5 ml |
| 0.5 | III | 1 ml |

Notice

The calibration standards can be kept in a sealed glass bottle for about one week at a temperature of 4°C.

# 7 How to Work With the Analyser

Once all installation and commissioning points have been met, the main switch (1) on the left side of the analyser can be operated by an authorized LAR technician to "ON".

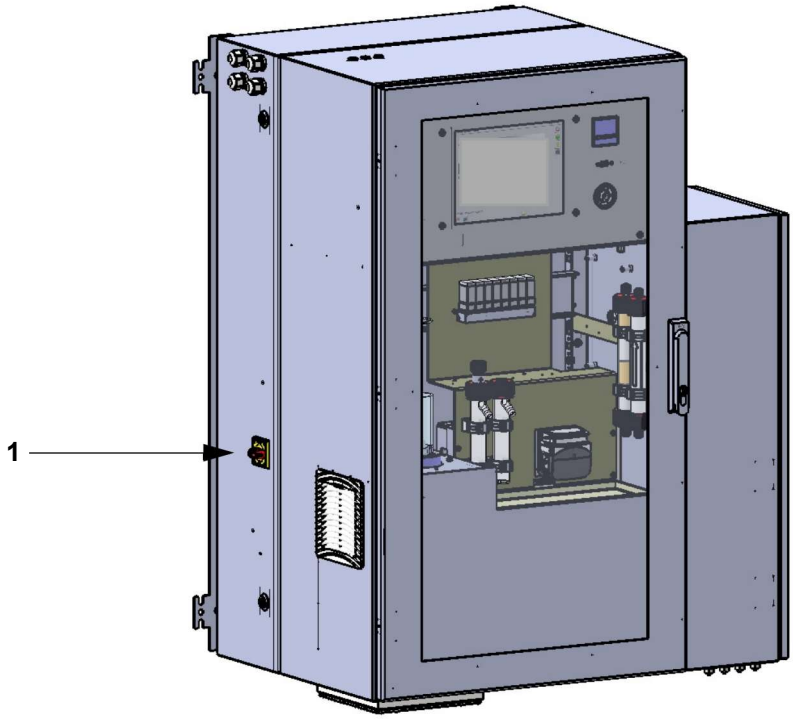



*Fig. 37: Main switch*

After a self-test of the device, the login screen is displayed.
Enter your login details here to log in. To get to user level I for the first time, press the button at the bottom right (1) without entering the password.

By default, the default password is 'lar'. Leave the input field "Operator Log" empty, to reach the Level II

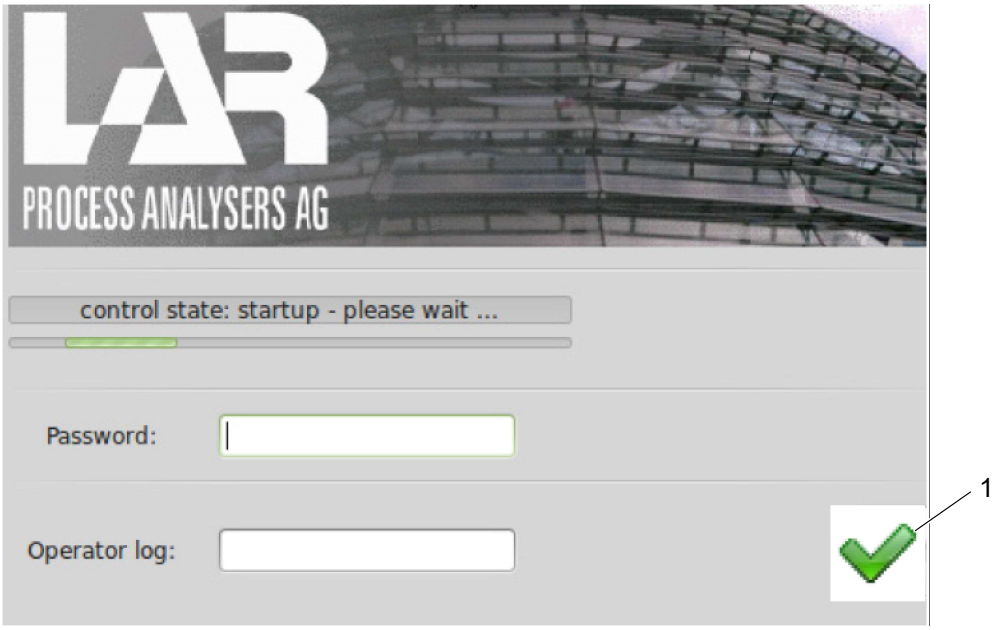



*Fig. 38: Login*

The opening screen with device number and software version is displayed.

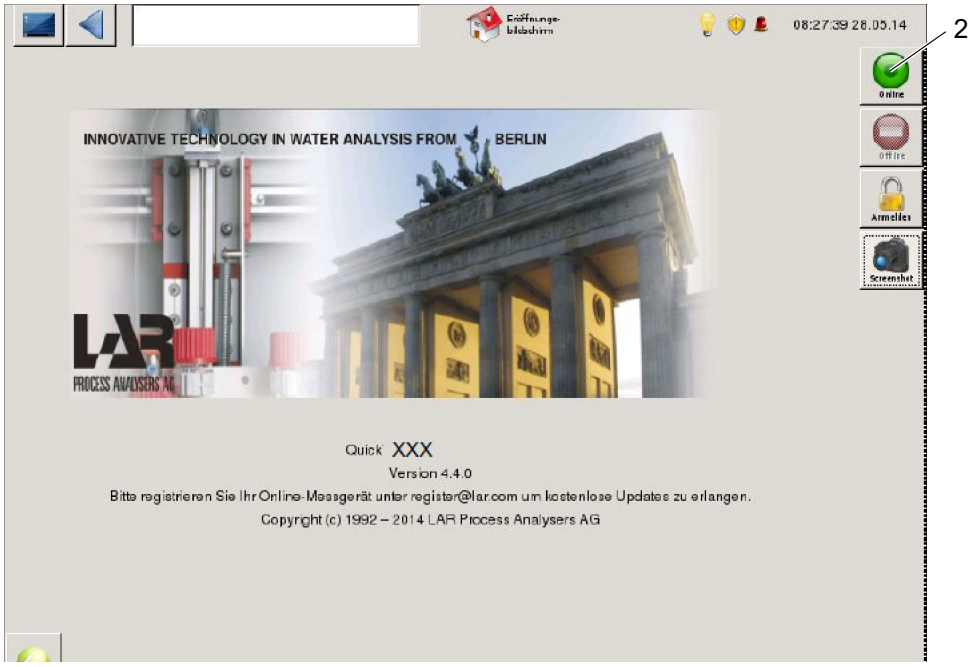



*Fig. 39: Opening screen*

When the analyser is first switched on, the device starts in offline mode. After switching off or after a power failure, the device starts and automatically and enters the last active mode (online or stand-by).

Notice

The analyser can only start a measurement when the furnace has reached the working temperature.

## 7.1 General

The QuickTOC® $_{purity}$ is equipped with a touchscreen. Use your fingers or a stylus to operate the touchscreen

Warning

**Damage to the touchscreen**

The touch screen can be damaged if it is operated with sharp objects. Operating errors and illegibility can be the result.

Use only your fingers or stylus to operate the touchscreen.

### 7.1.1 User Levels

The operating program has three user levels. The user levels control the access rights to the software. The current user level is displayed at the top left of the status bar.

Classification of user levels and access permissions:

- **User level 1**
  The user can view data (such as readings) but can not change anything in the system.

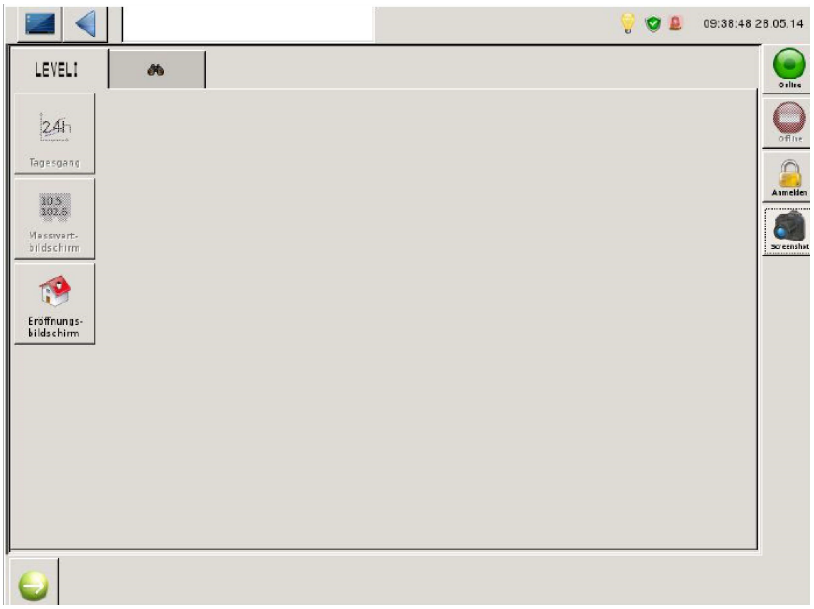



*Fig. 40: Opening screen user level 1*

- **User level 2**
  The user can view data (such as readings) and use functions described in this chapter. For user level 2 an access authorization with password can be set up (Chapter 7.3.1 on page 102).

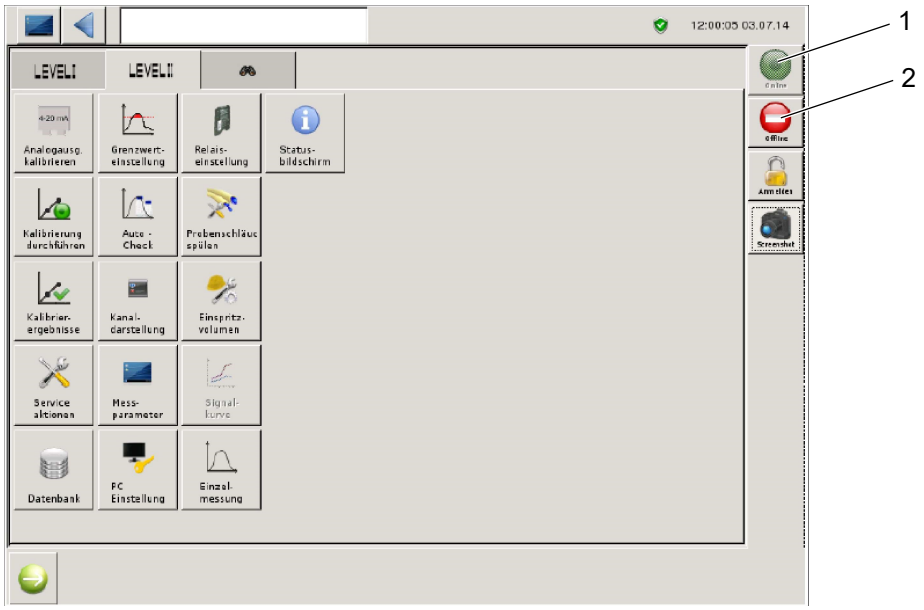



*Fig. 41: Opening screen user level 2*

> **Notice**
>
> In order to use the functions of user level 3 (expert level), you must first undergo training with LAR. If you are interested in this training, contact LAR Technical Support (Chapter 15.1 on page 187).
>
> User level 3 (expert level) can only be activated via an authorized USB stick from LAR.

After pressing the green "Online" button (1), the analyser goes into RUN mode. To cancel a running measurement or another action, press the red "Offline" button (2).

- **User level 3**
  In user level 3 advanced settings can be made. The advanced settings are described in Chapter 7.3.10 on page 104

## 7.2 Configuration

### 7.2.1 Setting the Working Parameters

In user level II, the measurement parameters, calibration, relay settings, operator password, date / time, name and units as well as the channels are set up. To set up the specific requirements, the following steps are necessary. Check the set parameters before starting the measurement.

- Setting up the measuring parameters (Fig. 7.2.2, page 71)
- Definition of the measured value screen (Fig. 7.2.1, page 70)
- Setting the limit values (Fig. 7.2.15, page 94)

Notice

Some values are set up by LAR Technical Support or a LAR-authorised technician. All values depend on the application and must be adapted to it. To change the values of the operating parameters, please contact LAR Technical Support

### 7.2.2 Setting the Measuremement Parameters

The measuring parameters are set up in user level 2. As soon as all measuring parameters have been set up, the measurement can be started by clicking the "Online" button.

The measured values are displayed on:
- Measurement screen at level I (user level 1)
- Status screen (user level 2)
- Database (user level 2, display "Measurement Parameters")

Notice

The unit in the signal screen or during calibration is indicated in FSR. FSR stands for "Full Scale Range". The values are between 0 and 1 FSR (corresponds to 0 to 20 or 4 to 20 mA).

Tthe "Status screen" lists all detectors. LAR has predefined the correct detectors of the device according to the application. If the parameters need to be changed, contact the **LAR technical support** (Chapter 15.1 on page 187).

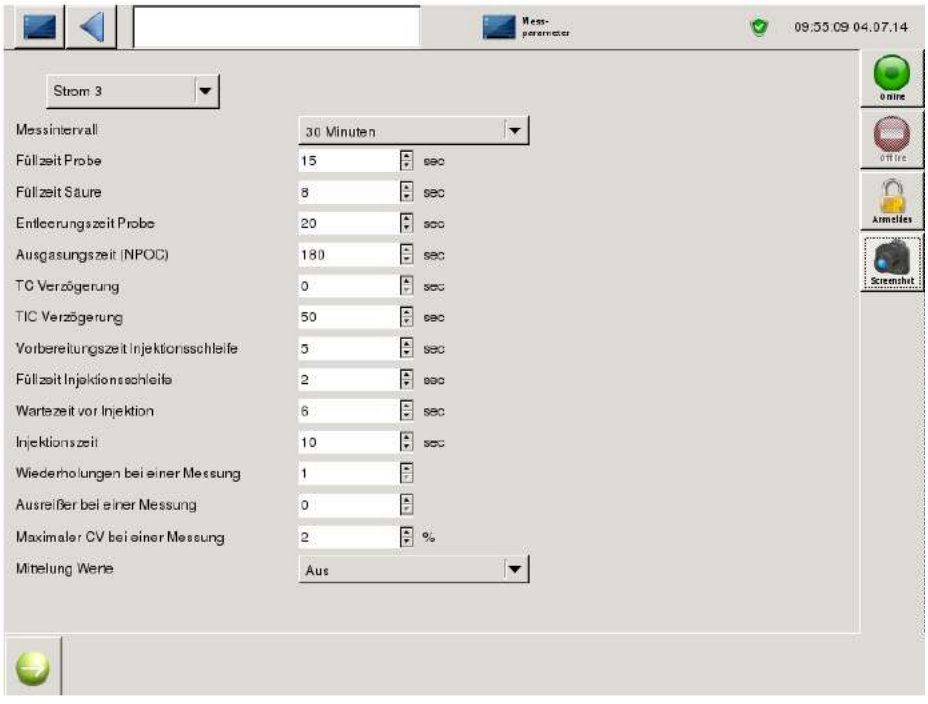



*Fig. 42: Setting the measurement parameters (Example)*

Here, parameters for gas measurement (gas calibration / gas validation) and sample measurement for the respective sample stream can be set.

#### 7.2.2.1 Measuring intervals of the sample streams 1 to 6

Here, the measurement intervals of the measurements per sample stream are selected. If a measurement takes more time than the selected interval, the instrument will automatically select the next higher interval. The following measurement intervals are available:

Possible measuring intervals

| Possible settings | Description |
|---|---|
| 1, 2, 3, 4, 5, 6, 10, 12, 15, 30 minutes | Measurement interval in minutes |
| 1, 2, 4, 6, 8, 12, 24 hours | Measurement interval in hours |
| Fastest testing mode | Shortest measuring frequency |
| Remote | Deviation at the carrier gas outlet |

Notice

Different parameters influence the maximum achievable measuring frequency. If an interval is selected that can not be performed, the unit automatically selects the fastest possible interval.

For further information please contact LAR Technical Support (Chapter 15.1 on page 187).

#### 7.2.2.2 Filling time of the sample

This parameter determines the duration of the filling of the sample storage vessel before the measurement (pumping time). A minimum of 30 seconds must be allowed for filling hoses and sample vessels.

#### 7.2.2.3 Filling time of the acid

This parameter determines the duration of the filling of the acid before the measurement (pumping time).

#### 7.2.2.4 Emptying time sample

Here, the duration of emptying the sample storage vessel can be set. The emptying of the sample storage vessel requires at least 45 seconds.

#### 7.2.2.5 Outgassing time (NPOC)

This parameter is only needed for the TOC direct method. The parameter determines the duration in seconds of stripping the sample in the sample receiver (TIC vessel) to blow out the TIC.

#### 7.2.2.6 TC delay

This parameter determines the waiting time before a TC measurement (sampling).

#### 7.2.2.7 TIC delay

This parameter determines the waiting time before a TIC measurement (sampling).

#### 7.2.2.8 Preparation time of the injection loop

Here you can specify the duration in which the device aspirates part of the sample to guarantee the permanent filling of the tubes. The preparation time of the injection loop is at least 5 seconds.

### 7.2.2.9 Filling time of the injection loop

Here you can specify the duration in which the device fills the injection loop with sample.

### 7.2.2.10 Waiting time of the injection loop

Here you can specify how long the filled injection loop will wait for the sample to be injected into the oven. The waiting time is at least 5 seconds.

### 7.2.2.11 injection time

This option can be used to specify how many individual measurements are to be made per output measured value. The permissible values are between 1 and 10. The default value of this option is 1. Several individual measurements are averaged over a measured value.

Notice

If a user with Level 3 permission on the Measure Parameters screen in User Level 2 modifies the Percentage on Multiple Determination parameter (> 0), users with Level 2 permission can only see this parameter in gray. Further parameters "Repetition during a measurement", "Outliers during a measurement" and "Maximum CV during a measurement" are then only visible in gray and can not be changed (Chapter 13.2.1 from page 172).

### 7.2.2.12 Outliers in a measurement

Using the outlier correction, incorrect measurements can be taken out of the averaging of the individual values. Permissible values are 0 to 2 measured values. For the determination of the outlier, the measured value with the largest standard deviation is chosen as the mean value. If the standard deviation is within the tolerance range of the maximum CV, the measured value of the individual measurements is used for averaging. If this is above the maximum CV, the measured value is treated as an outlier and is ignored when calculating the mean value and the coefficient of variation (CV).

### 7.2.2.13 Maximum CV for a measurement

The maximum CV or coefficient of variation describes the repeatability or reproducibility of several consecutive individual readings taken on the same sample. The maximum CV or coefficient of variation is only effective in combination with the outlier correction. If the outlier correction is activated by entering the numbers 1 or 2, then the maximum CV is taken into account when determining the outlier. The default value is 0, i. there is no consideration. The maximum adjustable value is 10%.

$$CV = \frac{\text{Standard deviation}}{\text{Medium value}} \times 100$$

### 7.2.2.14 Averaging values

Here, the calculation of the average values can be activated. Upon activation, the number (1-5) of values from which the average is formed may be indicated

### 7.2.3 Setting Parameters for Gas Measuremement

The following parameters can be set in user level 2 for a gas measurement (gas calibration / gas validation):

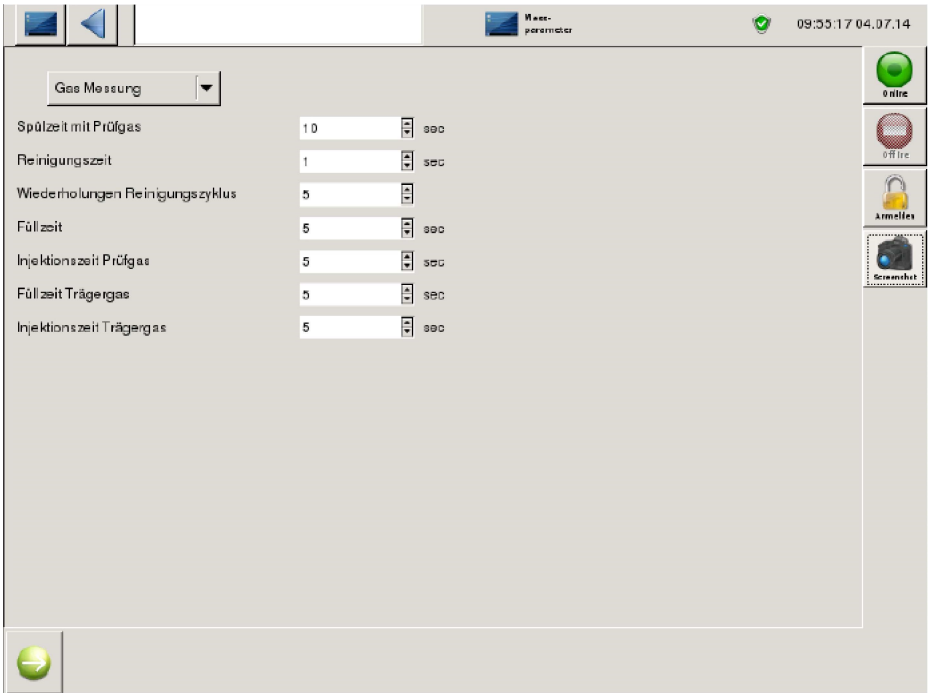



*Fig. 43: "Measurement Parameters" screen, "Gas Measurement" selection (Example)*

#### 7.2.3.1 Purge time test gas

Fill the injection loop with test gas before the gas measurement begins. Minimum 5 seconds are needed.

#### 7.2.3.2 Cleaning time

Duration of cleaning of the injection loop.

#### 7.2.3.3 Repeat the cleaning cycle

The cleaning can be repeated up to 20 times depending on the setting. If the value is set to zero, no cleaning cycle is performed.

#### 7.2.3.4 Filling

Duration of filling the injection loop with test gas during a gas measurement.

#### 7.2.3.5 Injection time test gas

Here you can specify the time in which the device should inject the test gas from the injection loop into the oven.

#### 7.2.3.6 Filling time carrier gas

Duration of filling the injection loop in a gas measurement with carrier gas and performing a zero-point measurement.

#### 7.2.3.7 Injection time carrier gas

Here, the duration can be specified in which the device is to inject the carrier gas from the injection loop into the oven. A zero-point measurement is performed.

### 7.2.4 Calibration

In user level 2 you can start a manual calibration.
Two screens provide calibration information:
- Perform calibration
  - Carry out calibration
  - Display details of the calibration
  - Calibration graph
- Calibration results

A manual calibration should be performed if:
- the analyser is put into operation for the first time
- maintenance was done while the reactor filling was changed
- the reactor or the reactor filling were replaced
- the carrier gas flow was changed
- the injection volume was changed.

Before a calibration can be performed, the necessary calibration solution must be provided and the necessary settings made in the Run Calibration screen. The concentrations and the production of the calibration standards (Chapter 6 from page 59). Depending on the selected measuring method, a mixed standard or a single substance standard is used.
The Calibration Results screen displays the measurement results of the individual calibration points. (Chapter 7.2.4.2 from page 78).
The calibration can be stopped at any time by clicking the "Offline" button


Notice

In a manual calibration, the current carrier gas flow is stored as a setpoint. If the volume flow after calibration has deviated by more than 5% over time, the error message "E1835 Carrier gas flow is low" is displayed.
If this error message occurs, the tightness of the carrier gas flow must be re-established (possibly a leak - leak repair).

#### 7.2.4.1 Perform Calibration


Notice

The alayser will display on the calibration screens as many sample streams as are enabled. Please repeat the steps given for each sample stream.

The calibration can be performed with both a water sample and test gas.
For gas calibration, the test gas must be connected. Test gas can be carbon dioxide and methane c in appropriate concentrations. Unlike calibration with liquid samples, the injection loop for the measurements during gas calibration is filled with test gas and which is then injected into the furnace. When using methane, this is burned in the oven to carbon dioxide. The carbon dioxide is guided by means of carrier gas to the detector and determines the signal surface. The injection parameters for the gas calibration are set in the "Measurement parameters" screen under "Gas measurement".

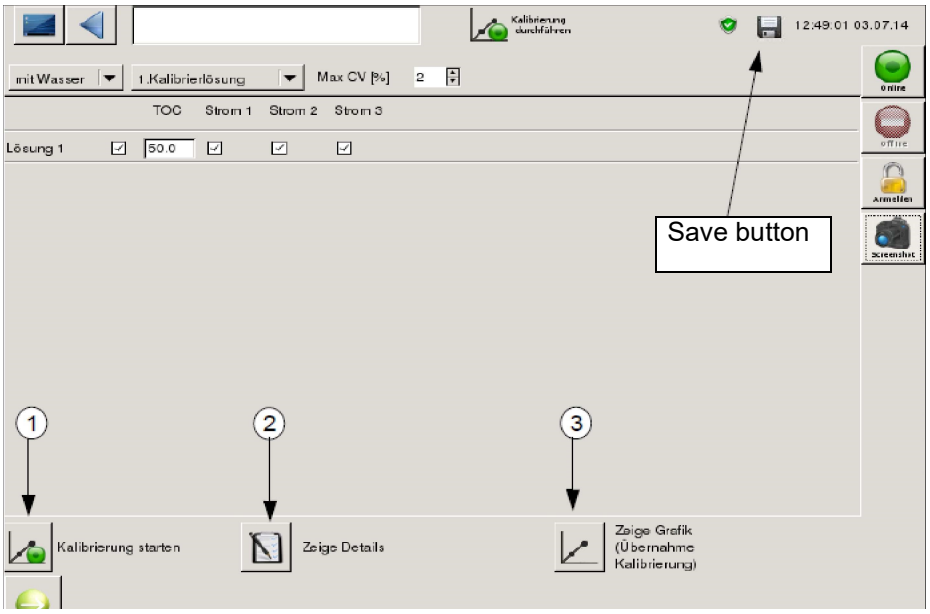



*Fig. 44: Perform Calibration Screen (Example)*

In this screen, a one-point calibration or a multi-point calibration for a stream can be performed. For a multi-point calibration, it must be noted that the calibration solutions can only be measured one after the other.

- **Show details (2)**
  First, a calibration must be performed to enable this button. Click the button to see a more detailed view of the raw values of the solutions, currents, and signals . Outliers are automatically highlighted in yellow and are not included in the calculation.
- **Show graphic (3)**
  First, a calibration must be performed to enable this button. To view the calibration graph (Fig. 57, page 103), the "Show graph" key must be pressed. The current (blue curve) and the new calibration graph (red curve) are shown in this graph. To go back to the start of calibration, press the "Back to Start Calibration" button. •
- **Back to the start of calibration (1)**
  This key returns you to the "Start Calibration" view. This button can only be clicked when it is in the "Show Details" or "Show Graph" view.

#### 7.2.4.1.1 Perform a 1-point calibration for a sample stream

1. Preparation of the calibration solution and positioning of the calibration vessel.
2. In the selection box "Calibration solutions" the number of calibration solutions can be selected. After selecting the number of solution, this quantity will be displayed on the screen.
3. The maximum CV can be entered in% for the calibration.
4. Between solution and stream there are input fields for the concentration of the solution. Enter all ingredients of the solution in the table. To make an entry: Click in the input field. A number pad and keyboard will appear. Please enter the concentration (in ppm).
5. To accept the new calibration concentration, save it with the floppy disk symbol (Fig. 44, page 76).
6. Activate the check box for the sample stream and the solution.
7. Now the calibration can be started with the button "Start calibration".
8. Raw values can be viewed in the next screen using the Show Details button.
9. All check boxes in the "Show Details" screen are enabled for the performed solution and the sample stream. Outliers are detected by the software and highlighted in yellow. These outliers are not included in the calculation.
10. Thereafter, the new calibration graph can be viewed in the "Display Graph" screen with the

previous graph.

11. In the Calibration Results screen, the calibration results (slope and intercept) can be viewed and activated.

#### 7.2.4.1.2 Perform a multipoint calibration (three solutions) for a sample stream

1. Preparation of the calibration solutions and positioning of the first calibration vessel.
2. In the selection box "Calibration solutions" the number of calibration solutions can be selected.
3. After selecting the number of solutions, this amount will be displayed on the screen. The maximum CV can be entered in% for the calibration.
4. Between solution and power there are input fields for the concentration of the solution. Enter all ingredients of the solutions in the table: Double-click in the input field. A number pad and keyboard will appear. Please enter the concentration (ppm).
5. To accept the new calibration concentration, save it with the floppy disk symbol (Fig. 44, page 76).
6. Select the check box for the sample stream and all solutions. Now the calibration can be started with the button "Start calibration".
7. After passing through the first solution (5 measurements), a message appears (Fig. 54, page 101). Here, the green arrow must be pressed when the next calibration solution has been placed to measure the next solution. This stop message will be displayed twice until all three solutions have been measured.
8. After passing through the three calibration solutions, the raw values can be viewed in the next screen with the "Show Details" button. All check boxes in the "Show Details" screen are enabled for the solutions and the power being performed. Outliers are detected by the software and marked in yellow. These outliers are not included in the calculation.
9. Afterwards, the new calibration graph can be viewed in the "Show graph" screen with the previous graph.
10. In the screen "Calibration results", the calibration results (slope and intercept) can be viewed (see chapter 7.2.4.1 from page 99) and activated.

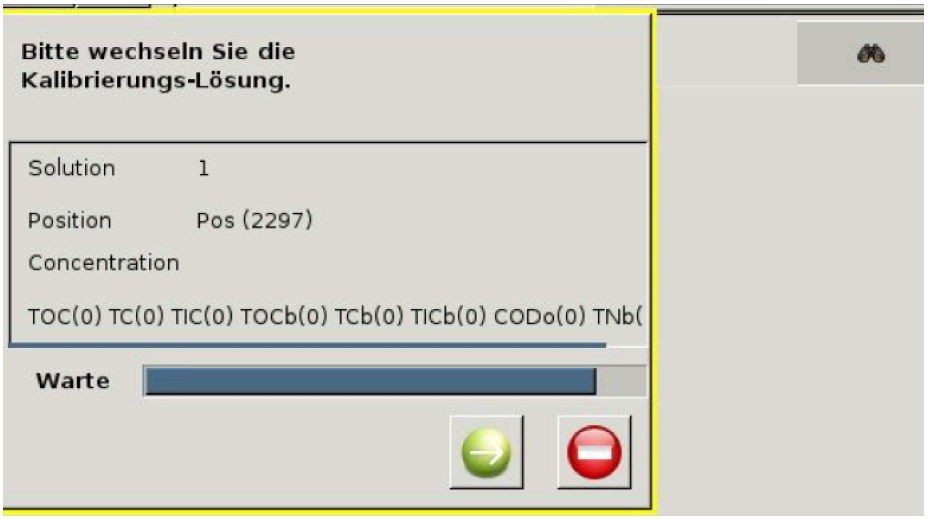



*Fig. 45: Stop message for further calibration solutions (Example)*

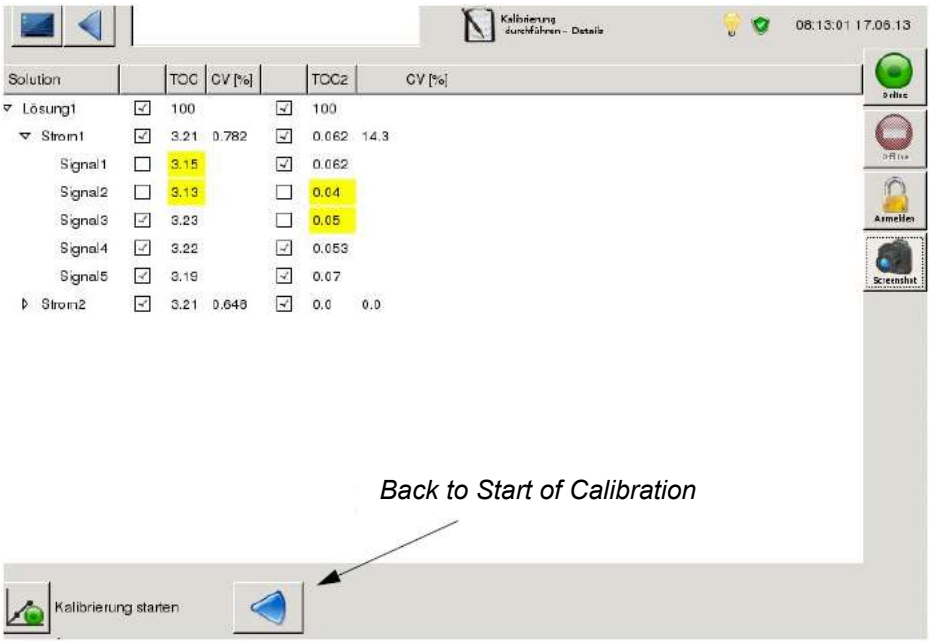



*Fig. 46: Calibrate Screen - Show Details (Example)*

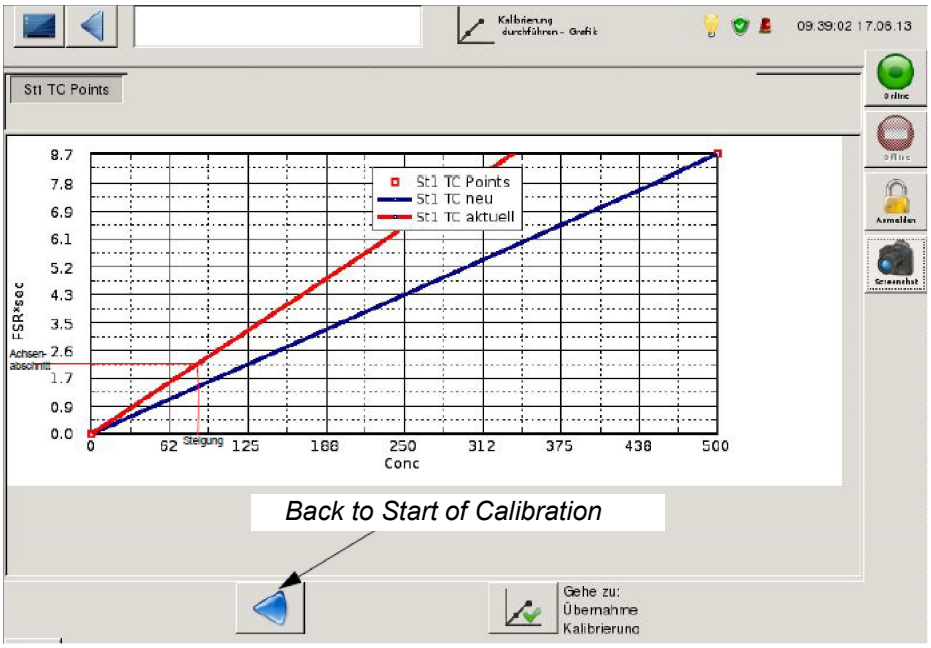



*Fig. 47: Calibrate Screen - Calibration Graph (Example)*

### 7.2.4.2 Calibration Results

After a successful calibration (Chapter 7.2.4.1 from page 75), the results are displayed on the "Calibration Results" screen (Fig. 48, page 79). To the right, the values of the previous calibration are displayed. Please activate the calibration via the button "Activate the calibration results". The result is saved. Furthermore, this screen displays the "carrier current setpoint".

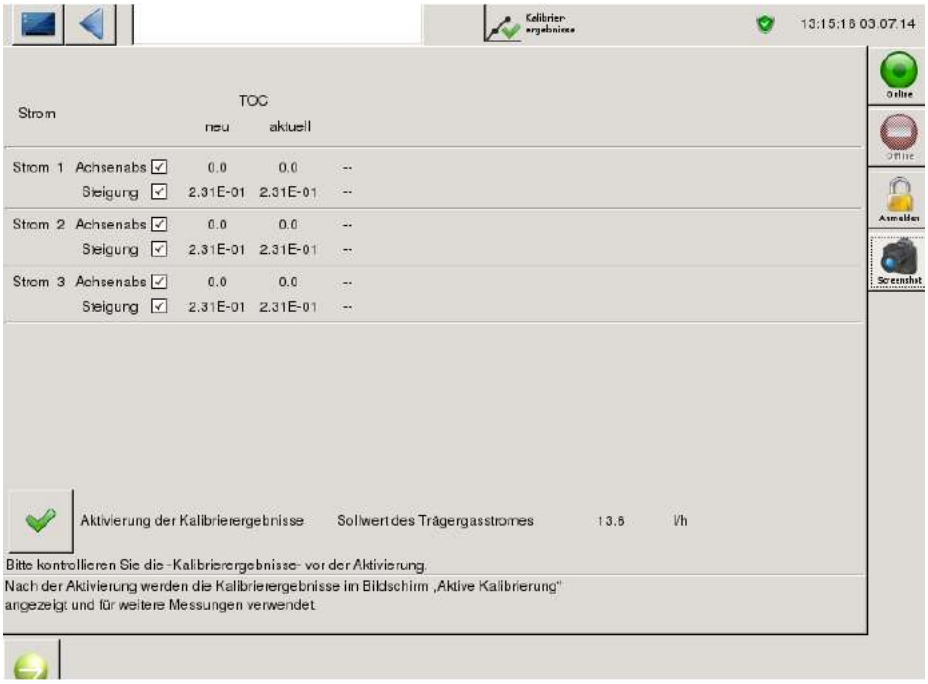



*Fig. 48: Screen with Calibration results*

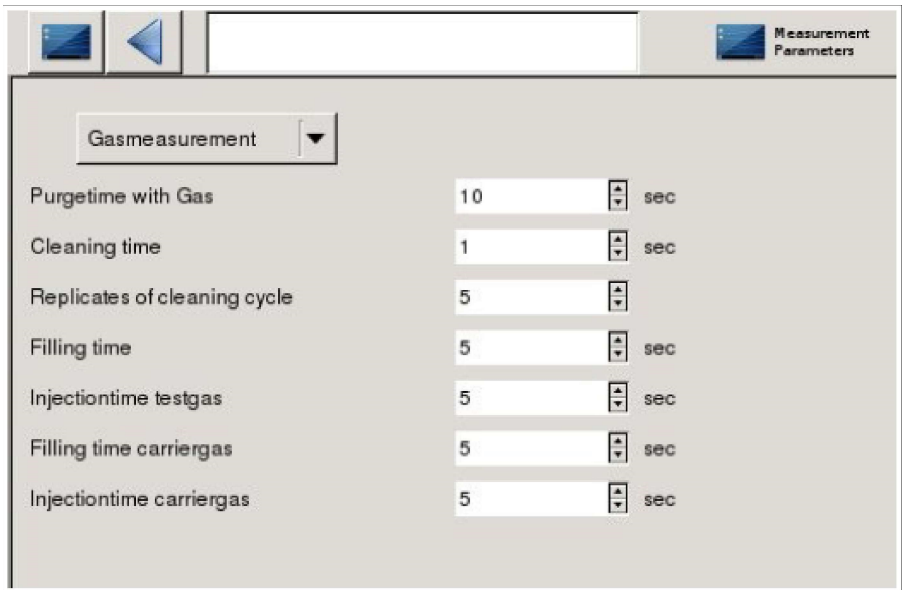
### 7.2.4.3 Perform a Gas Calibration

1. Check the stability of the carrier gas flow in the status screen.
2. Make sure that the injection system including the injection loop has been cleaned with calibration gas beforehand.
3. Select the calibration gas concentration depending on the measuring range of the NDIR detector:

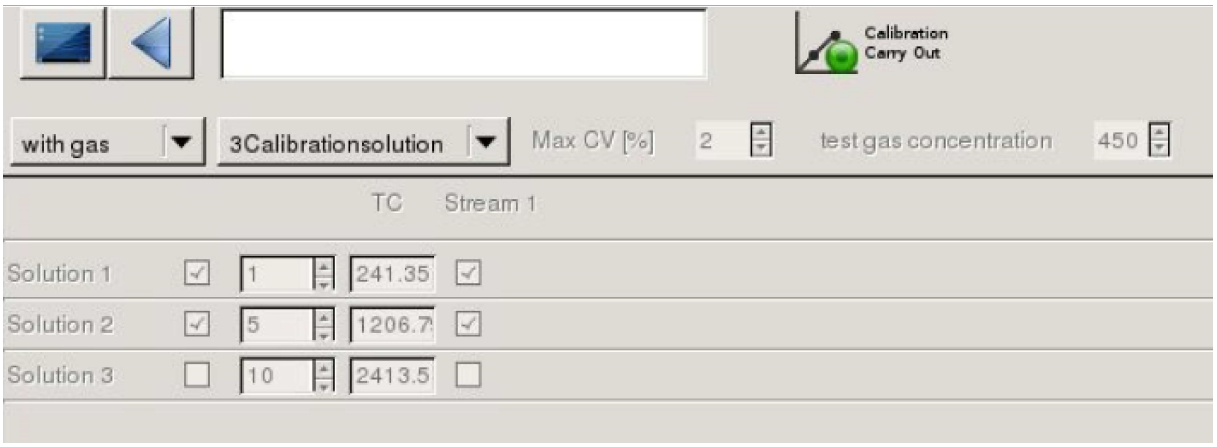
*Table 14: Gas Calibration*

| NDIR [CO2] | Calibration Gas |
|---|---|
| 50 ppm | 450 ppm |
| 150 ppm | |
| 500 ppm | 1500 ppm |

4. Open the main valve on the calibration gas bottle and set the secondary pressure between 0.5 and 1 bar. The internal pressure regulator (KH8) of the analyser is set to 0.2 bar. In the status screen (user level II) the system pressure is shown at approx. 200 mbar.
5. Enter the following values in user level II on the "Measurement parameters" screen:




6. In user level II go to the "Perform calibration" screen on the selection menu and select "Gas calibration".
7. Enter the values for the gas calibration in ppm in the field on the far right.




8. Select the calibration points (at least three calibration points) and the number of injections for each calibration point.The different concentration results depend on the number of loop injections. The software automatically calculates the concentration for each calibration point in ppb.
9. Start the calibration in user level II - "Perform calibration". The analyzer automatically executes all selected from calibration points.

### 7.2.5 Injection Volume

In user level 2, the injection volumes injected into the furnace during the measurement can be determined:

- TC for each existing stream


*Fig. 49: Injection volume screen (three sample streams, example)*

When changing the amount of injections for each stream (2) (especially for multiple injection), the injection amount (3) is increased or decreased.

#### 7.2.5.1 Volume of the Injection Loop

Here you can view the volume of the injection loop.

> Notice
>
> For the measuring methods TConly or TOC Difference, the injection volume should be at least 800 µl (1200 µl), otherwise condensate will be formed in the reactor bottom and CO2 will be absorbed. This can lead to minor findings.

#### 7.2.5.2 TC for each sample stream

Here you can determine how much liquid is injected into the furnace during a TC measurement. In the field next to it, the resulting injection volume is displayed.

### 7.2.6 Relay Settings

The analyser is equipped with eight relays. The function of the relays can be set individually by selecting the "Relay setting" screen.

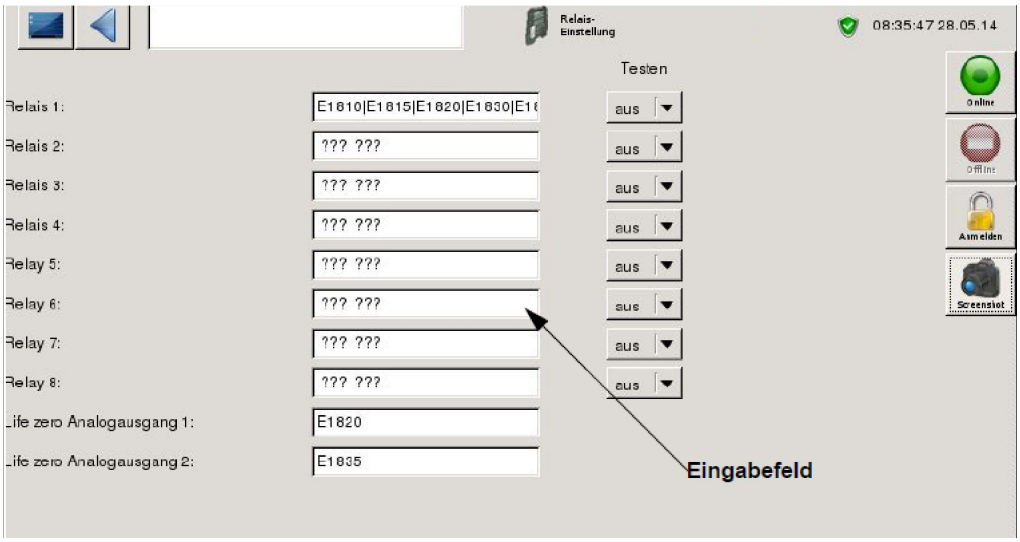



*Fig. 50: Relay settings screen (Example)*

> Notice
>
> As a default value, relay 1 is assigned as a group error for important fault messages.

To enter the desired values in the input fields, use the keyboard and number field.

1. Click in the input field. The keyboard is displayed at the bottom of the screen. If this is not the case, press the keyboard button on the bottom right of the screen.
2. Please enter the appropriate "limits or errors".
3. Save your changes (Chapter 7.3.9 on page 103).

#### 7.2.6.1 Programming Tools

- !-Operator

The! Operator is used to invert a condition (! L1 means that the condition is met if the set limit no. 1 has NOT been exceeded).
- &-Operator
  The & operator is used as a multi-condition AND connection (E1835 & E1810 & E2024 means that the analog output drops to 0 mA only if all three error messages occur simultaneously).
- | operator
  The | operator is used as an OR connection multiple condition (E1810 | E1844 | E2024 means that the analog output falls to 0 mA when one of the error messages occurs).

Examples:
- Collective alarm: The corresponding relay is programmed as follows: E1810 | E1844 | E1835 If the relay is to act as a normally closed contact, then the following must be entered:! (E1810 | E1844 | E1835 | E2024) ? Please observe the round brackets!
- Measurement finished: The corresponding relay is programmed as follows:! M1. This means that the relay is closed when the activity "Measure channel" is finished. The contact remains closed until the next measurement begins.

#### 7.2.6.2 Testing the Relays

Check the relays with a multimeter (to be carried out only by authorized personnel as the rear housing must be opened) or check the programming of the relays at the control center.

Check the relays with a multimeter (which can emit a sound):
1. Open the rear housing
2. Connect the multimeter to the relay (Fig. 19, page 31). First set the continuity test on the multimeter.
3. Activate the selection window for the multi-meter connection in the "Relay setting" view (Example the multimeter is connected in relay No. 2, so the relay 2 selection box in the "Relay setting" screen must be set to "ON")
4. A sound will sound (only if the multimeter can output a sound!)
5. If there is no sound, check the multi-meter. If the multi-meter is in order, please contact the technical support of LAR AG (*Chapter 15.1 on page 187*).
6. After checking the relays, close the housing again.

Check your programming of the relays in the control center:
1. If the relay is programmed and connected to the control center, this can be checked with the control center.
2. Confirm the corresponding relay with the selection box.
3. In the control center the error message is now displayed.
4. If no error message is displayed, it is usually due to a wiring error. Please contact the technical support of LAR AG (*Chapter 15.1 on page 187*).

### 7.2.7 PC Settings

There are the following settings options:
- Change password
- Change date / time
- View software version
- Calibrate the touch screen


*Fig. 51: PC settings screen*

Change password
For user level II, a password can be set up. If the password is deactivated, you need the USB key with the access permissions.

Factory default password: lar

To change the default password, proceed as follows:

1. Click in the input field to open the keyboard.
2. Enter a new password. Pay attention to uppercase and lowercase letters
3. Save by pressing the "Disk" button.

Set date/time
Date and time are displayed in all views in the upper right corner of the screen. To change to winter / summer time or to synchronize with other measuring devices, the current date and time can be reset in the "PC settings" view. Under the input field the input format is displayed.

Proceed as follows to set date/time:

1. Click in the input field to open the keyboard.
2. Enter the date and time in the format Year-Month-Day Hours: Minutes: Seconds.
   Example: **2012-08-28 13:51:32**
3. Save by pressing the "Disk" button.
4. Start a new measurement.

Versions number

Version number, patch and compile date are displayed automaticallyt

Calibrate Touchscreen

1. Calibrate the touchscreen if the display of the screen is too small or too large, e.g. if the touchscreen is not working properly.
2. Press the "Calibrate Touchscreen" button.
3. The calibration screen is displayed on the screen.
4. Press each calibration point by holding it for one second. Start with the calibration point at the bottom left.

**5.** After pressing all nine calibration points, the view returns to the PC Settings screen.

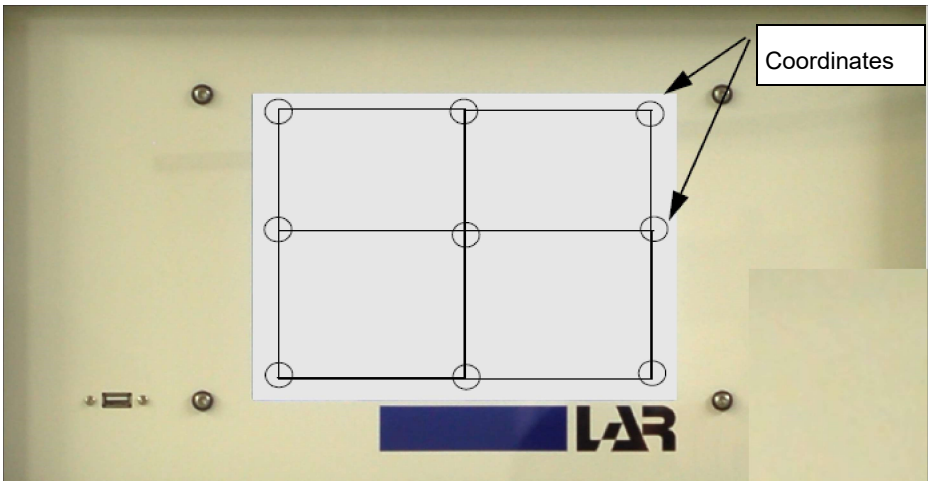



*Fig. 52: Calibrate touchscreen*

### 7.2.8 Channel Display

In the "Channel display" view, the measured value displays can be defined. A channel is defined by sample flow, sensor, function, parameters and channel parameters. These settings are factory-set and can be viewed in user level 3 under the "Names and Units" screen (Chapter 7.3.14 from page 113). The first 8 measured values (channel display) can be viewed in the measured value screen. The settings of the channel display are set with the requirements of the device. If the channel display has to be changed, the processing can be done by means of the corresponding selection boxes..

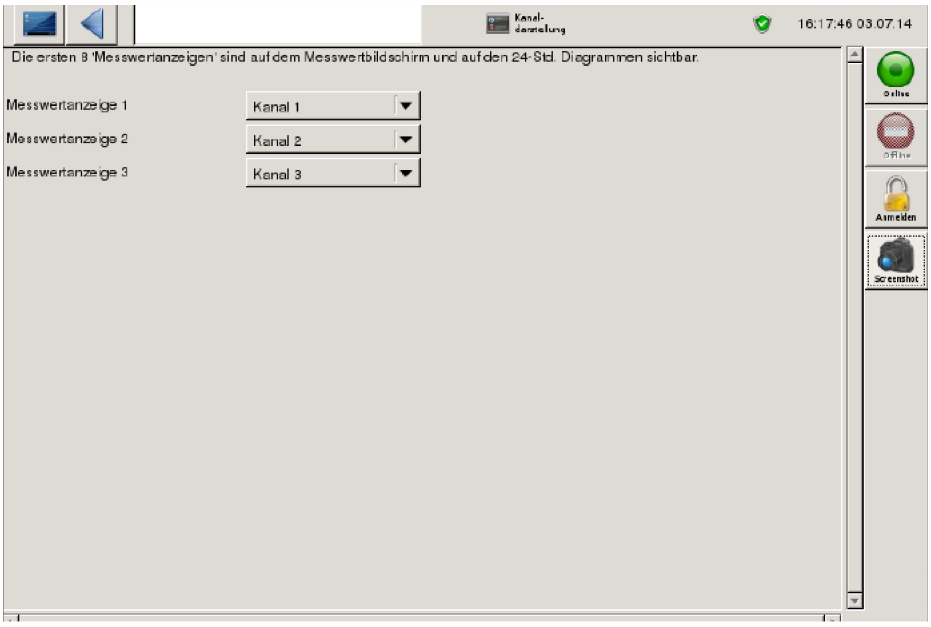



*Fig. 53: Channel display (Example)*

### 7.2.9 Measured Values Screen

The measured value screen displays the current measured values and the time they were measured. To change the settings, please contact LAR technical support *(Chapter 15.1 on page 187)*.

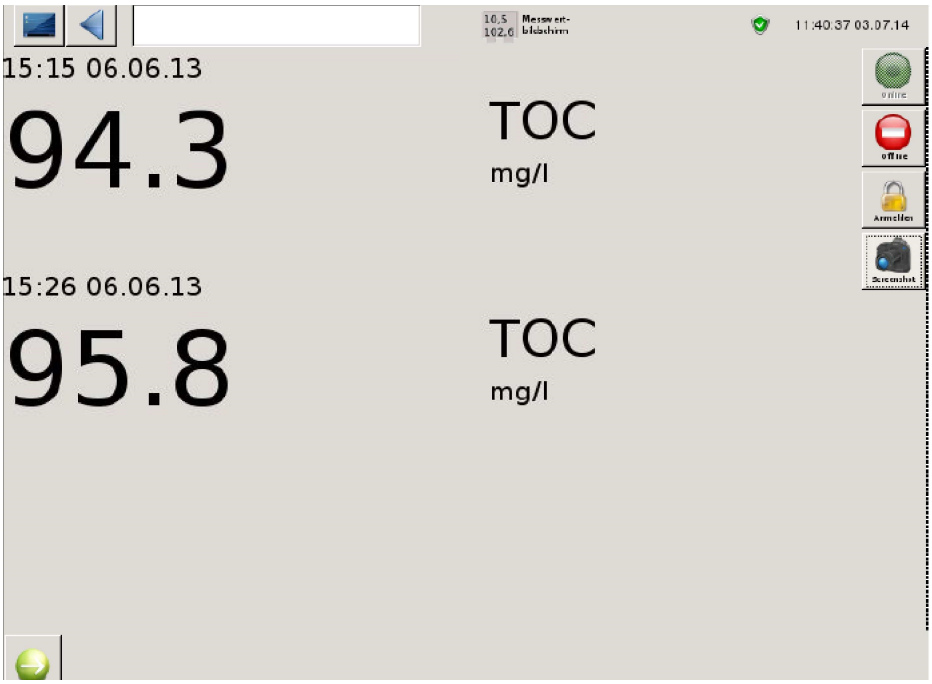



*Fig. 54: Measured values screen (Example)*

### 7.2.10 Signal Curve

To view the measurement curve, go to the "Signal Curve" view in Level II. If the analyser has more than one sensor, the detector can be selected on the upper left side of the screen.

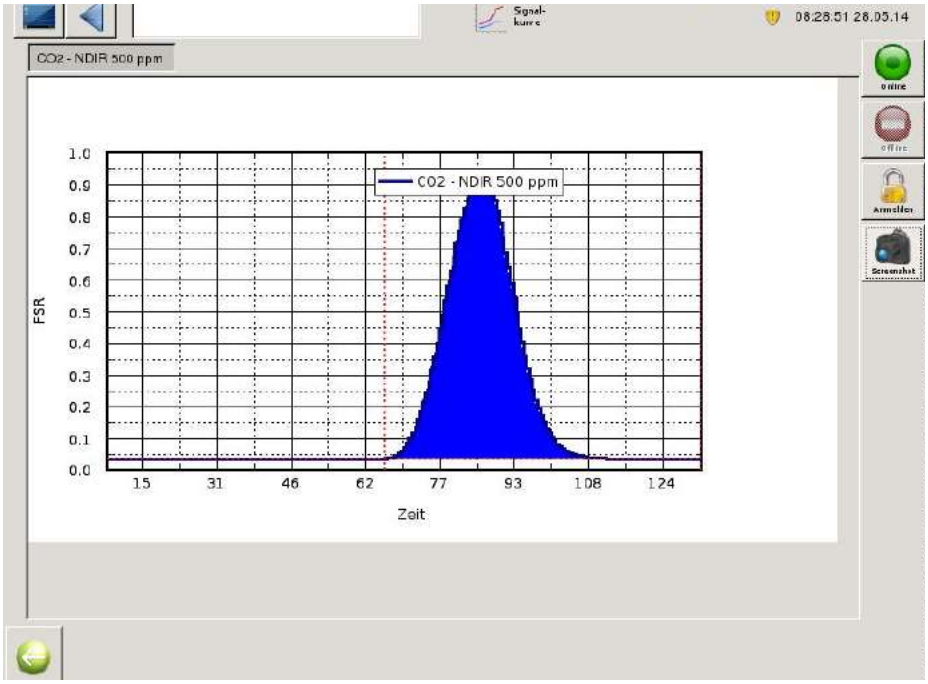



*Fig. 55: Signal Curve (Example)*

### 7.2.11 Status Screen

In this two-part screen, the right-hand window provides an overview of the current status of the device. In the left-hand window, the previous values can be viewed.
If further sample streams are installed in the analyser, the measured values of all existing sample streams can be displayed here.
To view the measured values of another sample stream, press the "Current" button. Next to these selection windows, the time of the next measurement is displayed for each sample stream. Column 1 shows the time [hh: min: sec] of the measurement. Column 2 shows the measured values. Other columns show more parameters (e.g., TNb, COD, etc.).

The following parameters are displayed in the top right-hand window:

- Oven status (on / off)
- Gas cooler status (on / off)
- Carrier gas flow input / output (actual / target)
- Humidity (actual / target)
- Gas pressure (actual / target)
- Status signals (error messages (errors), limit values (limit) and measuring status of the analyser (Controlstate)

The lower right screen shows the following values of the sensor:

- Selection of the sensor
  If several sensors are installed in the analyser, the corresponding sensor must be selected in the selection window.
- Zero signal

The zero signal of the detector is measured during an adjustable period of time before the start of the measurement. Upon detection of the zero or zero signal, the measurement begins when the difference between the current signal and the zero signal is greater than the value of the start integration. In general, the integration of a peak is the most relevant part of any measurement, as it directly affects the measurement results. In standby mode, the integration value of the last measurement is displayed until a new measurement starts. The integration is measured as FRS * s (full scale range of the detector * seconds).

- Integration
  Peak area after the measurement.
- Integration TIC
  Peak area of the TIC after the measurement. This value is only relevant for the TIC measurement.
- Current signal
  This value corresponds to the current signal during a measurement. This value can be used to control the basic contamination of the carrier gas when no measurement is taken.

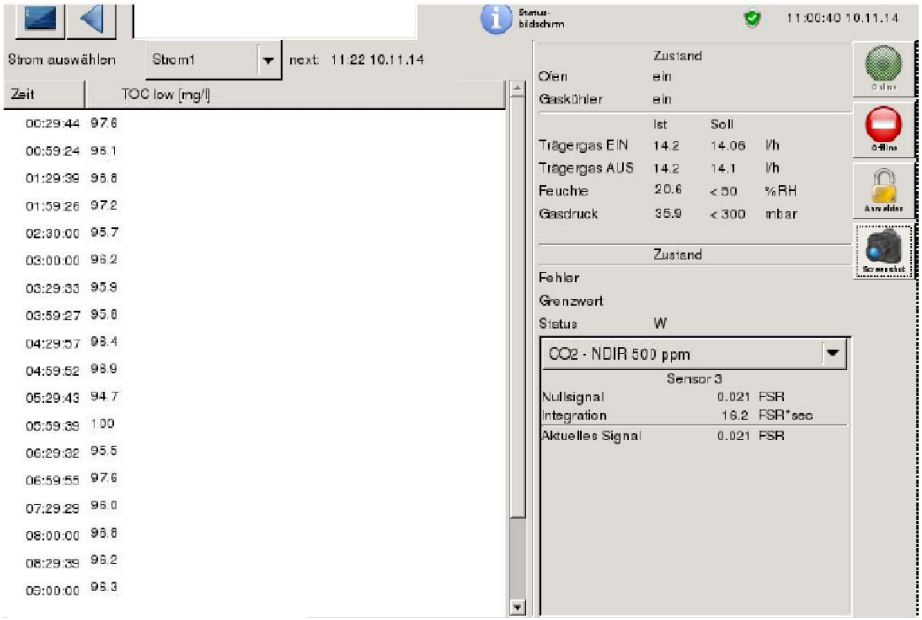



*Fig. 56: Status screen (Example)*

## 7.2.12 Service Actions

The following actions can be selected in the "Service Actions" view:

- Rinse sample tubes (with indication of rinse time)
- Oven on / off
- Condensate pump on / off

If a measurement or calibration is performed, none of these actions can be activated; First, the action currently being performed (for example, measurement) must be completed via the "Offline" button.

.

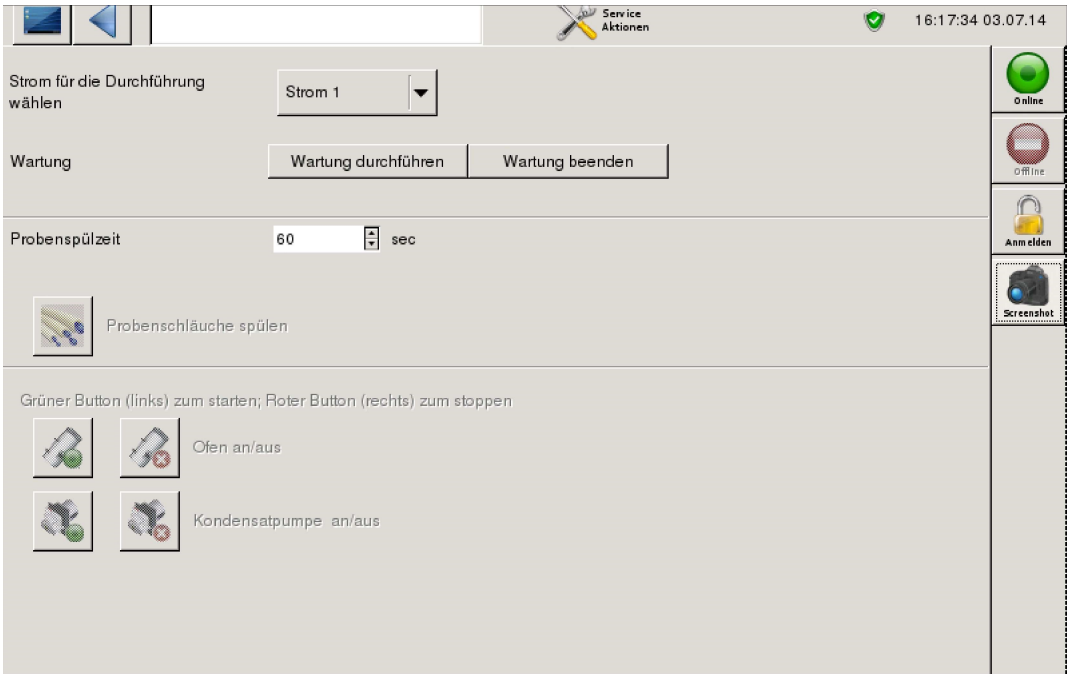



*Fig. 57: Service actions*

| | |
|---|---|
| Notice | The sample pumps must not be in continuous operation, as otherwise warranty claims for the pumps may go out.<br>If a new measurement, calibration or individual measurement is to be carried out again after a care or maintenance operation by pressing the "Perform maintenance" button, the "End maintenance" button must first be pressed. |

To activate the "Service Actions" screen:

1. End the measuring process or the current action with the "Offline" button.
2. Press the "Carry out maintenance" button

To disable the "Service Actions" screen:

1. Click on the button "End maintenance"
2. Start a new measurement or calibration.

### 7.2.12.1 Select sample flow for flushing the sample tubes

Select in this screen the sample flow for which the rinsing of the sample tubes is to be carried out.

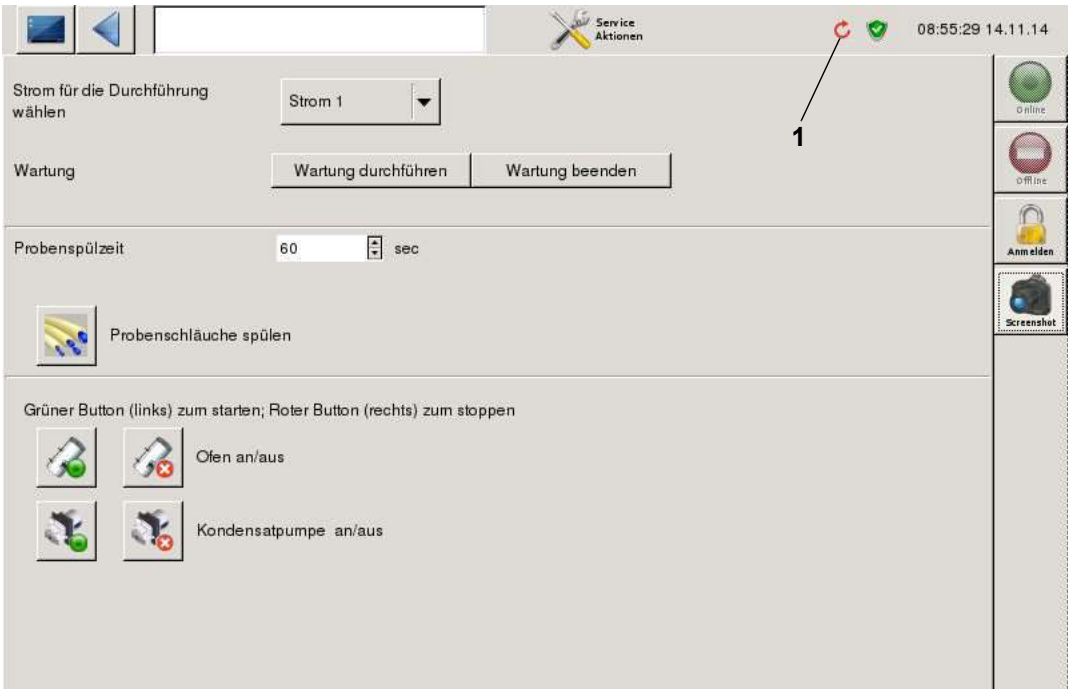



*Fig. 58: Service actions - „Perform maintenance“*

The icon (**1**) in the status bar on the right symbolizes that the "Perform maintenance" button has been pressed.

### 7.2.12.2 Maintenance

Pressing the „End Maintenance“ button greys and disables all of the service action buttons on the Online Action Services screen. The Perform Maintenance button activates the maintenance or maintenance buttons.

### 7.2.12.3 Rinse Sample Tubes

To prepare the measuring process, the sample tubes can be filled with the sample. The sample purging time is entered in seconds.

1. Select sample current (Fig. 58, page 90) via the "Select current for the execution" button.
2. Enter the sample rinsing time and save it via the "floppy disk symbol"
3. Press the "Carry out maintenance" button.
4. Press the button "Rinse sample tubes".
5. After completing the rinsing for the sample tubes, the button "End maintenance" must be pressed. Only then a measurement can be started.

### 7.2.12.4 Switching the Furnace On and Off

1. Press the "Perform maintenance" button Press
2. Press the "Furnace off" button. To switch the stove back on, activate the "Furnace on" button. After switching on the furnace, press the "End maintenance" button. Only then can a measurement be started.

Notice

The heating time of the oven is about 120 minutes (2 hours). This corresponds to a heating rate of 10° C / min. This time is fixed and not changeable.

### 7.2.12.5 Switching the Condensate Pump On and Off

1. Press the "End maintenance" button.
2. Press the "Condensate pump off" button / "Condensate pump on" button to switch the condensate pump on or off. When all maintenance has been completed, the "End maintenance" button must be pressed. Only then can a measurement be started.

## 7.2.13 Single Measurement

With the single measurement single calibrations or samples can be measured. The single measurement can be used to check calibrations.

Notice

The measured values of the single measurement are not saved in the database and in the "Status screen" and are not transmitted to the analog outputs.

The measured values are only displayed in the "Single measurement" screen.

During the online measurement, the buttons "Select stream" and "Start single measurement" are deactivated. A single measurement can only be performed in an offline mode.

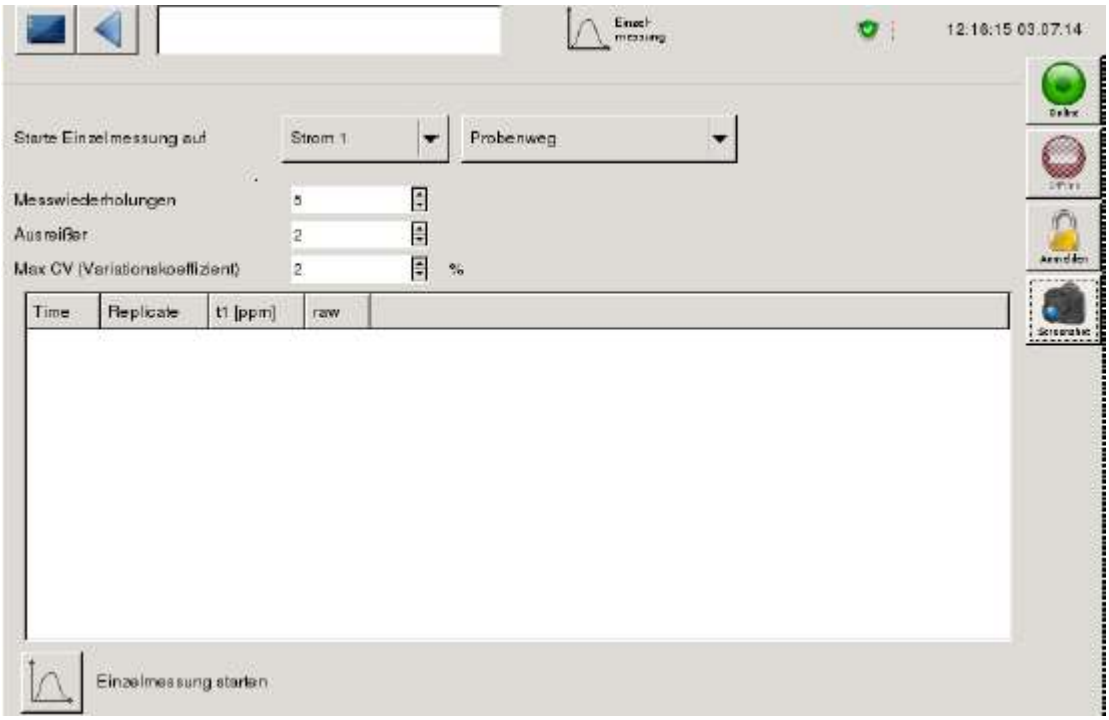



*Fig. 59: Single measurement screen*

The current, the calibration path / sample path and the three parameters (repeat measurement, outlier

and CV) can be adjusted before a single measurement. Once the three parameters (repeated measurements, outliers, max.CV) have been set and saved with the disk symbol, the single measurement can be started via the "Start single measurement" button. The table displays the repetitions, results and the CV of the measurement. The outliers are automatically highlighted in yellow and not included in the calculation.

Proceed as follows to set parameters:

- Repetition during a measurement
  This option can be used to specify how many individual measurements are to be made per output measured value. The permissible values are between 1 and 10. The default value of this option is 1. Several individual measurements are averaged over a measured value.

- Outliers in a measurement
  Using the outlier correction, incorrect measurements can be taken out of the averaging of the individual values. Permissible values are 0 to 2 measured values. For the determination of the outlier, the measured value with the largest standard deviation is chosen as the mean value. If the standard deviation lies in the tolerance range of the maximum CV, the measured value of the individual measurements is used for averaging. If this is above the maximum CV, the measured value is treated as an outlier and is ignored when calculating the mean value and the coefficient of variation (CV).

- Maximum CV in one measurement
  The maximum CV or coefficient of variation describes the repeatability or reproducibility of several consecutive individual measurements taken on the same sample. The maximum CV or coefficient of variation is only effective in combination with the outlier correction. If the outlier correction is activated by entering the numbers 1 or 2, then the maximum CV is taken into account when determining the outlier. The default value is 0, i. there is no consideration. The maximum adjustable value is 10%.

$$CV = \frac{\text{Standard deviation}}{\text{Average}} \times 100$$

### 7.2.14 Auto Check

This screen offers you the following functions:

- Auto Calibration: Automatic calibration with calibration standards
- Auto-Check: Automatic check with calibration standards

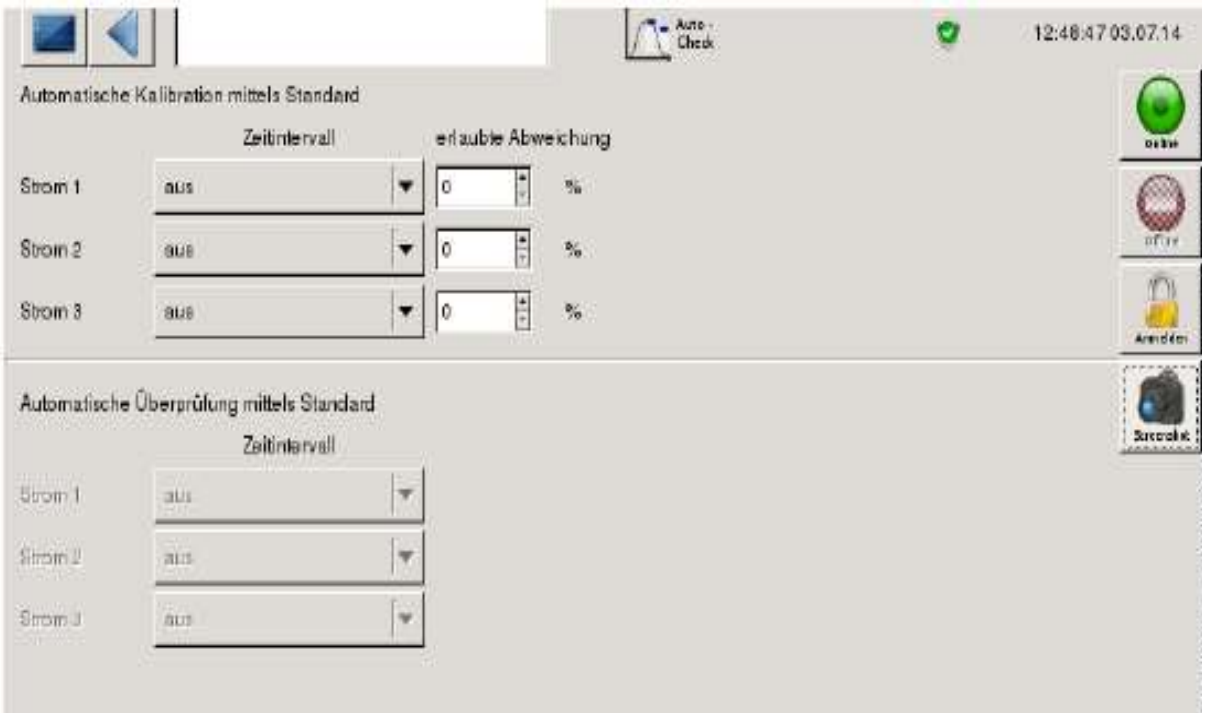



*Fig. 60: „Auto Check“ screen (Example for 3 sample streams)*

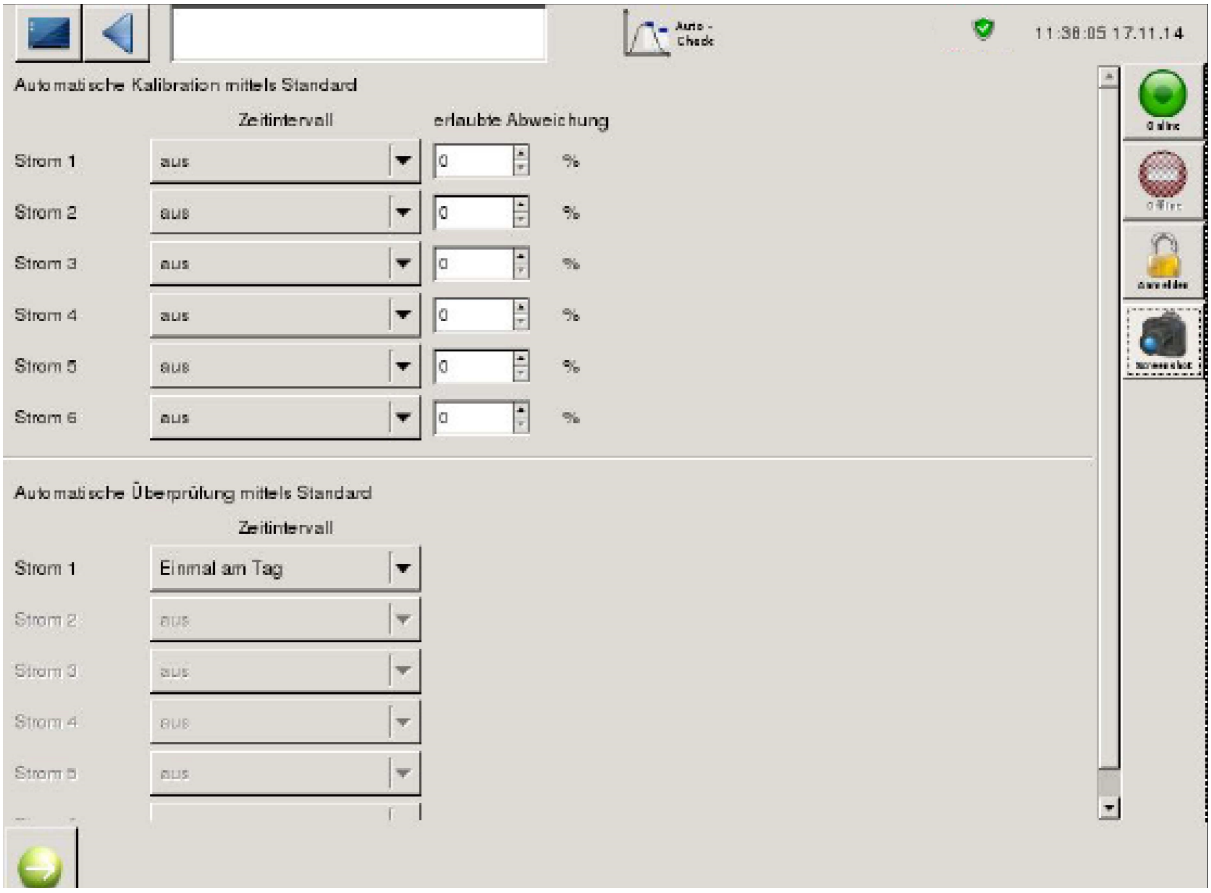



*Fig. 61: „Auto Check“ screen - Activation of one sample stream (Example)*

### 7.2.14.1 Auto Calibration: Automatic Calibration with Calibration Standards

This feature allows automatic calibration of the instrument, where each sample stream can be selected and eight different time intervals are available.
In the input field "Deviation", the percentage deviation of the new calibration must be entered.
The integration range of the automatic calibration is compared with the last manual calibration. If the deviation of the automatic and the manual calibration is within a defined percentage, the values of the automatic calibration are taken over as a new calibration. If the deviation is too large, the calibration is discarded.

Notice

Before a calibration or measurement can be started, the status must be checked and a visual check made on the meter. Otherwise, the Danger insists that an incorrect calibration or measurement occurs.

If an automatic calibration is set, please make sure that there is enough fresh calibration standard available.

Click the "Online" button to start an automatic calibration.

*Tabelle 15: Possible calibration intervals*

| Adjustment | Calibration on |
|---|---|
| NONE | No calibration |
| 1 day | after 24 hours |
| 2 days | after 48 hours |
| 3 days | after 72 hours |
| 4 days | after 96 hours |
| 5 days | after 120 hours |
| 6 days | after 144 hours |
| 7 days | after one week |

1. Activate time interval per sample stream (selection window).
2. Set deviation in percent per sample stream.
3. Start online measurement with the green button.
4. Auto-calibration starts after the selected time.

### 7.2.14.2 Autocheck - Automitic checking with Calibration Standards

This screen can be used to determine if the device should perform autochecks. For this, there must be a channel that is in an online measurement and another that performs the control measurement. In order to perform the "Check" function, please contact the technical support of the LAR (*Kapitel 15.1 ab Seite 187*), as this function must be enabled.
In this screen can be determined how often measured. Thus, the device itself checks in the interval you specify whether it still works correctly.

## 7.2.15 Setting Limits

A maximum of 41 limit values can be set. The parameters to be set are:
- the channel
- the minimum value of the measured value (lower limit)
- the maximum value of the measured value (upper limit)
- the name of the limit (name)

The first three points are necessary. The name is not binding and is for documentation purposes. Select

the channel by pressing the corresponding selection button. To enter the minimum or maximum limit and name, click in the white input field under "Minimum / Maximum". A number field and a keyboard are displayed. Please enter the desired value and save the change with the "disk" symbol.

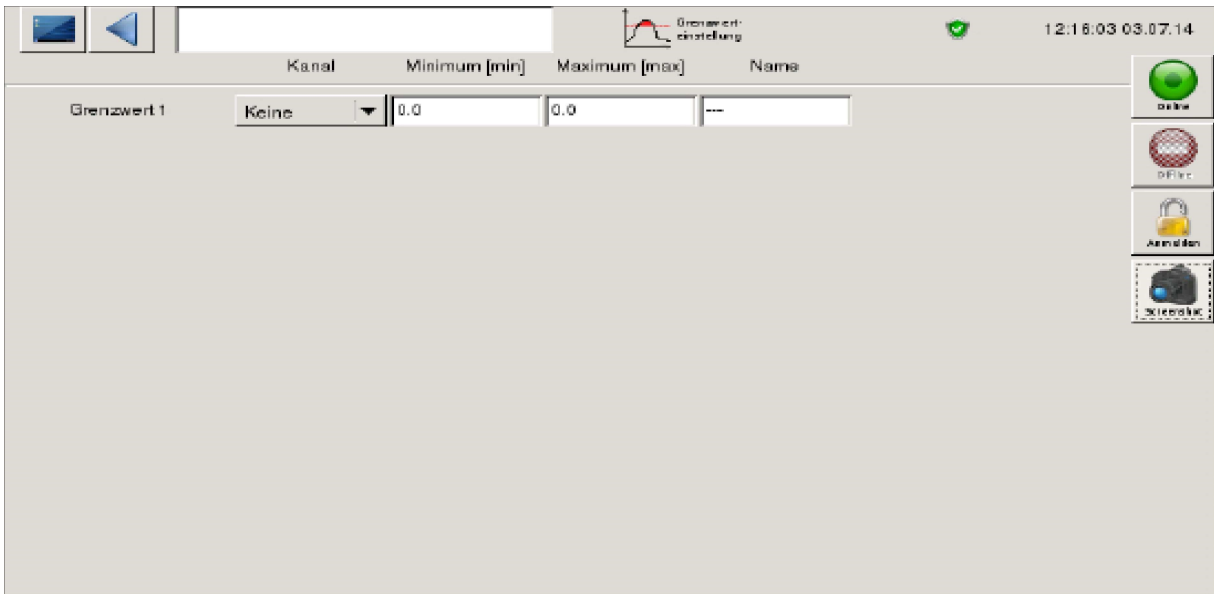



*Fig. 62: Limit setting screen (Example with one limit)*

> **Notice**
>
> To define more limits, the last limit must be selected and a next limit will be displayed automatically.

## 7.2.16 Rinse Sample Tubes

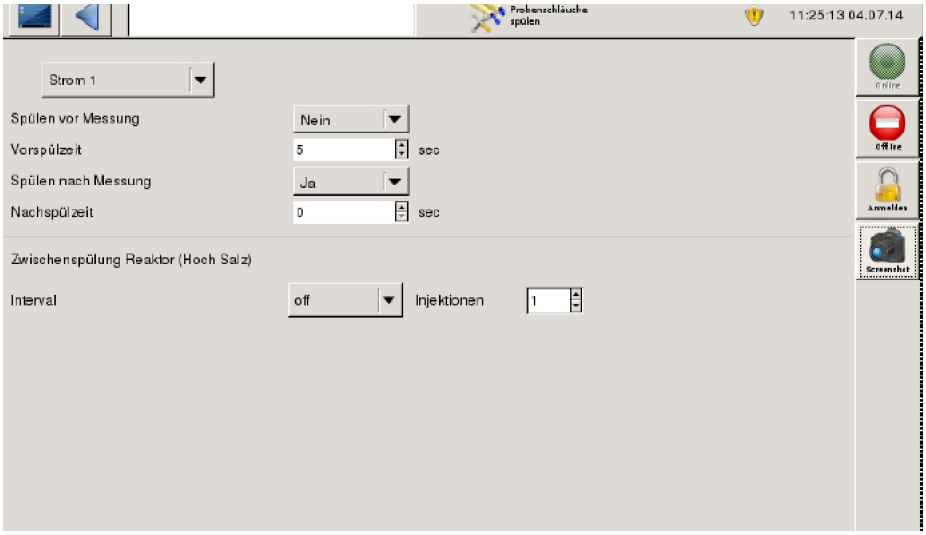



*Fig. 63: Rinse sample tubes screen*

All parameters in this screen are intended for deionized water.

#### 7.2.16.1 Rinse before Measurement

Here you can set whether the tubing system should be rinsed before a measurement with rinse water via Y3Y10.

#### 7.2.16.2 Purge Time

If the parameter "Rinse before measurement" is activated, the duration of the rinse must be specified here.

#### 7.2.16.3 Rinse after Measurement

Here you can set whether the tubing system should be rinsed after a measurement with rinse water via Y3Y10.

#### 7.2.16.4 Rinse

If the parameter "Purge after measurement" is activated, the duration of the purge must be specified in this field.

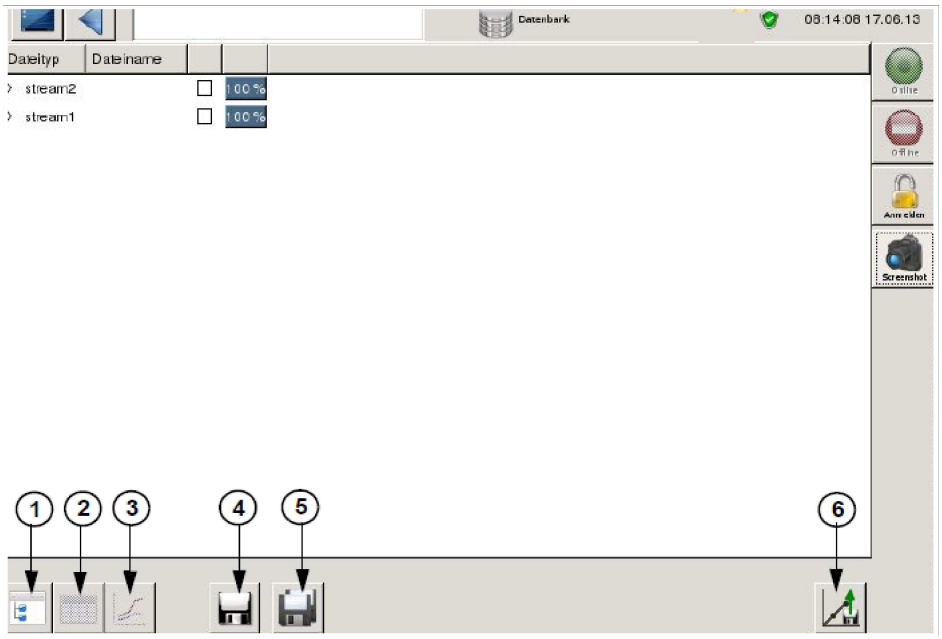
#### 7.2.16.5 Automatic high-salt rinse from the reactor

Choose if and how often rinse water should be injected into the reactor. The shortest possible interval is 30 minutes. Also select how many injections should be performed for each rinse.

### 7.2.17 Database

If you go to the "Database" screen, three screens can be activated for the user Level II:
- Overview of the database
- Table form of the measured data
- Daily course of the measured data

In the first screen "Overview Database" (Fig. 64, page 97) the measured data can be loaded per current and per day. To see the individual measurement data, click on "stream" and "day" (measurement). The selection boxes can be activated or deactivated. When the charging process is 100%, the measured data can be displayed as a table (Fig. 65, page 98) or daily course (Fig. 66, page 99). The "Table form of the measured data" button can be pressed to display a new table with the selected current and day.




**1** Overview of the database
**2** Data in table form
**3** Dayly results
**4** Save data to storage device
**5** Save all data to storage device
**6** Dub parameters

*Fig. 64: Database screen*

Notice

Only when a file is selected (100% loaded) the "Table shape and waveform of the measured data" button can be selected.

To see the subfolders, press the small triangle to the left of the stream or date.

Save data

1. Measurement data can be stored on a USB stick.
2. Connect the USB stick to the analyser.
3. Select the desired measurement data. All measurement data can also be selected individually. Activate the respective check boxes.
4. Press the "Save" button; the files are copied to the USB stick.

Dub Parameters

After successful commissioning, the default parameters are transferred to a USB stick. If parameters have been changed or the analyser is no longer running properly, the default commissioning parameters can be once more transferred to the analyser.

1. Stop measurement.
2. Connect USB stick to the device.
3. In the "Database" screen, click the "Transfer parameters" button.
4. A query is displayed. Confirm this with the green checkmark.
5. A query with Yes / No takes place: If yes, the device is automatically restarted. If no, the process is aborted.
6. After successful dubbing the stick can be removed.

Notice

The existing data and settings will be overwritten, please contact the technical support of the LAR (**chapter 15.1 from page 203**)!

### 7.2.17.1 Data in Table Form

The measured values are displayed to the right of the timestamp when you press the "Data in table form" button (**1**). If the selected measurement data is to be displayed as a curve, the "Measurement history" button (**2**) must be activated.

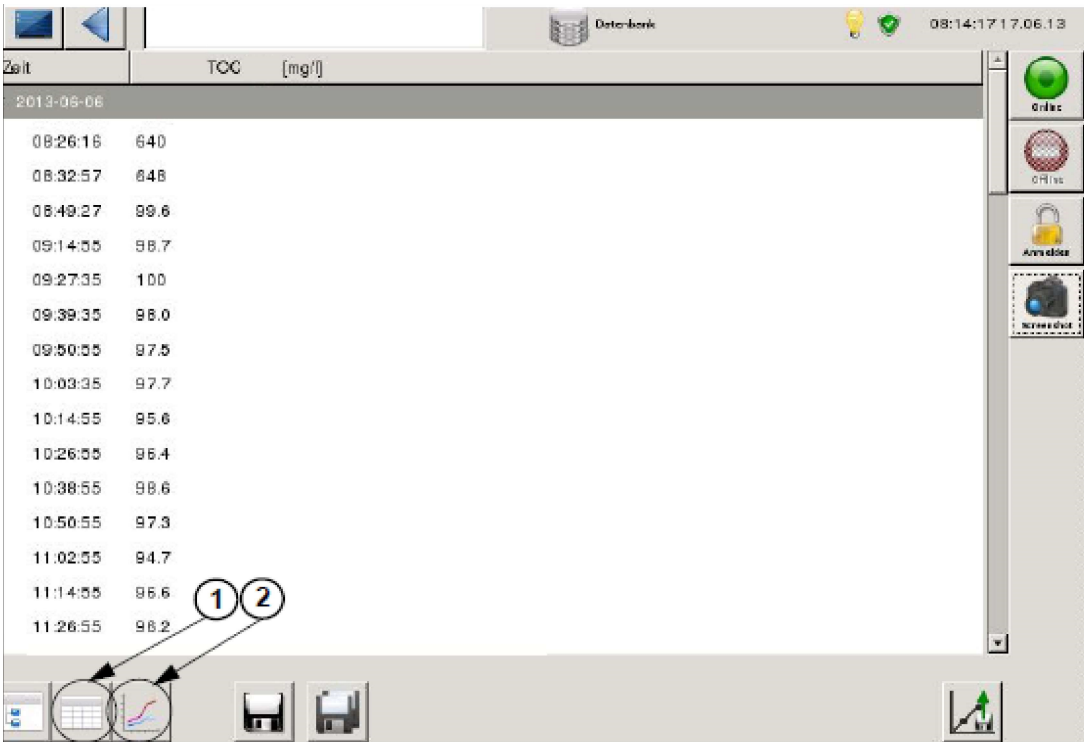



*Fig. 65: "Database" screen - table form of the measured data (Example)*

### 7.2.17.2 Daily results as a curve

If the selected measurement data is to be displayed as a graphic in the "Overview database" screen, the "Measurement data as curve" button must be activated. Each parameter has its own diagram. In order to change the parameters (e.g. TOC to TC) use the buttons on the top left. From the "Measured data as table" view (Fig. 64, page 97), you can access the trend view. Click on the button "Daily data history" (**3**, Fig. 64, page 97) and the corresponding trace will be displayed.

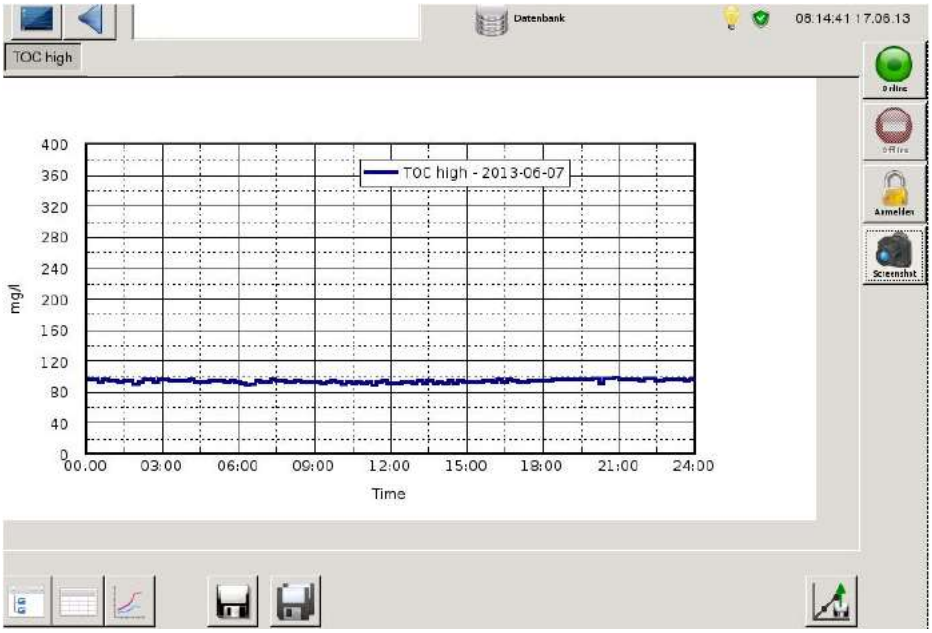



*Fig. 66: Database - curve form (Example)*

## 7.2.18 Log

> **Notice**
>
> The logbook screen is only displayed from User Level 2 upwards.

The logbook can be accessed via the status bar.

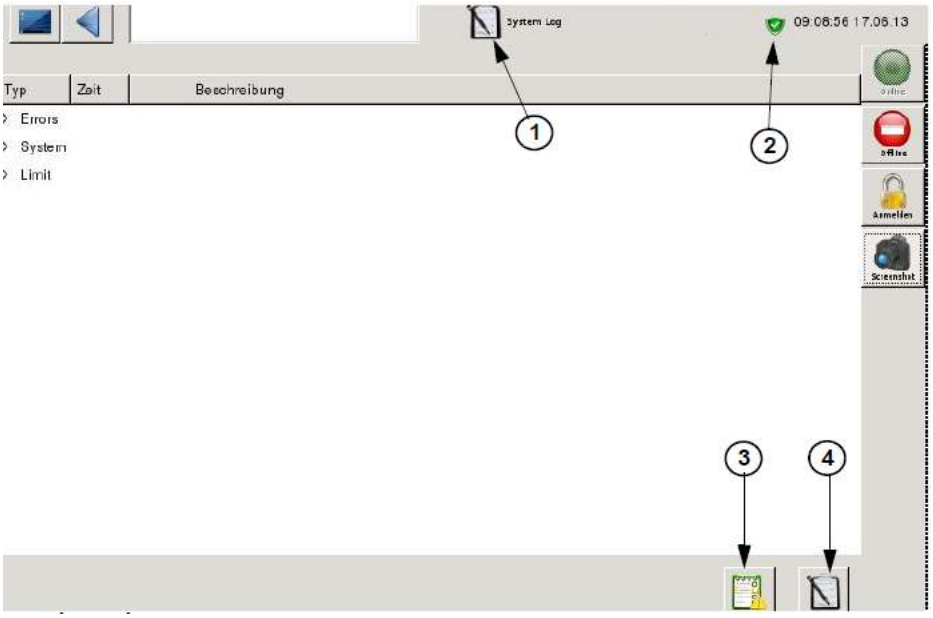
1. To do this, press the icon "Go to the logbook" (**2**).
2. A selection window is displayed (Fig. 68, page 100). Select "control state" on this selection window.
3. A new screen is displayed.

There are two views in the logbook:
- Archiving the logbook
- Currently applied errors

The logbook insight icon (**2**) top right consists of three colors:
Green: No fault messages are pending. All necessary conditions for a valid measurement are fulfilled. The measured value is trustworthy and process-relevant.
Yellow: Fault messages are pending. The measurement could be disturbed and untrustworthy.
Red: Fault messages are pending and the measurement is aborted. The boundary conditions do not allow a valid measurement (eg: missing reagents, failed calibration) The device requires immediate maintenance.

There are three subfolders in the archiving logbook view:
- Error
  List of all occurring errors with time of appearance and cancellation / reset.
- System
  The list contains system data of the entire activities of the system (measurement, parameters, self-test, etc.)

- Limits
  The list contains limit values or overshoots with times. To see the subfolders, press the small triangle on the left of Errors, System, Limit or Service Log. A corresponding listing is displayed.




**1** View of the log
**2** Go to Log
**3** Unsolved errors
**4** Log view

*Fig. 67: Log*

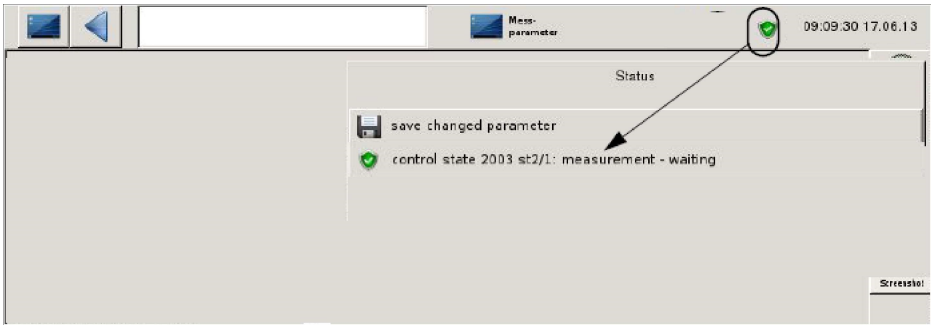



*Fig. 68: Selections for Log*

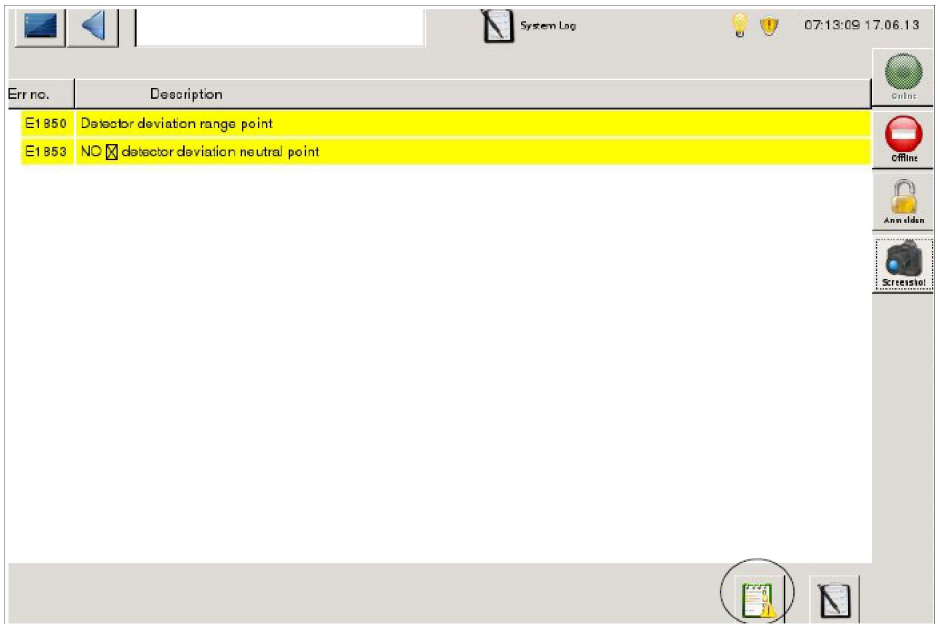



*Fig. 69: Database screen - Log - View of actual errors*

### 7.2.19 Saving Data

Data storage takes place during commissioning and maintenance of the device. Current operating parameters are stored and archived in the LAR database.
Please contact LAR technical support (*Chapter 15.1 on page 187*) if you need a backup.

### 7.2.20 Calibrate Analog Output

In principle, it is possible to operate the analogue outputs in the range 0-20 mA or 4-20 mA. The analyser integrates a "live zero" mechanism via the analogue outputs. This means that 0 mA can be applied to the current output in case of a device error. Under which conditions this "live zero" mechanism is activated can be set individually by the user in the selection window. To activate the "live zero" mechanism, the analogue output must be set to "4/20 mA".

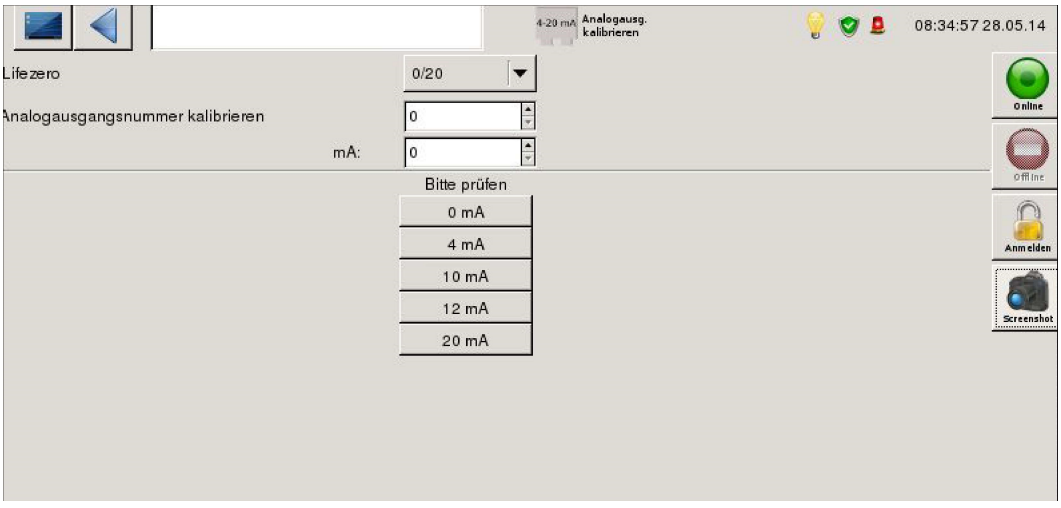



*Fig. 70: Calibrate analog output screen*

Only an authorized technician should perform an analog output calibration, as this requires opening the rear housing.

1. Open the rear part of the unit.
2. Connect the multimeter (amperemeter) to the analogue output.
3. In the Calibrate Analog Output view, specify the number (analog output) to which the multimeter is connected.
4. Click on the desired mA value (0, 4, 10, 12 or 20 mA).
5. The mA value must be recognizable on the ammeter. If a different value is displayed, please contact **LAR technical support** (*Chapter 15.1 on page 187*).
6. After checking the analog output, close the rear part of the unit.

Notice

Before checking all possibly already connected signal cables for
Remove process control system (connections to analog outputs).

## 7.3 Good to know

### 7.3.1 Password

The password can be changed to user level 2 (PC Settings screen). When changing the password, this should be documented in a safe place. If the default password has been changed or deactivated, a USB stick with access level 2 access rights becomes necessary. The USB stick is delivered in a separate spare parts container.

Notice

The default password is given by LAR AG at the factory and reads: **lar**

For security reasons, a USB stick with access level 2 access is required if the password is disabled or changed.

### 7.3.2 Software Version

The opening screen (Fig. 39, page 68) and the PC Settings screen (Fig. 73, page 104) show the current software version number.

### 7.3.3 Abort Measurement

The measurement continues until it is canceled by pressing the "Offline" button (top right). The device is then put into the wait state and all measurement data not yet stored are stored. Now you can carry out maintenance work (Chapter 7.2.12.2 on page 90), evaluate old measuring data or change operating parameters (measuring frequency, etc.). If the measurement was e.g. interrupted by a power failure, an autostart will be performed when the power is restored and automatically returns to the measurement mode. The unit continues its programmed measurement cycle after the power failure without operator intervention.

### 7.3.4 Furnace On - Off

Manually switching the furnace on - off
Please switch off the oven for maintenance purposes only. This can be done in the "Service Actions" view (Fig. 57, page 89). Frequent switching off and on reduces the life of the furnace. The meter is equipped with a high-temperature furnace, which makes it possible, at high temperatures without catalysts, to achieve complete conversion of the sample. The setpoint temperature is set at the factory and is password protected. An intervention in the programming of the temperature controller is inadmissible and can lead to damage of the oven. In case of temperature problems, contact the technical support of the LAR (*Chapter 15.1 on page 187*).

### 7.3.5 Automatic Temperature Control

The controller labeled "Temperature Control" displays two values at the front of the analyser. The actual value and the setpoint. With the help of the control knob "Temperature Monitor", the stove is switched off when the temperature rises above 1250° C. It is located on the back wall in the device. To heat the stove about 120 min = 2 h are needed. This corresponds to a heating rate of 10° C / min. These settings are factory set and can not be changed.

### 7.3.6 Condensate Pump On - Off

The condensate pump runs continuously and is only switched off for care and maintenance purposes (such as changing hoses). Switch on the condensate pump again after the care and maintenance work.

### 7.3.7 Date and Time

The date and time are visible in all views and can be found in the upper right corner of the screen. Changes can be made in the PC Settings view (Chapter 7.3.10.1 from page 104).

### 7.3.8 Language

The language settings of the software are factory set and can be changed by the LAR Technical Support (*Chapter 15.1 on page 187*) or an authorized service partner on the device.


Notice

German and English are available as standard languages in the device. For other languages, please contact LAR technical support *(Chapter 15.1 on page 187)*.

### 7.3.9 Save

Storage is necessary for all changes made to the operating parameters and settings. Perform storage:

1. Settings have been changed (eg. parameters). Press "Enter" (only for number fields).
2. The floppy disk button appears in the status bar (upper right side). Press the "Disk" button and a selection window will be displayed.
3. Select "Save changed parameter". A new window opens.
4. If the change is to be accepted, press the green "check mark" to confirm. If the change is not accepted, press the red "X".


*Fig. 71: Save - first step*

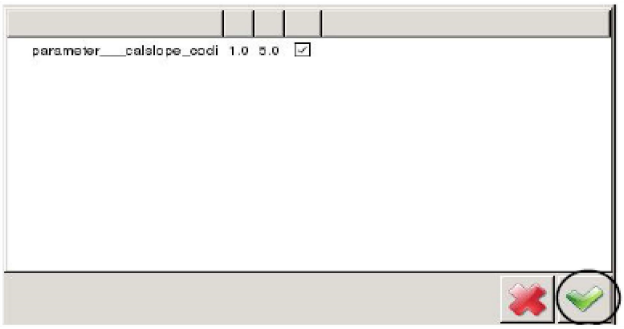



*Fig. 72: Save - second step*

Notice

In the second step of saving two values can be seen in the screen mask. The first value is the previous parameter value and the second value is the desired new parameter value that has been entered.
If several parameters are changed at the same time, a saving process is sufficient. During the saving process every parameter change can / should be checked. After pressing the "floppy disk" symbol, a list of the "old" and "new" parameter values appears, which are confirmed with "check marks". If one of the several changes is not accepted, the "tick" on the record must be removed. All parameters activated with "check mark" are saved and accepted.

## 7.3.10 User Level 3

In user level 3, various parameters can be set.

### 7.3.10.1 PC Settings


*Fig. 73: PC settings screen*

Activate / deactivate password protection for user level 2

1. As a user with authorization for user level 3, you can activate or deactivate password protection in user level 2. Save your changes via the "floppy disk" icon.
2. If the password is disabled, the USB key with access level 2 or level 3 access is required. The default password is: lar.

Drag and drop for buttons
Activate the checkbox to activate the function. If this function is activated, you can move buttons in different screens.

### 7.3.10.2 Calibration Results

In this screen form in user level 2, as user of user level 3, you can manually change and save the measurement results (intercept and slope).

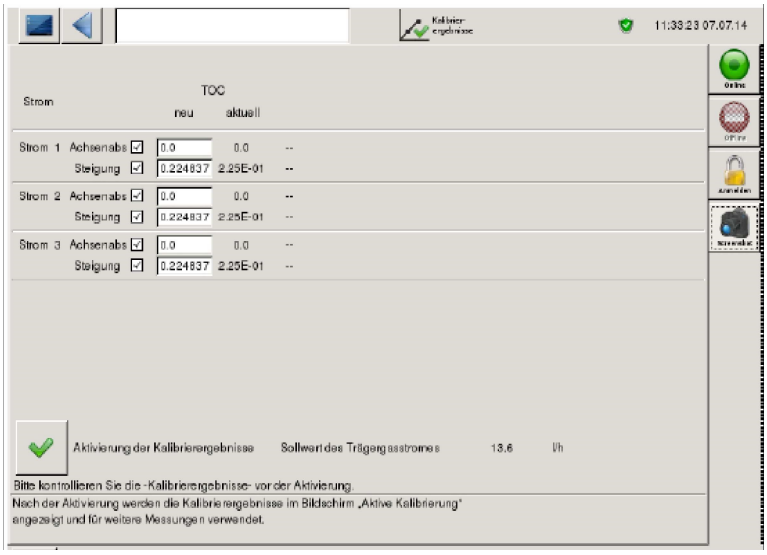



*Fig. 74: Service calibration results screen*

### 7.3.10.3 CAN Selftest

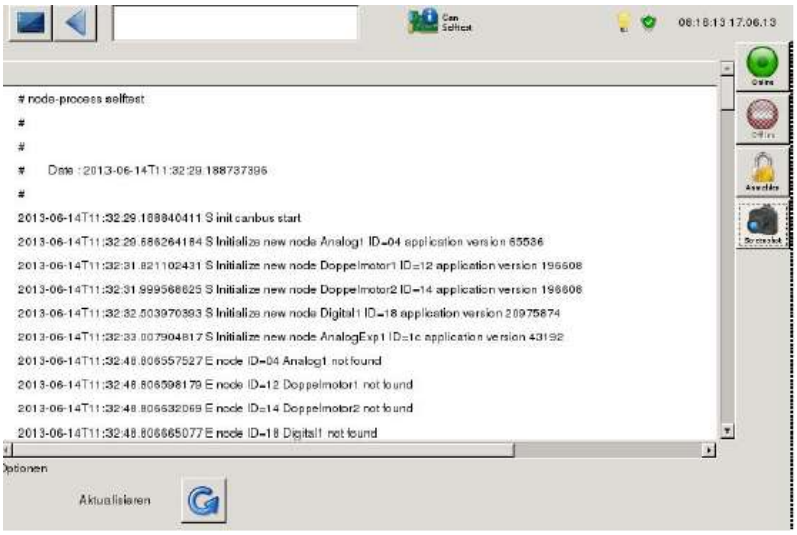



*Fig. 75: CAN Selftest screen*

The device has a so-called CAN circuit diagram. In the CAN circuit diagram, all parts of the device are entered with their own ID. The device independently tests this plan and displays the results in this screen. If, for example, a node is missing, this screen displays its name, ID and the suffix "not found". This information is important to LAR technical support for troubleshooting.

### 7.3.10.4 Hardware Info

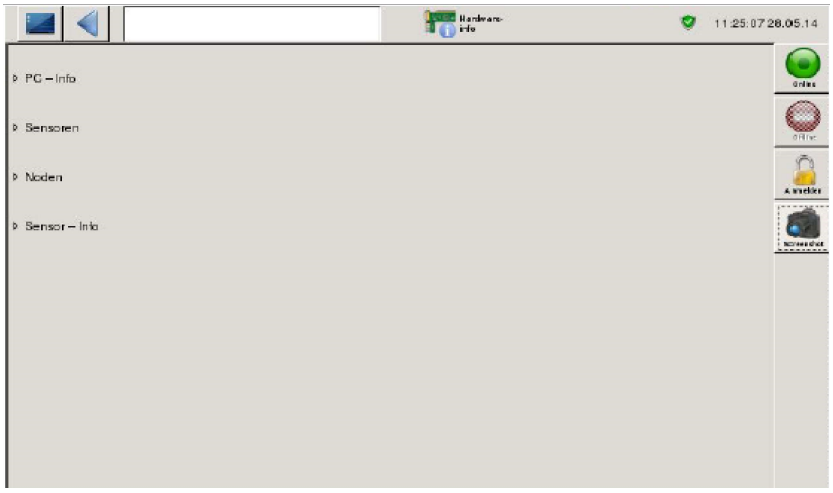



*Fig. 76: Hardware Info screen*

This screen provides information about the hardware of the device:
- PC Info
- Sensors
- Node Info
- Sensor Info

Furthermore, the voltages of the analog inputs of the respective device parts are displayed.

### 7.3.10.5 DIGITAL IN 1, 2 and 3

These three screens show the status of digital inputs 1, 2 and 3. The values can be changed manually.

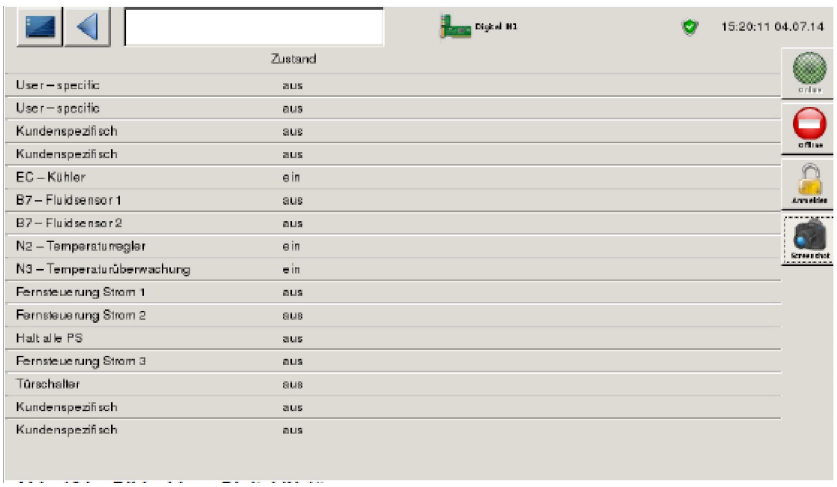



*Fig. 77: DIGITAL IN 1 screen*

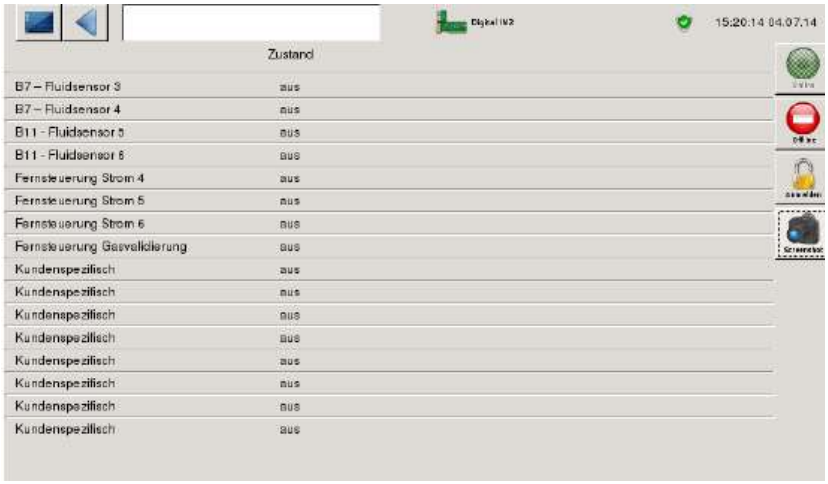



*Fig. 78: DIGITAL IN 2 screen*

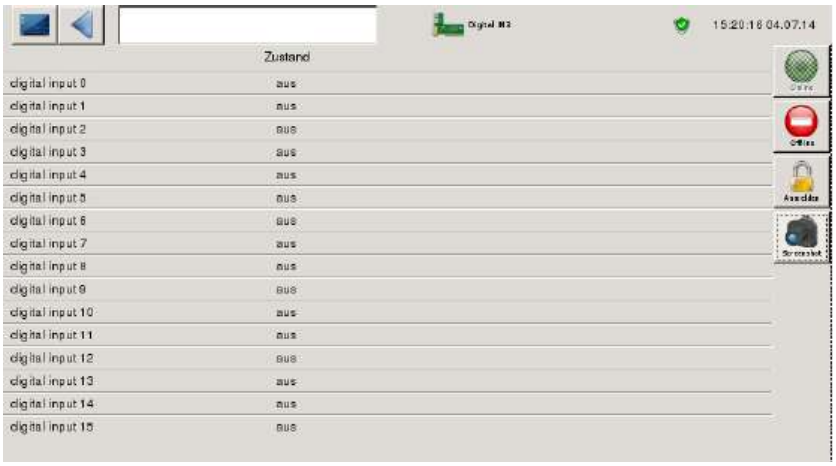



*Fig. 79: DIGITAL IN 3 screen*

### 7.3.10.6 DIGITAL OUT 1, 2 and 3

These three screens show the status of digital outputs 1, 2 and 3. The values can be changed manually.

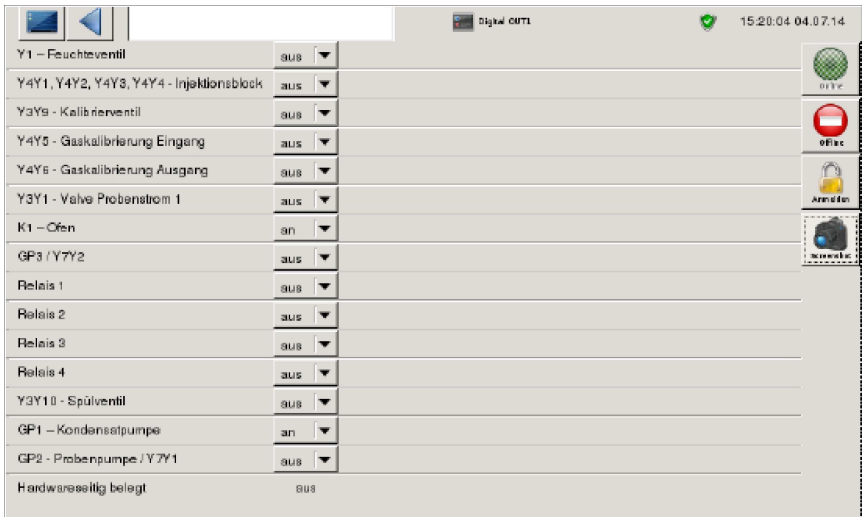



*Fig. 80: DIGITAL OUT 1 screen*


*Fig. 81: DIGITAL OUT 2 screen*

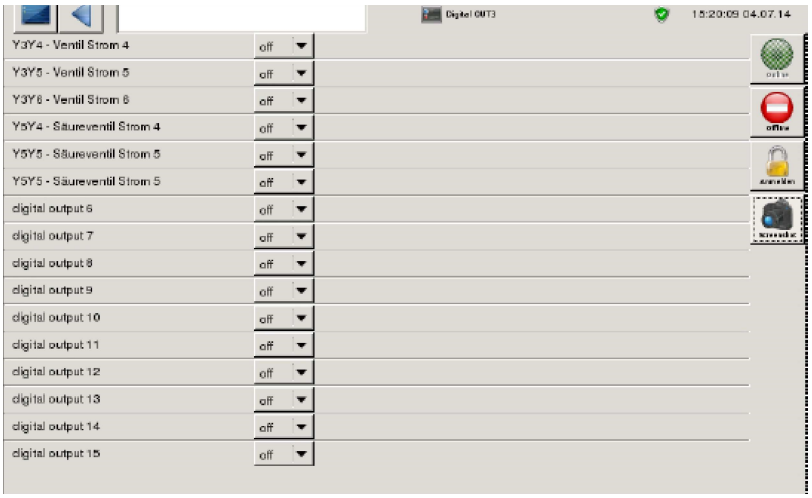



*Fig. 82: DIGITAL OUT 3 screen*

## 7.3.11 Calibrations

Calibrate in two different screens:

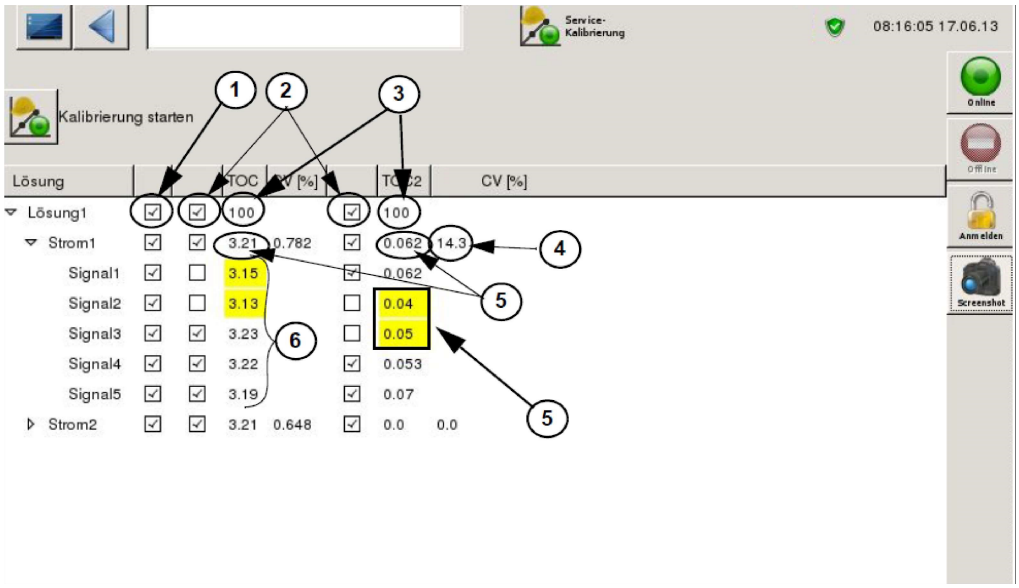
- in user level 2 in the screen "Perform calibration"
- in user level 3 in the screen "Service Calibration"

> **Notice**
>
> Before calibration can be performed, the necessary calibration solution must be provided and the necessary level II adjustments made in the Calibrate screen. Only then can a calibration be carried out in user level 3 under "Service Calibration".

Calibration can be stopped at any time by pressing the red "Offline" button.

### 7.3.11.1 Service Calibration

In user level 3 in the "Service Calibration" screen, "Start calibration" can also be selected. Please note the default settings in user level 3 (Chapter 7.3.10 from page 104). In the screen "Service Calibration" the 5 raw values (signal values) (6), as well as the calculated mean value (5) and the calculated CV (4) for the respective solutions and currents are displayed.
Outliers are automatically highlighted in yellow and are not included in the calculation. However, outliers can be included in the calculation by activating the respective checkbox. The checkboxes of the first column enable / disable all other checkboxes in the respective row. Furthermore, new raw values for outliers can be entered manually via the number field. The number field is displayed as soon as you click in the field to be filled in the screen mask.




**1** Check box, activates all other check boxes of a row
**2** Selection of individual value
**3** Calibration value [ppm]
**4** Calculated CV value of raw values
**5** Calculated mean of the raw values
**6** Raw value (signal value [FSR * s]
**7** Outliers

*Fig. 83: Service calibration screen*

Perform a one-point calibration for a sample stream:

1. Make a calibration solution and position the calibration vessel in the analyser.
2. In the "Calibration solutions" selection box at user level 2, "Perform calibration" screen, select the

calibration solution.

3. Enter the maximum CV in% for calibration in the Perform Calibration screen.
4. After selecting the solution number, it will be displayed in user level 3 in the "Service Calibration" screen.
5. Click on the solution to display the streams.
6. When you click on the measured current, the five repetitions (signals) are displayed.
7. Click in the input field to enter the ingredients of the solution.
8. Double-click in the input field. The number pad and keyboard are displayed. Please enter the appropriate concentration (**3**).
9. To accept the calibration concentration, save it with the floppy disk symbol.
10. Activate all check boxes for the stream and the solution to be measured.
11. Start the calibration via the "Start calibration" button
12. Raw values of the calibration can be viewed immediately in the table. When all calibration passes have been completed, raw values are available for each signal (repetitions). To the right of the stream is the mean value of the raw values (**5**). All check boxes are enabled for the measured solution and current. Outliers are detected by the software and highlighted in yellow. These outliers are not included in the calculation.
13. If you are sure that the 5 measurements (signals) have an outlier that was not detected by the software, this can be removed from the calculation by deactivating the corresponding check box.
14. In the screen "Calibration results" (user level 2), the results of the calibration (slope and intercept) can be viewed and activated.

Perform a multi-point calibration (three solutions) for a sample stream:


Notice

In a multi-point calibration, it must be noted that the calibration solutions can only be measured one after the other.

In the Service Calibration screen, the first left check box is responsible for the entire row. If this checkmark is removed (disabled), all others in the series will be disabled.

1. Make a calibration solution and position the calibration vessel in the analyser.
2. In the "Calibration solutions" selection box at user level 2, "Perform calibration" screen, select the calibration solution.
3. Enter the maximum CV in% for calibration in the Perform Calibration screen.
4. After selecting the solution number, it will be displayed in user level 3 in the "Service Calibration" screen.
5. Click on the first solution to display the streams.
6. When you click on the measured current, the five repetitions (signals) are displayed.
7. Click in the input field to enter the ingredients of the solution.
8. Double-click in the input field. The number pad and keyboard are displayed. Please enter the three concentrations (3).
9. To accept the calibration concentrations, save them with the "floppy disk" symbol.
10. Activate all check boxes for the current to be measured and the three solutions.
11. Start the calibration via the "Start calibration" button
12. Raw values of the calibration can be viewed immediately in the table. When all calibration passes have been completed, raw values are available for each signal (repetitions). To the right of the stream is the mean value of the raw values (**5**). All check boxes are enabled for the measured solution and current. Outliers are detected by the software and highlighted in yellow. These outliers are not included in the calculation.
13. If you are sure that the 5 measurements (signals) have an outlier that was not detected by the software, this can be removed from the calculation by deactivating the corresponding check box.

### 7.3.12 Service Parameter

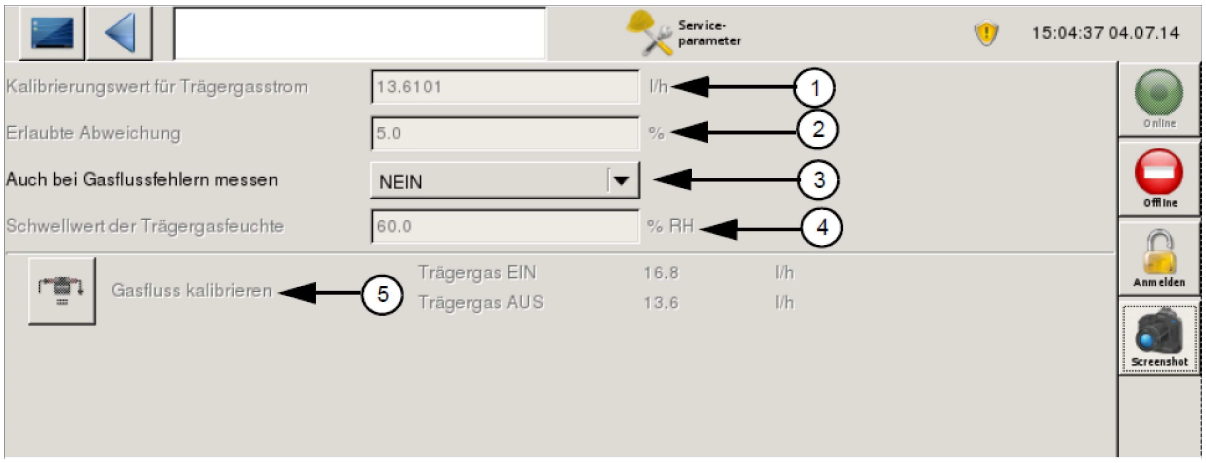



*Fig. 84: Service Parameter screen*

Define and view parameters for the carrier gas flow in this screen.

Definable parameter:

- Also measure for gas flow errors (**3**)
  Here you can choose between YES or NO. If YES is selected, the measurement will also be made if the deviation from the carrier current calibration value is greater than the value specified by them.

Fixed parameters:

- Calibration value for carrier gas flow (**1**)
  After a calibration, the value for the carrier gas flow is displayed here. If the actual value does not match the calibration value during a measurement, the measurement is aborted and the error must be corrected before a new measurement can be started.
- Permitted deviation (**2**)
  Here, the allowable deviation of the carrier gas flow will be indicated. If the deviation is below the percentage, it will still be measured.
- Threshold of carrier gas moisture (**4**)
  Here, the threshold value for the carrier gas moisture is defined. If the actual value is greater than the threshold, no measurement can be performed until the error is corrected. In the "Status screen", a "target value" is displayed for the two carrier gas sensors. This "target value" is generated by the "Carrier gas flow calibration value". The value that was generated during a calibration is automatically displayed.
- Calibrate gas flow (**5**)
  At this point, the carrier gas inputs and outputs can be viewed. This setting is factory set to YES.

### 7.3.13 Update Manager

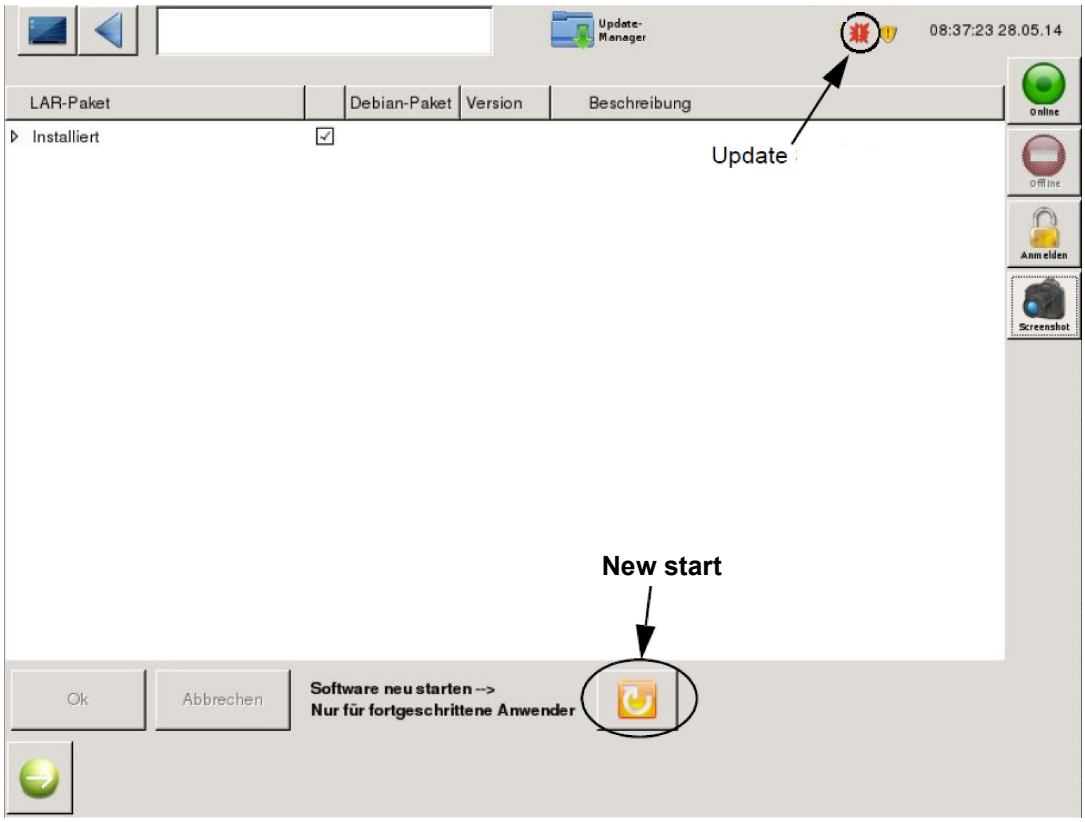



*Fig. 85: Update Manager screen*

This screen allows new software updates to be installed. To do this, a USB stick with access authorization for user level 3 and the update must be connected to the device. Furthermore, all installed files are displayed.
The yellow arrow key (bottom center) restarts the LAR software.

To run a software update:

1. Connect the USB stick with the analyser update.
2. A red "Update" symbol appears in the status bar. Click the icon to get to the Update Manager.
3. The screen for Update Manager will be displayed.
4. Select the installation file by checking the appropriate box.
5. Click "OK" to install the software. Click on "Cancel", if e.g. an incorrect file would be selected.
6. After pressing the "Ok" button, the screen will turn off for 30-40 seconds and the new software will be installed.

Notice

Already installed files can not be activated or deactivated.

### 7.3.14 Names and Units

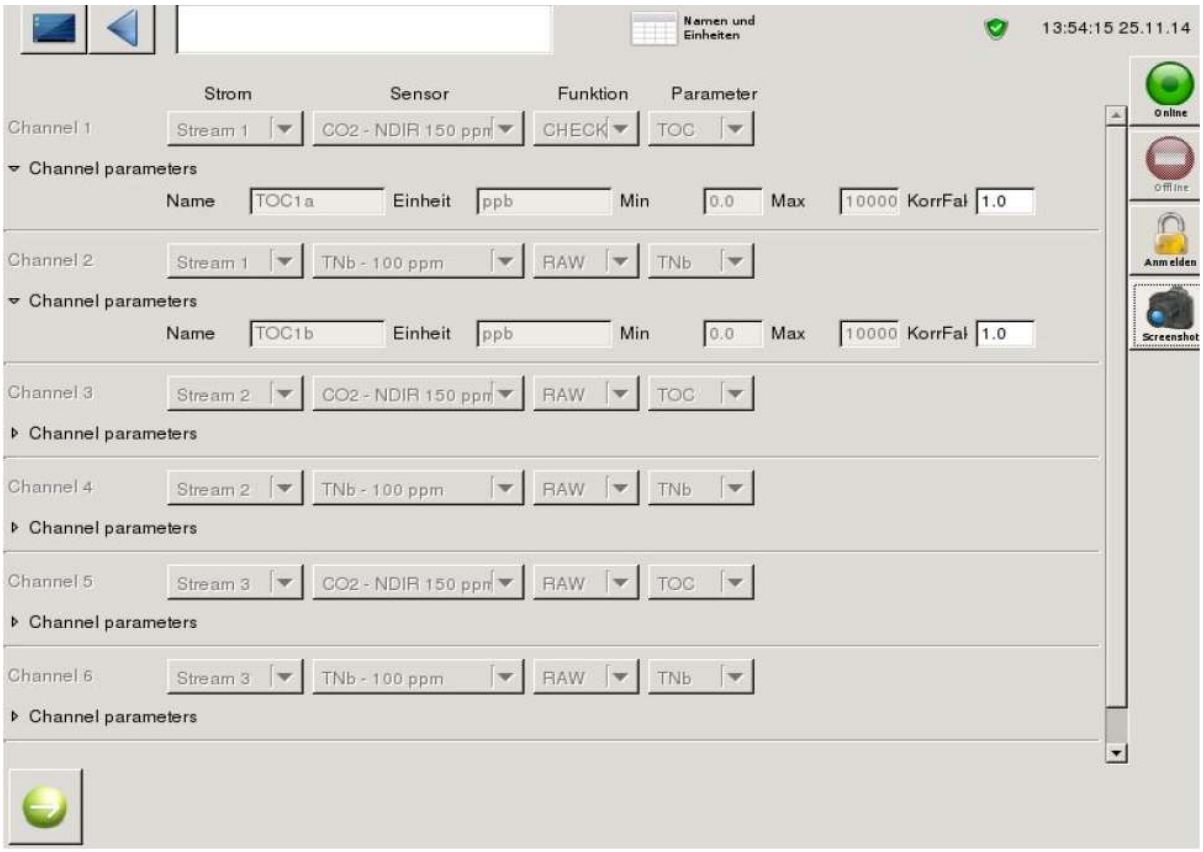



*Fig. 86: Names and Units screen*

In this screen, the parameter and channel settings can be viewed and a correlation factor can be adjusted for each channel. The logbook records a correlation change.

### 7.3.15 Control State

The current device status is displayed on the Status Screen. This view only shows the latest status report (**2**) and current error messages as well as limit overruns for the respective stream (**1**).

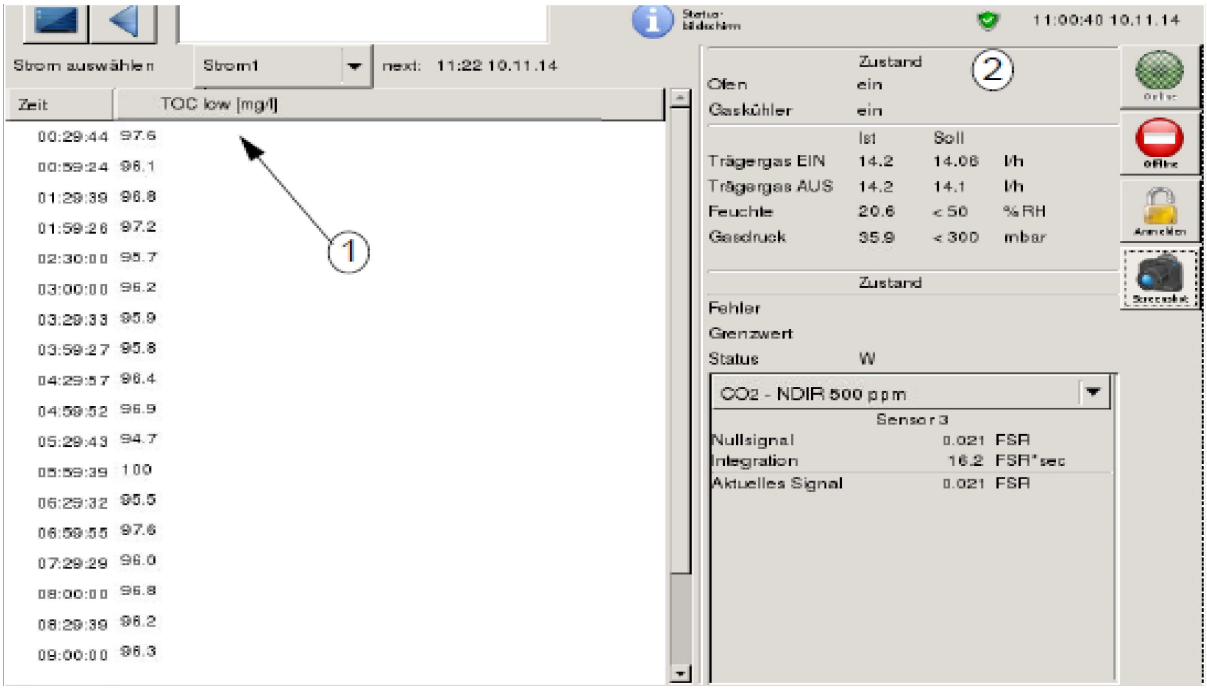



*Fig. 87: Control state screen*

To view the device status of the entire day (24-hour profile), go to the "Log" view and click on "Error" (Chapter 7.2.18 on page 99). For questions or help, please contact LAR AG Technical Support (Chapter 15.1 on page 187).

*Tabelle 16: Control State*

| Status | Description | Possible cause | Action |
|---|---|---|---|
| **Activity** | | | |
| M | Measurement (dependent on streams, e.g. one stream analyser → M1) | | |
| C | Calibration (dependent on streams, e.g. one stream analyser → C1) | | |
| W | Waiting time (Time between two measurement modes) | | |
| M&W | Short waiting time before each measurement (dependent on streams, e.g. one stream analyser → M1&W) | | |
| S | Single measurement (dependent on streams, e.g. one stream analyser → S1) | | |
| D | Auto-check - function (automatic calibration/validation using standards) (dependent on streams, e.g. one stream analyser → D1) | | |
| P | Offline mode | | |
| **Limits** | | | |
| L_min | Minimum limits (dependent on streams, e.g. one stream analyser → L1_min) | | |
| L_max | Maximum limits (dependent on streams, e.g. one stream analyser → L1_max) | | |
| **Selection of instrument incidents** | | | |
| E1810 | Furnace emergency off | Furnace overheating | Check cable and controller → **contact LAR technical support (9.2 on page 220)** |
| E1815 | Humidity emergency off | Relative humidity → > 60% or broken cable | Check the humidity and if necessary drainage the analyser → **contact LAR technical support (9.2 on page 220)** |
| E1820 | Furnace deviation band alarm | Furnace too cold | Please wait until the furnace has reached the right temperature |
| E1830 | Cooler deviation band alarm | Cooler temperature too hot | Please wait until the carrier gas flow (gas cooler) has reached the right temperature |
| E1833 | Pressure is high | Pressure > 600 mBar, furnace or filter blocked | Demount the reactor feed and check the end of the reactor (chapter 5.8, page 159 ff.) |
| E1835 | Carrier gas flow deviation > -5% | Carrier gas flow is low | Find leakage! |
| E1836 | TC carrier gas flow deviation > -5% | TC carrier gas flow is low | Find leakage! |

| Status | Description | Possible cause | Action |
|---|---|---|---|
| E1837 | TIC Carrier gas flow deviation > -5% | TIC carrier gas flow is low | Find leakage! |
| E1841 | Injection error stream1 | Injection of air, no sample | Check sample supply |
| E1842 | Injection error stream2 | Injection of air, no sample | Check sample supply |
| E1843 | Injection error stream3 | Injection of air, no sample | Check sample supply |
| E1844 | Injection error stream4 | Injection of air, no sample | Check sample supply |
| E1845 | Injection error stream5 | Injection of air, no sample | Check sample supply |
| E1846 | Injection error stream6 | Injection of air, no sample | Check sample supply |
| E1850 | Limit of detector exceeded | Limit exceeded detector | **Contact LAR technical support (chapter 10.2, page 156)** or an authorized distributor. |
| E1851 | Zero signal NDIR1 out of range | $CO_2$ - detector 1 defective or soda lime pellets exhausted | Check detector cable and change soda lime pellets |
| E1852 | Zero signal NDIR2 out of range | $CO_2$ - detector 2 defective or soda lime pellets exhausted | Check detector cable and change soda lime pellets |
| E1853 | Zero signal EC cell out of range | NO - detector defective | Check EC-detector cable |
| E1854 | Zero signal oxygen detector out of range | $CO_2$ - detector defective, leaking massflowpermation | Check Zirox detector cable, if necessary adjust the signal |
| E1950 | Sample missing (IN 05 digital input) | Sample is not available | Check sample supply |
| E1960 | Reagents missing (IN 06 digital input) | Reagents are not available | Check/ Prepare reagents |
| E2128 | Error when opening the furnace valve | Furnace valve defective | **Contact LAR technical support (chapter 10.2, page 156)** or an authorized distributor. |
| E2128 | Error at the time of closing the furnace valve | Furnace valve defective | **Contact LAR technical support (chapter 10.2, page 156)** or an authorized distributor. |
| E2136 | Error at the time of closing the furnace valve | Furnace valve defective | **Contact LAR technical support (chapter 10.2, page 156)** or an authorized distributor. |

# 8 Care and Maintenance

Only minor effort is required to service and maintain the analyser. This section shows you the best way to look after your analyser to guarantee trouble-free operation. The documentation of maintenance and service work is a precondition for any warranty and guarantee claims, and also represents a valuable aid in locating resolutions when malfunctions occur (Chapter 10 on page 165).

Notice

The scope of analyser maintenance and care work depends on the application.
All maintenance, care action and intervals, pertain to the most demanding of applications and are to be understood as recommendations from **LAR**.

**Care and Maintenance:**

- Care measures are application-dependent and are recommended by LAR. The effort for maintenance work is about 30 minutes / week.
- Maintenance includes replacement of consumables and consumables. The cost of maintenance is about 5 - 10 min / week.
- After maintenance and servicing, some functional tests must always be performed to check analyser status

Notice

If you have any questions about maintenance and / or service, contact LAR Technical Support (Chapter 15.1 on page 267).

As part of customer support, **LAR** Technical Support offers **customizable maintenance contracts** and **device-specific training** to extend your know-how. Further information at: **www.lar.com**.

## 8.1 Overview of Regular Care and Maintenance Actions

The following maintenance schedule provides an overview of recommended and regular actions for caring and maintaining your analyser. Visual inspections are used to check the applicative need for care and maintenance actions.

### 8.1.1 Tightness Test

After replacement of components, e.g. a reactor tube, a tightness test should be performed.

1. To run this test, the "status screen" in user level 2 must be called.
2. Set the pressure to 0.5 bar via the pressure regulator.
3. The screen shows the carrier gas inlet on the right side of the screen. This value must be considered in this test all the time.
4. Bend off the black Viton hose (outlet of the radiator) with a hose clamp. The exam takes a few minutes. The flow (carrier gas inlet) must drop to <5 l / h. If this is not the case, contact LAR AG Technical Support.
5. At the end of the test loosen the kink in the hose and set the pre-pressure to 0.5 bar.

## 8.2 Protocol for Visual Inspection (Analyser)

| Visual Inspection | Criteria | OK | Measures |
|---|---|---|---|
| Interval: 1 week | | | |
| Zero signal | • 0 - 0,1 FSR | ☐ | ☐ Check soda lime<br>☐ Contact support |
| Carrier gas | • Carrier gas on / off: ca.15 l/h | ☐ | ☐ Check fittings<br>☐ Contact support |
| Injection system | • no air bubbles in the glass | ☐ | ☐ Rinsing |
| Glass components | • no impurities | ☐ | ☐ Cleaning |
| Canister and supply tubes | • levels > 1 liter<br>• no impurities<br>• normale elasticity | ☐ | ☐ Top up canisters<br>☐ Clean canisters<br>☐ Replace tube |
| Input and drain tubes | • no impurities<br>• normal elasticity | ☐ | ☐ Replace tube<br>_____ |
| **Interval: 3 months** | | | |
| Injection tube | • no impurities<br>• normal elasticity | ☐ | ☐ Cleaning<br>☐ Replace tube |
| Tube cassette pump and sample pump | • no humidity<br>• rollers run smoothly<br>• no impurities<br>• normal elasticity | ☐ | ☐ Cleaning<br>☐ Set tubes forth<br>☐ Replace tube<br>☐ Contact support |
| Sample and pump tubes | • no impurities<br>• rollers run smoothly | ☐ | ☐ Cleaning<br>☐ Contact support |
| Viton tubes | • no impurities<br>• normal elasticity | ☐ | ☐ Cleaning<br>☐ Replace tube |
| Filter mats | • No discolouration | ☐ | ☐ replace filter mats |
| Acid trap | • at least 1/3 of the zinc is shiny<br>• at least 1/3 of the brass wool is yellow | ☐ | ☐ Replace filling<br>☐ Replace acid trap |
| Quartz wool filter | • no humidity<br>• no discolorations | ☐ | ☐ Replace filling<br>☐ Replace filter |
| **Date:** | **Signature** | | |

Proceed as follows:

1. In user level 2, call up the "Status screen" display.
2. Check if the zero signal is between 0 - 0,1 FSR.
3. If the signal is not within the permitted range, contact LAR Technical Support (chapter 11.1 on page 141).
4. Check the carrier gas flow. The volume flow at the input vein should have values between 13.5 - 15.5 l / h. Only during injection, the volumetric flows at the outputs can vary by ± 5 l / h. Normally, make sure that the volume flow at the outlet shows the same value as at the input. Vein = Vaus 13.5 - 15.5 l / h). Maximum deviation: 1 l / h.
5. Check all visual inspection items noted in the "Visual Inspection (Analyser) Protocol".

**6.** If the test criterion is fulfilled, proceed to the next step.

## 8.3 Care and Maintenance Tasks

### 8.3.1 Overview

| Interval | Measure | Type | Chapter |
|---|---|---|---|
| 1 week | Visual inspection and analyser status check | Care | *Chapter 8.2 on page 119* |
| | Check pump tubes and clean if necessary | Care | *Chapter 8.3.4 on page 122* |
| 3 months | Filter mats | Maintenance | Chapter 8.3.20 on page 132 |
| | Control of the gas cooling pipes | Care | *Chapter 8.3.6 on page 123* |
| | Check pump cassettes and clean if necessary | Care | *Chapter 8.3.9.1 on page 125* |
| | Check the pump head rollers for ease of movement | Care | *Chapter 8.3.9.1 on page 125* |
| | Clean and grease bearing pin | Maintenance | *Chapter 8.3.9.1 on page 125* |
| | Check and document analyser status | Care | *Chapter 8.3.11 on page 126* |
| | Observe and test a measurement | Care | *Chapter 8.3.12 on page 126* |
| 6 months | Replace pump tubes and condensate tubes | Maintenance | *Chapter 8.3.13 on page 126* |
| 1 year | Replace reactor tube or change reactor filling (if necessary) | Maintenance | Chapter 8.3.14 on page 127 |
| | Replace reactor seal (if necessary) | Maintenance | Chapter 8.3.15 from page 129 |
| | Replace loop tubing | Maintenance | Chapter 8.3.16 from page 131 |
| | Change sample drain tubes (if necessary) | Maintenance | Chapter 8.3.17 from page 131 |
| | Replace quartz wool filling | Maintenance | Chapter 8.3.18 from page 132 |
| | Replace pre-detector gas filter 0,1 µm | Maintenance | Chapter 8.3.19 from page 132 |
| If necessary | Check the Viton hoses, clean or replace if necessary | Care | Chapter 8.3.21 from page 133 |

### 8.3.2 Actions

Use a copy of the "Care Protocol (Analyser)" for the care actions, which you will find in *Chapter 13.3 on page 180*.

Use a copy of the "Maintenance Protocol (Analyser)" for maintenance purposes, which you will find in Chapter 13.4 on page 181.

| Interval | Measure | Task completed | Notes |
|---|---|---|---|
| 1 week | Check pump tubes and clean if necessary | ☐ | |
| 3 months | Check reactor pipe end and clean if necessary | ☐ | |
| | Inspection of the gas cooling pipes | ☐ | |
| | Check pump cassettes and clean if necessary | ☐ | |
| | Check the rollers of the pump head for ease of movement | ☐ | |
| | Checking the measured values with standard solution | ☐ | |
| | Check and document analyser status | ☐ | |
| | Perform a measurement and check the values | ☐ | |
| if neces-sary | Check viton tubes and replace if necessary | ☐ | |
| **Date:** | **Signature:** | | |

| Interval | Measure | Task completed | Notes |
|---|---|---|---|
| 3 months | Replace filter mats | ☐ | |
| | Clean and grease bearing pin | ☐ | |
| 6 months | Replace pump tubes and conden-sate tubes | ☐ | |
| 1 year | Replace reactor tube or change reactor filling (if necessary) | ☐ | |
| | Replace loop tubing | ☐ | |
| | Change sample drain tubes (if necessary) | ☐ | |
| | Change quartz wool filling | ☐ | |
| | Replace the pre-detector gas filter 0.1 µ | ☐ | |
| **Date:** | **Signature** | | |

### 8.3.3 Clean Vessel for Calibration Fluid and Replace Calibration Standard

Notice

First stop measuring mode with the "Offline" button before carrying out this monitoring and maintenance activity.

1. Renew the calibration standard weekly (with automatic calibration!) to prevent a change in the standard.

2. Discard the remainders of the old standard and rinse the container of the calibration standard carefully with deionised water. Establish the calibration standard according to the relevant regulations. Always use the same glass vessel for your calibration standard.

### 8.3.4 Check Pump Hoses and Clean if Necessary

1. Open the tube cassettes of the sample pump and check the tubing for contamination.
2. Clean the tubing from the sample inlet to the sample vessel.
3. Rinse the tubing with a wash bottle of deionised water.
4. Close the tube cassettes.
5.

### 8.3.5 Check Reactor Foot and Clean if Necessary

1. Use heat-resistant gloves!
2. Disassemble the air vent on the bottom of the analyser by gently pulling the air vent forward with your hands (Figure 112, page 175).
3. Undo the screws of the second bottom grid behind it and detach it. Now the reactor foot is visible.
4. Unscrew the four black spacer bolts (there are two for the high salt option).
5. Unscrew the three screws from the seating of the reactor foot.
6. Undo the screwed insert with teflon tube from the reactor foot seat.
7. Carefully pull the reactor foot from the reactor pipe end.
8. Use a 3.5 mm drill bit (**1**) to carefully drill into the reactor pipe (**2**) by hand [note: do not use a cordless or power drill].
9. Then use if required a bigger drill bit of maximum size 5.5 mm.
10. Manually drill into the reactor pipe all the way by hand to remove the deposits.
11. A drill bit is not necessary when the high salt option is used. Remove the deposits using a large screwdriver.


Warning

**Destruction of the reactor pipe filling**

Never insert the drill or screwdriver deeper than 7 cm into the reactor tube.


*Fig. 88: Manual cleaning of the reactor pipe with a drill bit*

### 8.3.6 Check the Gas Cooler

The gas cooler is located in the lower part of the device behind the lower front panel.

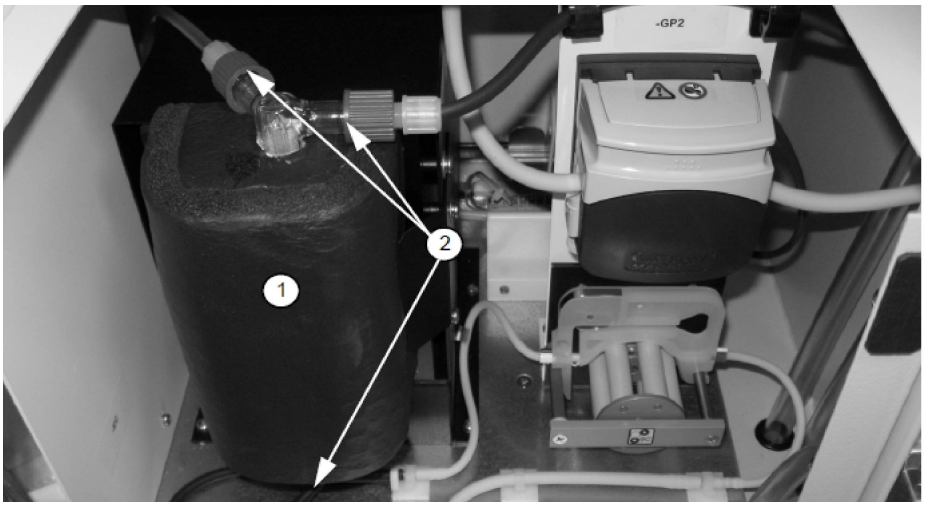
Warning

**Warning about improper connection!**

The analyser may give incorrect readings if the tubing of the gas cooling tube is reversed.

Mark the hoses before disassembling the gas cooler.

1. Unscrew the connectors with hose connections (**2**) to remove the gas cooler glass tubes (**1**).
2. After all connections have been removed, the glass heat exchanger can be carefully pulled up out of the guide.
3. After the heat exchanger or gas cooling tube has been pulled out of the cooler, the surface can be cleaned with a soft paper towel.
4. Rinse the gas cooling tube from the inside with deionised Water. Use a laboratory vial filled with deionized water or a disposable syringe. Rinse with deionised water in succession in the openings of the heat exchanger. If there are still contaminants in the heat exchanger after this flushing operation, a small bottle brush or pipe cleaner can be used for cleaning. If cleaning with demineralized water is not sufficient, glass cleaning agents can also be used. If cleaning agent is used, the gas cooling tube must be rinsed after cleaning with 200 ml of deionised water.
5. Dry the surfaces of the heat exchanger with a soft paper towel. The lateral hose connections of the heat exchanger are dried using a pipe cleaner. For cleaning of the gas cooling tube, a damp cotton cleaning cloth or a damp bottle brush can be used. The connectors of the gas cooler must not be cleaned with sharp objects, as otherwise the transition surface from the cooler to the gas cooler will be damaged.
6. Coat the outer surfaces of the gas cooling tube with silicon-free thermal compound.
7. Slide the gas cooling tube into the radiator receptacles.
8. Reconnect the hose connectors correctly.




**1** Gas cooler
**2** Tube connectors

*Fig. 89: Gas cooler, view from above*

3. be restarted.

### 8.3.7 CleanTube Cassette Pump and Pump Cassettes

Precondition: - Tube cassette pump and/or pump cassettes are contaminated.

1. Take the pump cassettes from the pump.
2. Take the tubes from the pump cassettes.
3. Clean the pump and the pump cassettes.
4. Fit the tubes into the pump cassettes.
5. Insert the pump cassettes into the pump.

### 8.3.8 Clean Sample Pump

Precondition: - Sample pump is contaminated.

1. Open the pump head.
2. Take the tube from the sample pump.
3. Use a paper cloth and a little water to clean the pump rollers.
4. Whilst cleaning the rollers, rotate them by hand so that everywhere can be cleaned.
5. Insert the pump tube back in.
6. Close the pump head.

### 8.3.9 Adjust Sample Pump

Precondition: - Sample pump not adjusted correctly.

1. Open the pump head all the way (the cover must be vertical).
2. Turn the adjustment wheel on both sides (left and right) so that the setting value is 3.2 or 4.8 depending on the tube used.

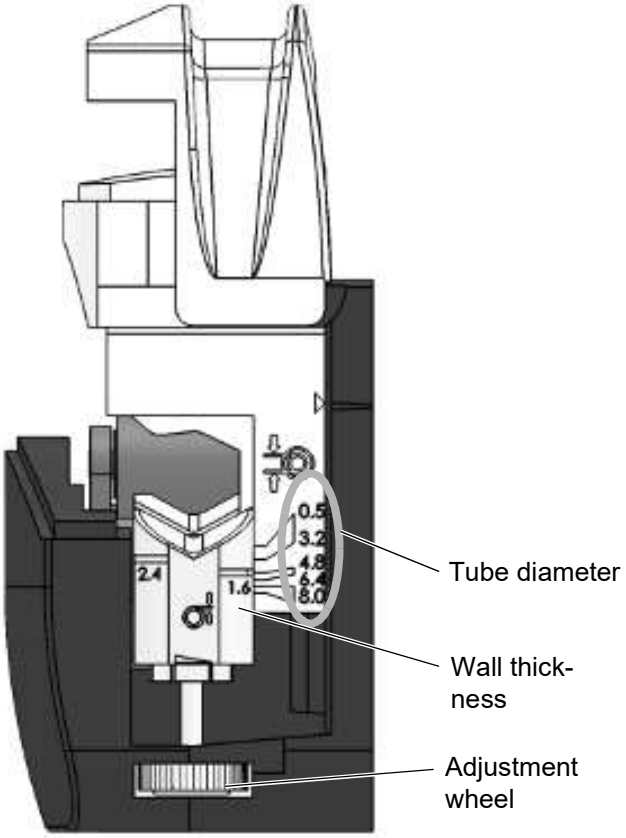



*Fig. 90: Sample pump Adjustment*

**Reduced delivery rate of the pump**

Deviating settings can cause poor pump performance and incorrect results.

Adjust the pump head according to the application and to the correct hose diameter.

Warning

#### 8.3.9.1 Clean and Grease Bearing Pin

3. Turn off the pump.
4. Remove the screws on both sides of the pump cassette.
5. Remove the metal sheet with the bearing pin and clean the bearing pin with a non-abrasive cloth.
6. Coat the bearing pins with grease.
7. Screw the sheet to the pump.
8. Check with your fingers if the rollers are running smoothly.
9. Switch on the pump.

### 8.3.10 Checking Measurement Values of the Standard Solution

1. Use a standard solution or use a ready-made standard solution from a certified laboratory.
2. Place the standard solution in a clean calibration vessel and place the vessel in the appropriate position for incorporation into the sample stream.
3. Measure the standard solution (screen mask "Single measurement", see Chapter 7.2.13 on page 91). In the measured value screen (see Chapter 7.2.9 on page 86) in user level 1 and in the single measurement screen in user level 2, the measured values of the standard solution can be

checked.

4. Start the measurement to complete the check

### 8.3.11 Check and Document the Status of the Analyser.

See Chapter 8.2 from page 119.

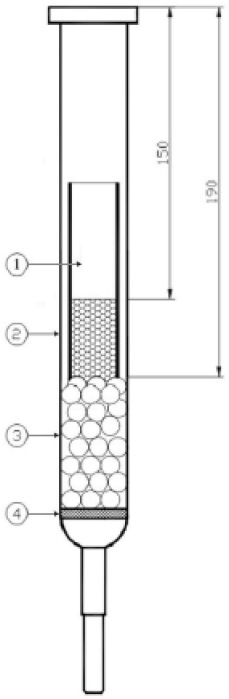
### 8.3.12 Check and Document a Measurement

1. Check the temperatures or displays in the device status. The instrument will only take measurements when the furnace has reached the working temperature of 1200° C and the radiator has reached its operating temperature between 4 and 5° C.
2. Check the carrier gas pressure on the indicating instrument. The setpoint is 0.3-0.5 bar.
3. Check the volumetric flow in the status screen in idle state, e.g. $V_{on}$: 10-50 l / h, $V_{off}$: 10-50 l / h. $V_{on}$ = $V_{off}$. At 15 l / h input value, the setpoint for the output is also 15 l / h.
4. Only during the injection may the output value have a deviation of up to 5% from the input value.

### 8.3.13 Replace Pump Tubes and Condensate Tubes

1. Switch off the pump (user level 2, screen window Service Actions, see Chapter 7.2.12 on page 88).
2. Take the pump hose out of the pump on both sides and insert a new, same hose into the pump.
3. Continue until all pump hoses have been replaced.
4. Switch on the pump and press the "End maintenance" button (user level 2, screen window Service Actions, see Chapter 7.2.12 on page 88).
5. After this maintenance work, the measurement can be restarted.

## 8.3.14 Replace Reactor Pipe or Reactor Pipe Filling




**1** Thermowell
**2** Ceramic balls 3,5 - 4,5 mm
**3** Ceramic balls 7 mm
**4** Ceramic sieve

*Fig. 91: Reactor filling*

Danger

**Danger of burns**

Allow the furnace to cool completely (2 hours in total). One hour after switching off the furnace, the temperature of the reactor tube is still about 400° C to 500° C!

Always use heat-resistant gloves when working on the furnace.

Warning

**Correct installation of removed components**

During assembly, remember that all parts that have been removed and / or disassembled must be reassembled as they were in their original condition.

Disassembly:

1. Switch off the oven via the "Service Actions" display (Chapter 7.2.12 on page 88) and allow it to cool down for 2 hours.
2. Disassemble the ventilation grille on the bottom of the analyser by carefully pulling it forward with your hands (Fig. 113, page 152).
3. Loosen the screws of the second floor grate behind and take it off. Now the reactor foot is visible.
4. Unscrew the four black spacers.
5. Unscrew the three screws from the socket of the reactor base.
6. Loosen the screwed connection with Teflon hose from the reactor foot receptacle.
7. Carefully pull the reactor foot off the reactor tube end and lay it to one side.

8. Disconnect the injection port connector.
9. Carefully loosen the three screws of the oven head one after the other crosswise.
10. Disconnect the hose from the hose connection.
11. Remove the furnace head and injection port from the reactor tube and set aside.
12. Make sure the furnace head, injection port, and reactor foot are removed.
13. After cooling the oven (about 2 hours), pull the reactor tube out of the oven. Use heat-resistant gloves.
14. Place the reactor tube on a fireproof pad or place it with the taper down in a sand-filled bucket and allow to cool completely.

Replacement:

1. If the reactor tube is damaged, replace it with a new reactor tube.
2. Observe the order of filling the reactor tube.
3. Place the ceramic sieve (**4**, Fig. 91, page 127) horizontally on the taper of the reactor tube or let it fall into the reactor tube.
4. Shake the reactor tube to bring the ceramic sieve into a horizontal position (you can use a flashlight to check placement).
5. Carefully insert the protective tube (**1**) from above into the reactor tube.

Warning

**Damage due to improper filling**

Incorrect filling of the reactor tube can damage the reactor tube.

Use a funnel to fill the ceramic balls so that the ceramic balls do not fall between the reactor tube and the protective tube.

6. Fill the ceramic balls with a diameter of 7 mm (**3**) to the specified height (190 mm, measured from the top edge with a measuring tape).
7. Fill the ceramic balls with a diameter of 3.5 mm - 4.5 mm (**2**) to the specified height (150 mm, measured from the upper edge with a tape measure).

Assembly:

1. Place the green protective gasket for the reactor tube on the furnace.
2. Push the filled reactor tube into the center of the oven from the top.
3. Place the oven head on the oven and reactor tube.
4. Connect the black hose to the intended hose connection.
5. Screw the three fixing screws of the furnace head with the oven head plate crosswise.
6. Carefully tighten the injection port until a slight resistance is felt (the injection port should point diagonally to the left front).
7. Insert the plug of the injection port again.
8. Attach the reactor foot receptacle to the reactor foot plate with three M4x30 screws.
9. Connect the Teflon tube (PFA) to the screwed connection.
10. Screw the screwed connection to the reactor foot receptacle.
11. Insert the reactor bottom from below onto the reactor tube.
12. Screw in the distance bolts (4x).
13. Pull the reactor bottom down so that the gas path is not blocked by the reactor tube.
14. Attach the floor grate again.
15. Reinstall the ventilation grille .
16. Dispose of the old reactor tube filling and, if necessary, the old reactor tube.
17. Switch on the oven via the "Service actions" display (*Kapitel 7.2.12 ab Seite 88*).

Notice

The reactor tube filling shown in Fig. 91, page 127 is an excellent solution for the majority of applications.

However, some applications can be optimized by varying the listed default fill. Any deviations from the standard filling should be discussed in advance with LAR Technical Support or with a LAR authorized service partner.

As our research and development progresses, we ask that you stay in touch with your LAR contact to stay up-to-date with any additions

### 8.3.15 Replace Reactor Seal

Danger

**Danger of burns**

Allow the furnace to cool completely (2 hours in total). One hour after switching off the furnace, the temperature of the reactor tube is still about 400° C to 500° C!

Always use heat-resistant gloves when working on the furnace.

Warning

**Correct installation of removed components**

During assembly, remember that all parts that have been removed and / or disassembled must be reassembled as they were in their original condition.

Disassembly:

1. Switch off the oven via the "Service Actions" display (Chapter 7.2.12 on page 88) and allow it to cool down for 2 hours.
2. Disassemble the ventilation grille on the bottom of the analyser by carefully pulling it forward with your hands.
3. Loosen the screws of the second floor grate behind and take it off. Now the reactor foot is visible.
4. Unscrew the four black spacers.
5. Unscrew the three screws from the socket of the reactor base.
6. Loosen the screwed connection with Teflon hose from the reactor foot receptacle.
7. Remove the reactor foot carefully from the reactor pipe.

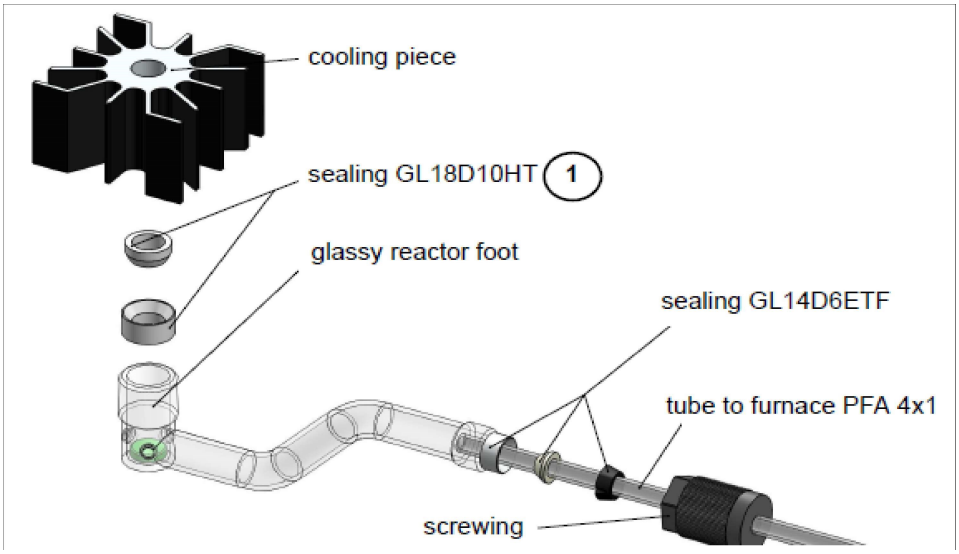


*Fig. 92: Reactor foot with cooler*

8. Remove the two gaskets (**1**, Fig. 92, page 130) between the furnace base and heat sink.
9. Clean the base of ash and dirt with a damp cloth and insert two new gaskets.
10. Attach the heat sink to the oven base.
11. Disconnect the injection port connector.
12. Carefully loosen the three screws of the oven head one after the other.

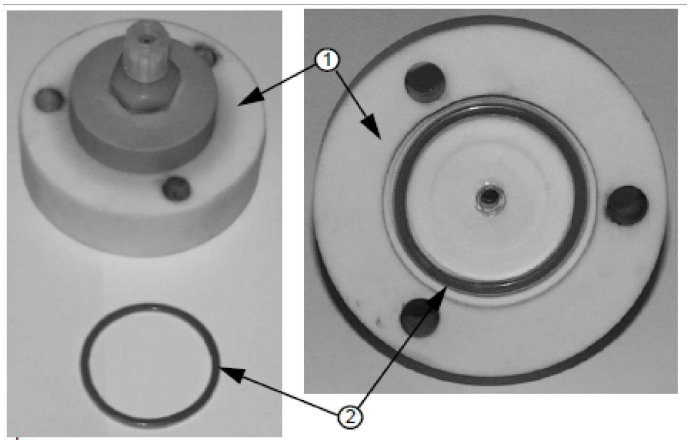



*Fig. 93: Furnace head with furnace head seal*

13. Remove the gasket (**2**) from the furnace head (**1**) with tweezers.
14. Insert a new furnace head gasket into the groove of the furnace head.
15. Disconnect the hose from the hose connection.
16. Remove the furnace head and injection port from the reactor tube and set aside.
17. Make sure the furnace head, injection port, and reactor foot are removed.
18. After cooling the oven (about 2 hours), pull the reactor tube out of the oven with heat-resistant gloves.

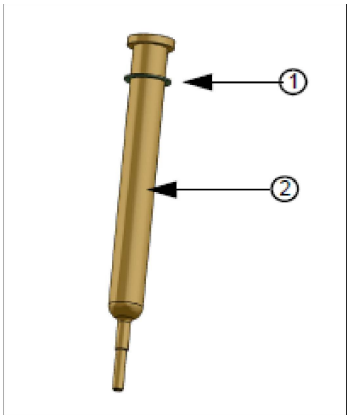



*Fig. 94: Ractor pipe*

19. Place the reactor tube (**2**) on a fireproof pad or place it with the taper down in a sand-filled bucket and allow to cool completely.
20. Remove the protective gasket (**1**) and replace the gasket with a new gasket.

Assembly:

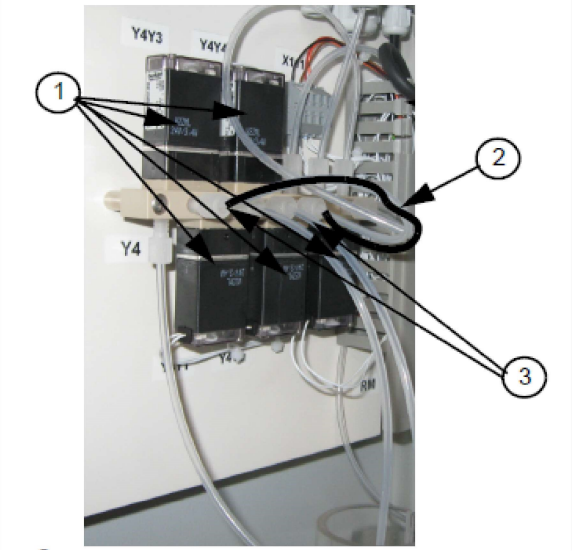
1. Insert the filled reactor tube (**2**) from the top into the center of the furnace.
2. Place the oven head on the oven and reactor tube.
3. Connect the black hose to the intended hose connection.
4. Screw the three fixing screws of the furnace head with the oven head plate crosswise.

5. Carefully tighten the injection port until a slight resistance is felt (the injection port should point diagonally to the left front).
6. Insert the plug of the injection port again.
7. Attach the reactor foot receptacle to the reactor foot plate with three M4x30 screws.
8. Connect the Teflon tube (PFA) to the screwed connection.
9. Screw the screwed connection to the reactor foot receptacle.
10. Insert the reactor bottom from below onto the reactor tube.
11. Screw in the distance bolts (4x).
12. Pull the reactor bottom down so that the gas path is not blocked by the reactor tube.
13. Attach the floor grate again.
14. Fasten the ventilation grille again.
15. Switch on the oven via the "Service actions" display (Chapter 7.2.12 from page 88).

### 8.3.16 Loop System Tube

The loop system is located on the left above the ceramic oven.

1. Loosen the hose connectors (**3**) of the loop hose (**2**) on the two solenoid valves (**1**).
2. Cut a new tube as required (50, 100, 200 or 400 µl).
3. Attach the new loop hose to the hose connectors (**3**).




**1** Solenoid valves
**2** Loop tube
**3** Connectors

*Fig. 95: Loop system*

### 8.3.17 Check Sample Drain Tubes and Replace

1. Check the sample drain tubes for brittleness and elasticity. If the tubes are brittle or inelastic, the hoses must be changed.

2. Loosen the cable gland and compression fitting on the device..


Warning

**Correct disassembly and assembly of components**

When removing hoses from the sample glass sample container, make sure that it is not damaged.

Do not grease hoses during assembly!

3. Using a sharp knife, cut the other end of the tube into the sample storage vessel and remove the tube from the sample storage vessel.
4. Slide a new tubing onto the drain of the sample storage vessel.
5. Attach the other end of the hose to the unit using the cable gland and compression fitting.

### 8.3.18 Check Quartz Wool Filter and Replace if Necessary

1. Call the Status Screen and make a not of the actual pressure value.
2. Take the quartz wool tube out of the holder.
3. Loosen the upper and lower screws.
4. Take the used quartz wool out of the tube.
5. Fill the pipe with new quartz wool. When filling, make sure that the pipe at the bottom is loosely filled with quartz wool at the top and that there is no quartz wool at the top of the pipe.
6. Clean the red fittings of any deposits.
7. During assembly, make sure that the black O-ring is securely in the groove provided in the screw connection.
8. Put the quartz wool tube back in the holder.
9. After installing the freshly filled quartz wool filter, the status screen must be recalled. The pressure value [mbar] should not deviate too much from the previously read pressure value.
10. Insert a new tube of the same length into the sample pump.

### 8.3.19 Replace Gas Filter

The gas filter is located behind the control panel in front of the detector.

1. Open the clamp at the top right where the gas filter (**2**) is attached.
2. Disconnect the connection hoses (**1**) of the gas filter from the connections.
3. Pay attention to the direction of the volumetric flow (see black arrow).
4. Insert the new gas filter (**2**).
5. Pull the connecting hoses (**1**) of the gas filter onto the connections.
6. Close the clamp.

### 8.3.20 Replace Filter Mats

**Precondition:** - Filter mats have strong discolouration.

1. Open the ventilation grid on the left side of the analyser by levering out the ventilation flap ).
2. Remove the ventilation grid on the bottom side of the analyser by pulling it forward with your hands
3. Remove the filter mats which to be replaced.
4. Dispose the filter matd in an environmentally responsible way.
5. Insert new filter mats.
6. Close the ventilation grid.

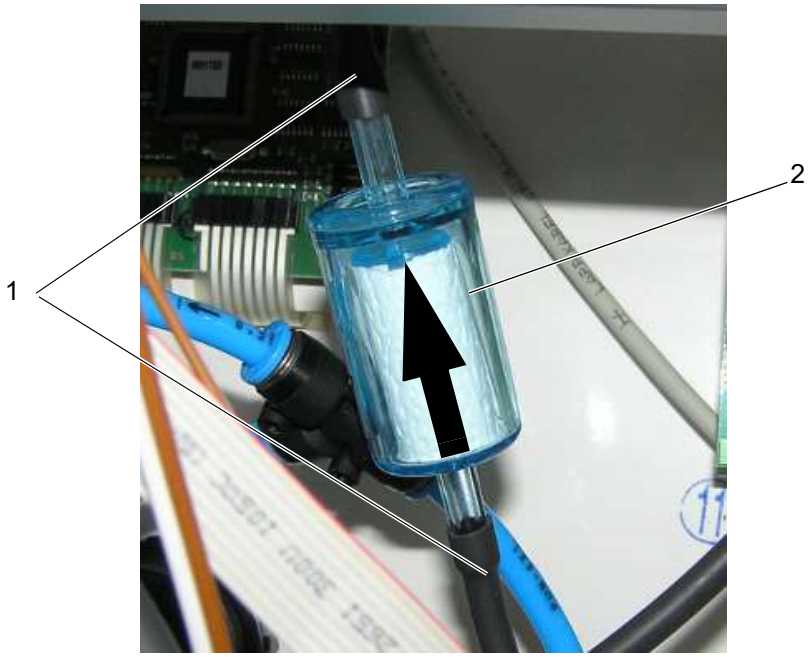



*Fig. 96: Gas filter*

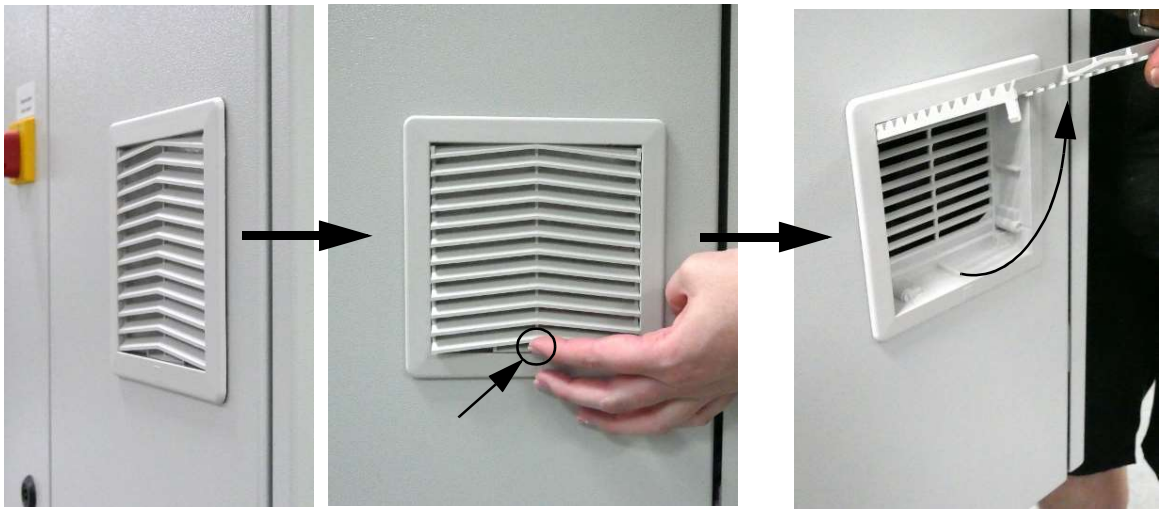


*Fig. 97: Replace the Filter Mats on the left side of the Analyser*

### 8.3.21 Check Viton Tubes and Replace if Necessary

The Viton tubes are black and are located on the gas cooler.

1. If the visual inspection results in a lining or blockage inside the tube, it must be cleaned or replaced.
2. Clean the hose with deionised water and a pipe cleaner in a laboratory flask. If the hose is too dirty, it should be replaced.
3. Remove the hose from both sides of the device and insert a new, identical Viton tube. This allows the hoses to be replaced one after the other.

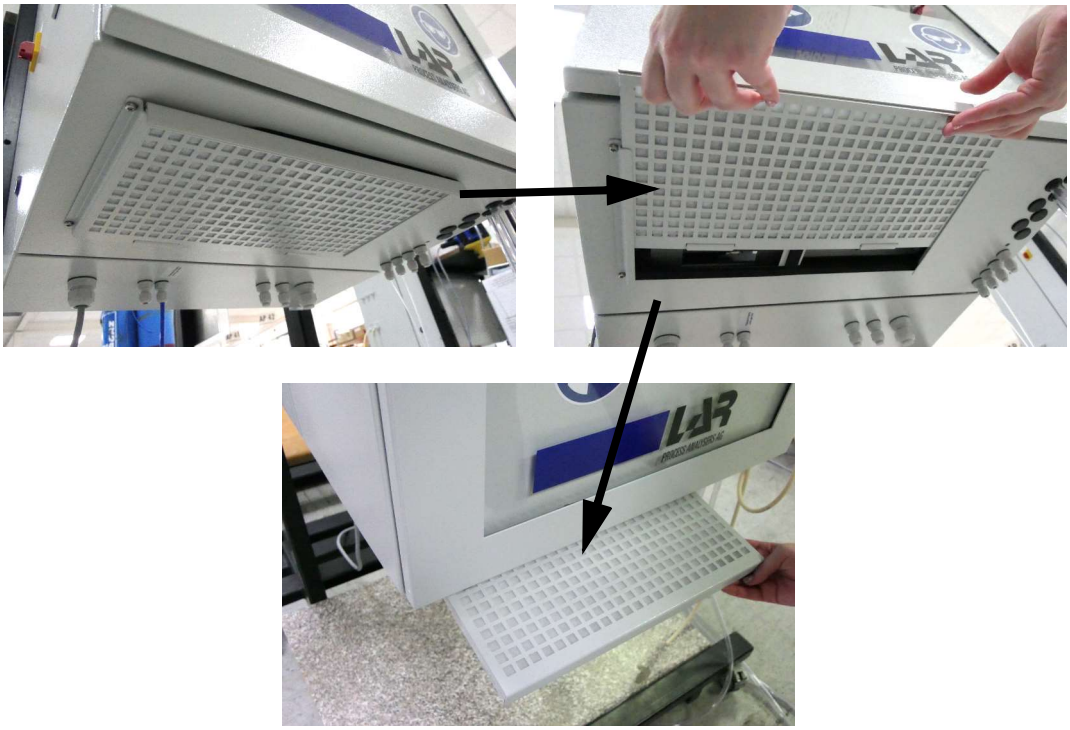


*Fig. 98: Replace the Filter Mats on the bottom side of the Analyser*

# 9 Accessories and Options

In this section you will find illustrations for and explanations of components you can select as accessories or options for the analyser.

## 9.1 Overview

Accessories:

- Reagent cabinet
- Air Treatment Unit
- $CO_2$-Remover
- Mounting rack

Options:

- Multistream option
- Multiparameter option
- Auto-TIC-Port (for TOC difference methos)

Notice

If you have any questions, contact the **distributor of LAR** (Chapter 15.1 on page 187).

## 9.2 Reagent Cabinet

The reagent cabinet is used for the protected storage of the following reagents:

- Ac id
- Rinsing Water

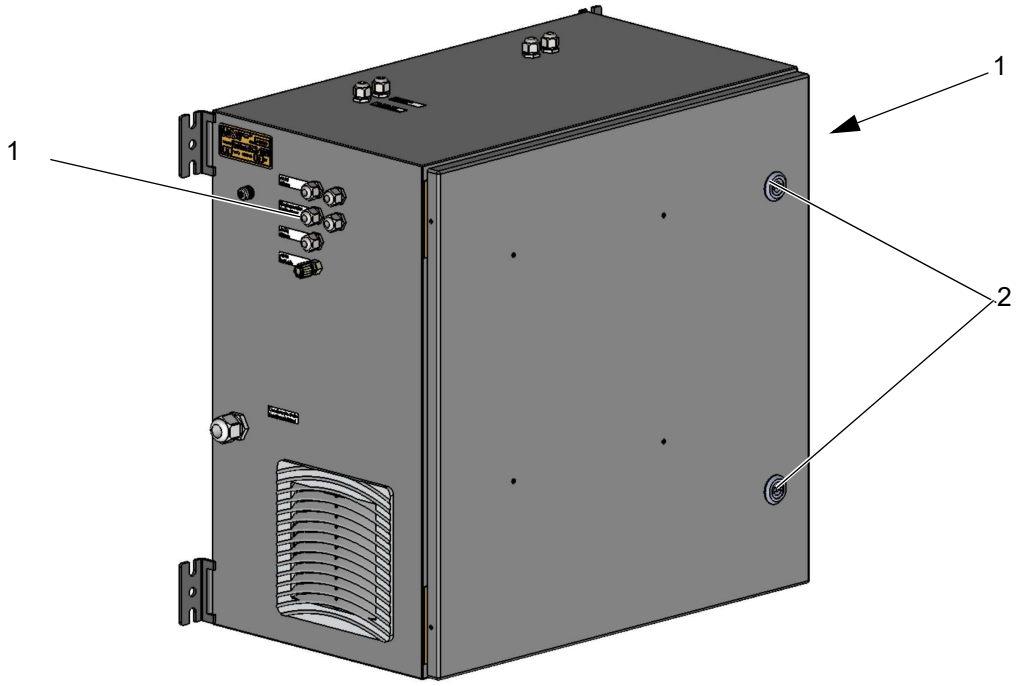
For the dimensions of the reagent cabinet, see Chapter 11.3 on page 170.

Notice

The containers for the reagents are delivered separately.

The reagent cabinet has different outputs for the solutions, which are labelled specifically for the application. Please note the labelling.

### 9.2.1 Construction of the Reagent Cabinet




**1** Tube feedthroughs
**2** Housing locks

*Fig. 99: Reagent cabinet*

### 9.2.2 Installation of the Reagent Cabinet

Installation of the Reagent Cabinet is dependent on the mounting variant.

Variant 1 (without mounting):
Place the Reagent Cabinet onto the floor or the PVC plate of the mounting rack under the analyser.

Variant 2 (Wall mounting):
Fit the Reagent Cabinet with the stud bolts on the wall underneath the analyser (Chapter 4.3.2 from page 34).

Warning

Do not fit the Reagent Cabinet too high (near to the analyser) because otherwise the ventilation unit underneath the analyser is difficult to access.

Variant 3 (Mounting Rack):
Use holes Q1 and Q2 in the mounting rack, and holders Q1 and Q2 on the Reagent Cabinet, for fitting on the mounting rack (Chapter 9.5 from page 160).

### 9.2.3 Start-Up of the Reagent Cabinet

At delivery, the tubes are rolled up inside the analyser and secured with a cable tie.

Proceed as follows

1. Use side-cutting pliers for example to remove the cable tie.
2. Guide the tubes through the cable feedthroughs provided on the side of the reagent cabinet.
3. Undo the union nuts of the canisters.
4. Put the tubes into the relevant canisters.
5. Secure the union nuts of the canisters.

Warning

Ensure not to damage the tubes when removing the cable tie.
The tubes must be connected to the right canisters. Note the labelling.

Notice

A suitable O-ring can be pulled onto a tube so that it has the correct penetration depth (Fig. 100, page 138). The O-ring should be fitted about 6 cm from the end of the tube.

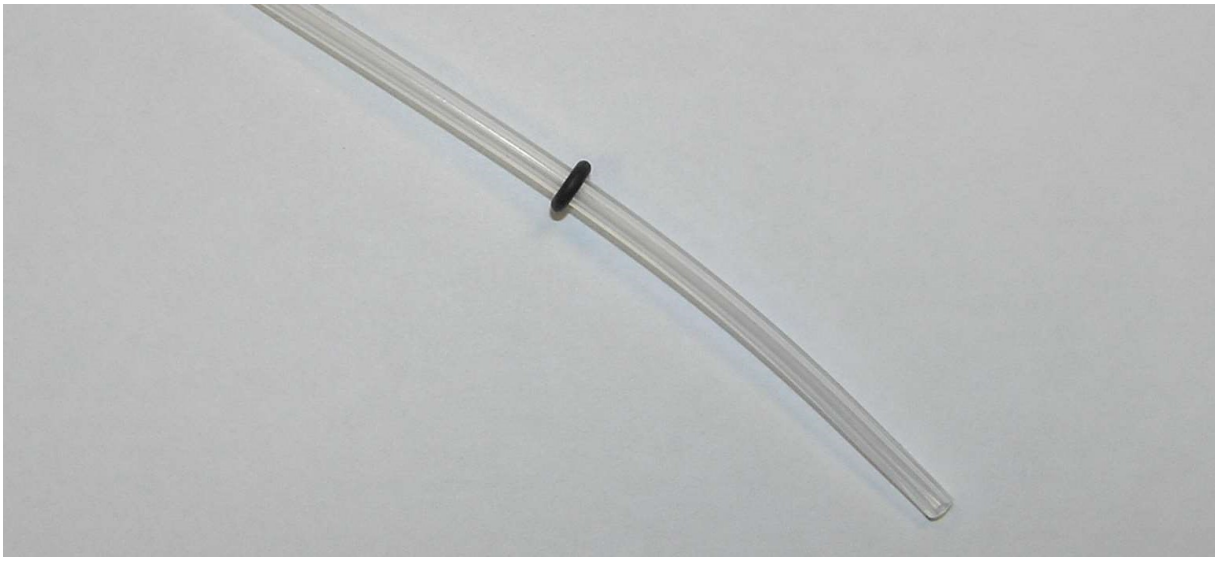


*Fig. 100: Tube with O-Ring*

# 9.3 Air Treatment Unit / Carrier Gas Processing

## 9.3.1 Activated Carbon

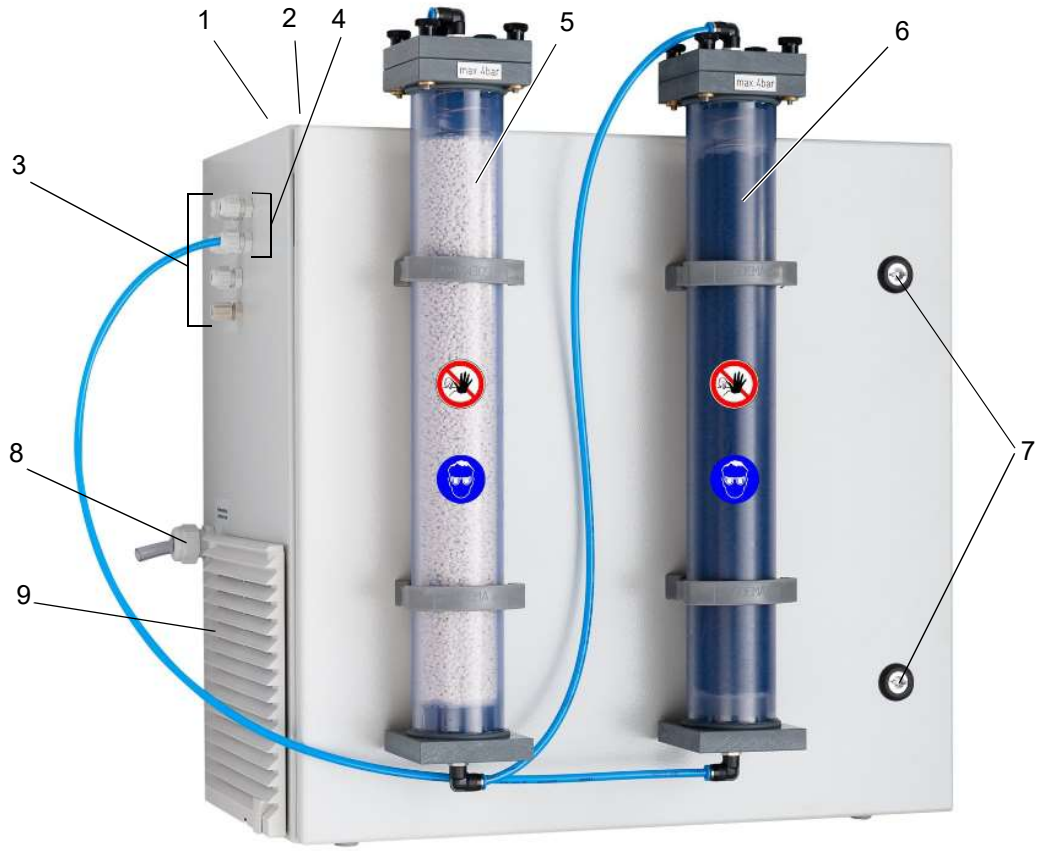
With the help of activated carbon, most volatile carbon compounds can be adsorbed. The use of activated carbon is harmless. The filter cartridge for the activated carbon is located on the cabinet on the right side (Fig. 110, page 149).

## 9.3.2 Soda Lime Pellets with Indicator

The $CO_2$ in the ambient air must be removed before entering the analyser. When using soda lime cookies with indicator, the safety regulations for corrosive substances must be observed. Gloves and goggles should always be worn to prevent burns. When dust develops, a breathing mask must also be worn. The filter cartridge for the soda
Lime cookies with indicator is located on the cabinet on the left side (Fig. 110, page 149).

Notice

If the absorption capacities of the chemicals mentioned above are exhausted, the zero signal of the $CO_2$ detector rises. The Zero signal can be chacked in the view „Sensors“ (Chapter 7.7.5.1 on page 115).




**1** Power connection to the analyzer (hidden)
**2** Carrier gas to the analyzer (hidden)
**3** Tube feedthroughs (rear row)
**4** Tube feedthroughs (front row)
**5** Soda lime filter cartridge
**6** Activated carbon filter cartridge
**7** Cabinet lock
**8** Condensate drain
**9** ventilation grille

*Fig. 101: Components of the carrier gas processing*

#### 9.3.2.1 Tubing of the Carrier Gas Processing

The carrier gas for the measurements must meet certain criteria. If ambient air is to be used, it must be prepared accordingly.
The tubing for circulating air treatment is shown in the following figure. The legend for the item numbers can be found in Fig. 104, page 144.

### 9.3.3 Installation of the Carrier Gas Processing

The installation of the circulating air treatment depends on the installation variant carried out.

Variant 1 (without mounting):
Place the recirculating air preparation on the floor or on the PVC plate of the mounting rack under the analyser.

Variant 2 (wall mounting):
Mount the recirculation unit with the heavy duty anchors on the wall underneath the analyser.

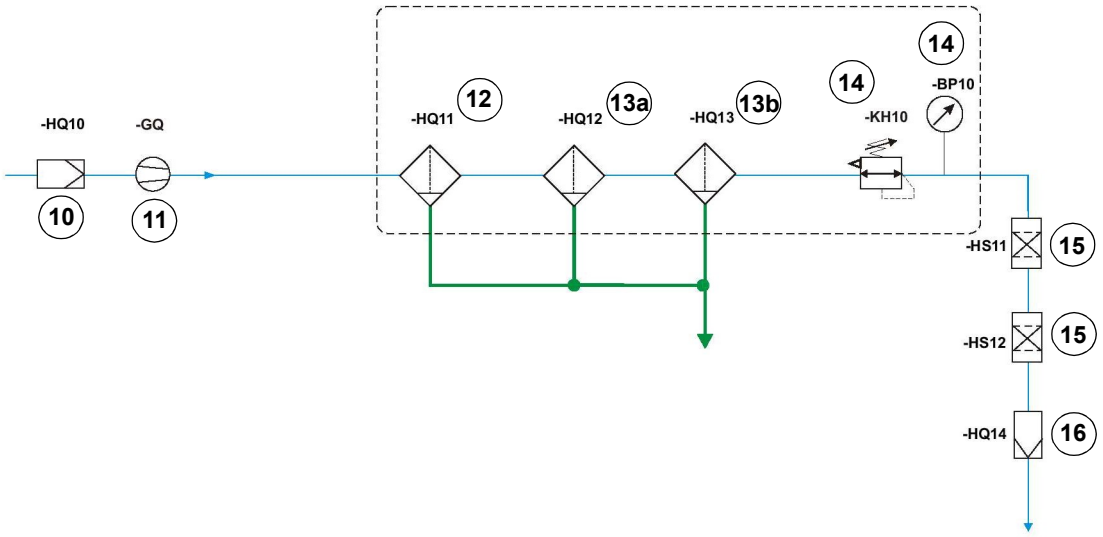



*Fig. 102: Tubing scheme of the carrier gas processing*

Notice

Do not mount the recirculation system too high (close to the analyser), as the ventilation below the analyzer is otherwise difficult to access.

Variant 3 (mounting rack):
Use the holes Q1 and Q2 of the mounting frame and the recirculating air conditioning brackets Q1 and Q2 for mounting on the LAR mounting rack (Chapter 9.5 from page 160).

## 9.3.4 Set-up of the Carrier Gas Processing


Warning

**Warning of insufficient air supply**

Pass the tubing according to the tubing diagram in Fig. 102, page 141 as otherwise no or insufficient air can flow in.

### 9.3.4.1 Transport Locks

The carrier gas processing is supplied with a bridging of the soda lime filter cartridge (left filter cartridge) and the activated carbon filter cartridge (right filter cartridge). This prevents consumption of soda lime cookies with indicator.

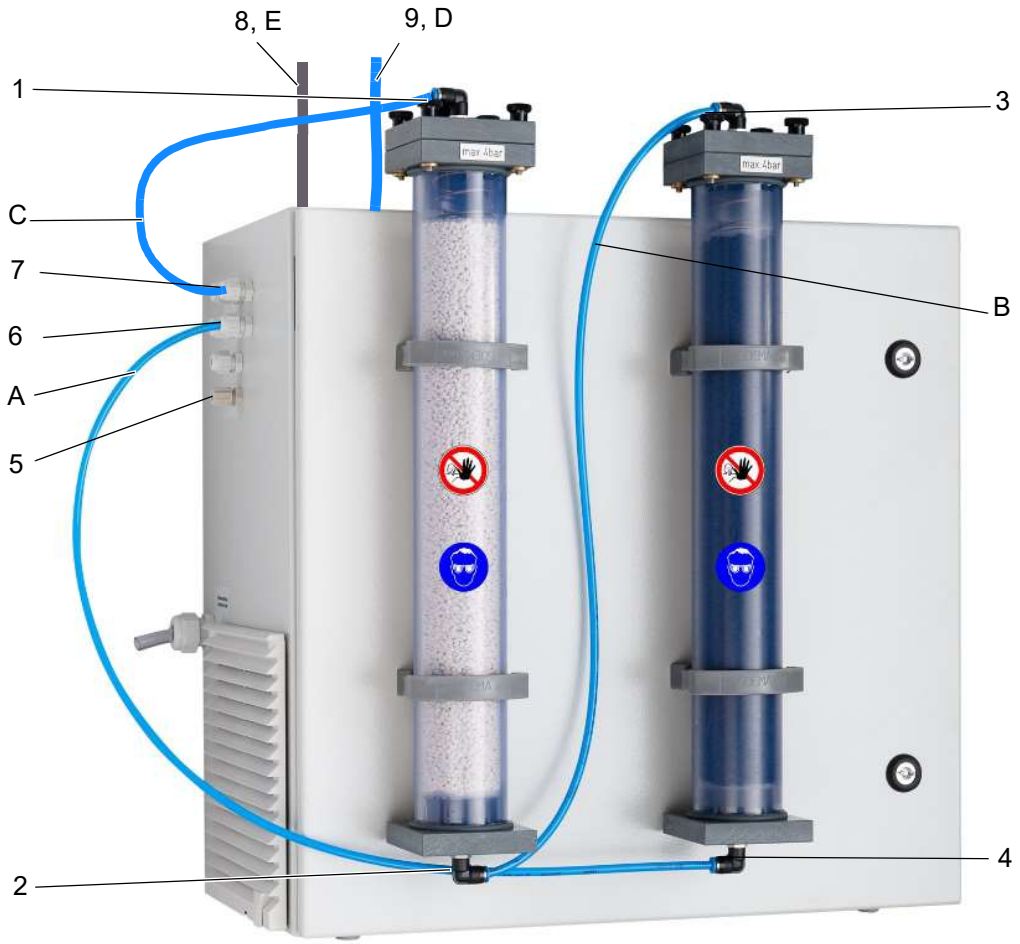
For transportation purpose (Fig. 101, page 140):

- hose A is attached between points 1 and 4
- hose B is attached between points 2 and 3

### 9.3.4.2 Tubing of the Carrier Gas Processing

Connect the tubing of the carrier gas processing as shown in the tubing diagram Fig. 103, page 143:

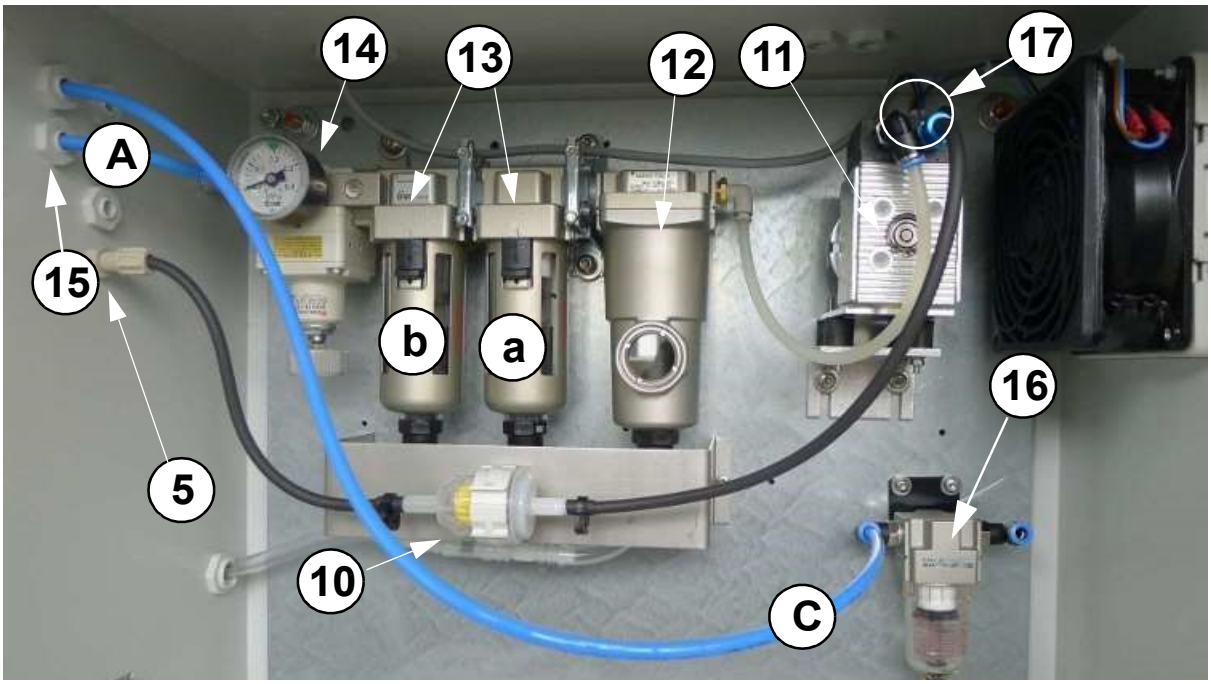
1. Disconnect the hose (**A**) from the connector (**1**, Fig. 103, page 143).
2. Feed the hose (**A**) through the point (**6**, Fig. 103, page 143) into the recirculating air treatment.
3. Mount hose (**A**) in the recirculating air treatment unit on the pressure regulator KH10.
4. Feed hose (**C**) (in circulating air preparation at the fine filter) through point (**7**) to the outside.
5. Fit hose (**C**) to point (**1**).
6. Hose (**B**) remains at points (**2**) and (**3**).
7. Route hose (**D**) from analyzer through point (**9**) to recirculation unit.
8. Mount hose (**D**) on the fine filter HQ14 in the circulating air preparation (Fig. 105, page 144).




**1** Carrier gas outlet soda lime filter
**2** Carrier inlet soda lime filter
**3** Carrier gas outlet activated carbon filter
**4** Carrier inlet activated carbon filter
**5** Ambient air input
**6** Carrier gas outlet of the recirculating air treatment to the activated carbon filter
**7** Carrier gas inlet of the recirculating air treatment from the soda lime filter
**8** Feedthrough for power supply cables
**9** Feedthrough for carrier gas hose to the analyser

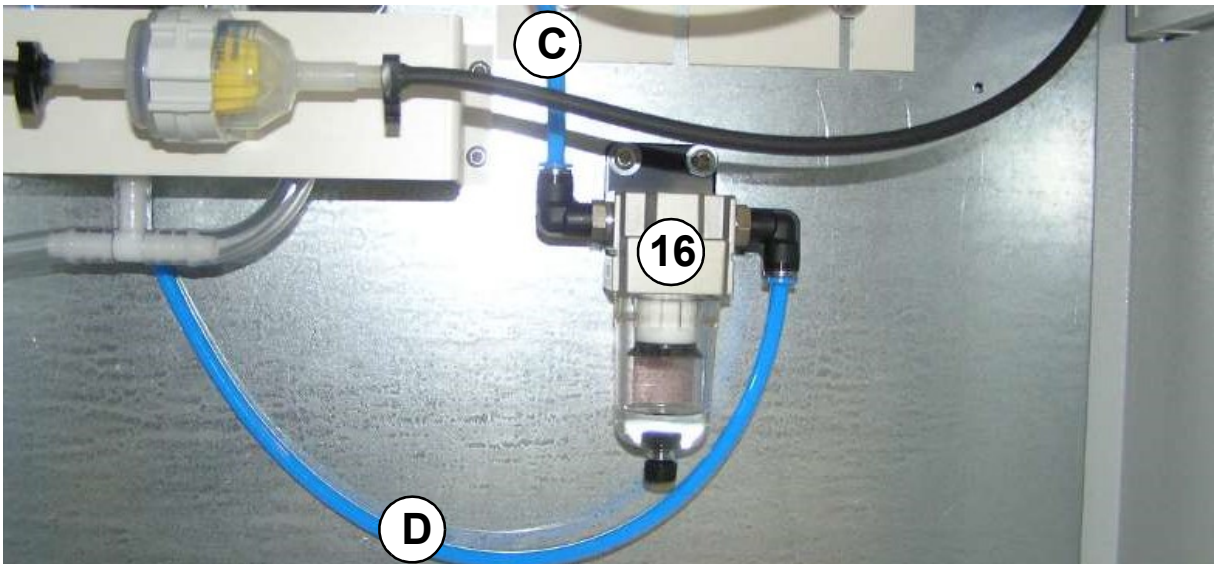
A-D carrier gas hose (blue)
E power cable (black)

*Fig. 103: Carrier gas processing in operation*




**10** HQ10 - Gas filter
**11** GQ - Compressor
**12** HQ11 - Water separator
**13** Filter unit
a HQ12 - Compressed air filter 1, coarse filter
b HQ13 - Compressed air filter 2, fine filter
**14** KH10 - Pressure regulator + BP10 - Pressure indicator
**15** Connection to activated carbon (HS11) and connection to soda lime (HS12)
**16** HQ14 - Fine filter to analyser
**17** Electric connection (2-pole plug - from analyser to compressor)

*Fig. 104: Tubing of the carrier gas (No. 10-16) and electrical connection (No. 17) of the circulating air treatment*




C Carrier gas hose coming from the soda lime filter (mounted on the circulating air treatment)
D Carrier gas hose to the analyser
16 HQ14 - Fine filter

*Fig. 105: Detailed view of the fine filter - HQ14*

### 9.3.4.3 Electric Connection

1. Feed the power cable with the brown, blue and green-yellow wires through the recirculation unit (**8**, Fig. 103, page 143).
2. Open the rear case of the analyzer to access the mounting plate (Fig. 20, page 35).
3. Locate the 24 V / DC (X4) recirculating air connection terminal.
4. Attach the brown wire to brown (terminal 8).
5. Attach the blue wire to black (terminal 9).
6. Attach the green-yellow cable to green-yellow (terminal 10).
7. Lose the rear housing.
8. .

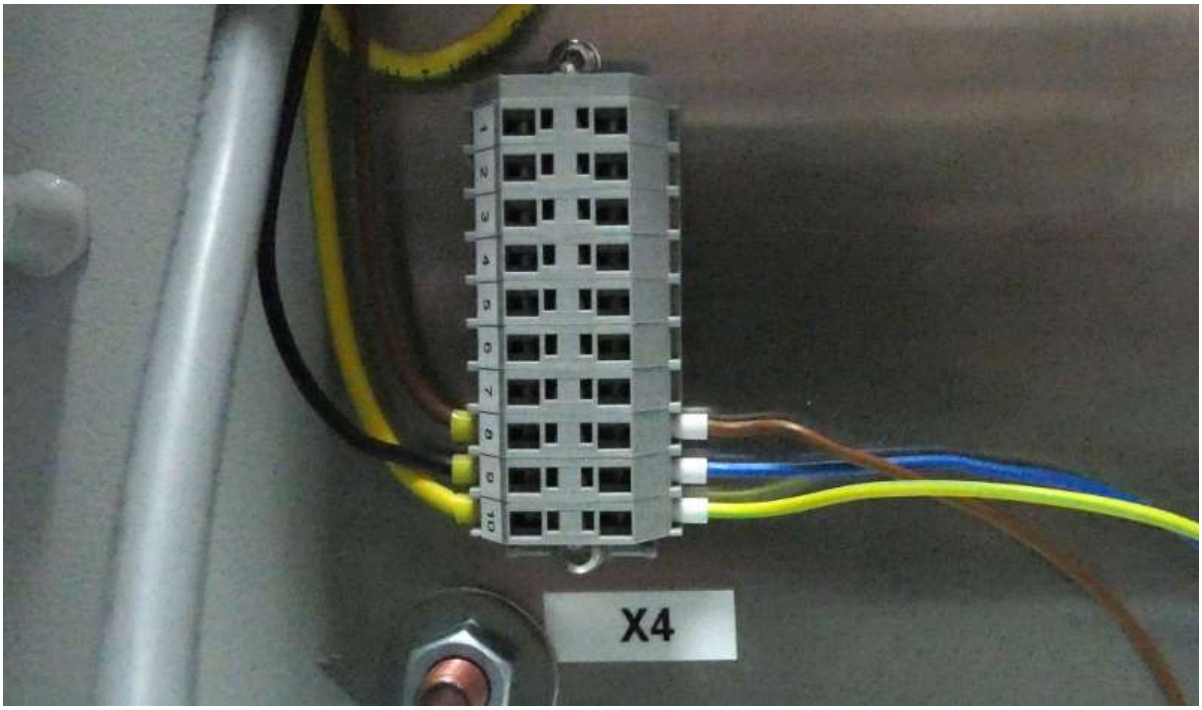



*Fig. 106: Electric connection of the carrier gas processing in the analyser*

Warning

The connection terminal of the circulating air conditioning has a voltage of **24 V / DC**.

### 9.3.5 Care and Maintenance (Carrier Gas Processing)

This chapter will show you how to optimally maintain your recirculating air treatment to ensure proper operation. The documentation of the care and maintenance measures is a prerequisite for any guarantee and warranty claims and a valuable help in finding a solution in the event of a malfunction

*Table 17: Care and Maintenance procedure*

| Interval | Action | Kind of Action | OK | Comment |
|---|---|---|---|---|
| If necessary | Replace soda lime pellets | Maintenance | ☐ | |
| 3 Months | Replace gas filter | Maintenance | ☐ | |
| | Replace filter mats | Maintenance | ☐ | |
| 1 Year | Replace sub-microfilter | Maintenance | ☐ | |
| | Replace filter 5µm | Maintenance | ☐ | |
| | Replace activated carbon | Maintenance | ☐ | |
| Date: | | Signature: | | |

Notice

A corresponding copy of the log is in Chapter 13 from page 229.

If you have any question to visual inspections, please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 245).

### 9.3.6 Perform Visual Inspection (Carrier Gas Processing)

Proceed as follows:

1. Follow the instructions below for the visual inspections for each component.
2. Carry out care and / or maintenance measures if the test criteria have not been adhered to and document them in the care and maintenance report (recirculation air conditioning).
3. After the inspection and any care and maintenance measures (circulating air treatment), complete the documentation of the protocol(s).

*Fig. 107: Innenraum der Carrier Gas Processing*

#### 9.3.6.1 Sub-Microfilter

1. Open the Carrier Gas Processing.
2. Check for cleanliness of the condensate drain of the filter unit.
3. If all criteria are met, proceed with the next step.

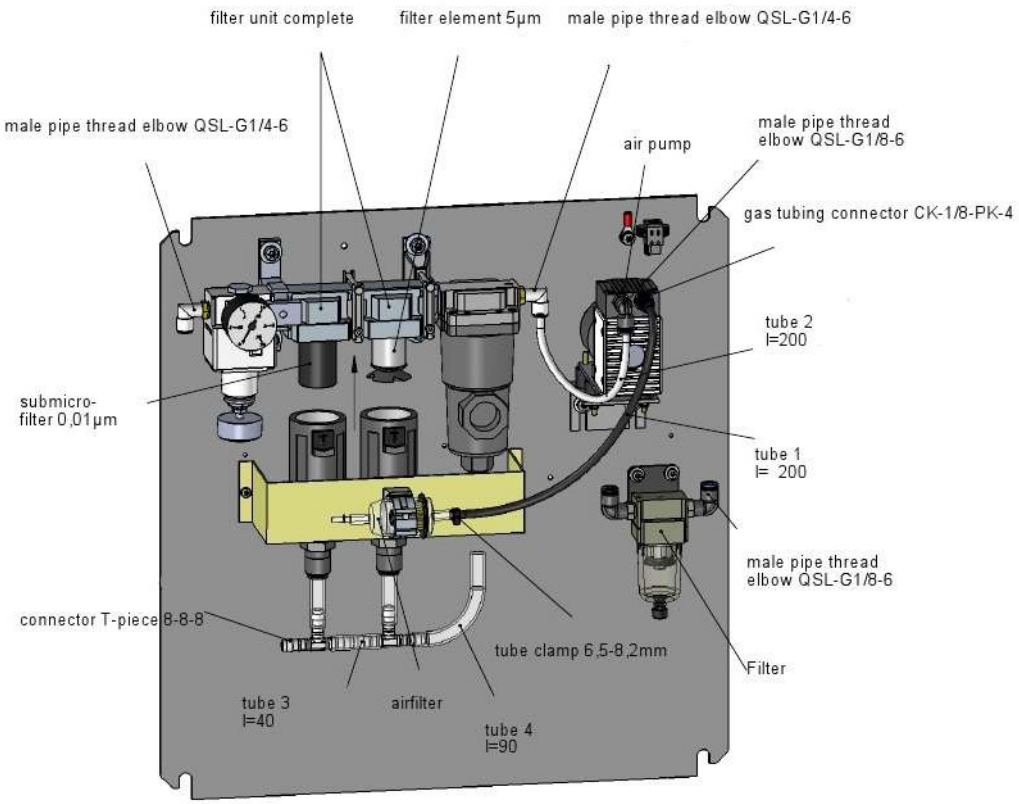



*Fig. 108: Inside view of the Carrier Gas Processing Unit*

### 9.3.6.2 Filter Unit

1. Unplug the electrical connector for the compressor so that there is no more pressure in both filters.
2. On both filters, pull the black lug down and turn the containers to release the containers of the compressed air filter (coarse or fine).
3. As a test, fill the containers with water (min. 30 ml) to above the float and reinsert them.
4. Plug the electrical connector of the compressor back into the jack. The pressure rises and the condensate should drain at a pressure > 1 bar.
5. If it does not, the float mechanism is defective and the relevant filter unit needs to be replaced.
6. Once all test criteria are met, proceed with the next step.

### 9.3.6.3 Soda lime cookies with indicator

1. Look at the left filter cartridge, which is filled with soda lime cookies.
2. Check the soda lime cookies for their white color.
3. If the soda lime cookies are 75% discolored (purple / violet), the soda lime cookies must be replaced, as the discoloration indicates consumption of the indicator.
4. If the criterion is fulfilled, proceed to the next step.

### 9.3.6.4 Tube Connections

1. Check that all tube and screwed connections are hand-tightened.
2. Once the test criterion is met, proceed with the next step.


*Fig. 109: Fine filter with floater*

### 9.3.6.5 Pre Pressure of the Carrier Gas

1. Check that there is a carrier gas primary pressure and that it is 2 - 3 bar.
2. Once the test criterion is met, proceed with the next step.

### 9.3.7 Perform Care and Maintenance Actions (Carrier Gas Processing)(Filter Cartridge)

Proceed as follows:

1. Disconnect the electrical connection of the circulating air treatment at the analyser for all care and maintenance measures.
2. Take a care and maintenance protocol (recirculation preparation) (Chapter 13.6 on page 183).
3. Follow the instructions below for the care and maintenance for each component.
4. Document the actions taken in the care and maintenance log.
5. After the inspection and maintenance procedures, complete the documentation of the protocol(s).
6. Reconnect all electrical connections of the recirculation system to the analyser.

#### 9.3.7.1 Replace Soda Lime Pellets

Precondition: 75% of the soda lime pellets have discoloured into lilac/violet.

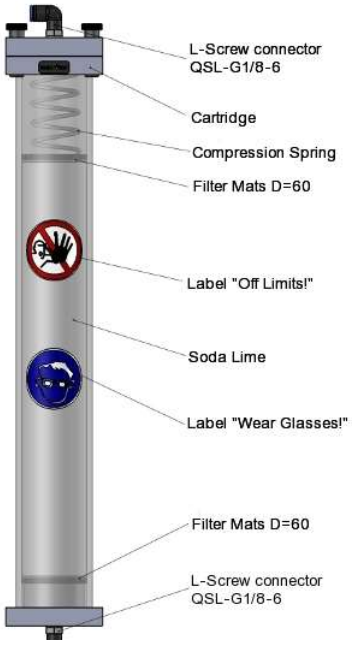



*Fig. 110: Soda lime filter cartridge*

1. Remove the upper and lower hose of the filter cartridge.
2. Open the clamps with a screwdriver.
3. Remove the filter cartridge from the circulating air treatment.
4. Carefully open the filter cartridge from the top. Pay attention to the spring contained in the filter cartridge (Fig. 111, page 150).
5. Remove the cover, o-ring, filter mats, perforated disc and spring.
6. Dispose of the used soda lime cookies with indicator in an environmentally friendly way.
7. Fill new soda lime cookies with indicator into the filter cartridge and leave enough space for the spring to be clamped.
8. Place on the soda lime cookies with indicator in the following order: the filter mats, the perforated disc, the spring and the O-ring in the groove of the filter cartridge (Fig. 111, page 150).
9. Now put the lid on by hand and fix it with the four screws.
10. Reinstall the filter cartridge in the pipe clamps.
11. Reconnect the upper and lower tubing to the filter cartridge.

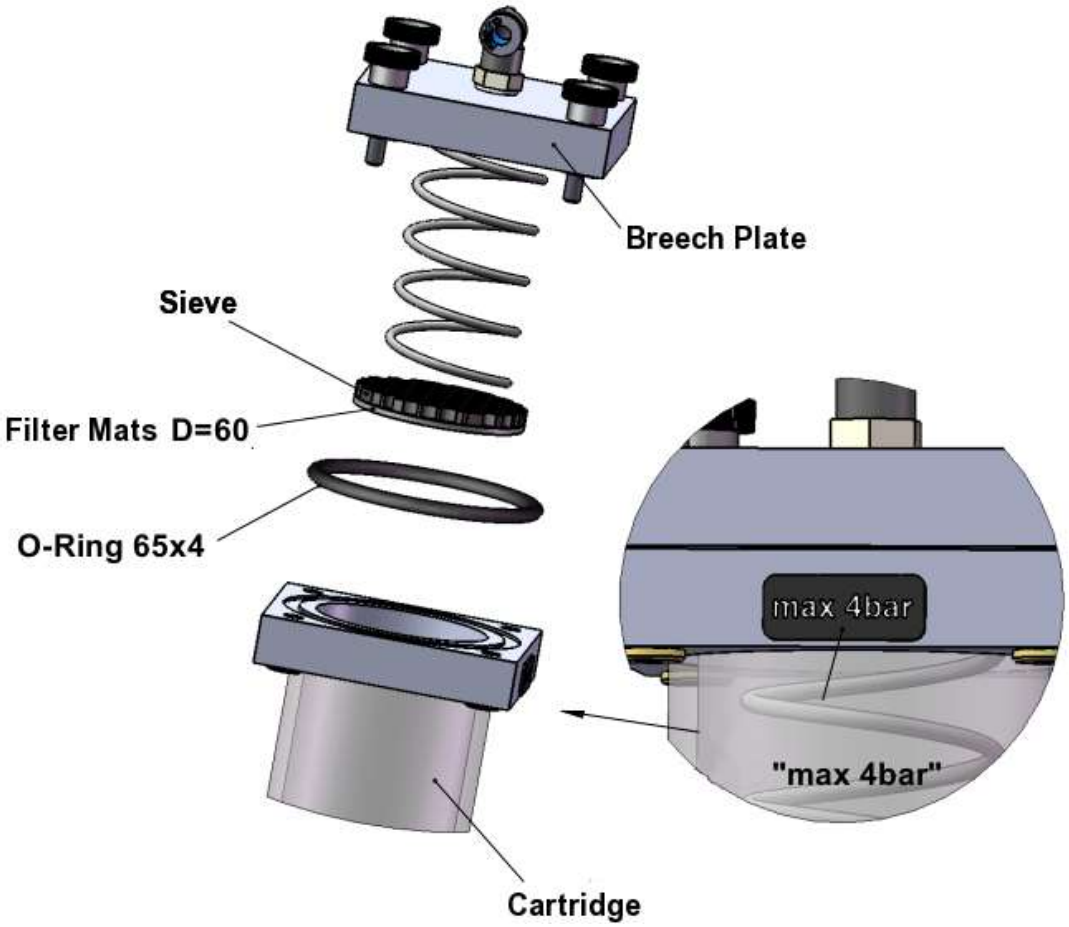



*Fig. 111: Filter Cartridge (exploded assembly drawing)*

### 9.3.7.2 Replace Gas Filter

**Recommendation:** - Replace the gas filter every 3 months.

1. Pull the connection tubes of the old filter from the connectors.
2. Connect the new filter with the connection tubes of the Ambient Air Preparation Unit, noting the direction of flow (black arrow).

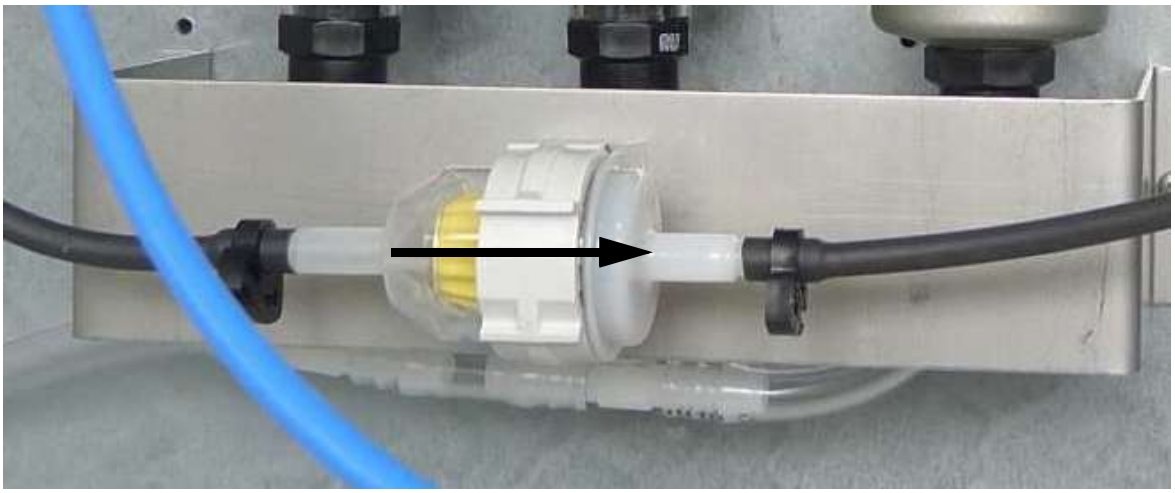


*Fig. 112: Gas Filter (Ambient Air Preparation Unit)*

### 9.3.7.3 Replace Filter Mats

**Recommendation:** - Replace filter mats every 3 months.

1. Open the ventilation grids on the left and the right side of the analyser by levering out the ventilation flap (Fig. 113, page 152).
2. Replace the filter mats.
3. Close the ventilation grids..

> Notice
>
> The Ambient Air Preparation has to filter units, one on the left side and one on the right side.

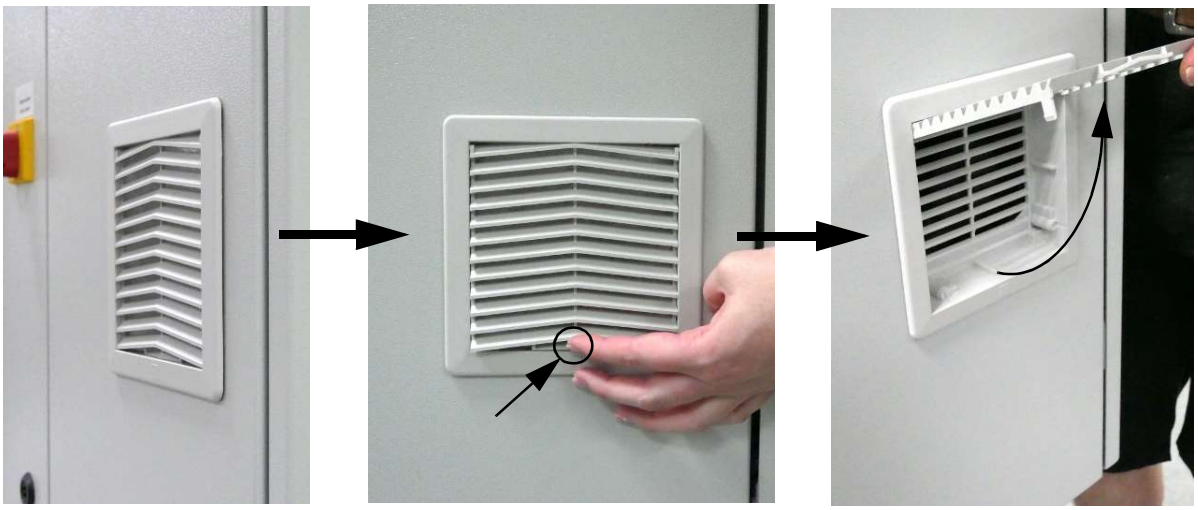


*Fig. 113: Replace filter mats on both sides*

### 9.3.7.4 Replace Fine Filter Unit

**Recommendation:** - Replace the fine filter unit every 12 months.

1. To depressurise the filter unit, disconnect the compressor from the water separator (undo the tube on the water separator).
2. Pull the black lug of the left container down and turn the container to remove it.
3. The sub-micro filter is visible.
4. Unscrew the filter.
5. Screw on the new filter.
6. Fit the container onto it.
7. Establish the connection to the compressor.

### 9.3.7.5 Replace Coarse Filter Unit

**Recommendation:** - Replace the coarse filter unit every 12 months.

1. To depressurise the filter unit, disconnect the compressor from the water separator (undo the tube on the water separator).
2. Pull the black lug of the left container down and turn the container to remove it.
3. The white separator is visible.
4. Turn the black plastic disc and take the white separator.
5. Screw on the new filter.
6. Fit the container onto it.
7. Establish the connection to the compressor.

### 9.3.7.6 Replace Activated Carbon

Recommendation: - Replace the activated carbon once a year..

Proceed analogously to replacing the soda lime pellets with indicator (Chapter 9.3.7.1 on page 149).

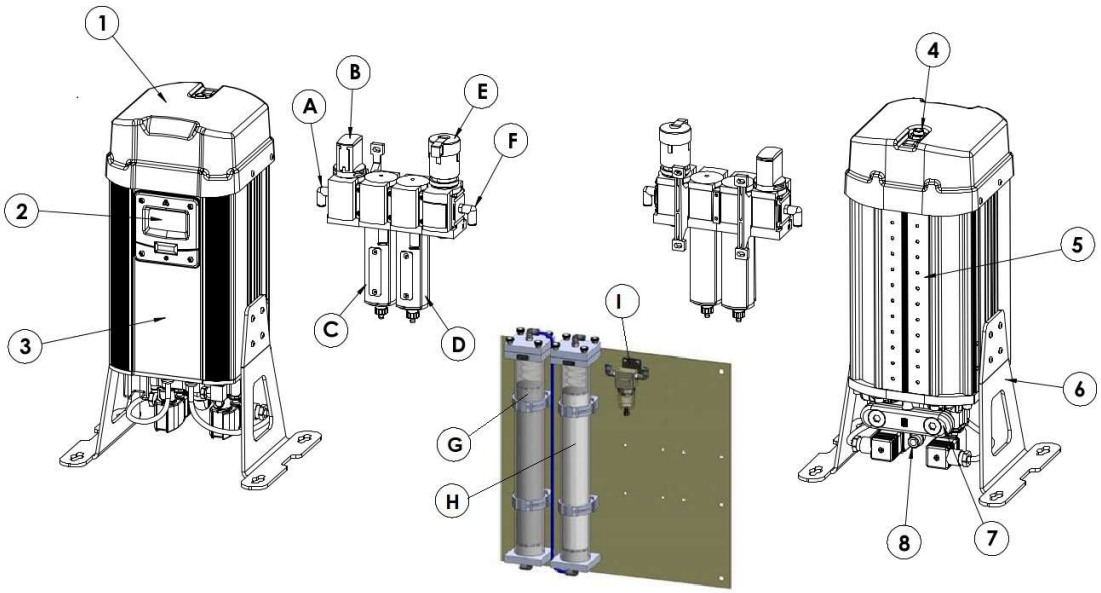
## 9.4 $CO_2$-Remover

The $CO_2$-Remover serves to dry the compressed air and to remove the $CO_2$ from the compressed air and operates according to the principle of pressure swing adsorption. Two identical columns with a hygroscopic desiccant bed are used.

### 9.4.1 Procedure of compressed air drying and $CO_2$ removal

The compressed air is transported through a filter and pressure regulator unit to the $CO_2$-Remover. In this filter and pressure regulator unit, most of the moisture, as well as oil aerosols and particles are removed. The compressed air is then lead through one of the two columns of the $CO_2$-Remover. Each column contains a densely filled desiccant cartridge in which any remaining moisture and the contained $CO_2$ is adsorbed. Subsequently, a large portion of the $CO_2$-free dry air flows through the particle filter (<1 micron / ISO8573.1, class 2) from the $CO_2$-Remover to the analyser.
For regeneration, a small amount of this $CO_2$-free dry air flows down countercurrently through the other desiccant cartridge, removing the absorbed moisture and the absorbed $CO_2$ from this desiccant cartridge. This air is released into the atmosphere and the desiccant cartridge is ready for the next adsorption.
The control switches regularly between the columns after renewed pressurisation at the upper end. This ensures a continuous supply of $CO_2$-free dry air at constant pressure. The $CO_2$-Remover may also be controlled by a zero-volt signal from the compressor. This energy saving mode detects when the compressor is off and stops the operation until the compressor starts again.

## 9.4.2 Construction of the $CO_2$-Remover




**1** Top cover
**2** Controller display
**3** Front cover
**4** Air outlet
**5** Silencer strips
**6** Socket
**7** Silencer box
**8** Air inlet

**A** Filter and pressostat unit inlet
**B** Manual switching valve
**C** Fine filter 0,1 µ
**D** Microfilter 0,01 µ
**E** Pressure regulator 4 bar (58 psi)
**F** Filter and pressostat unit outlet
**G** Soda lime cartridge
**H** Activated carbon cartridge
**I** Submicrofilter

*Fig. 114: Construction of the $CO_2$-Remover*

### 9.4.3 Installation of the $CO_2$-Remover

Installation of the $CO_2$-Remover is depending on the preferred way of mounting it.

**Variant 1 (without mounting):**
- Place the $CO_2$-Remover unit on the floor or the PVC plate of the mounting rack underneath the analyser and mount the filter and pressure regulator of the $CO_2$-Remover on the wall near the analyser.

**Variant 2 (wall mounting):**
- Install the $CO_2$-Remover unit and the filter and pressure control unit on the wall near the analyser.

**Warning**

**Correct leveling of the unit**

When mounting on the wall, make sure that the $CO_2$-Remover unit is in a vertical position by rearranging the mounting feet.

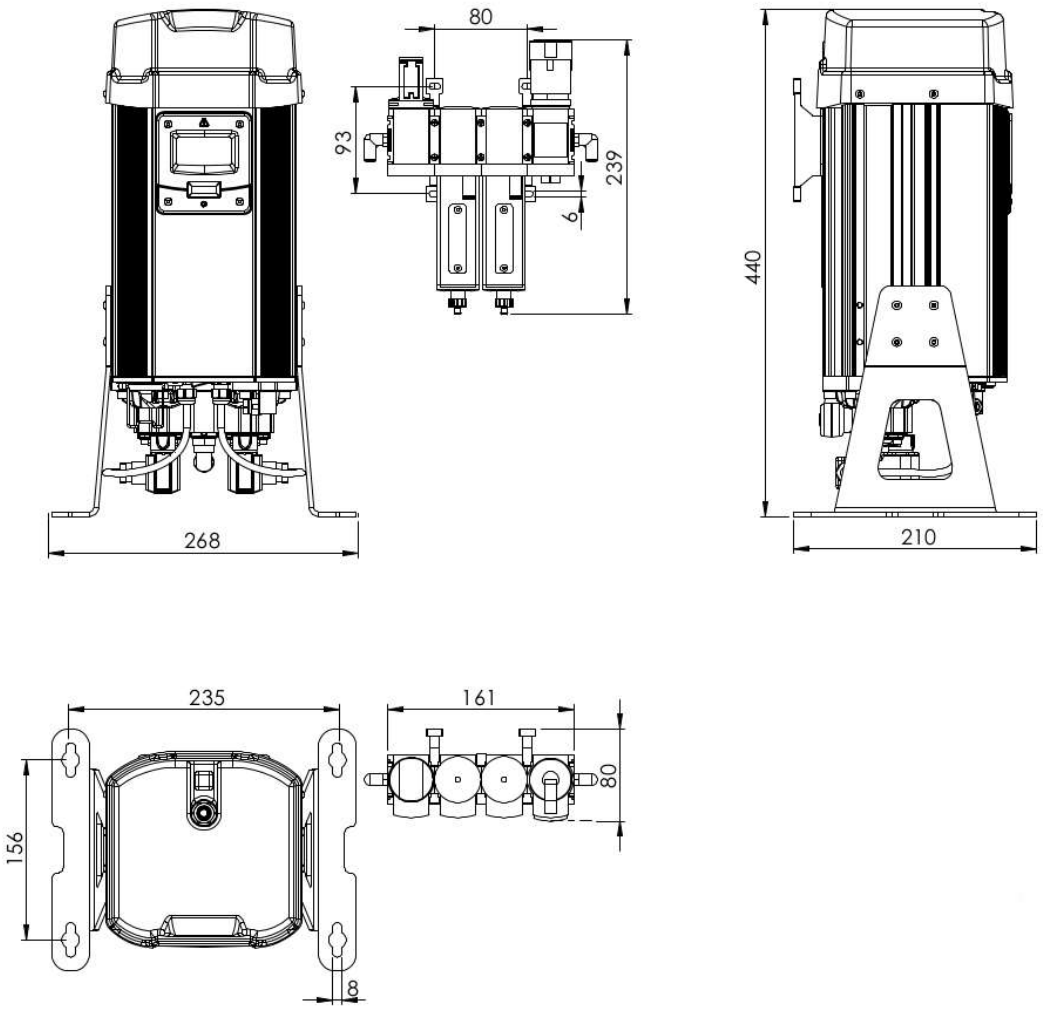


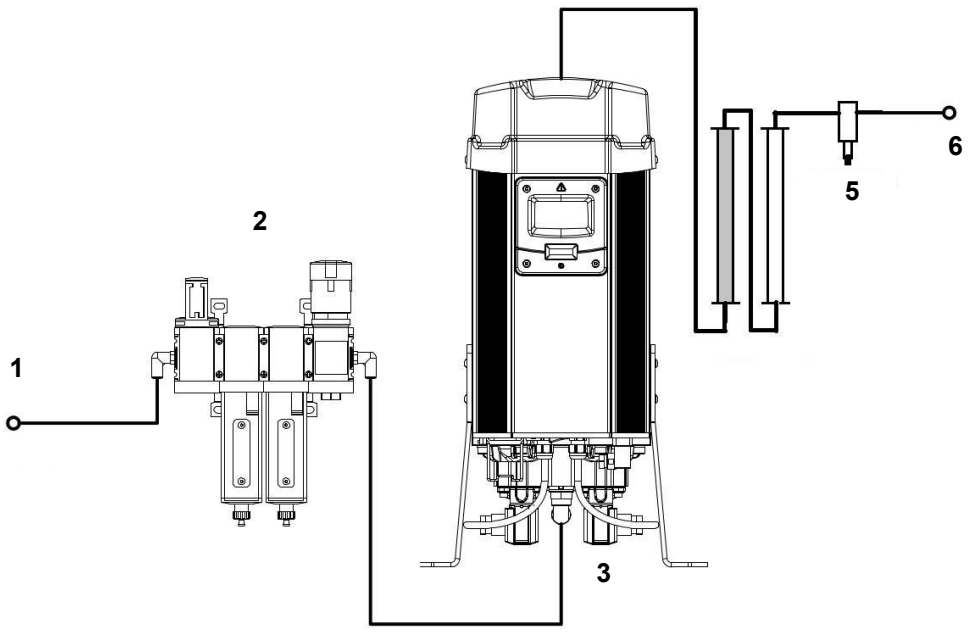

*Fig. 115: Dimensions of the $CO_2$-Remover*

### 9.4.4 Start-Up of the $CO_2$-Remover

**Warning**

**Improper installation**

Make sure that air can flow before the $CO_2$-Remover is put into operation (turned on). If the air does not flow, there may be a desiccant contamination, which means that the desiccant has to be replaced.




**1** Inlet
**2** Filter and Pressostat Unit
**3** $CO_2$ Remover unit
**4** FIltercartridges for soda lime and activated carbon
**5** Submicrofilter
**6** Outlet to analyser

*Fig. 116: Start-Up of the $CO_2$-Remover*

1. Connect all pipes to the $CO_2$-Remover as shown above.
2. Connect the $CO_2$-Remover to a suitable power source (100 - 240 V AC / 50 - 60 Hz).
3. Supply the $CO_2$-Remover with suitable instrument air (in accordance to DIN ISO 8573-1) (4 to 12 bar and +1,5°C to +50°C).

**Warning**

**Improper installation**

Ensure that the filter and pressure control unit is correctly connected to the $CO_2$-Remover unit.

4. Release the instrument air supply slowly until the $CO_2$-Remover is under pressure.
5. Turn on the $CO_2$-Remover to display its status and begin operation.
6. Let the $CO_2$-Remover work for 2 cycles.
7. After the first 2 cycles, open the exhaust valve of the $CO_2$-Remover.

### 9.4.5 Care and Maintenance Actions ($CO_2$-Remover)

Only minor effort is required to service and maintain the $CO_2$-Remover. This section shows the best way to look after your $CO_2$-Remover to guarantee trouble-free operation. The documentation of maintenance and service work is a precondition for any warranty and guarantee claims, and also represents a valuable aid in locating resolutions when malfunctions occur (Chapter 10 from page 165).

*Table 18: Visual Inspection Log ($CO_2$-Remover)*

| Interval | Visual Inspection | Criteria | OK | Action |
|---|---|---|---|---|
| 1 Day | Housing | • no damage<br>• no contamination | ☐ | ☐ Contact Support<br>_____ |
| | Service-Lamp | • red service-lamp is inactiv | ☐ | ☐ Contact Support<br>_____ |
| Date: | | Signature: | | |

*Table 19: Care and Maintenance Log ($CO_2$-Remover)*

| Interval | Action | Kind of Action | OK | Comment |
|---|---|---|---|---|
| 12,000 operating hours (or every 2 years) | Replace the desiccant cartridges | Maintenance | ☐ | |
| | Replace the internal ball valves | Maintenance | ☐ | |
| | Replace all seals which removed during maintenance | Maintenance | ☐ | |
| 24,000 operating hours (or every 4 years) | Replace the exhaust valves | Maintenance | ☐ | |
| Date: | | Signature: | | |

**Notice**

A corresponding copy of the log is in Chapter 13 from page 185.

If you have any question, please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 187).

## 9.4.6 Perform Visual Inspections ($CO_2$-Remover)

**Procedure for visual inspections:**

1. Use a visual inspection log ($CO_2$-Remover) for documentation.
2. Follow the instructions below for visual inspections of individual components.
3. Carry out care and/or maintenance actions when test criteria are not met, and document them in the care and/or maintenance log ($CO_2$-Remover).
4. After the check and any care and/or maintenance actions, conclude the documentation of the log(s).

### 9.4.6.1 Housing

1. Check the housing of the $CO_2$-Remover for integrity.
2. If you see damage, please contact Technical Support.
3. Check the $CO_2$-Remover for cleanliness.
4. If contamination is detected, remove it with a damp cloth.
5. Once all test criteria are met, proceed with the next step.

**Warning**

**Improper cleaning**

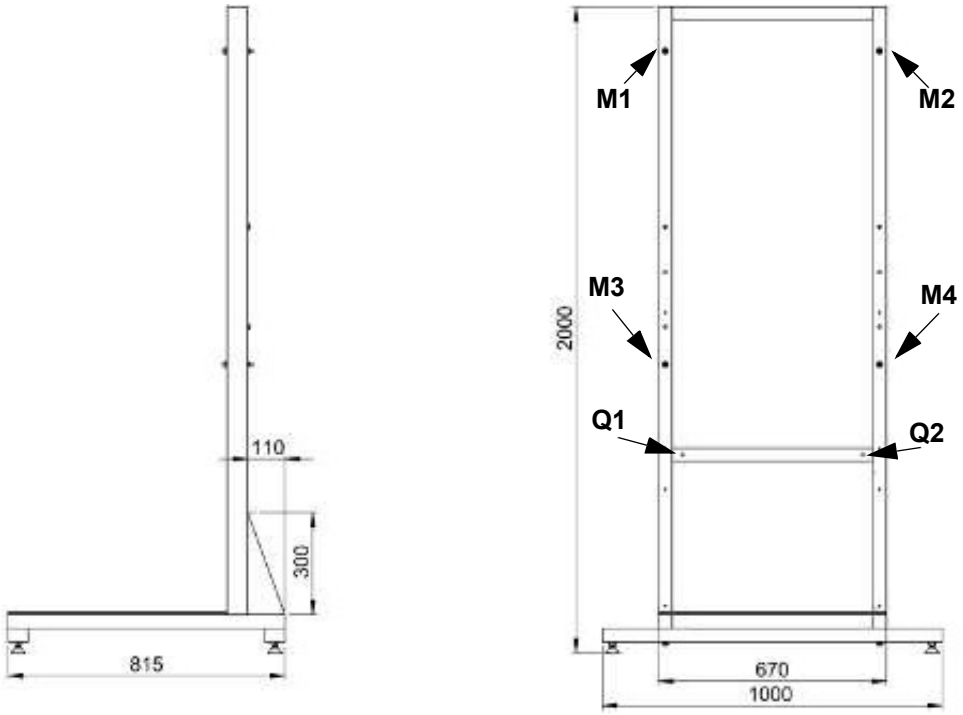
Do not clean the $CO_2$-Remover with abrasives or solvents. Use only a mild detergents.

### 9.4.6.2 Service Lamp

1. Check the red service light for inactivity.
2. If the red service light is lit, maintenance of the $CO_2$-Remover is required to ensure the best possible air quality. Please contact the **Technical Support of LAR** (Chapter 15 on page 187).
3. Once the test criterion is met, proceed with the next step.

## 9.5 Mounting Rack

The analyser can be supplied with an optional LAR mounting rack.




M1 - M4: Holes for the fixing of the Analyser
Q1 - Q2: Holes for the fixing of the Ambient Air Preparation Unit / Reagent Cabinet

*Fig. 117: LAR Mounting Rack*

Warning

The LAR mounting rack is not fully assembled on delivery. The cross braces and adjustable feet of the installation rack must be fitted before the installation.

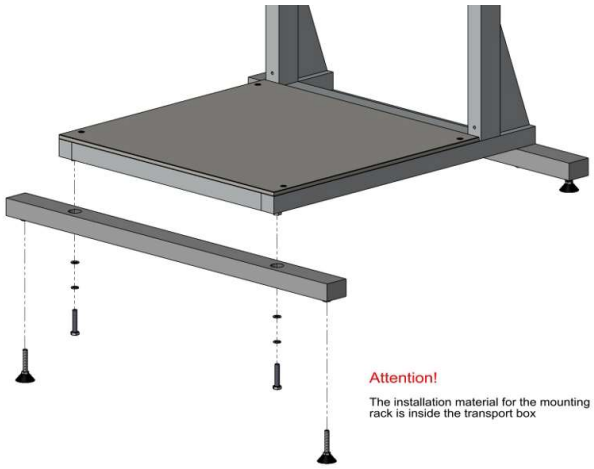



*Fig. 118: Mounting of the LAR Mounting Rack*

The following installation dimensions must be observed:
min. 1,070 x 2,000 x 1,420 mm (W x H x D)

Warning

The distance to side and opposing walls must be kept so that the analyser can be swivelled open.
If you do not have access to a forklift or lifting equipment, the analyser should be fitted by at least four people.

Recommendations for installation on the LAR mounting rack:

- The simplest method is to lay the analyser in the horizontal (flat) position after pre-assembly onto the similarly horizontal LAR installation rack and secure it with four M8 bolts (M1 - M4). It is then raised into the vertical position using lifting equipment (or a crane).
- In the second method, the analyser is mounted directly onto the vertical LAR rack using the M8 bolts. The weight of the analyser means lifting equipment or a forklift is required for this variant. First, screw two bolts into the upper holes of the rack so they protrude by about 15 mm. Then hook the analyser into these bolts with the mounting eyes, and lower it until the rear part of the housing is resting against the rack. Then screw the bottom bolts through the mounting eyes into the LAR rack, and tighten all the bolts.

## 9.6 Multi Stream Option

The analyser may measure up to six sample streams in succession. Each sample stream is equipped with a sample vessel and pump. The parallel switchover means that during the measurement cycle of one sample the preparation of the next sample starts thus there are no measurement delays.

**Notice**

For optimal operation, LAR recommends a maximum of four sample streams. This ensures that calibration of the analyser and rinsing of the injection needle can be automatic without any additional effort.

**Caution**

For an analyser with five sample streams, there is only one position left for calibration vessel or rinsing vessel. This position may have to be swapped with the calibration or rinse vessel depending on requirement. Only one place is available for one of the vessels.

For an analyser with six sample streams, six sample vessels take up all the space for vessels (V1-V6). For a calibration, the first vessel must be removed from the position and be replaced by a calibration vessel. Before a calibration can be performed, the positioning must be checked on the „Test Run“ display). To rinse the injection needle, a sample preparation vessel must be defined, at best in one in which no repeat measurements take place and preferably low concentrations are present.

## 9.7 Multi Parameter Option

The analyser may measure multiple parameters with single sample streams. This can be factory-set or be upgraded later.

The analyser can be fitted with up to four detectors for this option. The parameters can also be set for every sample stream and channel.

**The parameters can be measured are:**

- TOC = Total Organic Carbon
- TIC = Total Inorganic Carbon
- TC = Total Carbon (TOC + TIC)
- COD = Chemical Oxygen Demand
- $TN_b$ = Total Nitrogen bound

**Notice**

Please contact the **Sales Department of LAR** if you are interested in upgrading to this option (Chapter 15 on page 187).

# 10 Minor Disruptions - Quickly Solved

## 10.1 Preconditions for Fault-Free Measurement Mode

If disruptions of your analyser occur during measurement mode and the causes are not entirely obvious, please check the following:

**1. Ambient conditions**
The ambient temperature must be within the range permitted. The relative humidity should be below 80% (not condensing).

**2. Chemicals used**
It is advisable to renew all chemicals and calibration standards when you notice that readings or reproducibility are/is being severely impacted. Contamination of phosphoric acid, hydrochloric acid, rinsing water and calibration standards can severely impact measurement results and reproducibility. To prevent gas from forming in the injection system, it is important to acidify the rinsing water of the needle to pH3.

**3. Configuration of the Software**
If there are questions about the configuration, note the system parameters and please contact your local partner or the Technical Support of LAR (Chapter 15 on page 245). A USB stick may be used to store screenshots generated with the Screenshot button (which show system parameters for example).

**4. Autostart in Case of a Power Cut**
After a power outage, the analyser automatically performs an Autostart. If the analyser was performing a measurement at the time of the power outage, the analyser continues the measurement. The Autostart can be prevented by pressing the red “Offline” button. If the temperature of the furnace drops so much during a power outage that it is no longer within the temperature tolerance, the furnace is, after the Autostart, first heated until it has reached its target temperature. Only then the measurement will be continued.

**5. Storage of the Analyser in Dry Conditions which are protected from Frost**
The analyser must be stored under dry conditions, protected from frost. The period of storage should not exceed 6 months.

## 10.2 Breakdowns

This section provides information on and solutions for possible malfunctions with the measurement system. Possible causes and actions are listed in the following table - the problem type is used as an indicator. If you have questions, please contact your local partner or the Technical Support of LAR (Chapter 15 on page 245).

*Table 20: Troubleshooting*

| Problem | Possible cause | Actions |
|---|---|---|
| Analyser does not start after connecting the power supply plug and switching the main switch to „ON“ | • No voltage<br>• No power | • Check the fuses (Chapter 5.2 on page 48).<br>• Switch on if necessary. |
| Software does not start/ Screen is black | • Main siwitch off<br>• Blown fuse(s) | • Switch on the analyser using the main switch on the left side of the analyser.<br>• Check the fuses (Chapter 5.2 on page 48). |
| Cooler temperature is too low or high | • Ambient temperature is too low or high<br>• Cooler fuses are blown<br>• Cooler is out of order | • Ensure the ambient temperature is between 5 °C - 35 °C.<br>• Replace the fuses<br>• Contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 245) |
| Furnace temperature is too low or high | • Furnace fuse is blown<br>• Connecting cable is defective<br>• Furnace is defective | • Switch on the fuses<br>• Check the connections<br>• Contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 245) |
| The difference of temperature and temperature regulator is more than 10°C | • Thermocouple is not at the right position or defective | • Contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 245) |
| Calibration values are not plausible | • Calibration standard empty or prepared false | • Produce a new calibration standard<br>• Perform a new calibration |
| Measurement values sway strongly | • Sample vessels are contaminated<br>• High particle density<br>• Bubbles in the injection system<br>• System leaky | • Clean sample vessels<br>• Check injection system (glass syringe)<br>• Check tighteness and rectify leaks |
| Measurement cannot start | • Temperature of cooler or furnace is not in the allowed range<br>• Analyser is in maintenance mode<br>• | • Check the temperature of the cooler and the furnace |
| Error E1810 is shown | • Emergency shutdown of the furnace<br>• Error in the position of the injection system | • Contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 245) immediately! |

*Table 20: Troubleshooting*

| Problem | Possible cause | Actions |
|---|---|---|
| Needle is dripping | • Injection system leaky | • Check the tubing of the injection system.<br>• Contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 245) |
| Injection needle does not hit the needle guide of the furnace or other x-positions | • Positions have been altered due to maintenance or care actions | • Perform a test run and adjust the injection positions (Chapter 7.2.13 from page 92). |

## 10.3 Check the Fuses - Automatic Circuit Breaker

A measurement must be ended and the analyser switched off (main switch) before a fuse can be checked or replaced. Unlock the housing using the key. The automatic circuit breaker is on the rear installation plate (Fig. 14, page 18). If a fuse has blown, tilt the lever back up to its original position.

*Table 21: Check the Fuses*

| Fuses | 115 V AC Power Supply | 230 V AC Power Supply |
|---|---|---|
| Analyser (F1) | 13 A Type K | 6 A Type K |
| Furnace (F2 + F3) | 8 A Type K | 8 A Type K |

The cooler has 2 x internal 5 AT fuses, which can be checked and/or replaced by unscrewing them from the back of the plate on the cooler when the rear housing part is opened.

Caution

If a fuse blows again when the analyser is switched on, please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 245).

## 10.4 Breakdowns of the Temperature Regulator

Your analyser is fitted with a high temperature furnace which facilitates conversion in full of the carbon contained in the sample to $CO_2$ without catalysts. The target temperatures of the furnace regulators are factory-set and password-protected.

The programming of the temperature regulator may not be changed. If you have questions, please contact your local partner or the Technical Support of LAR (Chapter 15 on page 245).

Target temperature ranges of the individual units of the analyser:

- Temperature Furnace: 1,180°C – 1,250°C
- Temperature Cooler: 4°C – 5°C

*Table 22: Error message of the temperature regulator*

| **Display** | Description | Troubleshooting |
|---|---|---|
| 9999 (blinking) | No connection between temperature element and regulator. | • Check the electrical connections, renew the thermocouple if required.<br>• If the temperature regulator is still inactive after the thermocouple is replaced, go to display “Service actions” (Chapter 7.2.11 on page 86) and activate „furnace“. |

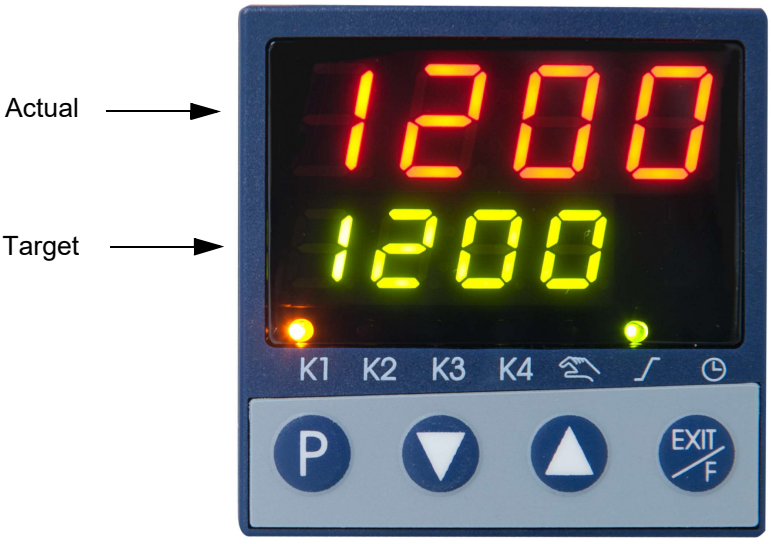



*Fig. 119: Temperature Regulator on the Front Plate*

# 11 Technical Data

Notice

All graphic, electronic or mechanical changes intended for technical progress are reserved.

## 11.1 Specifications

*Tabelle 23: Analyser specifications*

| Type | Dimensions/Description |
|---|---|
| Housing | Splashproof steel housing (IP54) |
| Dimensions<br>(W x H x D) | ca. 600 x 1.062 x 608 mm for 1 sample stream<br>ca. 820 x 1.062 x 608 mm for 2 to 6 sample streams |
| Weight | ca. 115 kg |
| Mains voltage<br>(see specifications on the type plate) | 115/230 V/AC at 50/60Hz<br>Fusing minimum 16A (K-characteristics) |
| Power input | max. 900 VA, average 600 VA |
| Signal outputs | Number: depending on configuration 2 - 33 analog outputs<br><br>Warning: Each analog output is galvanically isolated from the other analog outputs and the analog outputs are galvanically isolated from the housing.<br><br>0 – 20mA or 4 – 20mA<br>max. load 500 Ohm |
| Interface | serial interface RS 232 |
| Noise level | max. 70 dB |
| Potential-free contacts | 8 programmable relays (NO or NC)<br><br>Voltage: max. 24 V=, 24 V~<br>Amperage: max. 1 A=, 1 A~ |
| USB interface | USB 2,0 |
| Display | 10,4“ resistive Touchscreen, TFT Display |
| Carrier gas consumption | Standard: ca. 20 l/h (Nitrogen 5.0) |
| External air supply(optional) | Dew point max. -5°C |
| Digital inputs | 8 digital inputs |

## 11.2 Ambient Conditions

*Tabelle 24: Ambient conditions*

| Type | Dimensions/Description |
|---|---|
| Temperature | min. 5°C - max. 35°C |
| Humidity | max. 80% |
| Dimensions (wall mounting)) | min. 1.030 x 1.760 x 1.210 mm (W x H x D) |
| Dimensions (LAR mounting rack) | min. 1.070 x 2.000 x 1.440 mm (W x H x D) |

## 11.3 Specifications for Accessories and Options

*Tabelle 25: Specifications for accessories and options*

| Type | Dimensions/Description |
|---|---|
| Dimensions of the LAR mounting rack | ca. 1.000 x 2.000 x 815 mm (W x H x D);<br>Weight approx.65 kg |
| Dimensions of Ambient Air Preparation | ca. 500 x 555 x 400 mm (W x H x D); |
| Dimensions of the reagent cabinet | approx. 500 x 500 x 300 mm (W x H x D)<br>Space for 3x 5l canisters |

# 12 Flow Diagrams

The analyser can be operated with different configurations and methods. Furthermore, several methods can be used in an analyser.

Notice

**If you have any questions, contact LAR Technical Support** (Chapter 15.1 on page 187).

## 12.1 Component Labelling

*Tabelle 26: Component labelling*

| Component | Labeling |
|---|---|
| Detector | B |
| Sensor | BF |
| Humidity sensor | BM |
| Pressure sensor | BP |
| Furnace and reactor | EB |
| Cooler | EC |
| Pump | GP1 |
| Filter | HG |
| Acid trap | HS |
| Regulator | KH |
| Filter | HQ |
| Non-return valve | RM |
| Valve | Yx |

## 12.2 TC-Only Method (1 Sample Stream)

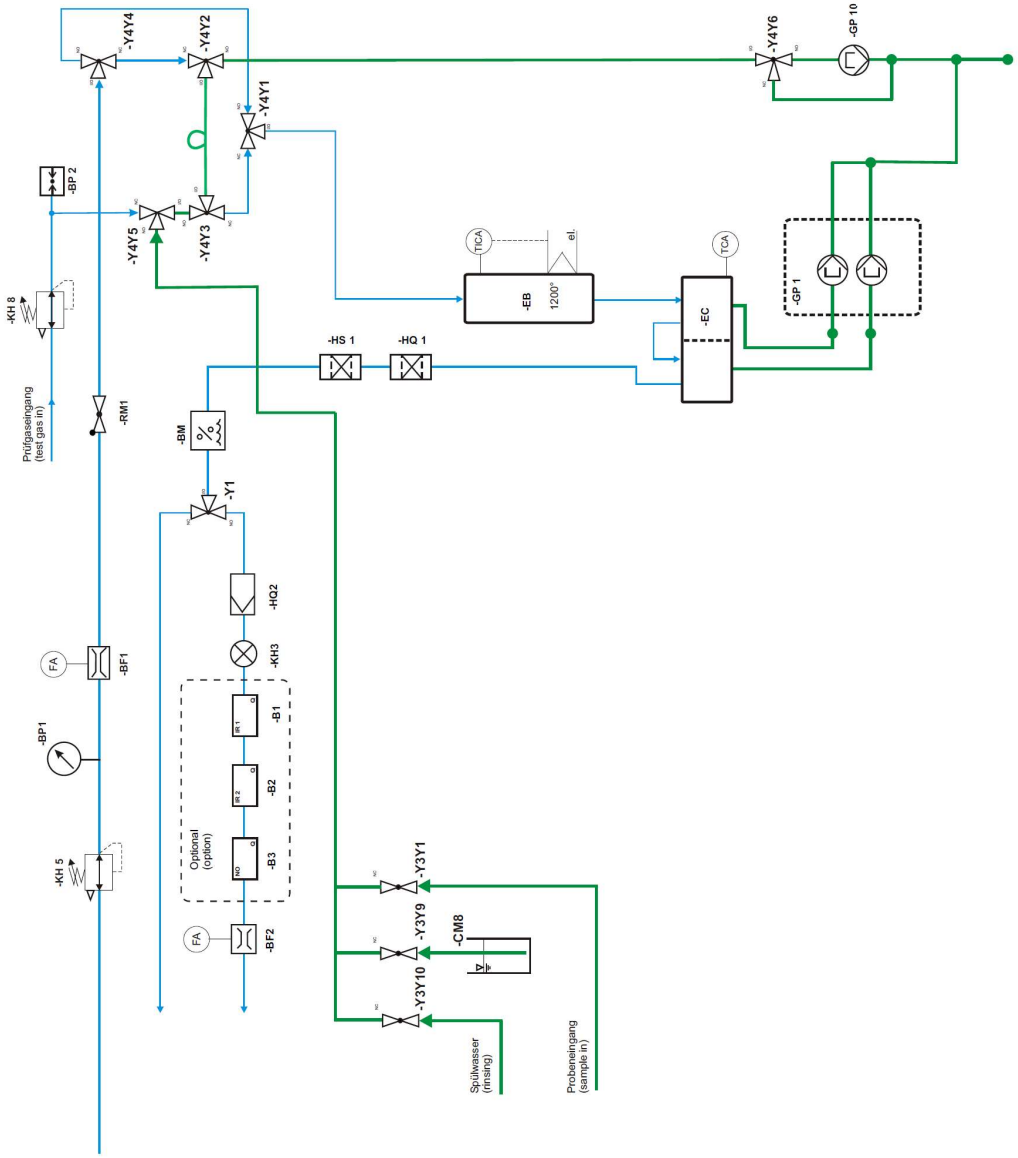



*Fig. 120: Flow Diagram TC-only Method (1 Sample Stream)*

## 12.3 TC-Only Method (6 Sample Streams)

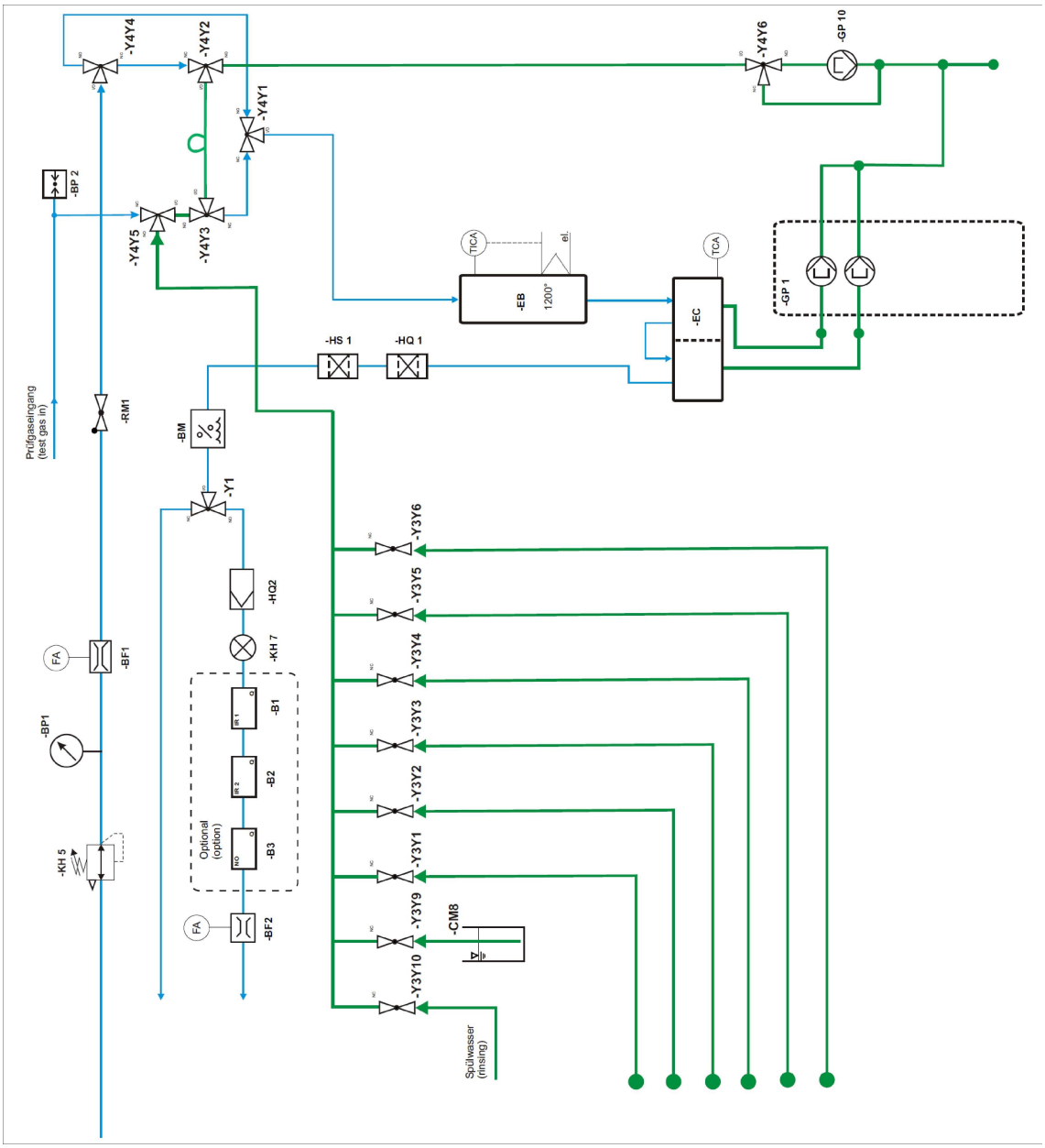



*Fig. 121: Flow Diagram TC-only Method (6 Sample Streams)*

# 12.4 NPOC (1 Sample Stream) with Gas Acidification

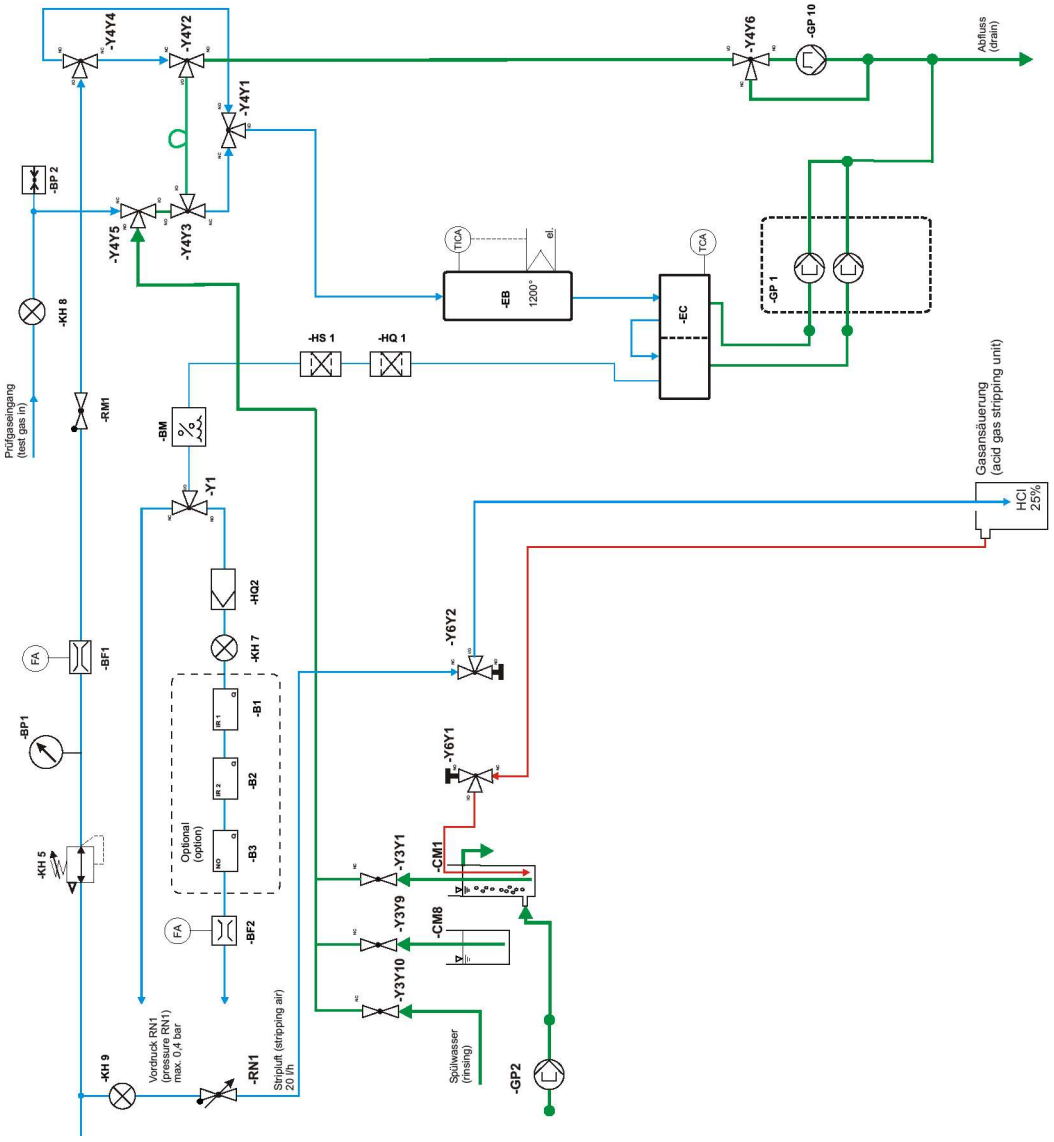



*Fig. 122: Flow Diagram NPOC Method (1 Sample Stream) with Gas Acidification*

## 12.5 NPOC (6 Sample Streams) with Gas Acidification

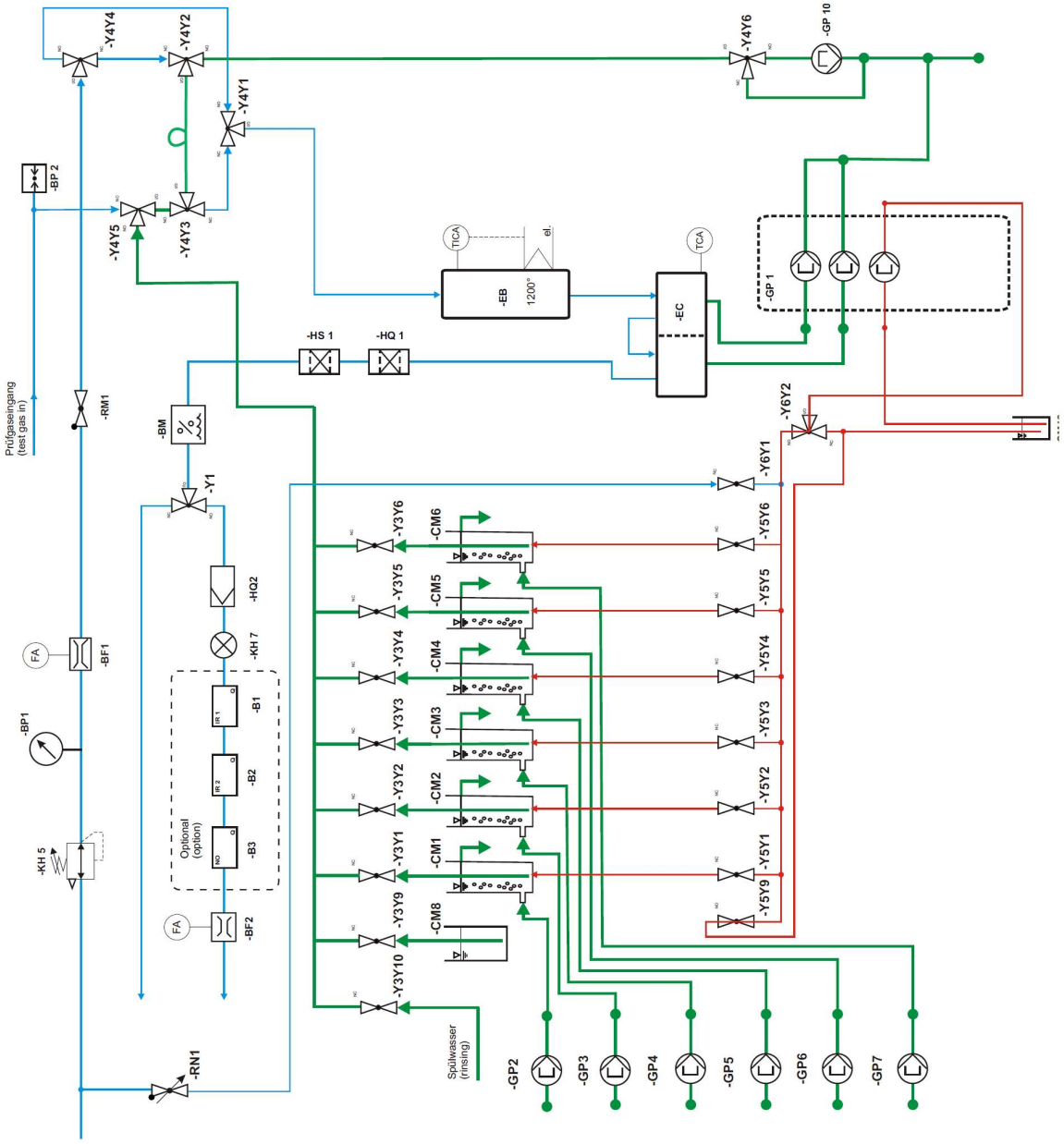



*Fig. 123: Flow Diagram NPOC Method (6 Sample Streams) with Gas Acidification*

# 13 Logs and Protocols

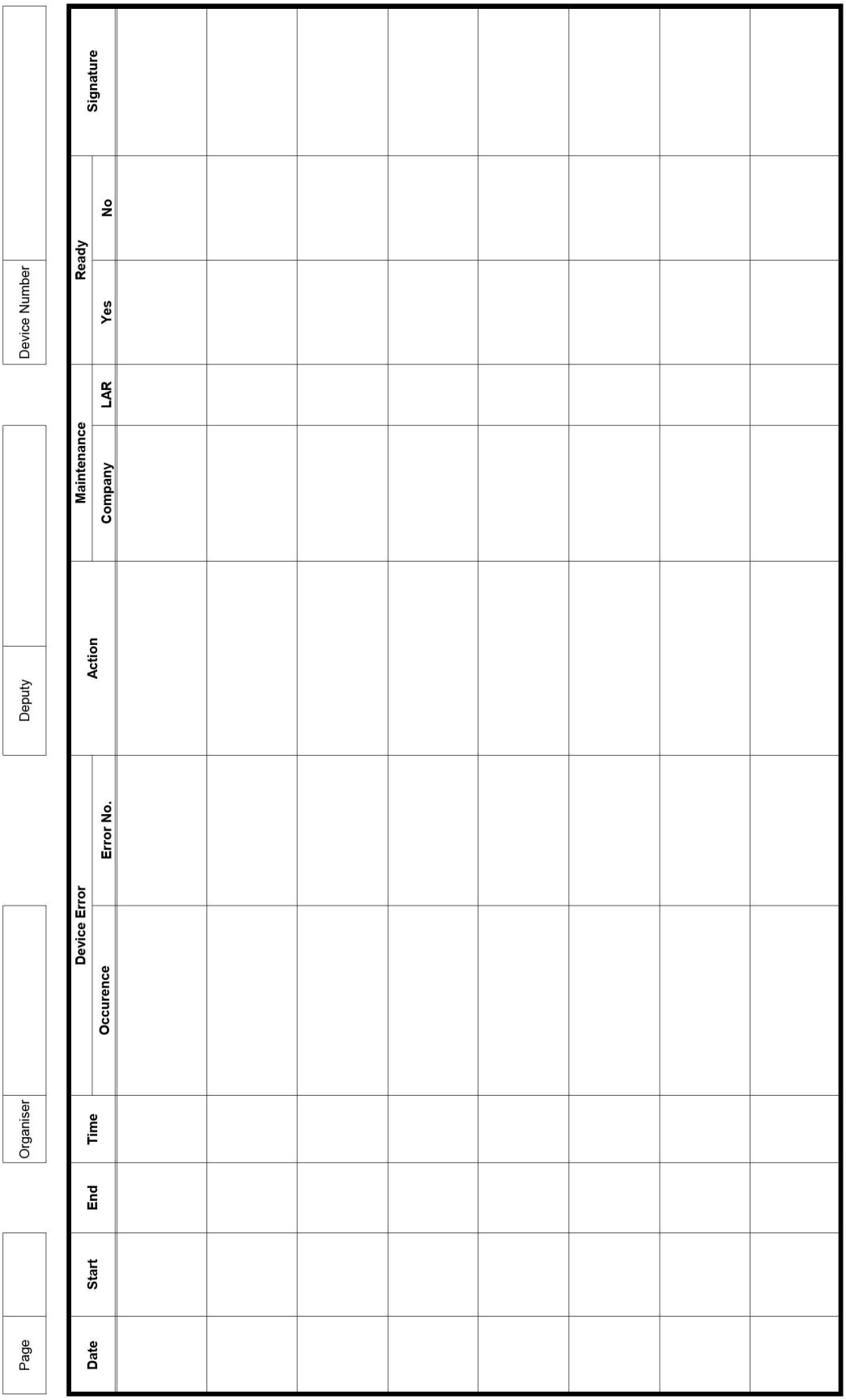
On the following pages you will find the operating log and the protocols mentioned in the operating instructions as a copy template. It is recommended that you make a few copies and file them in a folder at the end of the manual or separately.

Warning

**Do not write on the templates**

Do not write on the templates. You will not be able to use them as a template later.

# 13.1 Operating Log



## 13.2 Protocol for Visual Inspection (Analyser)

| Visual Inspection | Criteria | OK | Measures |
|---|---|---|---|
| Interval: 1 week | | | |
| Zero signal | • 0 - 0,1 FSR | ☐ | ☐ Check soda lime<br>☐ Contact support |
| Carrier gas | • Carrier gas on / off: ca.15 l/h | ☐ | ☐ Check fittings<br>☐ Contact support |
| Injection system | • no air bubbles in the glass | ☐ | ☐ Rinsing |
| Glass components | • no impurities | ☐ | ☐ Cleaning |
| Canister and supply tubes | • levels > 1 liter<br>• no impurities<br>• normale elasticity | ☐ | ☐ Top up canisters<br>☐ Clean canisters<br>☐ Replace tube |
| Input and drain tubes | • no impurities<br>• normal elasticity | ☐ | ☐ Replace tube<br>_____ |
| **Interval: 3 months** | | | |
| Injection tube | • no impurities<br>• normal elasticity | ☐ | ☐ Cleaning<br>☐ Replace tube |
| Tube cassette pump and sample pump | • no humidity<br>• rollers run smoothly<br>• no impurities<br>• normal elasticity | ☐ | ☐ Cleaning<br>☐ Set tubes forth<br>☐ Replace tube<br>☐ Contact support |
| Sample and pump tubes | • no impurities<br>• rollers run smoothly | ☐ | ☐ Cleaning<br>☐ Contact support |
| Viton tubes | • no impurities<br>• normal elasticity | ☐ | ☐ Cleaning<br>☐ Replace tube |
| Filter mats | • No discolouration | ☐ | ☐ replace filter mats |
| Acid trap | • at least 1/3 of the zinc is shiny<br>• at least 1/3 of the brass wool is yellow | ☐ | ☐ Replace filling<br>☐ Replace acid trap |
| Quartz wool filter | • no humidity<br>• no discolorations | ☐ | ☐ Replace filling<br>☐ Replace filter |
| **Date:** | **Signature** | | |

## 13.3 Care Protocol (Analyser)

| Interval | Measure | Task completed | Notes |
|---|---|---|---|
| 1 week | Check pump tubes and clean if necessary | ☐ | |
| 3 months | Check reactor pipe end and clean if necessary | ☐ | |
| | Inspection of the gas cooling pipes | ☐ | |
| | Check pump cassettes and clean if necessary | ☐ | |
| | Check the rollers of the pump head for ease of movement | ☐ | |
| | Checking the measured values with standard solution | ☐ | |
| | Check and document analyser status | ☐ | |
| | Perform a measurement and check the values | ☐ | |
| if neces-sary | Check viton tubes and replace if necessary | ☐ | |
| **Date:** | **Signature:** | | |

## 13.4 Maintenance protocol (Analyser)

| Interval | Measure | Task completed | Notes |
|---|---|---|---|
| 3 months | Replace filter mats | ☐ | |
| | Clean and grease bearing pin | ☐ | |
| 6 months | Replace pump tubes and condensate tubes | ☐ | |
| 1 year | Replace reactor tube or change reactor filling (if necessary) | ☐ | |
| | Replace loop tubing | ☐ | |
| | Change sample drain tubes (if necessary) | ☐ | |
| | Change quartz wool filling | ☐ | |
| | Replace the pre-detector gas filter 0.1 µ | ☐ | |
| **Date:** | **Signature** | | |

## 13.5 Functional Test Protocol (Analyser)

| Visual inspection | Criteria | OK | Measure |
|---|---|---|---|
| Analyser status | • Zero signal between 0 - 0,1 FSR<br>• Carrier gas on / off: approx. 20 l/h | ☐ | ☐ Contact support<br>_____<br>_____<br>_____ |
| Tightness test | • Carrier gas rate falls to < 5 l/h | ☐ | ☐ Contact support<br>_____<br>_____ |
| Checking the measured values | • Measured values correspond to the calibration standard | ☐ | ☐ Contact support<br>_____<br>_____ |
| Checking the measurement | • Measurement takes place without problems | ☐ | ☐ Contact support<br>_____<br>_____ |
| **Date:** | **Signature** | | |

## 13.6 Care and Maintgenance Protocol (Air Recirculation)

| Interval | Measure | Type | OK | Notes |
|---|---|---|---|---|
| If neces-sary | Replace soda lime cookies with indicator | Maintenance | ☐ | |
| 3 Months | Replace gas filter | Maintenance | ☐ | |
| | Replace filter mats | Maintenance | ☐ | |
| 1 Year | Replace fine filter | Maintenance | ☐ | |
| | Replace coarse filter | Maintenance | ☐ | |
| | Replace activated carbon | Maintenance | ☐ | |
| Date: | | Signature: | | |

# 14 Safety Data Sheets

Different chemicals, depending on the application, are used to operate the analyser. Chemical-suppliers provide safety data sheets for their produced chemicals. Please ensure that you receive the safety data sheets from your chemical suppliers.

Please feel free to contact us - we can provide you with safety data sheets for the following chemicals:

- Potassium hydrogen phthalate
- Sodium carbonate
- Sodium bicarbonate
- Potassium permanganate
- Sulfuric acid
- Hydrochloric acid
- Phosphoric acid
- Brass wool (acid trap)
- Zinc chips (acid trap)
- Quartz wool (acid trap)
- Soda lime (Ambient Air Preparation Unit)
- Activated carbon (Ambient Air Preparation Unit)

# 15 Contact

## 15.1 Contact to LAR

*Table 27: LAR Contact Details*

| **Kontakt** | Telefon | E-Mail |
|---|---|---|
| **Contact** | Telephone | E-Mail |
| Technical Support | +49 30 278958 - 55 | service@lar.com |
| Sales Department | +49 30 278958 - 31<br>+49 30 278958 - 43 | export@lar.com |

## 15.2 Distributors / Authorized Service Partners

You will find contact details of all our distributors and authorized service partners on our website:

www.lar.com/about-lar/international-sales

## 15.3 Optimization

If you have any requirements for or comments about the LAR analyser, please contact the Technical Support of LAR or the Sales Department of LAR.

# INDEX

## T



## U



## V



## W