PROCESS ANALYSERS AG

QuickTOC ultra

TOC-ANALYSIS

Instruction Manual

Document QuickTOC® ultra IECEx - 12E5119
12/2019
Software Version: 5.3

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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

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PROCESS ANALYSERS AG

EU-KONFORMITÄTSERKLÄRUNG
DECLARATION OF CONFORMITY

Erzeugnis Product	**Online Meßsystem**
Typenbezeichnung Model/Type	QTex, QUex, QPex, QTNPex, QTNPCex, QTNex, QCODex, QTOGex, QTONex, QTOCnpoex , QuickTOCuvex **Zone 1 /T4 (ATEX/ IECex)** **Zone 2 /T3** **Zone 2 /T4**
Hersteller (Firma und Ort) Manufacturer (Name and place)	LAR Process Analysers AG Neuköllnische Allee 134 12057 Berlin
CE Koordinator CE Coordinator	O. Dacke

Das bezeichnete Erzeugnis stimmt mit den Anforderungen der folgenden europäischen Richtlinien überein:

The described product is in accordance with the requirements of the following european Directives:

2006/42/EG	**Maschinenrichtlinie**	**Machinery directive EN**
2014/30/EU	**EMV-Richtlinie**	**EMC directive**
2014/34/EU	**ATEX-Richtlinie**	**ATEX directive**
2011/65/EU	**ROHS Richtlinie**	**Restriction of Hazardous Substances**

Folgende Normen wurden angewendet: The following standards were used:	Kennzeichnung: Marking:
VDE 0701/0702 EN 61010-1: 2011 EN 61010-2-010: 2015 (Zutreffende EMV Normen; applicable EMC norms) EN 60079-0: 20012 + A11:2013 Elektrische Betriebsmittel für gasexplosionsgefährdete Bereiche (allg. Anforderungen) electrical devices for explosion proof areas affected by explosive gases (general standards) EN 60079-2: 2014 Überdruckkapselung „p"; Explosion proof enclosure type „p"	QTex, QUex, QPex, QTNPex, QTNPCex, QTNex, QCODex, QTOGex, QTONex, QTOCnpoex, QuictTOCuvex **Ex II 2 G Ex px IIC T4 Gb** QuickTOCuv **Ex II 3 G Ex pz IIC T4** QuickTOC **Ex II 3 G Ex pz IIC T3**

Berlin, 09.10.2017
Ort, Datum/place, date

Unterschrift Hersteller/sign manufacturer

(1) **EG-Baumusterprüfbescheinigung** ZELM ex

(2) Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen – **Richtlinie 94/9/EG**

(3) EG-Baumusterprüfbescheinigungsnummer

ZELM 15 ATEX 0539 X

(4) Gerät: **QuickTOCex**

(5) Hersteller: **LAR Process Analysers AG**

(6) Anschrift: **Neuköllnische Allee 134, D-12057 Berlin**

(7) Die Bauart dieses Gerätes sowie die verschiedenen zulässigen Ausführungen sind in der Anlage zu dieser Baumusterprüfbescheinigung festgelegt.

(8) Die Prüf- und Zertifizierungsstelle ZELM Ex bescheinigt als benannte Stelle Nr. 0820 nach Artikel 9 der Richtlinie des Rates der Europäischen Gemeinschaften vom 23. März 1994 (94/9/EG) die Erfüllung der grundlegenden Sicherheits- und Gesundheitsanforderungen für die Konzeption und den Bau von Geräten und Schutzsystemen zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen gemäß Anhang II der Richtlinie.

Die Ergebnisse der Prüfung sind in dem vertraulichen Prüfbericht Nr. ZELM Ex 07915261118 festgelegt.

(9) Die grundlegenden Sicherheits- und Gesundheitsanforderungen werden erfüllt durch Übereinstimmung mit

EN 60079-0:2012 + A11:2013 **EN 60079-2:2014**

(10) Falls das Zeichen "X" hinter der Bescheinigungsnummer steht, wird auf besondere Bedingungen für die sichere Anwendung des Gerätes in der Anlage zu dieser Bescheinigung hingewiesen.

(11) Diese EG-Baumusterprüfbescheinigung bezieht sich nur auf Konstruktion, Überprüfung und Tests des spezifizierten Gerätes oder Schutzsystems in Übereinstimmung mit Richtlinie 94/9/EG. Weitere Anforderungen der Richtlinie können für das Herstellungsverfahren und die Lieferung dieses Gerätes oder Schutzsystems gelten. Diese sind von vorliegender Bescheinigung nicht abgedeckt.

(12) Die Kennzeichnung des Gerätes muss die folgenden Angaben enthalten:

Ex **II 2 G Ex px IIC T4 Gb**

ZELM ex
Zertifizierungs-stelle

Braunschweig, 2016-03-02

Zertifizierungsstelle ZELM ex
Dipl.-Ing. Harald Zelm

ZELM ex

Seite 1 von 2

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Auszüge oder Änderungen bedürfen der Genehmigung der Präf- und Zertifizierungsstelle ZELM ex

ZELM ex
Prüf- und Zertifizierungsstelle
Siekgraben 56 · D-38124 Braunschweig

(13) **Anlage**

ZELM ex

(14) **EG-Baumusterprüfbescheinigung ZELM 15 ATEX 0539 X**

(15) Beschreibung des Gerätes

Die Gerätefamilie QuickTOCex der LAR Process Analysers AG besteht aus Online Messgeräten für die Bestimmung von Summenparametern in Abwässern z.B. Gesamtkohlenstoff (TC), gesamter organischer Kohlenstoff (TOC), anorganischer Kohlenstoff (TIC), gelöster organischer Kohlenstoff (DOC), Sauerstoff, Phosphor, Stickstoffoxide usw. Die Unterschiede innerhalb der Gerätefamilie liegen in unterschiedlichen Detektoren (siehe unten), unterschiedlicher Probenzuführung, variierender Kanalzahl, unterschiedlicher Probenverschlauchung, variierender Software.

Die Varianten sind wie folgt bezeichnet:

QUex	QuickToc ultra	Probenzufuhr über XY System
QPex	QuickToc purity	Probenzufuhr über LOOP Schlaufe
QTNPex	QuickToc	Messparameter Stickstoff/Phosphor
QTNPCex	QuickToc	Messparameter Stickstoff/ Phosphor/ Kohlenstoff
QTNex	QuickToc	Messparameter Stickstoff
QCODex	QuickToc	Messparameter Sauerstoff
QTOGex	QuickToc	Messparameter Fett in Wasser
QTONex	QuickToc	Messparameter Sauerstoff/ Stickstoff
QTOCnpoex	QuickToc	Messparameter Stickstoff/Phosphor/ Sauerstoff
QTODex	QuickToc	Messparameter Sauerstoff (amerikanische Variante)

Der zulässige Umgebungstemperaturbereich beträgt: +5°C bis +42°C

(16) Prüfbericht Nr.

ZELM Ex 07915261118

(17) Besondere Bedingungen

1. Das Öffnen des Gehäuses ist in potentiell explosionsfähiger Atmosphäre nicht zulässig.
2. Nach dem Ausschalten ist eine minimale Wartezeit von 45 Minuten vor dem Öffnen einzuhalten.
3. Das Reinigen des Gerätes ist nur mit einem feuchten Tuch zulässig.
4. Ausschließlich nicht brennbare Gase sind zum Spülen zulässig. Die Betriebsanleitung ist zu beachten.
5. Der Umgebungstemperaturbereich ist zu beachten.
6. Externe Eingabegeräte sind optional und müssen separat bescheinigt sein.

(18) Grundlegende Sicherheits- und Gesundheitsanforderungen

Durch Normen erfüllt. Die Bewertung bezieht sich nicht auf die separat bescheinigten Komponenten.

ZELM ex
Zertifizierungs-stelle

Braunschweig, 2016-03-02

Zertifizierungsstelle ZELM ex
Dipl.-Ing. Harald Zelm

ZELM ex

Seite 2 von 2

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Auszüge oder Änderungen bedürfen der Genehmigung der Prüf- und Zertifizierungsstelle ZELM ex

ZELM ex
Prüf- und Zertifizierungsstelle
Siekgraben 56 · D-38124 Braunschweig

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, and so the XY system is in the Stop position. It must not be moving (to prevent hand injuries).

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

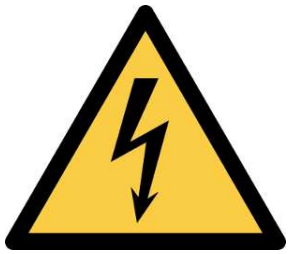

Use goggles


Use gloves

Warning:


Hot surfaces


Corrosive agents


Electric hazard

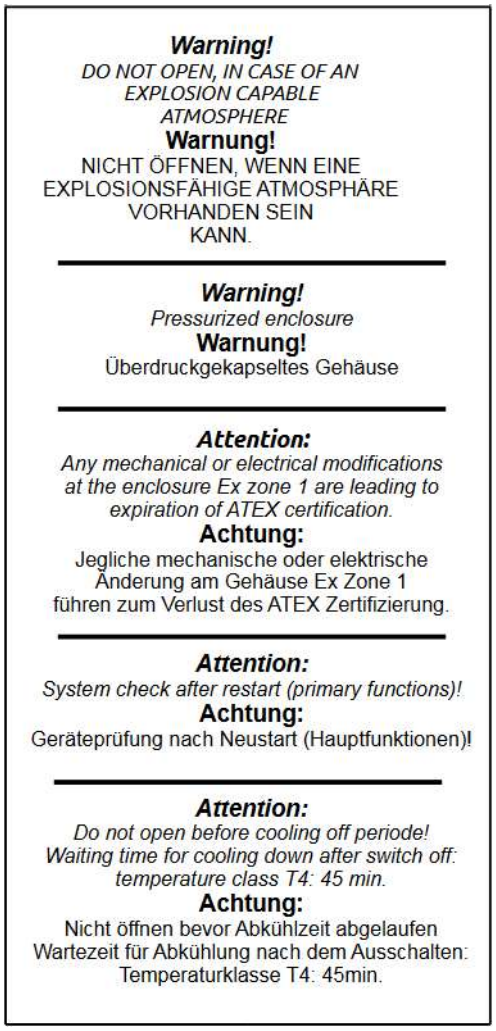
Prohibition:


Keep out

1.3 Warning Sign on Casings with Explosion Protection:

Any modification of the casing or the eletric wiring lead to loss of the Certificate for Explosion Protection. Contact our Technical Services prior to carrying out modifications on the casing or its wiring.

The following warning label is attached to the front door of the casing:



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 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:

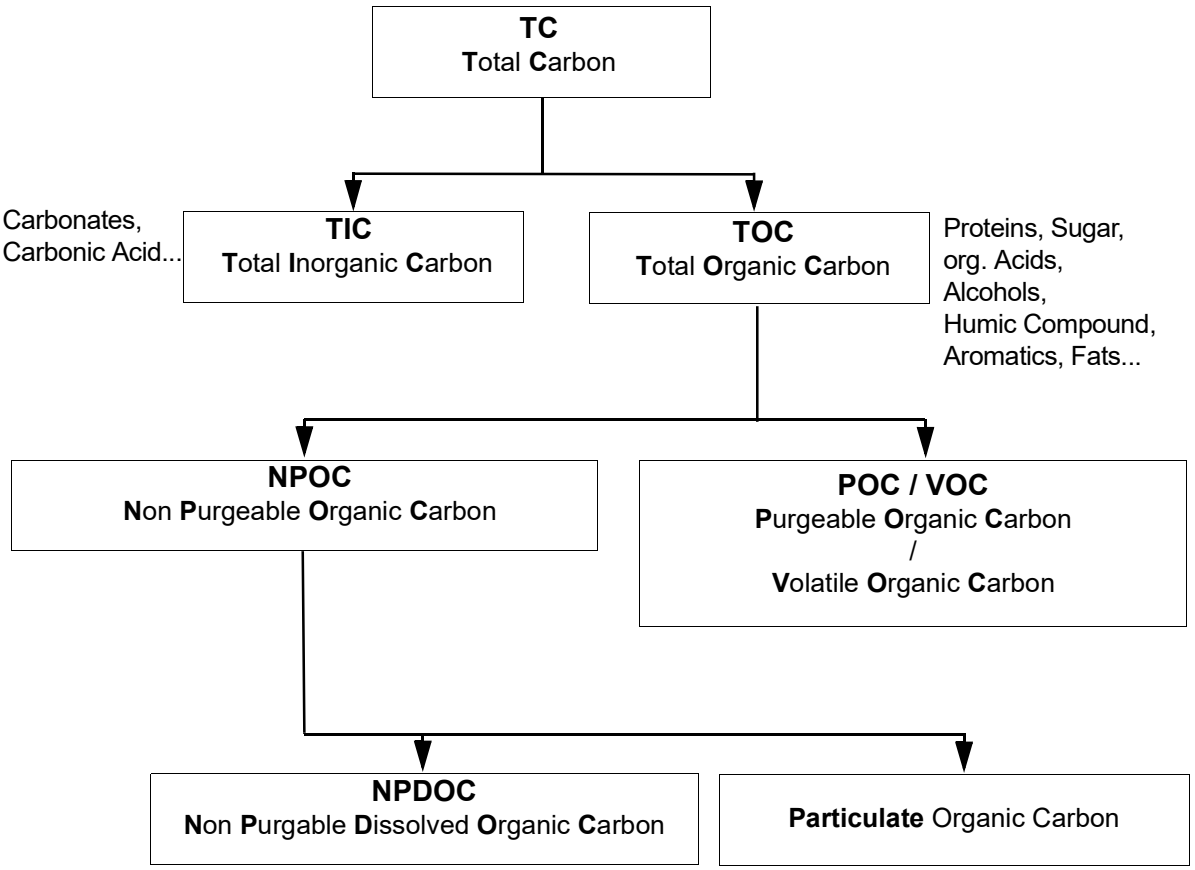


Fig. 1: Sum parameters of organic compounds

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 determined quantitatively.

2.2 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.

2.3 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®$_{ultra}$.

2.4 The Measurement Principle of the TOC-Difference Method

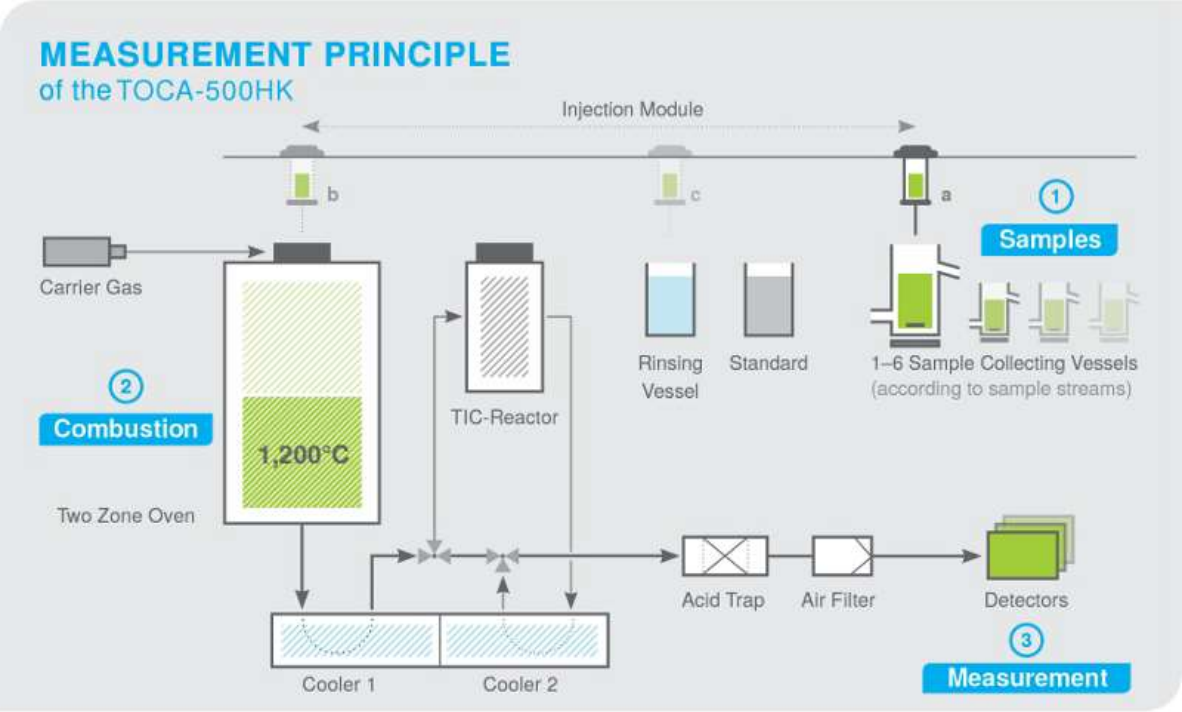


Fig. 2: Measurement Principle of the TOC-Difference Method

2.4.1 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:

TOC = TC - TIC [mg/l C]

2.4.2 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 and 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.

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

2.5.1 Proceeding

In the TOC direct method, the sample is first acidified externally with a strongly diluted hydrochloric acid before it is moved into the sample vessel. 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 com-

bustion gasses are then cleaned by the filters. Then the CO_2 concentration is determined in a NDIR detector and output as the TOC.

2.5.2 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

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 283) before using other concentrations.

2.6 The Measurement Principle of the TConly Method

2.6.1 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.

2.6.2 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 - (~0)

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.

2.7 Measurement and Working Ranges of the QuickTOC®ultra

The analyser can be deployed in several measurement ranges (application-specific). Each measurement range is assigned a recommended working range. These working ranges are in the table below

Table 1: Overview of Measurement and Working Ranges

Measurement Ranges [mg/l C]	Recommended Working Ranges [mg/l C]
0 - 100	0.1 - 100
0 - 400	2 - 400
0 - 2,000	5 - 2,000
0 - 15,000	100 - 15,000
0 - 50,000	500 - 50,000

2.8 Explosion Protection

The Instruction Manual at hand describes the use of the analyser in areas with high risks of explosions. The pressurization according toIECEx prevents potentially explosive atmospheres from entering the analyser. Thanks to the pressurization, the atmosphere rating in the analyser is downgraded from „dangerous“ to „inert“.

The analyser has been built in accordance with the IECEx standard. Please see the relevant certifications *in Chapter Certificates from page 1*.

During operation of the analyser the casing is overpressurised, thus preventing potentially explosive atmosphere from getting inside the casing.

The overpressure is regulated by a control unit and a magnetic valve. At startup, the control unit finitiates a flushing procedure to remove all potentially explosive atmosphere from inside the analyser. During the flushing procedure at 7 to 10 mbar, the casing is simultaneously checked for pressurisation.

After the flushing procedure, the overpressure in the casing is reduced and maintained at 2 to 3 mbar.

Danger

Adhere to local safety guidelines and the regulation EN 60079-14.

Do also follow the information about Ex px-systems contained in the user manual of the control unit F 870S by Gönnheimer Elektronik GmbH.

The flushing procedure is ensured by a separate compressed air supply. All dead spots in the casing (ceramic furnace, pump engines and the transformer) are being reached by the flushing air. The pump engines and the transformer are equipped with aeration holes. The furnace is flushed through a separate conduct.

From the flushing air conduct, a separate conduct is diverted for the carrier gas. The carrier gas flows through filter cartridges with activated carbon and natron lime. The processed carrier gas then enters the casing of the analyser.
In case of automatic shutdown due to loss of pressure or power outage, an emergency flushing procedure is initiated. The emergency flushing cools hot surfaces (especially in the area around and on the furnace) within a predetermined time. The backup air for the furnace emergency cooling must come from a separate source.

The pressurisation is controlled by three interface relays. These relays manage

- the power supply of the analyser
- the emergency shutdown of the analyser
- the cutoff of external signals to the analyser.

Temperature classes

Devices and utilities may be operated in explosive atmospheres only if their surface temperature is below the ignition point of the potentially explosive air mix. The air mix is subdivided in temperature classes from T1 to T6. For the determination of the temperature classes the maximum operating temperature has to be taken into account.
Depending on the temperature class, the ventilator must ensure cooling down within 45 mins. to the maximum temperature for the selected temperature class:

- for temperature class T4 max. 135° C

Depending on the temperature class, your analyser is equipped with an accordingly suitable ventilator for cooling.

3 Product

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

3.1 Scope of delivery

The analyser, associated individual parts and any required operating material are delivered in a sturdy wooden crate.

The packaging includes:

- Analyser „QuickTOC®$_{ultra}$“ for ATEX Zone 1 for IECEx
- Instruction manual „QuickTOC®$_{ultra}$“ für ATEX Zone 1for IECEx
- Reactor Foot
- Injection Port
- Furnace Head
- Reactor
- Tube Cassettes
- Vessels
- Operating Material
- Data Stick
- Spare Part Box
- Optional Accessories (Chapter 9 from page 205)
- Additional Manual
- Control unit
- Ventilator
- Backup flushing system for emergency shut-down

3.2 Identification plate

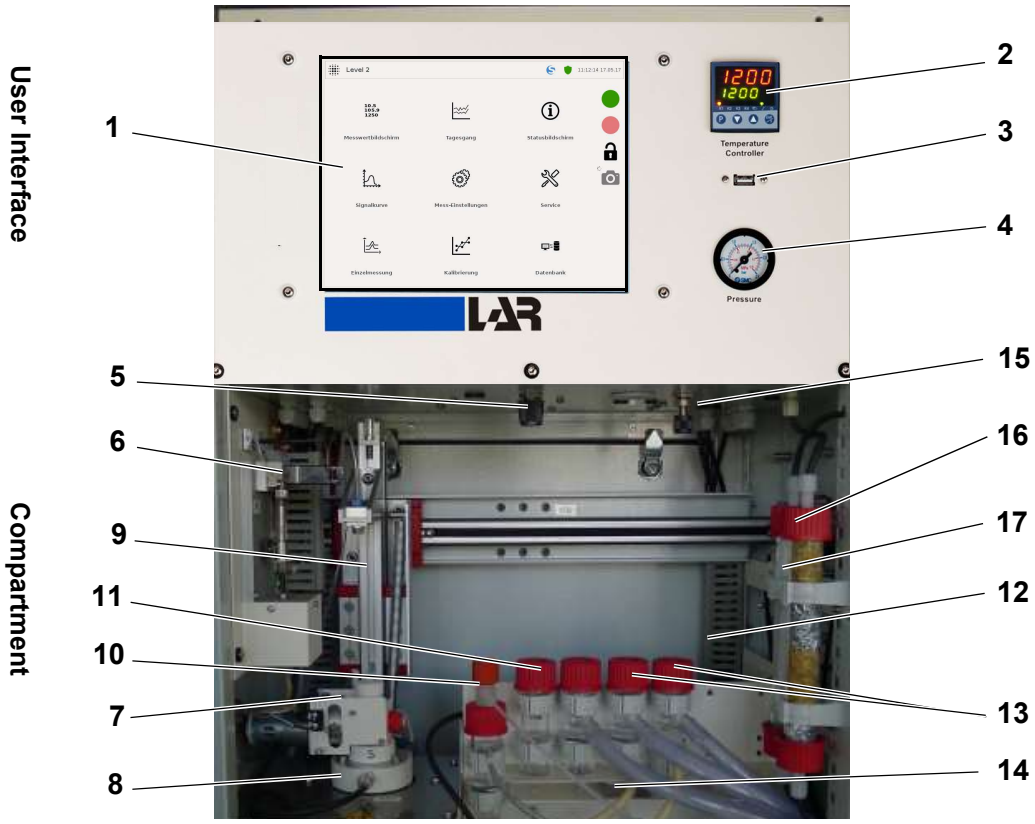
On the side of the housing is a identification plate with name of the analyser, serial number, year built, mains voltage, power consumption, further technical data and the contact address of LAR.

Fig. 3: Identification plate

Fig. 4: Identification plate

3.3 Construction of the Analyser

3.3.1 Front view of the analyser



1 Touchscreen
2 Temperature Regulator (Actual / Target)
3 USB 2.0 Port
4 Pressure Display of Carrier Gas Prepressure
5 Precision Flow Regulator
6 Glass Spray Unit
7 Injection Port
8 Furnace Head
9 Injection Needle with XY-System
10 TIC Reactor
11 Calibration Vessel
12 Rinse Vessel
13 Sample Vessels
14 Magnetic Stirrer
15 Precision Pressure Regulator
16 Acid Trap
17 Quartz Wool Filter

Fig. 5: Front view of QuickTOC®$_{ultra}$ (Example: 2 sample streams, TOC-Difference Method)

Danger

Danger of hot surfaces!

The area of the injection port and the furnace head are very hot.

Always wear heat-resistant gloves when working in this area.

Danger

Risk of injury due to moving parts!

During operation the XY-system is moving.

Keep your hands and loose parts out of the area of the XY-system and the injection needle.

Notice

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

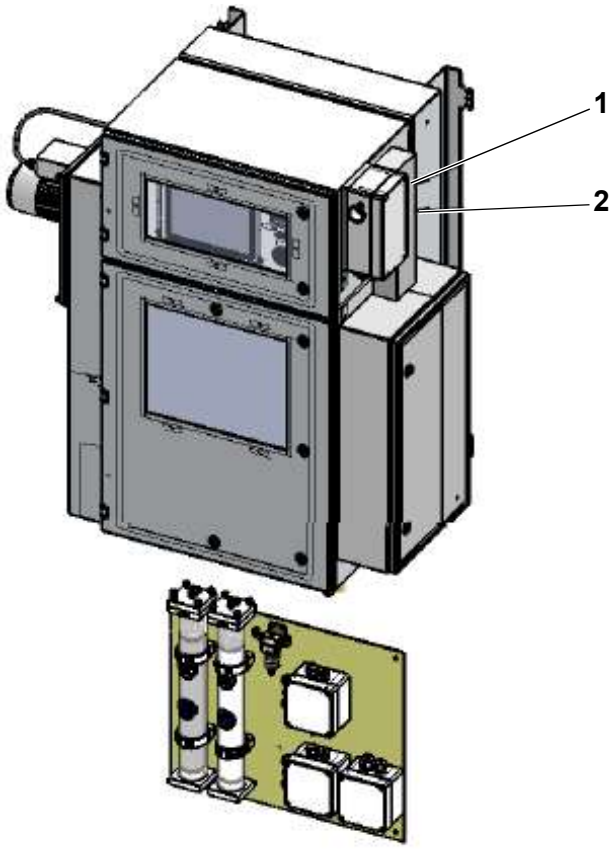
Notice

The positioning of the vessels can differ depending on the number of sample streams and the measurement method.

Furthermore, depending on the measurement method and number of samples, there can be pump housings on the right-hand side of the analyser which are used to transfer samples into the analyser.

Bottom View of the Analyser (Example: TOC-Difference Method - 2 Sample Streams)
Fig. 6:

3.3.2 Right-hand Side View of the Analyser



1 Carrier gas outlet
2 Carrier gas outlet

Fig. 7: Right-hand side 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 pump may vary within the analyser (installed inside or outside).

The following table gives an overview over the types of pump system in the analyser:

Table 2: Location of pumps

Amount of Sample Streams	Pump type & transported medium		CODo, TOC-Difference & TConly Method		TOC-Direct Method
			Inside	Outside	Outside
1	Tube Cassette Pump	Sample & Acid			1
	Sample Pump	Sample	1		
2	Tube Cassette Pump	Sample & Acid			2
	Sample Pump	Sample		2	
3	Tube Cassette Pump	Sample & Acid			3
	Sample Pump	Sample		3	
4	Tube Cassette Pump	Sample & Acid			4
	Sample Pump	Sample		4	
5	Tube Cassette Pump	Sample & Acid			5
	Sample Pump	Sample		5	
6	Tube Cassette Pump	Sample & Acid			6
	Sample Pump	Sample		6	

Notice

A tube cassette pump is installed inside the analyser. The tube cassette pump is equipped with five tube cassettes on the factory side. This tube cassette pump is used to drain the condensate and, when using the TOC-Difference Method, to transport the required acid into and out of the TIC Reactor.

3.4.1.1 Tube Cassette Pump

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

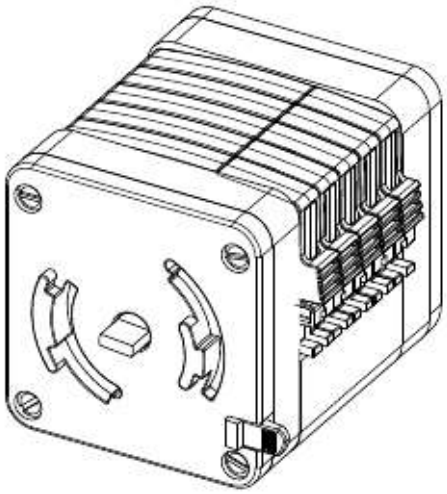


Fig. 8: Tube cassette pump with five tube cassettes

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.

3.4.1.2 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.

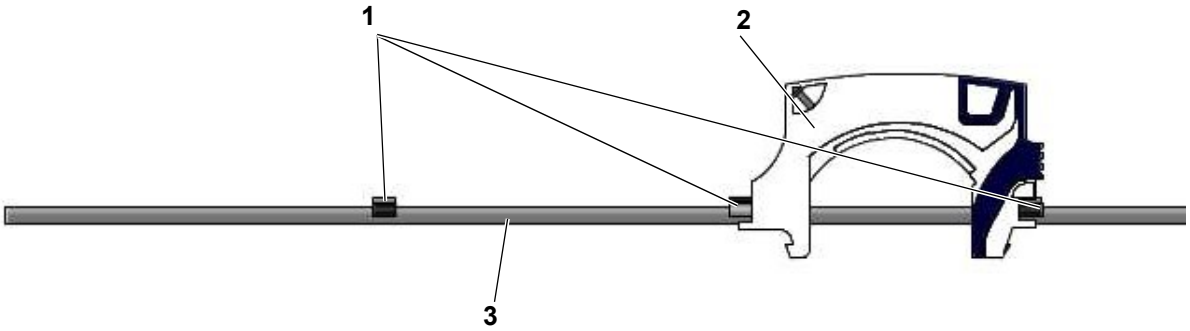


Fig. 9: Tube for the tube cassette pump (example)

3.4.1.3 Sample Pump

The sample pump (Fig. 10) 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.

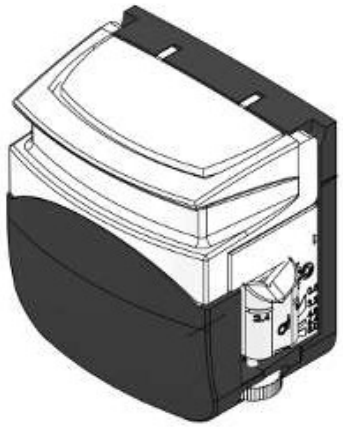


Fig. 10: Head of the sample pump (closed)

Danger

Danger of crushing

During operation, the rollers of the sample pump are in motion.

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

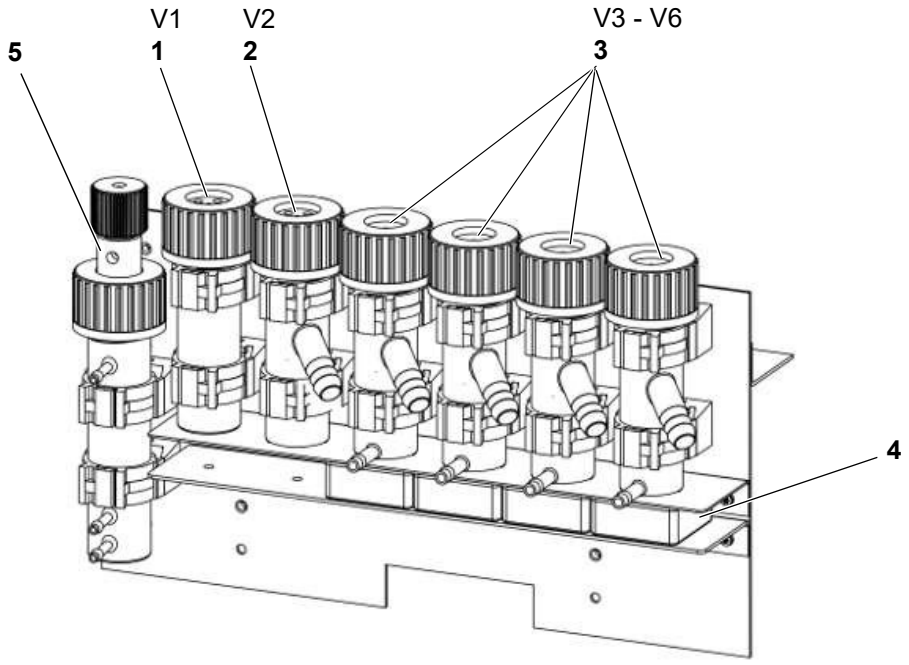
3.4.2 Glass Components

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:

- TIC-reactor (only for TOC-difference method)
- Calibration vessel
- Rinse vessel
- Sample vessel(s)

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 overhead.



1 Calibration vessel V1
2 Rinse vessel V2
3 Sample vessels V3 - V6
4 Magnetic agitator
5 TIC-reactor (TOC-difference method)

Fig. 11: Glass components (Example: TOC-difference method with 4 sample streams)

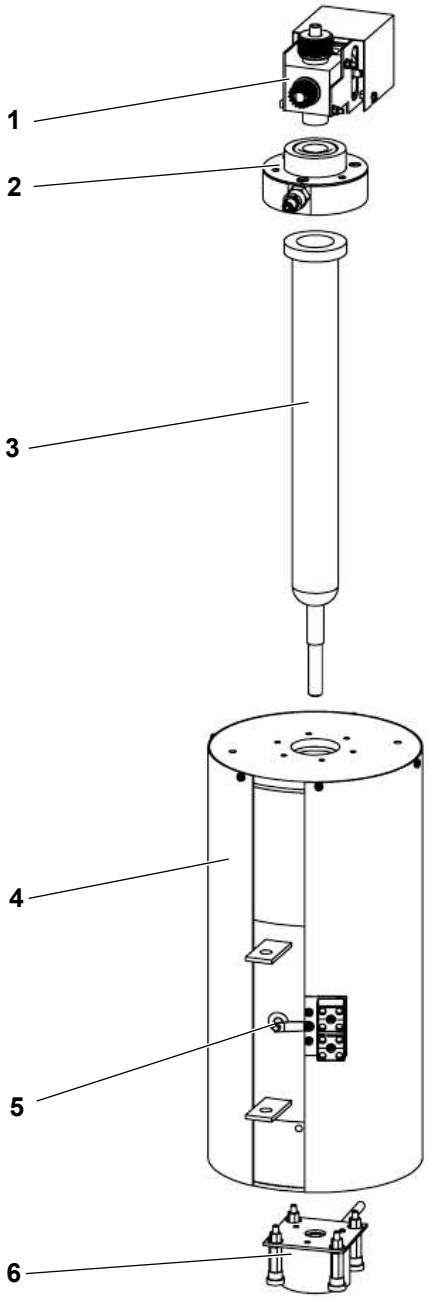
Notice

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 (Chapter 7.2.13 from page 94). To rinse the injection needle, a sample vessel must be defined, at best in one in which no repeat measurements take place and preferably low concentrations are present.

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.



1 Injection port
2 Furnace head
3 Ceramic reactor pipe
4 Furnace
5 Thermacoupler
6 Reactor foot

Fig. 12: Components of the furnace

3.5 Explosion Protection Components

3.5.1 Overpressure system

The overpressure is established by the control unit F870S (**1**). The control unit ensures that the analyser is constantly flushed by an inert gas. Through a proportional valve (**2**) the casing is constantly filled with the inert gas to an overpressure rate in order to override all leaks.
At start-up, the control unit starts with a purging sequence to eliminate all potentially explosive gases. During this sequence, the analyser remains shut down. All dead spaces over 20cm^3 are flushed.
After the successful flushing of the casing, the analyser (**4**) is switched on by means of interface relays (**3**). Only at this point the connection to the consumer level is established.
An error leads to an alarm relay in the control unit.
For service or maintenance by trained staff, a bypass mode (protected by password) in the control unit is set in place.

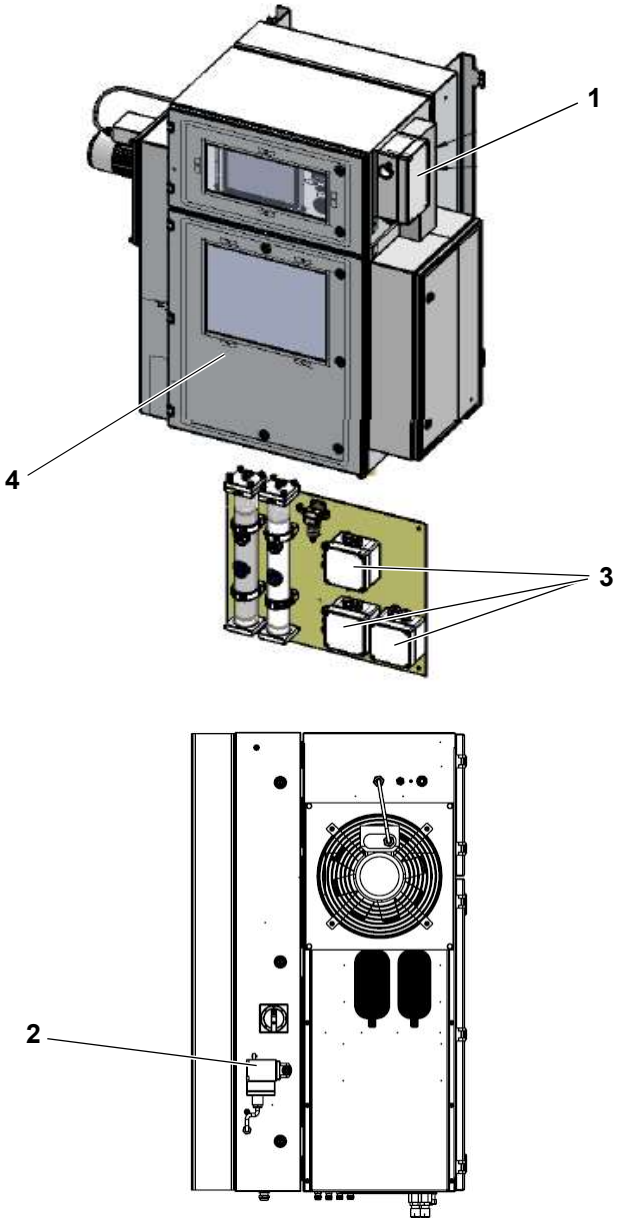


Fig. 13: Components of the overpressure system

3.5.2 Cooling and Emergency Cooling

The analyser is equipped with a a heatpipe (**3**) in order to keep the inner temperature of the casing within acceptable limits for the control logic - despite the high temperature of the furnace. Deflectors (**4**) within the heatpipe transport the hot air out of the casing. The heatpipe is filled with a liquid and uses the physical effect of of evaporation and condensation. These two processes generate a high output of enegry. The liquid evaporates on the hot side of the heatpipe, and condensates on the cool side. Thanks to capillary force, the condensation then returns to the hotter area in the heatpipe.
The correct functioning of the heatpipe is guaranteed by two ventilators (**1**, **5**). The ventilator (**1**) is located in the explosive area. This ventilator is set up for temperature class T4, allows for continuous operation and has protection class IP55.

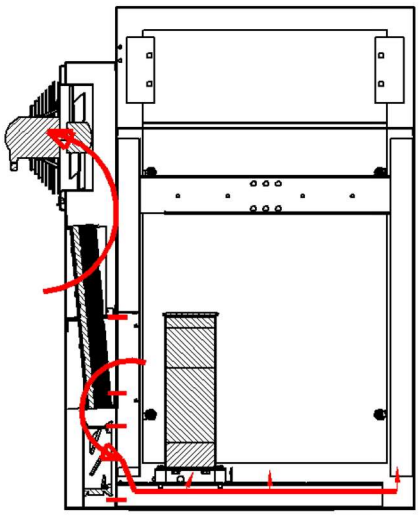


Fig. 14: Cooling principle

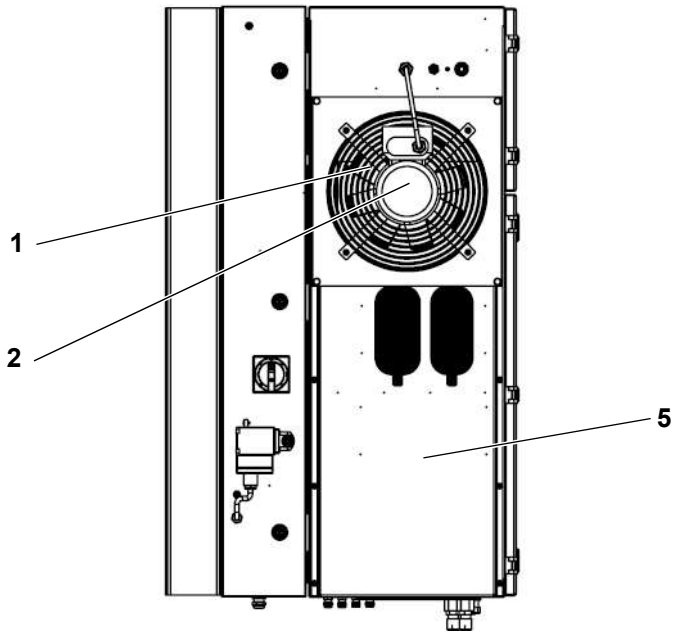


Fig. 15: Heatpipe, outside view, with mounted upper ventilator

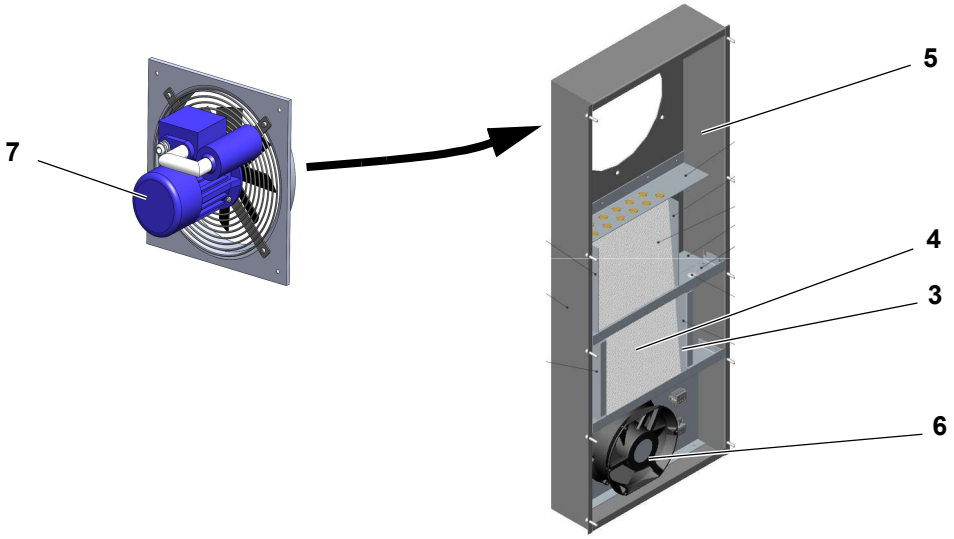


Fig. 16: Heatpipe, view from inside

The ventilator (**7**) conforms with temperature class T4.
Fig. 17:

3.6 Components of the Ex-Protection

3.6.1 Overpressure system

The overpressure is established by the control unit F870S (**1**). The control unit ensures that the analyser is constantly flushed by an inert gas. Through a proportional valve (**2**) the casing is constantly filled with the inert gas to an overpressure rate in order to override all leaks.
At start-up, the control unit starts with a purging sequence to eliminate all potentially explosive gases. During this sequence, the analyser remains shut down. All dead spaces over 20cm^3 are flushed.
After the successful flushing of the casing, the analyser (**4**) is switched on by means of interface relays (**3**). Only at this point the connection to the consumer level is established.
An error leads to an alarm relay in the control unit.
For service or maintenance by trained staff, a bypass mode (protected by password) in the control unit is set in place.

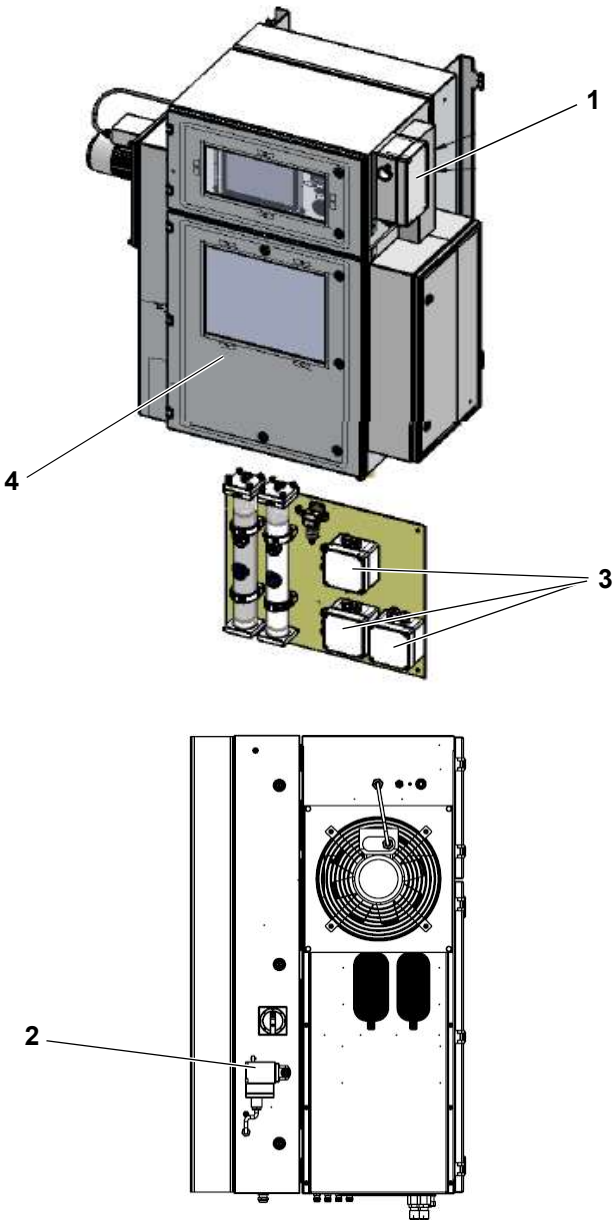


Fig. 18: Components of the overpressure system

3.7 Cooling and Emergency Cooling

The analyser is equipped with a a heatpipe (**3**) in order to keep the inner temperature of the casing within acceptable limits for the control logic - despite the high temperature of the furnace. Deflectors (**4**) within the heatpipe transport the hot air out of the casing. The heatpipe is filled with a liquid and uses the physical effect of of evaporation and condensation. These two processes generate a high output of enegry. The liquid evaporates on the hot side of the heatpipe, and condensates on the cool side. Thanks to capillary force, the condensation then returns to the hotter area in the heatpipe.

Fig. 19: The correct functioning of the heatpipe is guaranteed by two ventilators (**1**, **5**). The ventilator (**1**) is located in the explosive area. This ventilator is set up for temperature class T4, allows for continuous operation and has protection class IP55.

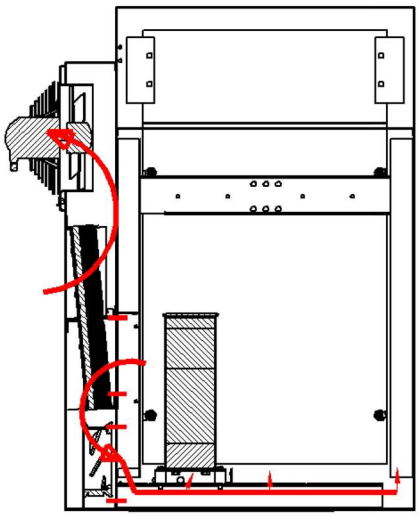


Fig. 20: Cooling principle

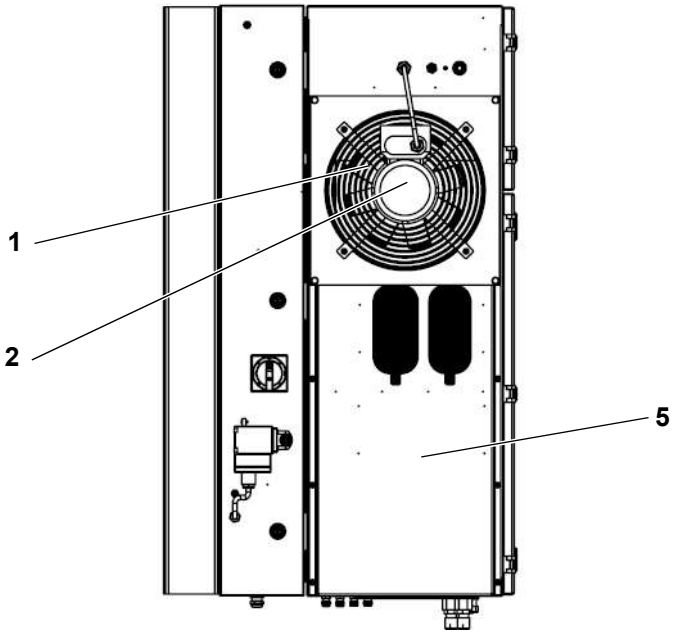


Fig. 21: Heatpipe, view from outside with ventilator

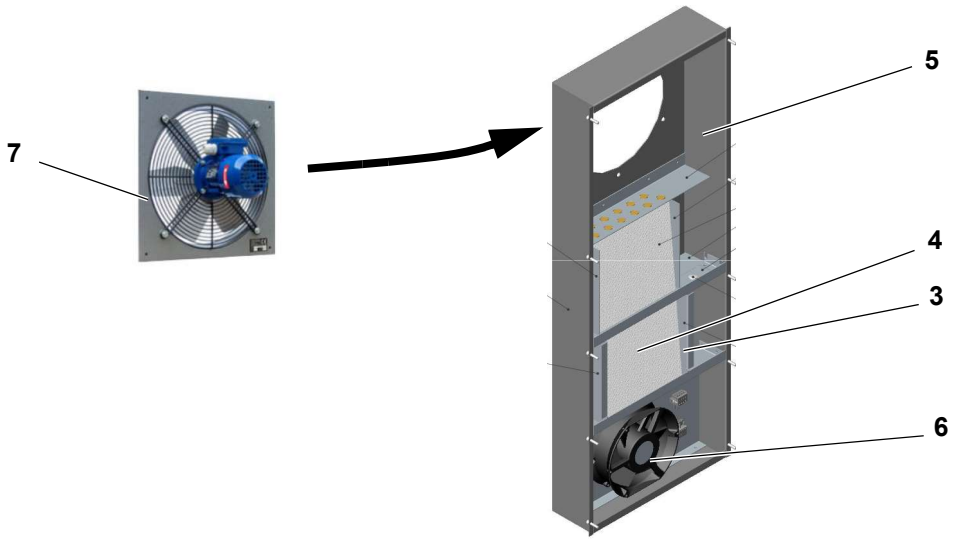


Fig. 22: Heatpipe, view from inside

The ventilator (**7**) complies with temperature class T4.

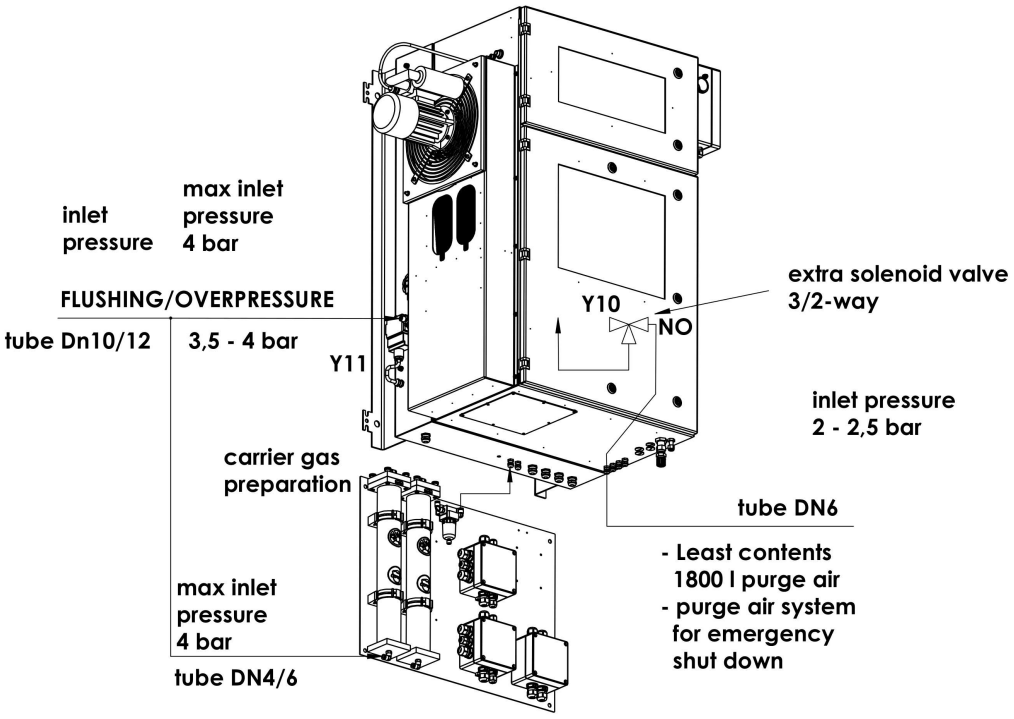


Fig. 23: Tubing for carrier gas, overpressure and emergency cooling

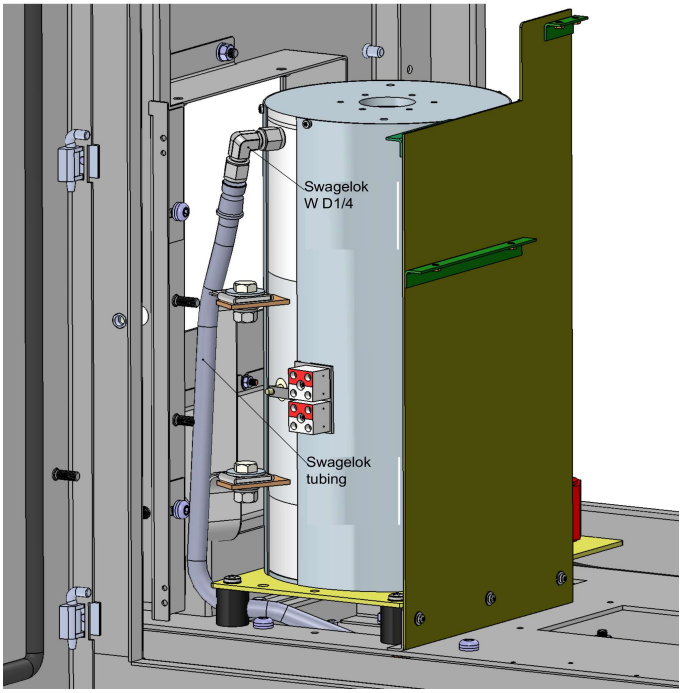


Fig. 24: Ceramic furnace with tubing for cooling and emergency cooling

3.7.1 Connections

Danger

Danger of burns

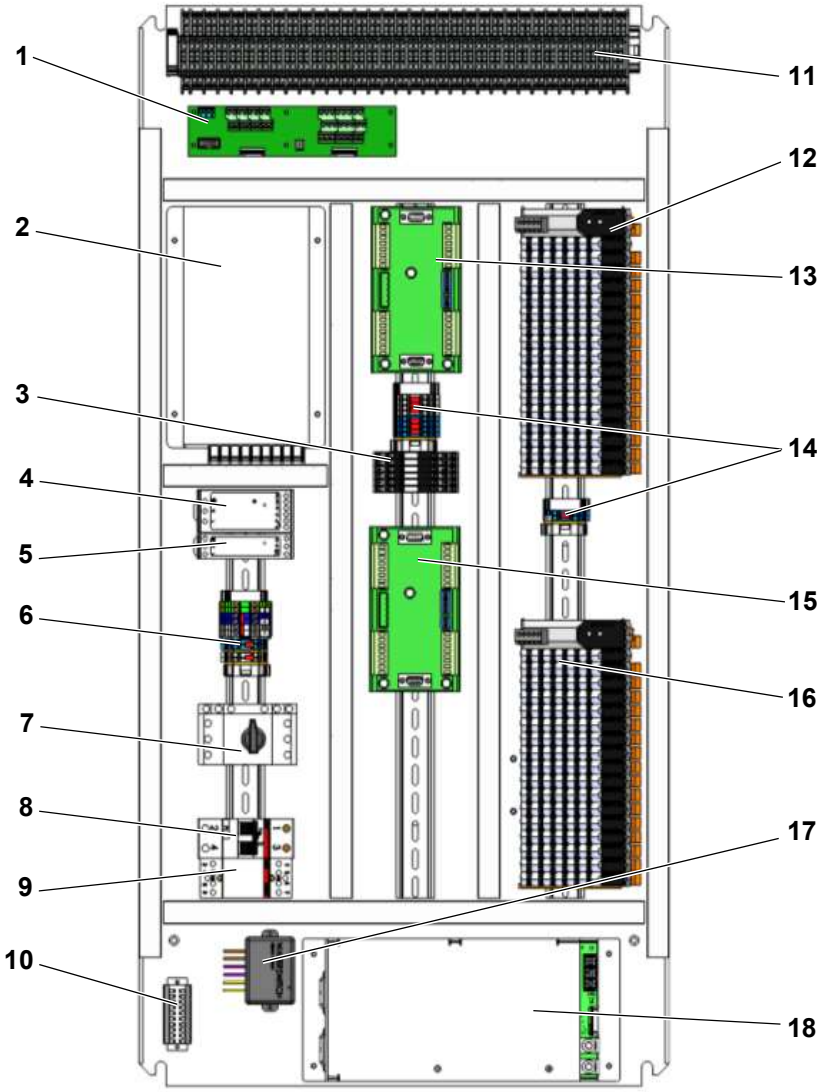
The ceramic furnace is extremely hot during operation.

Always wear heat-resistant gloves during works in the area of the ceramic furnace.

Notice

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

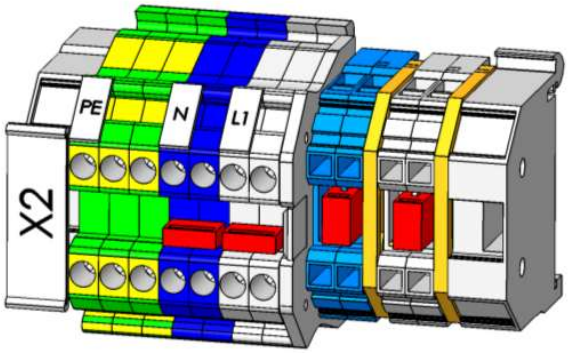
The analyser has different ports and connections. These are explained below.



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. 25: Installation plate with maximum placement

3.7.1.1 Mains connection



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

Fig. 26: Mains connection

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 283).

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.

3.7.2 Electronic Connections (Digital and Analog Connections)

Notice

Switch off the power supply prior to cabling.

3.7.2.1 Connections on the TRC-Board

The analyser is fitted with a TRC board which is used to connect to external devices and/or process control systems. It is in the top left-hand side of the installation plate in the rear part of the housing (Fig. 25, page 36). The rear part of the housing needs to be opened to access it.

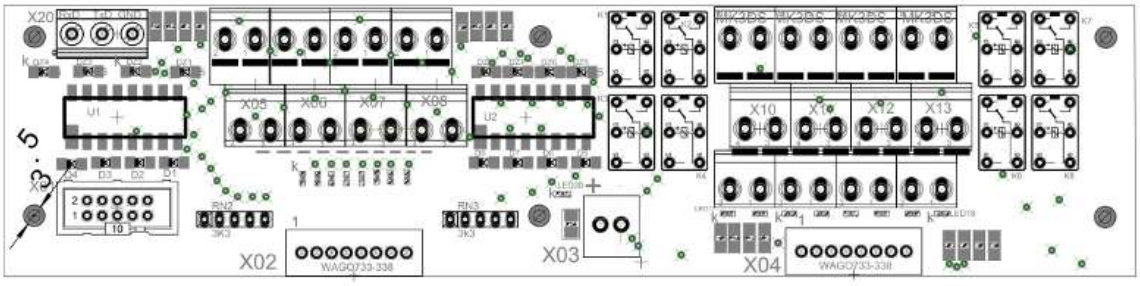


Fig. 27: TRC-Board (complete)

The TRC-board has the following connections

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

Notice

A cable cross-section of 1.5 mm^2 = cable diameter of 1.4 mm can be used to connect the signal lines to the TRC board.

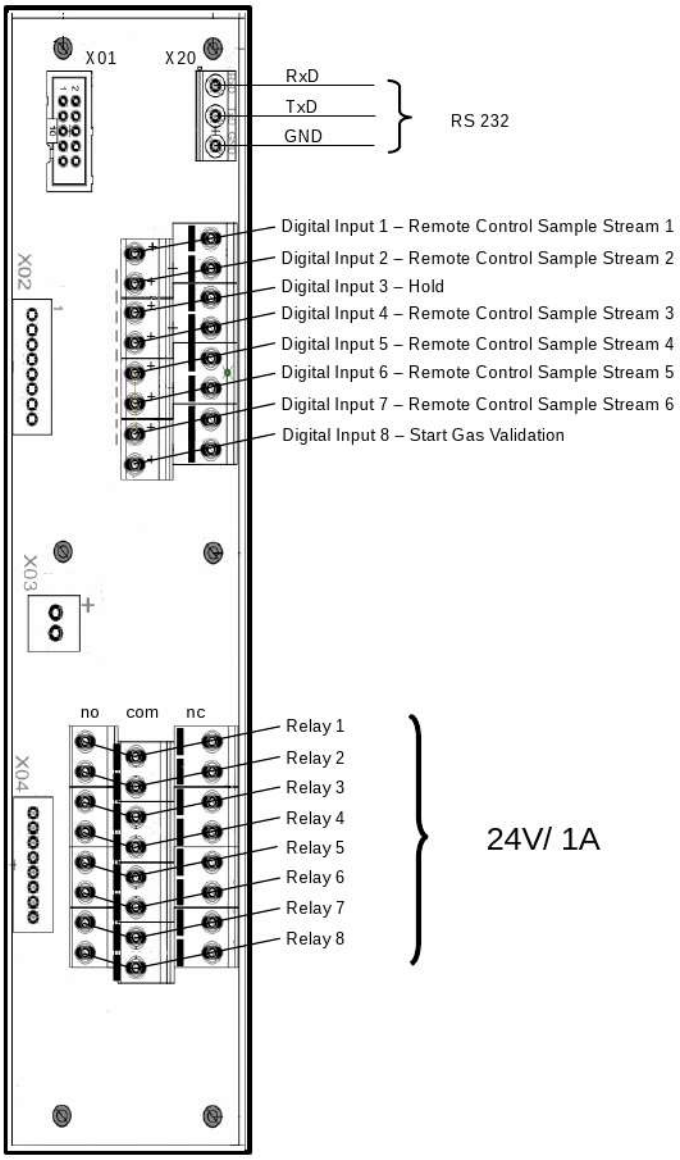


Fig. 28: TRC-Board (RS 232 serial interface, digital inputs and relays)

3.7.2.2 RS232 Serial Interface

The analyser is fitted with a TRC board which is used to connect to external devices and/or process control systems. It is in the top left-hand side of the installation plate in the rear part of the housing (Fig. 25, page 36). The rear part of the housing needs to be opened to access it:

Table 3: Serial interface parameters

Baud rate	9600 Bd
Parity	no
Data bits	8
Stop bits	1
Protocol	Xon / Xoff

Example:

When you send letter „D“, the analyser responds by sending the current data in the following format:

Date;Time;ReadingDisplay1;ReadingDisplay2;...Last ReadingDisplay;Respective status

Formats:

- Date;Time: dd.mm.yyyy-hh:mm:ss
- ReadingDisplay: @@@@@@.@@ (six places before and two after the decimal point; places not used are filled with zeroes)
- Status (examples): "Errors = (E1835_E1836)" ; "Limits = (L1_max LV1_max)" ; "Status = (M1)" (the underline stands for space)

Different activities are listed in the status string. The maximum length of the string sent is 4095 characters.

3.7.2.3 Digital input

The analyser can be monitored and controlled via the digital inputs. This option enables for example only one measurement to be started when there is a sample. The input signals (0 - 24 V DC) necessary must be provided by the user:

Table 4: Digital inputs with DC voltage applied

Digital Input 1, 2, 4, 5, 6, 7 (Measurement of Sample)	
0 - 3 V	Analyser waits
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. 28, page 39.

3.7.2.4 Relays

The analyser has eight isolated relays (switch contacts). They are capable of activating external circuits up to 24V AC/DC with 1A, and can be assigned in the system software by the user. The relays can be programmed as NCC (normally closed) or NOC (normally open). (The settings are in the software, NOC is the default.) (Chapter 7.7.3 from page 108).

3.7.2.5 Analog outputs

The maximum apparent ohmic resistance for the isolated 0/4-20mA current loops is 500 Ohm. The type of analog output (0-20 mA or 4-20 mA current loop) can be set in the software. If it is set to 4-20 mA, a “Live-Zero” feature can be set in the system software. This means instrument faults are output with 0 mA. The conditions for the fault display can be programmed individually in the system software. On the installation plate of the analyser (Fig. 25, page 36) is terminal strip X101 for the analog outputs (Fig. 29, page 41).
The individual terminals of X101 are labelled. The first digit stands for the sample stream and the second for the outgoing parameter.

Warning

Warning of damage of the analyser due to voltage or current on the analg outputs!

No current or voltage must be applied to the analog outputs. LAR analysers only output different currents in mA.

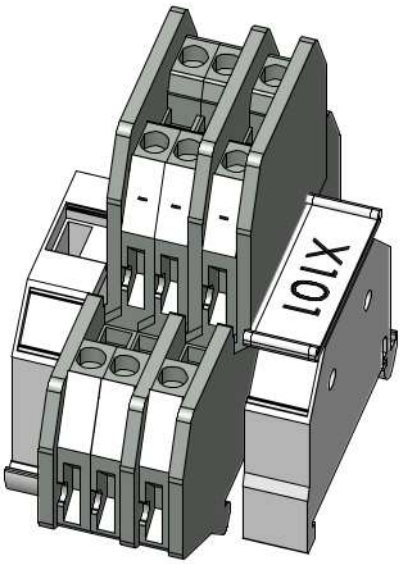


Fig. 29: Analog outputs

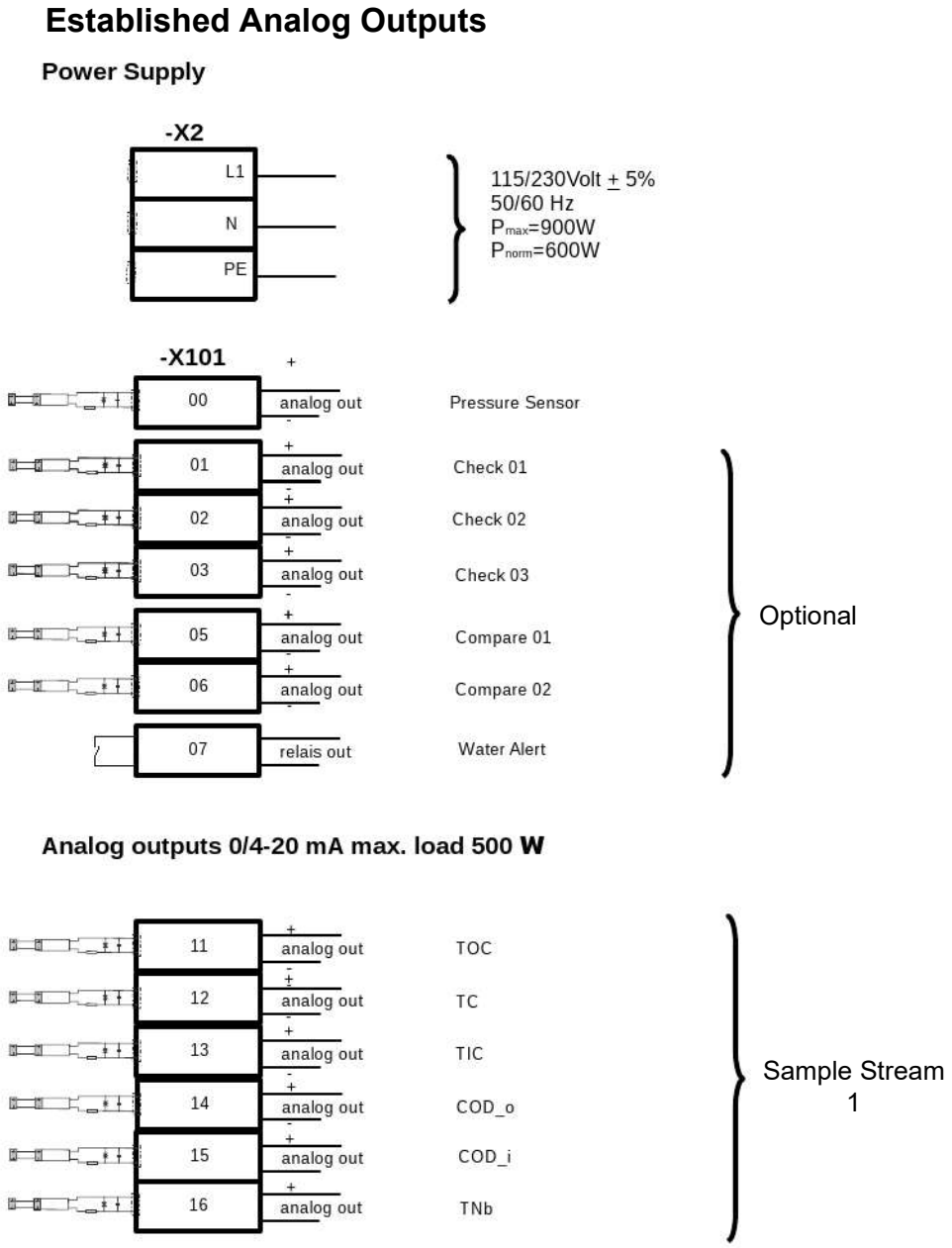


Fig. 30: Terminal Diagram (Part I) - Power Supply, established Analog Outputs, programmable Analog Outputs

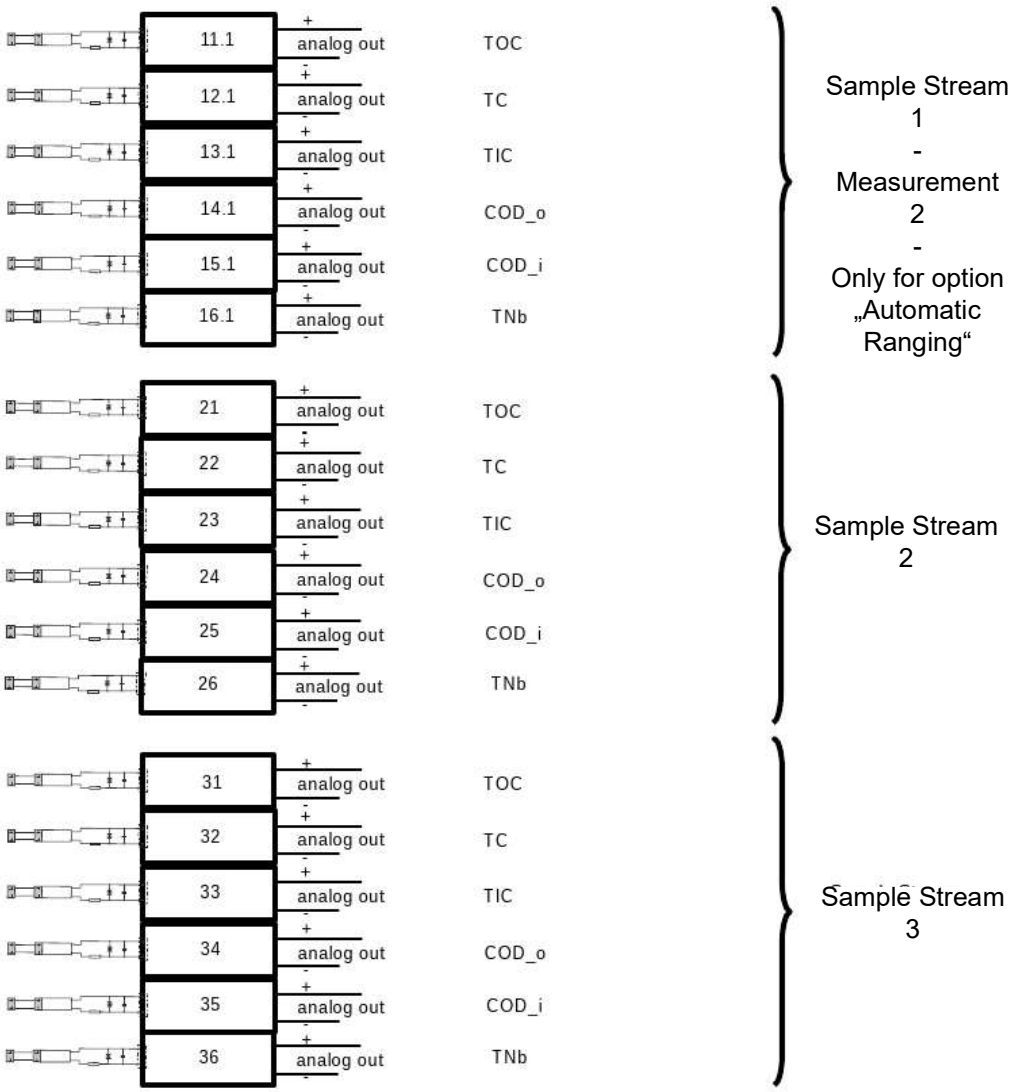


Fig. 31: Terminal Diagram (Part II) - programmable Analog Outputs

Notice

Please note that the terminal diagram (Fig. 30 - Fig. 32) is shown as an example of the maximum configuration (six sample streams), and the analyser ordered corresponds to your configuration.

The relays and analog outputs can be programmed individually by **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 283) as part of the start-up.

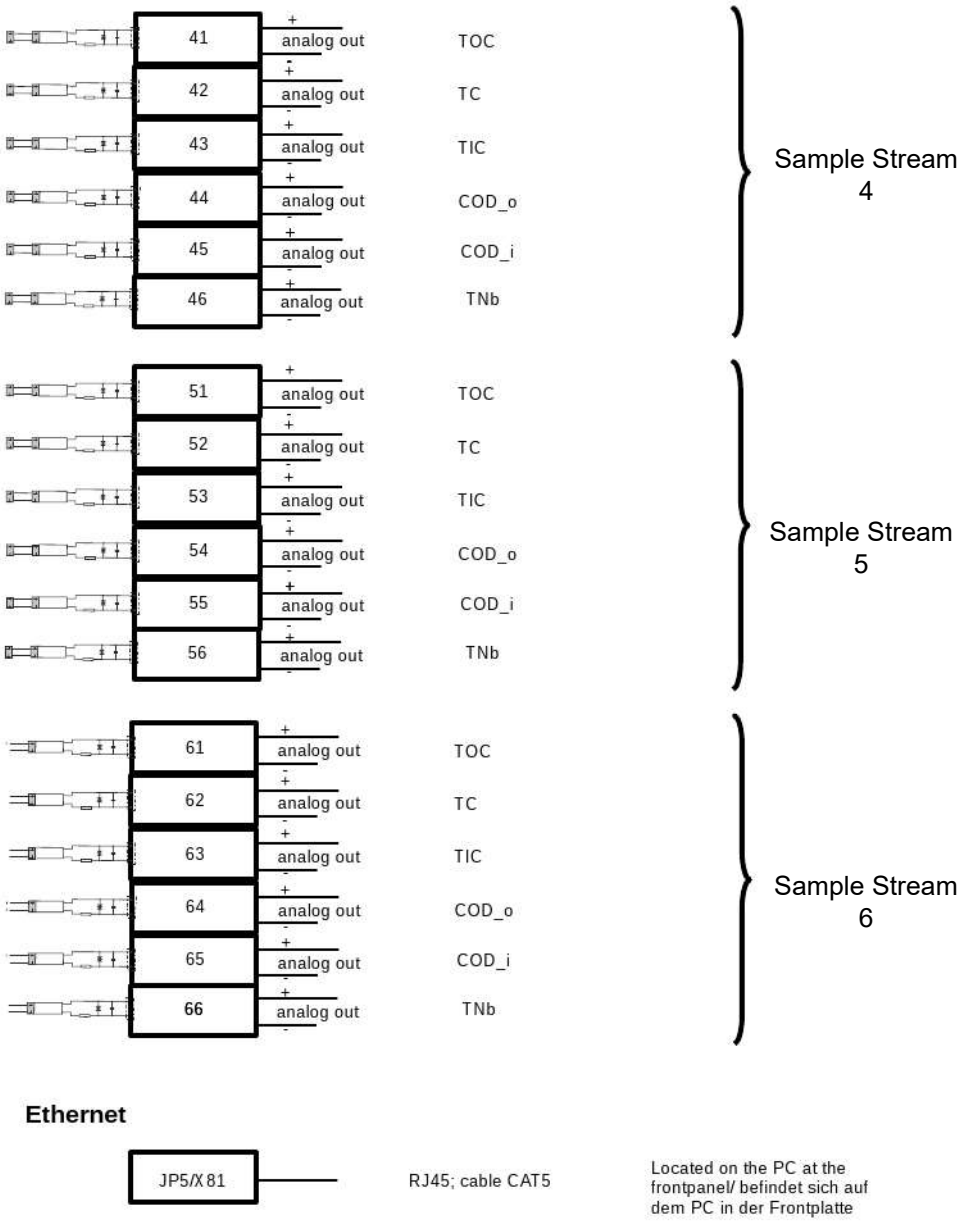


Fig. 32: Terminal Diagram (Part III) - programmable Analog Outputs

Notice

More detailed information on the “Automatic Ranging” option is available in Chapter 9.9 on page 239.

3.7.3 Carrier Gas

The carrier gas which is supplied to the measuring system has to be free of CO_2 because it transports the CO_2, which arises through the oxidation of the sample, to the detector. A pre pressure of 2 - 3 bar must be applied for the carrier gas.

The carrier gas must be free from:

- CO_2
- Carbon
- Dust
- Water
- Oil

4 Installation

This section gives you the instructions for installing the analyser. The following installation process serves as an overview, and should be carried out and logged properly by you.

Danger

Explosion Protection

During installation, observe the local safety guidelines and the VDE 57 165 guideline. In addition, see the conditions for the Ex px system in the separate operating instructions for pressurized systems from Gönnheimer Elektronik GmbH.

Warning

Warning about structural changes to the analyser

Any changes to the housing or the internal wiring lead to the immediate expiration of the ATEX certificate. This information is also noted on the front door.

Before switching on the analyser, check whether the local voltage corresponds to that on the nameplate.
Contact the **Technical Support of LAR** (Chapter 15.1 from page 283), if changes to the analyser are required.

Warning

Explosion protection

All external or external components (purge valve, control unit, Ex interface relays) must be installed with electrical grounding wires.

Unused cable glands must be closed with blanking plugs. Covers on all external units (pressure control, circuit breaker) must be installed. Otherwise, the system must not be used in Ex environments!!

4.1 Installation process

The installation process is divided into installation of the analyser and installation of the analyser accessories.

4.1.1 Installation of the Analyser

- Ensure Environmental Conditions (Chapter 4.2 on page 50)
- Mounting and Installation of the Analyser on Site (Chapter 4.3 from page 51)
- Provide Carrier Gas (Chapter 4.4 on page 54)
- Provide Sample Inlet and Drain (Chapter 4.5 on page 54)
- Provide Power Supply (Chapter 4.6 on page 54)
- Install Signal Connections (Chapter 4.7 on page 54)
- Provide Rinsing Water (Chapter 4.8 on page 55)
- Provide Acid Solution (Chapter 4.9 on page 55)
- Provide Calibration Standard (Chapter 4.10 on page 56)

4.1.2 Installation of Optional Accessories

- Installation of the Reagent Cabinet (Chapter 9.2.2 from page 207)
- Installation of the FlowSampler® (Chapter 9.3.4 from page 221)

Notice

Careful documentation is a precondition for any guarantee and warranty claims.

If you have any questionto the installations, please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 283).

Table 5: Installation log of the analyser

Task	Criteria	OK	Comment
Ensure Environment Conditions	• Dry and frost-proof • Temperature: 5°C - 35°C • Rel. humidity: < 80% • No direct exposure to sunlight • No aggressive environment • No aggressive sample contents	☐	
Mounting and Installation of the Analyser on Site	• Wall mounting: Free space (W x H x D) approx. 1,030 x 1,720 x 1,210 mm	☐	
	• Mounting rack: Free space (W x H x D) approx. 1,070 x 2,000 x 1,420 mm	☐	
Provide Carrrier Gas	• Free of CO2, Carbon, Dust, Water und Oil • Pre pressure 2 - 3 bar • Available in the direct vicinity	☐	
Provide Sample Inlet	• Depressurised • Available in the direct vicinity	☐	
Provide Drain	• Depressurised • Available in the direct vicinity	☐	
Provide Power Supply	• Mains voltage correct • Power cable on power supply connected	☐	
Install Signal Connections	• Serial interface connected • Digital Inputs connected • Analog Outputs connected • Relays connected	☐	
Provide Rinsing Water	• Rinsing water provided	☐	
Provide Acid Solution	• Acid solution provided	☐	
Provide Calibration Standards	• Calibration Standard provided	☐	
Date:	Signature:		

Table 6: Installation log for optional accessories

Task	Criteria	OK	Comment
Installation of Reagent Cabinet	• Mounted on the wall, mounting rack or placed under the analyser	☐	
Installation of the FlowSampler®	• FlowSampler® mounted on the wall to the right of the analyser	☐	
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.

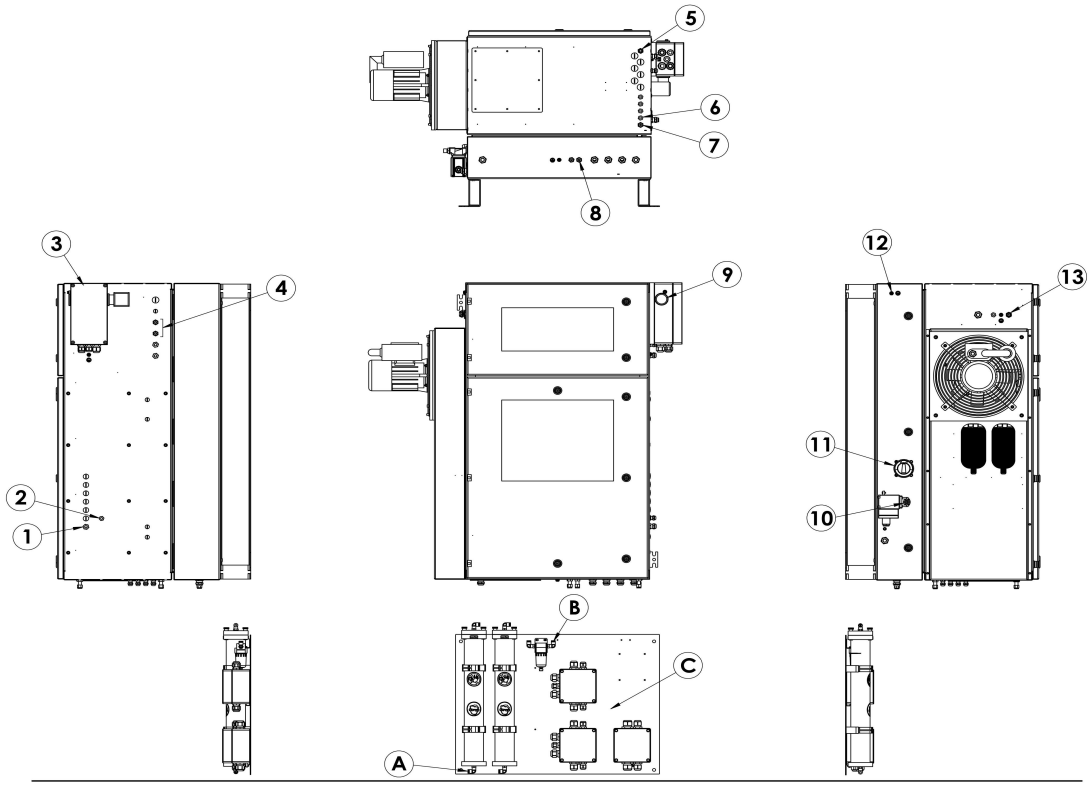
Before the analyser is switched on, a check must be run on whether the local voltage supply matches that on the nameplate.

If this power supply is not available, please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 283).

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 Mounting and Installation of the Analyser On-site

The analyser is normally fixed to a wall (Chapter 4.3.2 from page 53) or onto the LAR mounting rack (Chapter 9.6 from page 235).



No.	Description	Connector (Stainless Steel)	Tubing
1	Sample Inlet (Sample Stream 1- 4)	Cable Gland PG	ID 1,6 mm x 0,8 mm PFA
2	Gas Calibration Inlet	Bulkhead Union OD = 6 mm	
3	Purge Air Connection		
4	Carrier Gas Outlet	Bulkhead Union OD = 6 mm	
5	Outlet for Condensate & Rinsing Solution	Bulkhead Female 1/4" Tube OD x 1/4" Female NPT	
6	Inlet Rinsing Solution	Cable Gland PG	ID 1,6 mm x 0,8 mm PFA
7	Emergency Purge Air Inlet	Bulkhead Union OD = 6 mm	
8	Carrier Gas Inlet	Bulkhead Union OD = 6 mm	
9	Purge Air Outlet		
10	Purge Air Inlet	Valve Inlet	DN10/12
11	Main Switch		
12	Earth Connection		
13	Connection Operation Component		
A	Pressure Air Inlet M	Fitting OD = 6 mm	DN4/6
B	Pressure Air Outlet to 8	Fitting OD = 6 mm	DN4/6
C	Relays Connections		

Notice

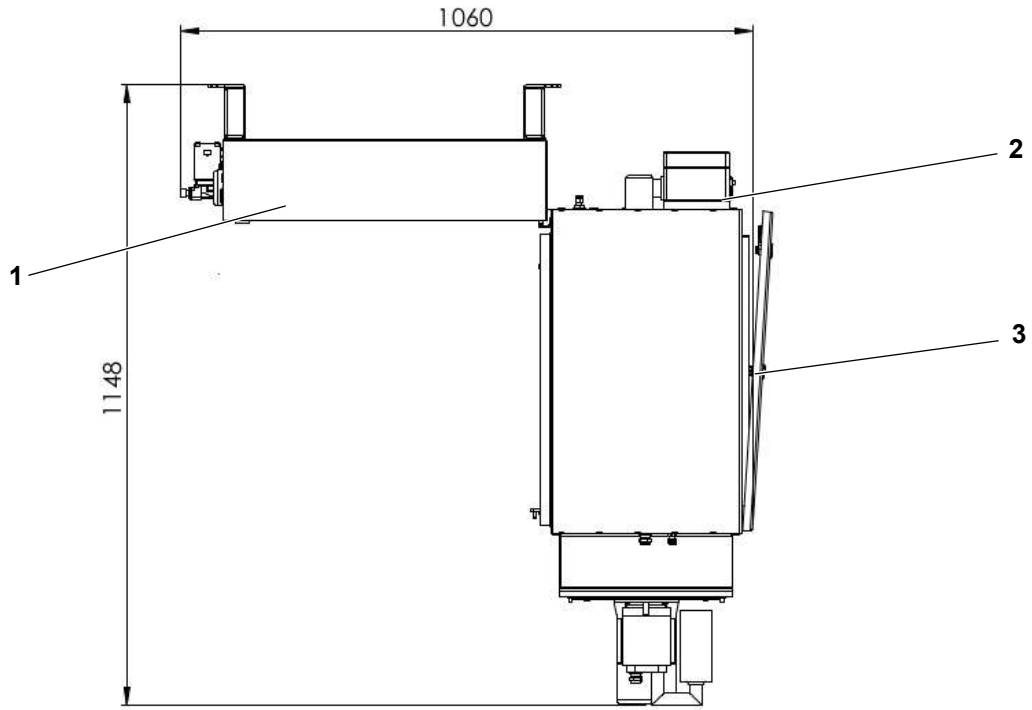
The mounting of the analyser and options has to be done by the user prior to the start-up of the analyser.

Fig. 33: QuickTOC$_{ultra}$ (1 Sample stream, T4, with carrier gas conditioning and relays on mounting plate (Example))

4.3.1 Maximum Swing Open of the Housing

Notice

The mounting of the analyser and options has to be done by the user prior to the start-up of the analyser.



1 Rear housing
2. Front housing
3. Housing door

Fig. 34: Maximum Swing Open

4.3.2 Wall Mounting

Observe the following mounting dimensions:

At least 1.430 x 1.760 x 1.210 mm (W x H x D)

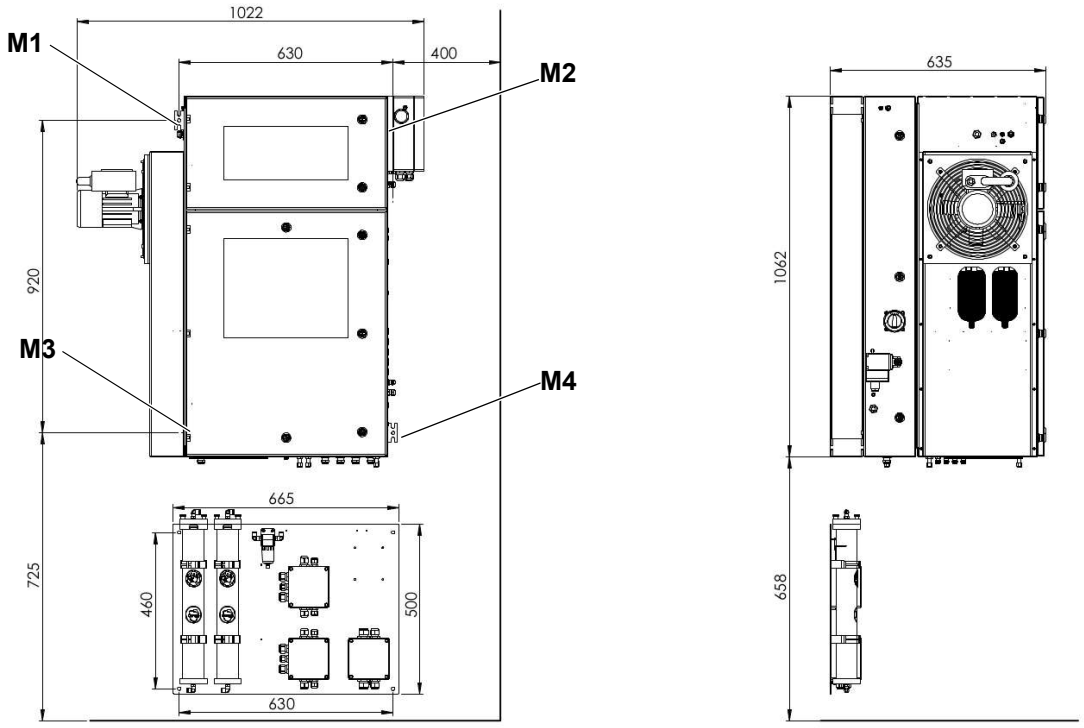


Fig. 35: Wall mounting

Warning

Improper Mounting!

The distance to side and opposing walls must be kept so that the analyser can be opened.

Take into account the condition of the wall to which the analyser is to be affixed. The wall should have the solidity of a concrete wall. Gas concrete walls are unsuitable!

Use all of the brackets (M1 - M4) of the analyser for installation.

Ensure that the analyser is aligned horizontally. Use a spirit level for levelling.

4.4 Carrier Gas

For the operation of the analyser, a carrier gas is required with the following specifications. For more information see Chapter 3.7.3 on page 45.

Ensure that he carrier gas is:

- free of CO_2, carbon, dust, water and oil
- pre-pressurized to 2 - 3 bar
- provided in the direct vicinity of the analyser

4.5 Sample Inlet and Drain

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

Notice

If you are not able to make available a depressurised sample inlet and drain, you can order optional accessories like the FlowSampler® of LAR.

Detailed information on the FlowSampler® is available in Chapter 9.3 from page 218.

If you have any question, please contact the **Sales Department of LAR** (Chapter 15 on page 283).

4.6 Power Supply

A 115/230 V, 50/60 Hz mains voltage is required to use the analyser. The mains voltage for your analyser is specified on the nameplate (Fig. 3, page 18) (on the right-hand side). You must provide a mains lead and connect it to the mains connector (Fig. 26, page 37) on the installation plate (Fig. 25, page 36) of the analyser.

Notice

It is possible to use other mains voltages.

If you have any question, please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 283).

4.7 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 3.7.2.2 on page 40)
- Digital Inputs (Chapter 3.7.2.3 on page 40)
- Relays (Chapter 3.7.2.4 on page 41)
- Analog Outputs (Chapter 3.7.2.5 on page 41)

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 283).

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 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.

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

4.8 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 79.

4.9 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 80 for the TOC-Difference Method or the Chapter 6.1.4 on page 80 for the TOC-Direct Method.

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 9.2 from page 206).

4.10 Provide Calibration Standards

A calibration standard must be provided by the operator to calibrate the analyser. See Chapter 6.2 from page 82.

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 283).

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 59)
2. Checking the Installation Plate (Chapter 5.3 on page 59)
3. Remove Transportation Locks (Chapter 5.4 from page 59)
4. Align the Voltage (Chapter 5.5 on page 62)
5. Switch on the Fuses (Chapter 5.6 on page 62)
6. Filling and Installation of the Reactor Pipe (Chapter 5.7 from page 63)
7. Completing the Furnace System (Chapter 5.8 on page 65)
8. Installation of the Glass Components (Chapter 5.9 on page 67)
9. Installation of the Pump Tubes (Chapter 5.10 from page 68)
10. Tubing of the Analyser (Chapter 5.11 on page 70)
11. Electrical Connection of the Control Unit and the Relays (Chapter 5.16 on page 76)
12. Connection of the Emergency Cooling for the Furnace (Chapter 5.13 on page 72)
13. Switching on the Analyser (Chapter 5.14 on page 73)
14. Set Bypass of the Control Unit (Chapter 5.15 on page 74) and switching into the bypass mode.
15. Test Run (Chapter 5.16 on page 76)
16. Rinse the Injection System and Sample Tubes (Chapter 5.17 on page 76)
17. Customization of application specific Settings (Chapter 5.18 on page 76)
18. Checking the Status Parameters (Chapter 5.19 on page 76)
19. Perfom a Calibration (Chapter 5.20 on page 77), and, if necessary, perform a second calibration

5.1.2 Start-up of Options

- Start-Up of the Reagent Cabinet (Chapter 9.2.3 on page 208)
- Start-Up of the FlowSampler® (Chapter 9.3.5 from page 221)

Table 7: Start-up protocol for the analyser

Task	Criteria	OK	Comment
Checking the Pre-Fuses	• Pre-Fuse is installed correctly	☐	
Checking the Installation Plate	• Components are fixed	☐	
Remove Transportation Locks	• Furnace Transport Screw is removed • Cable tie at XY-System is removed	☐	
Align the Voltage	• Voltage is correct	☐	
Switch on the Fuses	• Fuse Lock is removed • All Fuses are switched on	☐	
Filling and Installation of the Reactor Pipe	• Reactor Pipe is filled • Reactor Pipe is installed	☐	
Completing the Furnace System	• Furnace Head is installed • Injection Port is installed • Reactor Foot is installed	☐	
Installation of Glass Components	• Glass Components are mounted	☐	
Tubing of the Analyser	• Tubing is performed like in Flow Diagram • Tubes are hand-screwed onto the screwed joints	☐	
Electrical Connection of the Control Unit and the Relays	• Control Unit and Relays are connected	☐	
Connecting the Emergency Cooling of the Furnace	• Emergency Cooling of the Furnace is connected	☐	
Switching on the Analyser	• Analyser is switched on • Analyser is booted	☐	
Set bypass of the Control Unit and switching into the bypass mode	• Bypass for the Control Unit is set and Bypass mode is ON	☐	
Test Run	• All Positions are hit	☐	
Rinse the Injection System and Sample Tubes	• Injection System and Sample Tubes are rinsed	☐	
Customization of application specific Settings	• Hardware and Parameter Settings are set	☐	
Checking the Status Parameters	• Carrier Gas IN / OUT: approx. 30 l/h (High Salt: approx. 20 l/h) • Humidity: Actual < Target • Gas Pressure: Actual < Target • Zero Signal: 0 - 0.1 FSR	☐	
Perfom a Calibration	• Analyser is calibrated	☐	
Start the Measuring Mode	• Measuring Mode works just fine	☐	
If necessary, perfom a second Calibration	• Analyser is calibrated	☐	
Date:	Signature:		

Notice

Careful documentation is a precondition for any guarantee and warranty claims.

If you have any question, please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 283).

Table 8: Start-up protocol for options

Task	Criteria	OK	Comment
Start-Up of the Reagent Cabinet	• Connection to Analyser is made	☐	
Start-Up of the FlowSampler®	• FlowSampler® is connected with Analyser • FlowSampler® is connected with process	☐	
Date:	Signature:		

Notice

Measurement mode of the analyser must be checked to ensure perfect operation of the analyser. This may mean start-up can take up to two days.

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. 25, page 36) must also be checked.

5.4 Remove Transportation Locks

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

5.4.1 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 205.

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. 36: Removing the transport locks of the furnace

5.4.2 Transport lock of the XY-System

The XY system is secured with a cable tie for transportation, which must be removed for operation of the analyser.

Proceed as follows:

1. Remove the cable tie (**1**) of the XY-System with side-cutting pliers.
2. Check for moveability of the needle gallows (**2**).

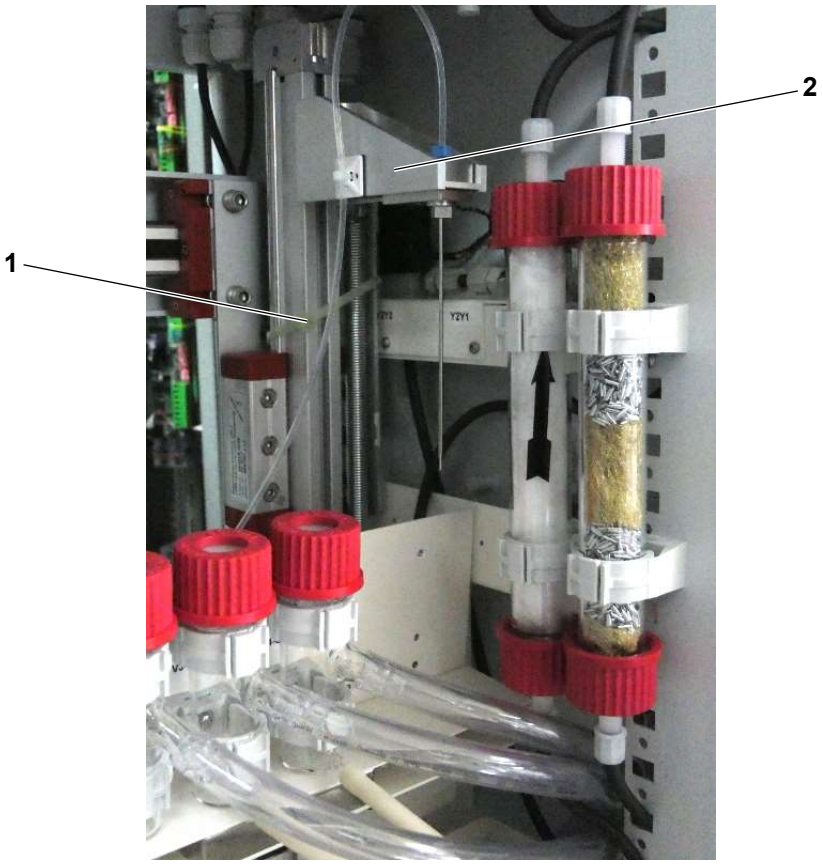


Fig. 37: Removing the cable tie

Warning

Warning of damage

Ensure not to damage any cables, tubes or the XY system with the pliers.

5.5 Voltage Alignment

1. Check the power supply.
2. Compare the mains voltage with that specified on the nameplate of the analyser (Fig. 3, page 18).

5.6 Fuses Switch-On

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 installation plate (Fig. 25, page 36).
2. Remove the cable tie (**1**) with a side cutter from the lock.
3. Remove the safety notice (**2**) attached to the cable tie.
4. Open the yellow lock (**3**) by pulling it forwards.
5. Use your finger and thumb to press in the metal clip, and remove the lock (**3**).
6. Switch all fuses on.
7. Close the rear part of the housing.

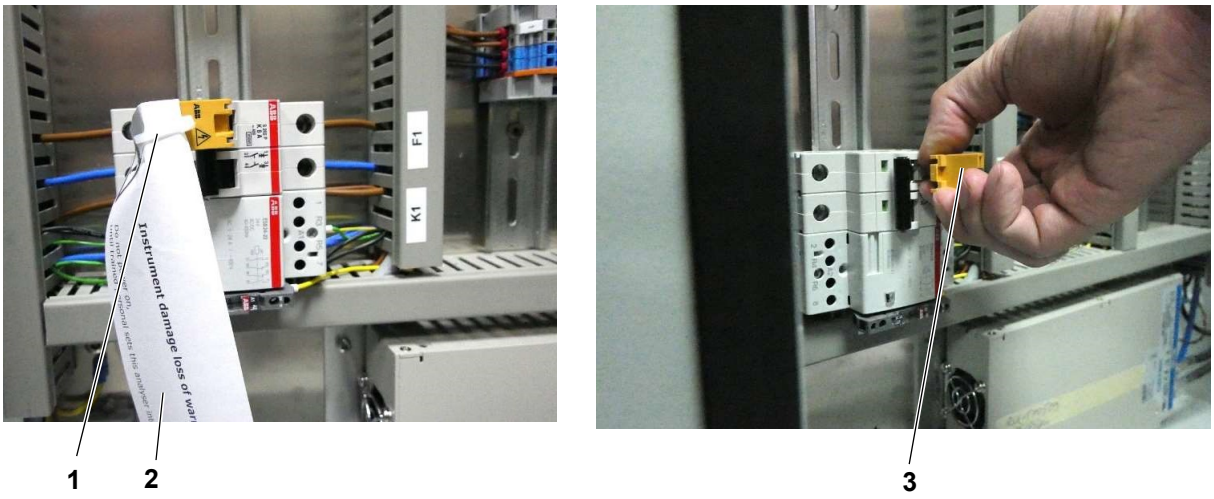


Fig. 38: Removing the fuse lock

5.7 Reactor Pipe Filling and Installation

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.

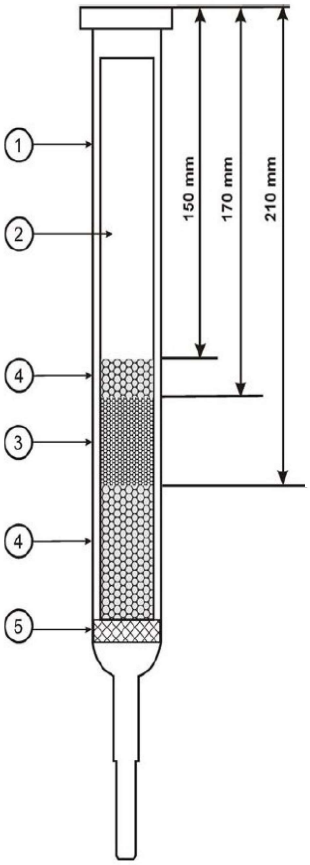
Fill the reactor pipe and install the reactor pipe in the furnace before operating the analyser.

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 ceramic reactor pipe in the furnace::



1. Reactor Pipe
2. Protective Pipe (Ceramic)
3. Ceramic Balls 1.6mm
4. Ceramic Balls 3.5 - 4.5mm
5. Ceramic Sieve

Fig. 39: Reactor pipe filling (Standard)

Proceed as follows:

1. Push the needle (**7**) with the needle gallows (**6**) fully to the top to avoid the needle (**7**) touching the sample vessel (**8**).
2. Push the needle (**7**) on the needle gallows (**6**) fully to the right.

Fig. 40: Needle gallows, full right position

3. Position the ceramic sieve (**5**, Fig. 39, page 63) horizontally on the taper of the reactor pipe / allow it to drop into the reactor pipe.
4. Shake the reactor pipe to move the ceramic sieve into a horizontal position (you can use a torch to check the position).
5. Carefully insert the long protective pipe (**2**, Fig. 39, page 63) into the reactor pipe from above.

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.

6. Fill the ceramic balls with diameters 3.5 mm - 4.5 mm (**4**, Fig. 39, page 63) up to the height specified (210 mm, measured from the top edge with a tape measure).
7. Fill the ceramic balls with diameters 1.6 mm (**3**, Fig. 39, page 63) up to the height specified (170 mm, measured from the top edge with a tape measure).
8. Fill the ceramic balls with diameters 3.5 mm - 4.5 mm (**4**, Fig. 39, page 63) up to the height specified (150 mm, measured from the top edge with a tape measure).
9. Place the green protective seal for the reactor pipe onto the furnace.
10. Push the filled reactor pipe through the green protective seal into the centre of the furnace from above.

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 Completion of the Furnace

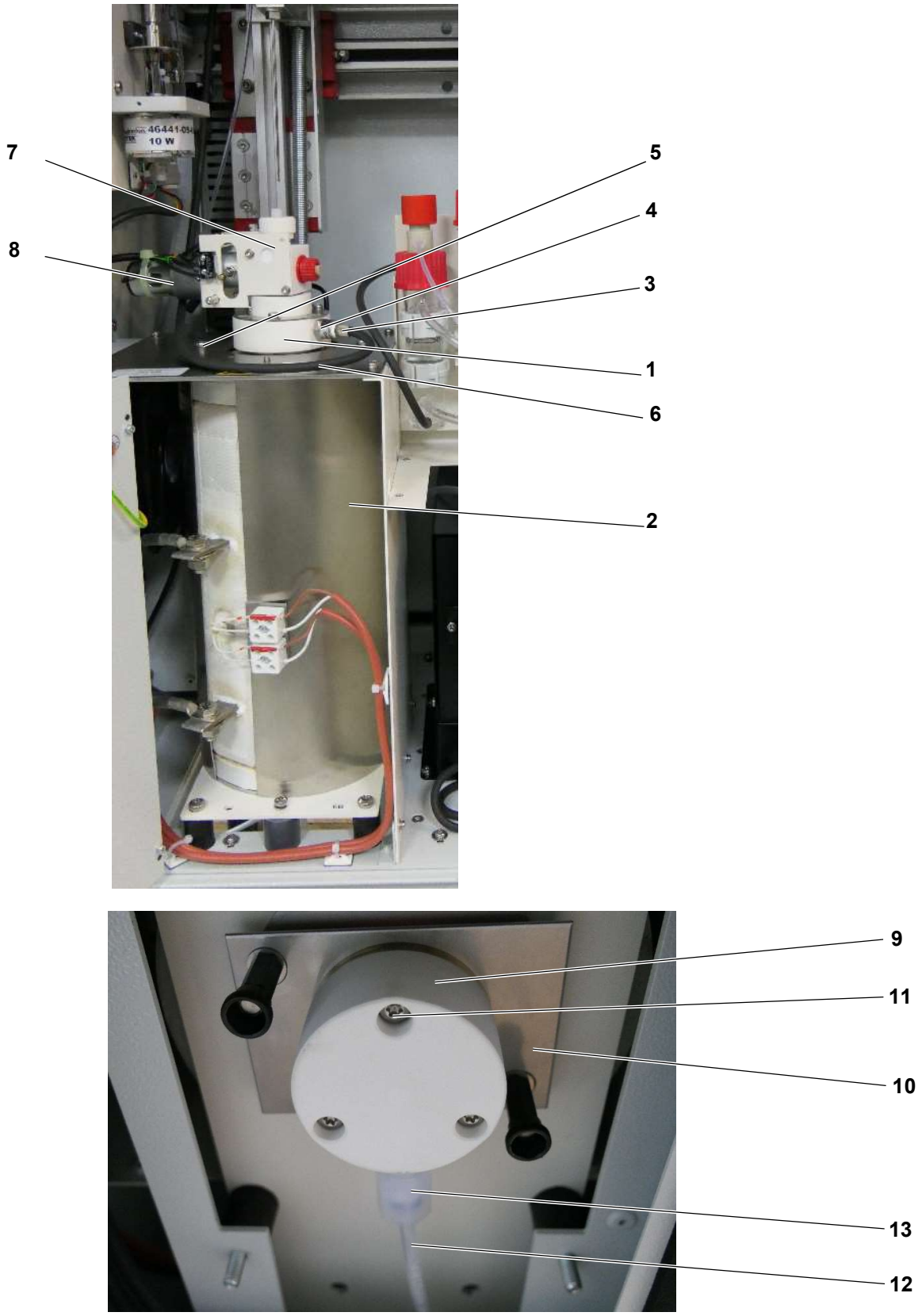


Fig. 41: Completion of the furnace

Proceed as follows:

1. Place the furnace head (**1**) on the furnace (**2**) and on the furnace pipe (**1**, Fig. 39, page 63).
2. Connect the black tube (**3**) to the tube connector (**4**).
3. Tighten crosswise the attachment bolts (**5**) of the furnace head (**1**) with the furnace head panel (**6**).
4. Carefully tighten the injection port (**7**) by hand until slight resistance is felt (the injection port (**7**) should point to the front left at an angle).
5. Plug in the injection port connector (**8**) .
6. Attach the reactor foot seating (**9**) to the reactor footplate (**11**) using three M4x30 bolts (**10**).
7. Connect the teflon tube (PFA) (**12**) to the screwed insert (**13**).
8. Screw the screwed insert into the reactor foot seating (**10**).

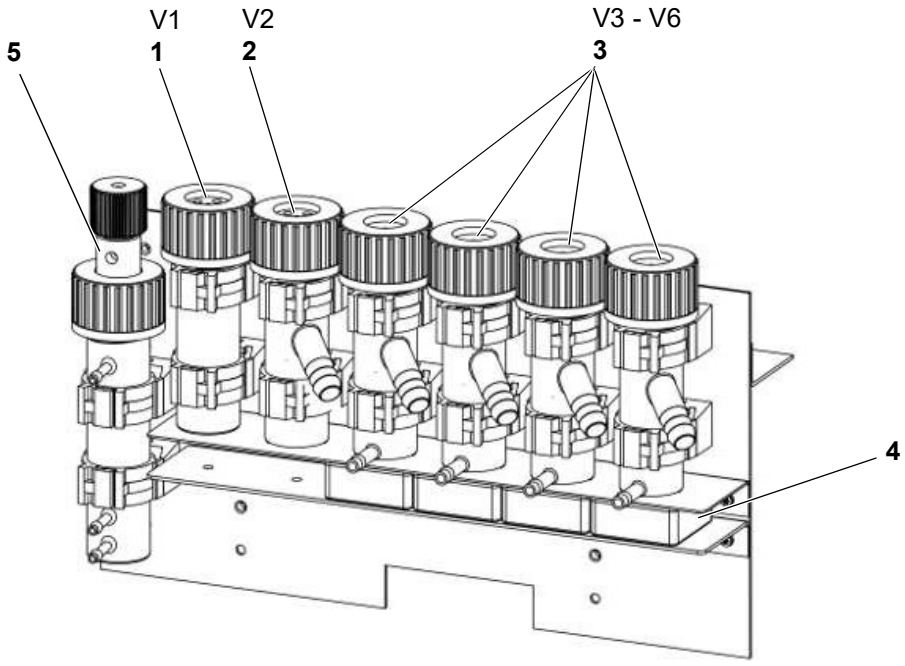
Notice

Before you fit the reactor foot, you should wait until the furnace has reached a temperature of 800°C. This simplifies the installation of the reactor foot.

9. Plug the reactor foot onto the reactor pipe from below.
10. Screw on the four spacer bolts.
11. Pull the reactor foot down so that the gas path is not blocked by the reactor pipe.
12. Attach the bottom lid.

5.9 Installation of Glass Components

1. Check the vessels for integrity.
2. Check that the vessels are in the right order (**1**, **2**, **3**).
3. Check that all tube connections are correctly installed.



1 Calibration vessel V1
2 Rinsing vessel V2
3 Sample vessel V3 - V6
4 Magnetic stir
5 TIC-Reactor (TOC-Difference method)

Fig. 42: Glass Components (Example - TOC-Difference Method, 4 Sample Streams)

5.10 Installation of the Pump Tubes

5.10.1 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 21).
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..

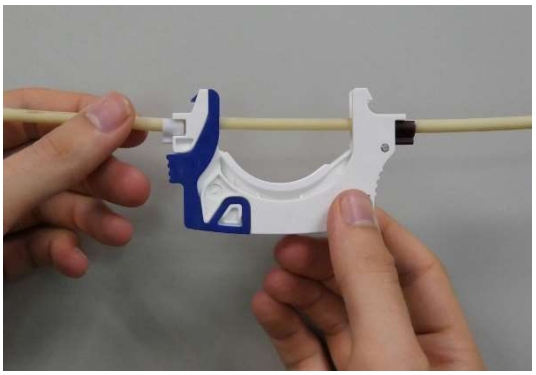


Fig. 43: Insert tube (Example)

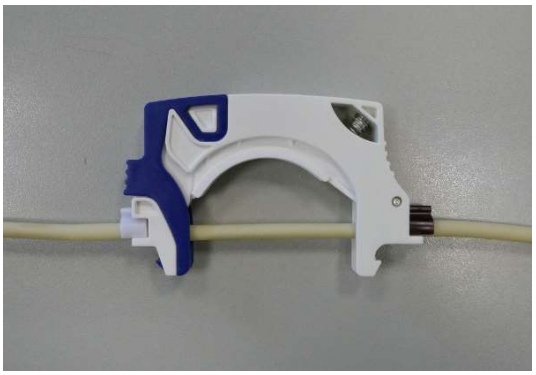


Fig. 44: Cassette with fixing flap (Example)

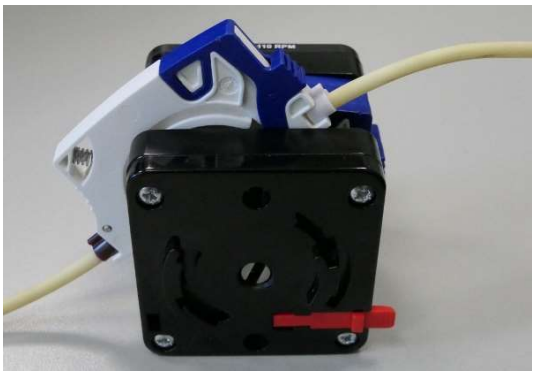


Fig. 45: Mounting the tube cassette (Example)

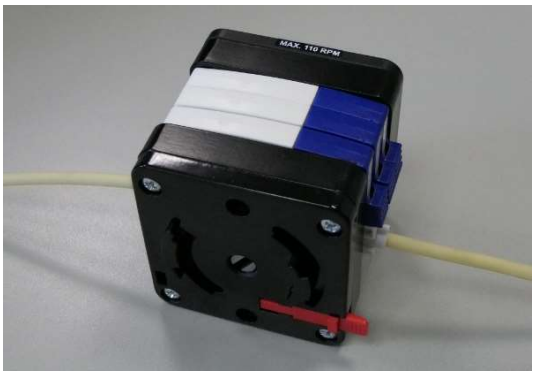


Fig. 46: Tube cassette on pump (Example)

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.

5.10.2 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 21.
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.

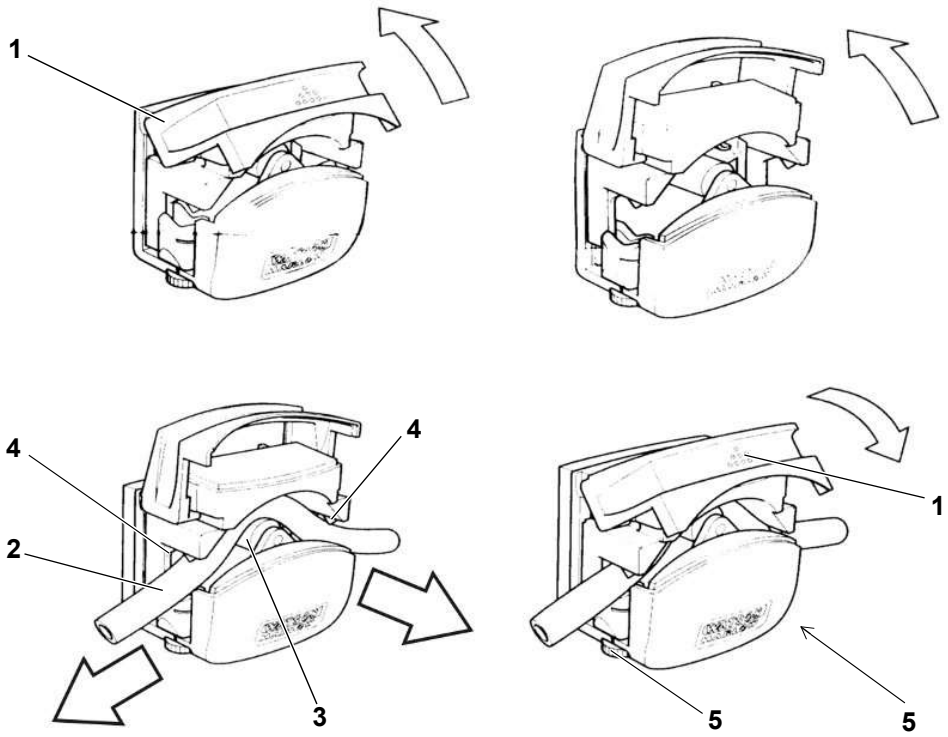


Fig. 47: Installation of the Tubes into the Sample Pump

5.11 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 255).

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

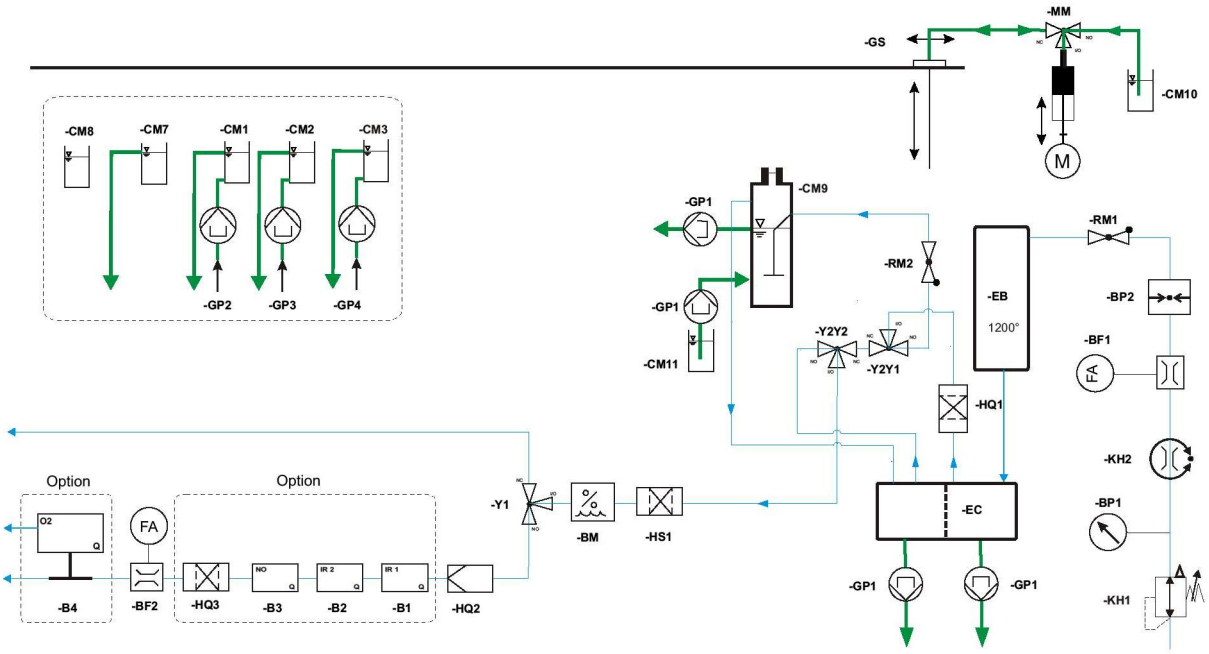


Fig. 48: Flow Diagram (Example: TOC-Difference Method - 3 Sample Streams)

5.12 Electrical Connection of the Control Unit and the Relays

Connect the control unit F870S and the relays SR852 (two pieces) and SR853 according to the following connection plan.

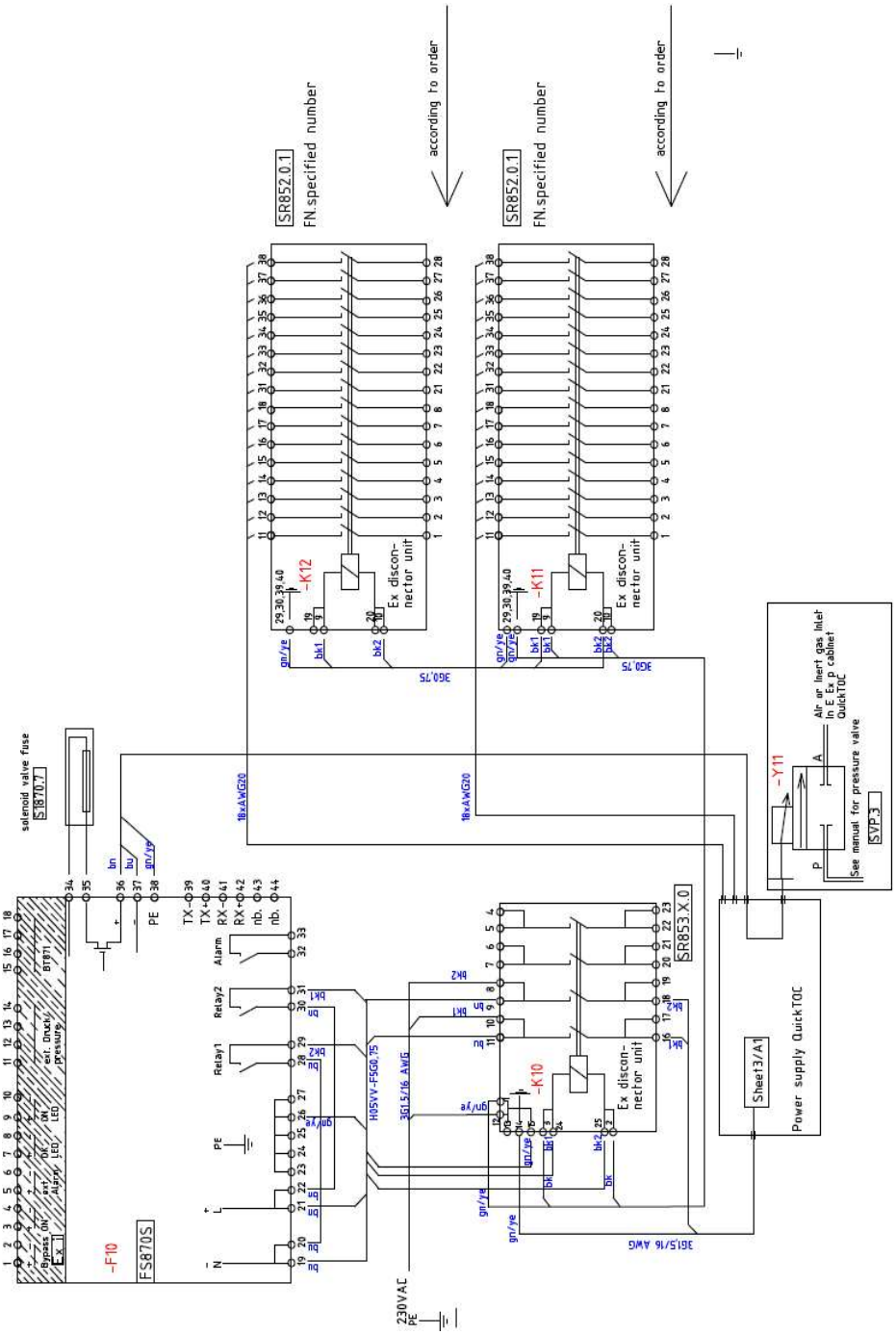


Fig. 49: Connection plan for control unit and relays

5.12.1 Emergency Shutdown

When operating the analyser for ATEX Zone 1, the analyser will shut off if the internal pressure is too low or too high (0.8 - 15 mbar). To do so, the control unit measures the internal pressure and switches off the analyser when the minimum pressure drops below the defined value. Please refer to the operating instructions for pressurized enclosure systems type F 870S (Gönnheimer Elektronik GmbH).

There are three units for the power supply and the input signals. The power supply to the analyzer is disconnected by unit SR853. This unit switches the analyser off in case of a pressure alarm of the control

unit.
Furthermore, the input signals must be disconnected when the analyser is turned off. The SR852 units separate the input signals so that external signals can not cause explosions in hazardous areas.
All units are delivered in ex-tested enclosures.

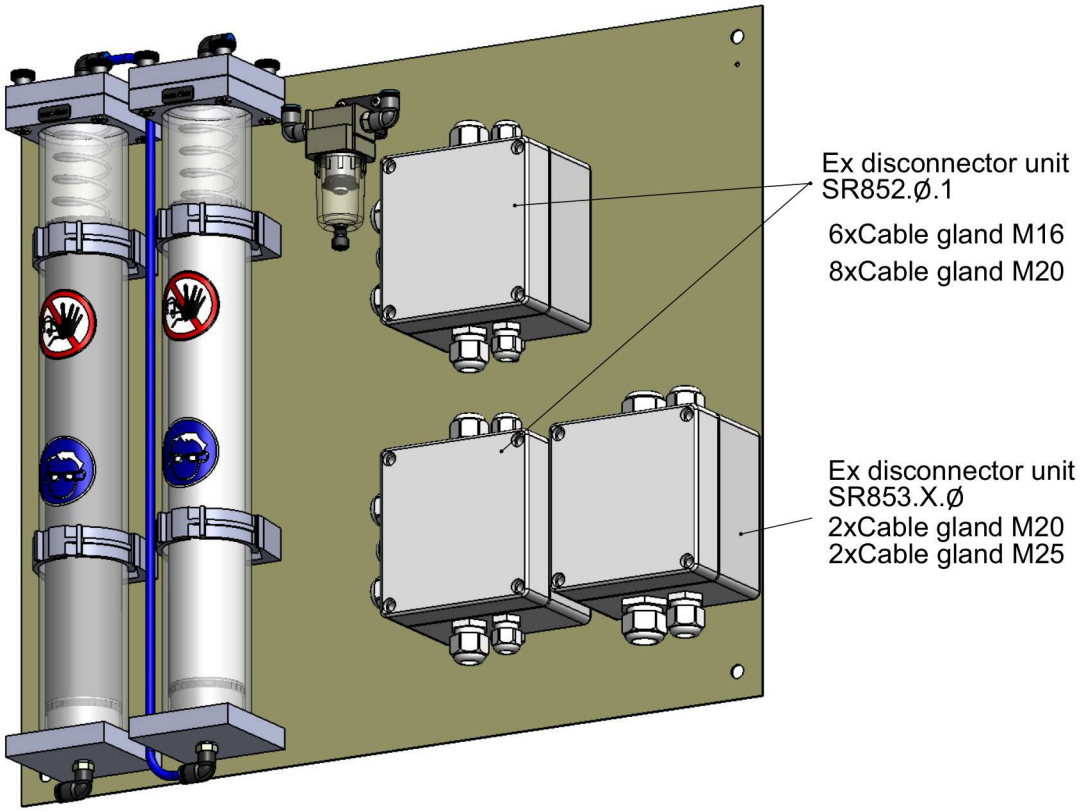


Fig. 50: Ex-disconnector units

5.12.2 Restart after Emergency Shutodown

After restarting the analyser due to an emergency shutdown, a full system test is required:

- Oven temperature
- Carrier gas flow (leaks)
- Gas detector signals
- Injection system
- Gas cooler (primary functions)

5.13 Connection of the Emergency Cooling for the Furnace

Connect the tubing for the emergency cooling (1) of the furnace according to the figure below.

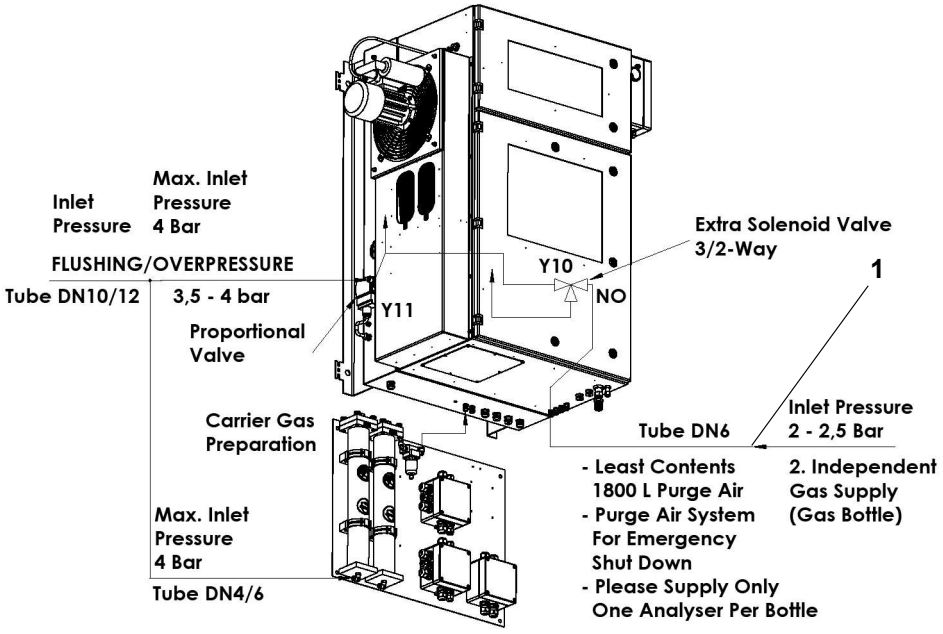


Fig. 51: Emergeny cooling connection (Example)

5.14 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 all installation steps (Chapter 4 from page 45)
- Removal of transport locks (Chapter 5.4 from page 59)
- Switch-on of internal fuses (Chapter 5.6 on page 62)
- Filling and installation of the reactor pipe (Chapter 5.7 from page 63)

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.

1. Before the measuring mode is started, the control unit produces the pressurized enclosure.
2. Close the analyser (if it previously was open).

3. The control unit produces an overpressure of 7 to 10 mbar in the analyser for 10 to 15 minutes to check the tightness of the pressurized enclosure.
4. After successful verification of the tightness, the overpressure in the analyser is reduced to 2 to 3 mbar.

5.15 Setting the Bypass of the Control Unit

Notice

Never close the air outlet (**1**) of the pressurized enclosure system.

To perform maintenance or repair work, set a bypass for the control unit. The analyser can only be opened when the bypass is set. The bypass can only be adjusted if you are sure that there is no explosive atmosphere in the housing. For this a fire protection certificate must be available.

Activate bypass:
The F870S control unit is operated via the mini-joystick (**1**) and display (**2**). The mini joystick (**1**) can be moved up and down (↑ ↓) and left or right (← →). Pressing the mini-joystick will take you to the respective sub-menu on the display (**2**).

1. Loosen the four screws of the control unit cover and remove the cover.
2. Press the joystick. The display shows "Actions". Confirm by pressing the joystick.
3. Press the joystick downwards (↑ ↓). The display shows "Bypass". Confirm by pressing the joystick.
4. Press the joystick right (→) until you reach the last digit and then upwards (↑) to change the bypass code.
5. The bypass code to enter is **0002**.
6. Press the joystick downwards (↓). The display shows "Bypass ON".
7. Attach the control unit cover with the four screws.

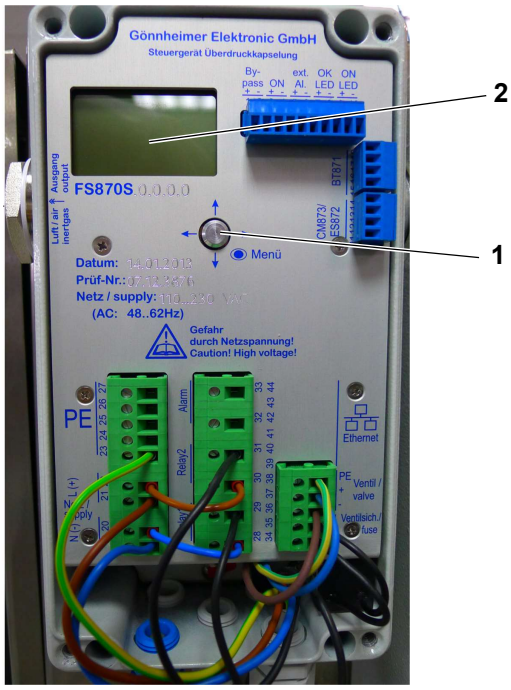


Fig. 52: Control unit F 870 S, with removed cover

Disable bypass:

1. Loosen the four screws of the control unit cover and remove the cover.
2. Press the joystick. The display shows "Actions". Confirm by pressing the joystick.
3. Press the joystick downwards (↑ ↓). The display shows "Bypass". Confirm by pressing the joystick.
4. Press the joystick right (→) until you reach the last digit and then upwards (↑) to change the bypass code.
5. The bypass code to enter is **0002**.
6. Press the joystick downwards (↓). The display shows "Bypass OFF".
7. Attach the control unit cover with the four screws.

5.16 Perform a Test-Run

Notice

If the injection needle does not pierce the vessels correctly, the X position must be corrected manually from the “Test run” display (Chapter 7.8.3 from page 120).

If you have any question, please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 283).

A test run must be performed to check whether the injection needle hits all positions correctly (furnace and vessels). Follow the instructions in Chapter 7.8.3 from page 120 to perform a test run.

5.17 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 7.8.2 from page 118).
2. Rinse the injection system using the “Rinse injection system” function.
3. Rinse the sample tubes using the “Rinse sample tubes” function.

5.18 Costumisation of Application-Specific Settings

Application-specific hardware and parameter changes can be set.

Change the following settings:

- Measurement Parameters (Chapter 7.7.1 from page 101)
- Measurement Channels (Chapter 7.7.2 on page 105)
- Relays (Chapter 7.7.3 from page 108)
- Analog Outputs (Chapter 7.8.5 on page 124)

5.19 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 58), in which all relevant status parameters are recorded with associated status information permitted. The status parameters are on the “Status screen” display (Chapter 7.1.4 from page 91).

Notice

If a status parameter differs from the status, contact the **LAR** Technical Support (Chapter 15.1 on page 283).

5.20 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 7.10.1 from page 135).

Notice

The calibration standards provided by the user are a prerequisite for calibration (Chapter 6.2 from page 82).

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 9: 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

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 283) before using another acid.

6.1.4 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 283) before using another concentration.

6.1.5 Cleaning Solution for Glass Components

Conventional cleaning agents can be used to clean sample and calibration vessels. Very thorough cleaning with a bottle brush is required for analysers working in low TOC working ranges (< 100 mg/l C). We recommend the following cleaning method for high levels of contamination which cannot be removed using a bottle brush.

Proceed as follows:

1. Fill a 1 l graduated flask with 0.8 litres of water.
2. Add 10 ml of concentrated sulphuric acid (H_2SO_4) and 1 g of potassium manganate (KM_4O_4).
3. Fill the graduated flask up to 1 l with water.
4. Allow the glass vessels to stand in this solution overnight.
5. Fill a 1 l graduated flask with 0.8 litres of water.
6. Add 10 ml of concentrated sulphuric acid (H_2SO_4) and 10 to 20 ml of hydrogen peroxide (H_2O_2).
7. Fill the graduated flask up to 1 l with water.
8. Allow the glass vessels to stand in this solution for about 24 hours.
9. Thoroughly rinse the glass vessels at least three times with clean distilled water.

If ambient air cleaned with **LAR** equipment is used as the carrier gas, the following chemicals are required:Highly volatile organic components (eg solvents) in the ambient air may have a negative impact on the accuracy of the measurement, depending on the installation site. All volatile carbons (VOCs) must be removed from the ambient air. Activated carbon is used for this task. The CO2 in the ambient air is removed by the soda lime pellets. When the chemicals are saturated with volatile carbon (VOC), the analyser's base signal rises. The signal value depends on the detector connected to the analyser.

If the activated carbon has changed color, the activated carbon must be replaced.If the soda lime pellets have changed color, the soda lime pellets must be replaced.

6.2 Calibration Standards

The concentration of the standard is dependent on the chosen working range . It should be at least 50% and at most 100% of the working range end value. The standard is prepared in accordance with DIN EN 1484:1997.

Example:

If a working range of 1,000 mg/l C is set, the calibration standard must be between 500 mg/l and 1,000 mg/l C. A concentration of 750 mg/l C or 800 mg/l C would be ideal in this case.

Warning

Warning of malfunctions

Make sure that you provide a logical concentration for your working range. Otherwise, the analyser won‘t work correctly after calibration.

Notice

Appropriate certified calibration standards can be purchased directly from the LAR to minimize the effort of preparation.

For more information please contact the **Sales Department of LAR** (Chapter 15 on page 283).

The calibration standards in the calibration vessel should replaced as follows (potassium hydrogen phthalate):

- Weekly for a concentration > 100 mg/l C.
- Daily for a concentration < 100 mg/l C.

6.2.1 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.

6.2.1.1 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.

6.2.1.2 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.

6.2.2 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.

6.2.2.1 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.

6.2.2.2 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/IC] 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

The following section gives an overview about the analyser‘s software and how to use it.

7.1 General

QuickTOC®$_{ultra}$ is equipped with a touchscreen. You can either use a stylus or your fingers to operate the software

Warning

Damage to the touchscreen

The touch screen can be damaged by handling sharp objects. Operating errors and illegibility can be the result.

Use only your fingers or stylus to operate the touch screen.

7.1.1 User level

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.
- User level 2
  The user can view data (such as readings) and use functions described in this chapter.
- User level 3 (expert level)
  The user can view data (such as readings) and perform functions described in this chapter. User level 3 authorizes the execution of further functions, which are marked in the following with "user level 3 only".

Notice

For user level 2 an access authorization with password can be set up (Chapter 7.8.4 on page 123).

User level 3 (expert level) can only be activated via an authorized USB stick from LAR.

To be able 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 283).

7.1.2 User interface

The user interface consists of the status bar (**1**), the navigation bar (**2**), the control bar (**3**) and the main display (**4**).

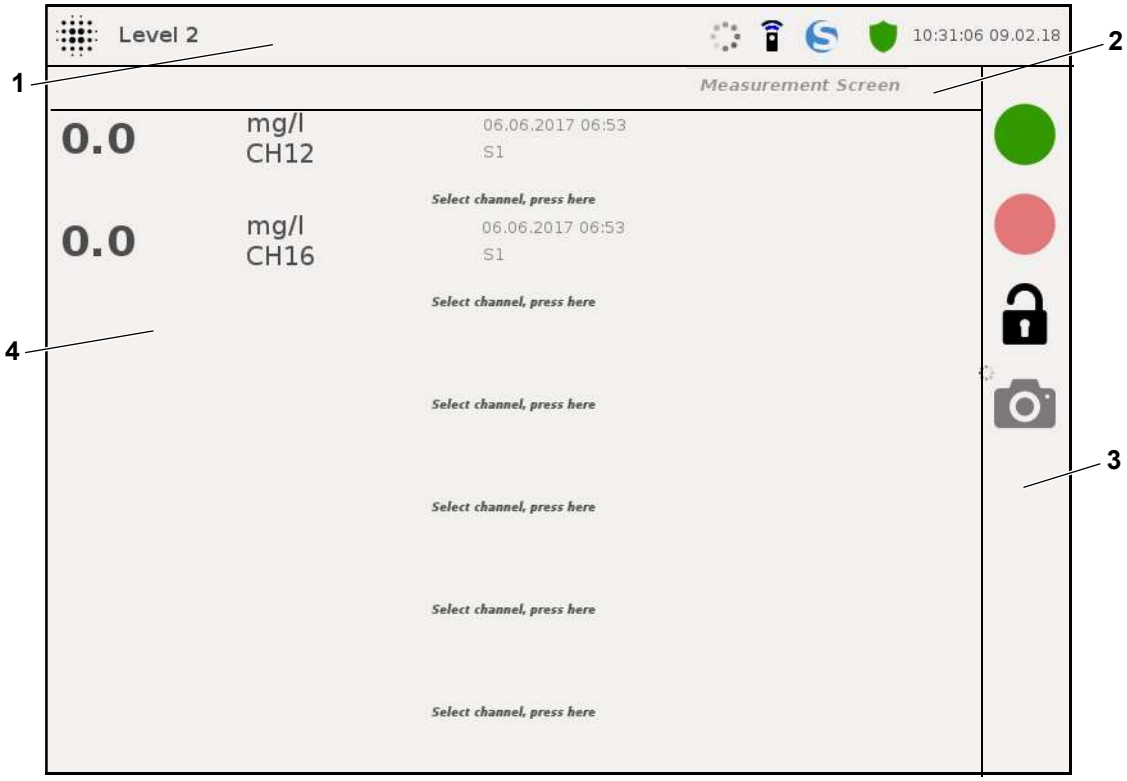


Fig. 53: User interface (example)

7.1.2.1 Status bar

The status bar displays the operating status, user level, time and date. Furthermore, the start screen, the update manager and the logbook can be reached from here.

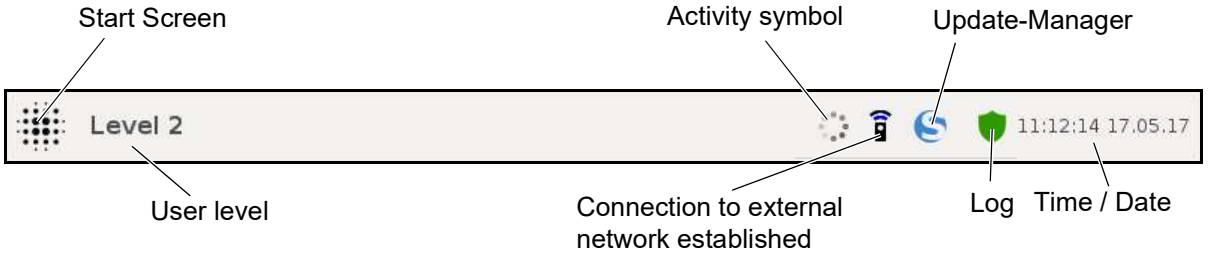


Fig. 54: Status bar (Example)

7.1.2.2 User Level Navigation bar

The navigation bar indicates at which menu level you are currently (right) and in which menu level you can return (arrow on the left side).

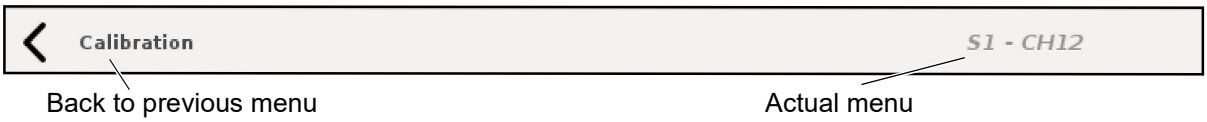


Fig. 55: Control bar (Example)

7.1.2.3 Control Bar

The control bar is used to switch the online measurement on and off, to log in the user and to take screenshots.

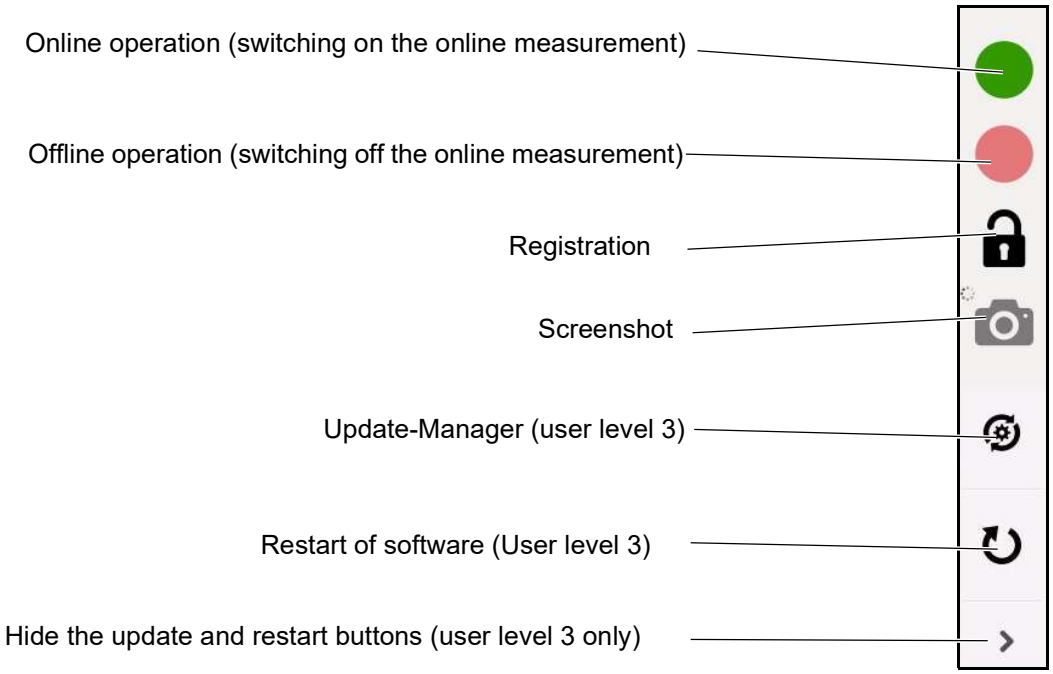


Fig. 56: Control bar

7.1.2.4 Main view

The main view is for viewing and setting the analyser

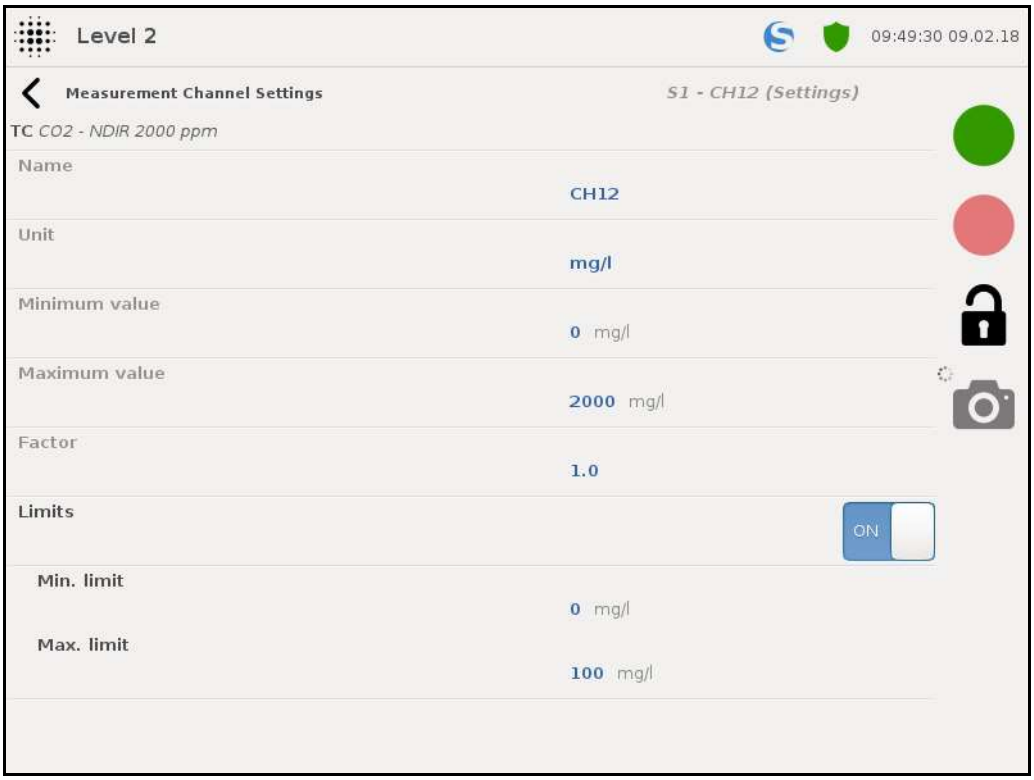


Fig. 57: Main view (Example)

7.1.2.5 Keyboard

For inputs in the main display, the following keyboard appears as soon as you click on the field to be edited.

Fig. 58: Keyboard

7.1.3 Registration

The registration button (Fig. 56, page 89) will take you to the registration window. Here you can switch between user level 1 and user level 2. The level classification serves to recognize the access authorization of the user.

Notice

For user level 2, an access authorization with password can be set up (Chapter 7.8.4 on page 123).

User level 3 (expert level) can only be activated via an authorized USB stick from LAR.

7.1.4 Operating status

The operating status is displayed via the status bar and can be displayed in 3 variants.

Notice

The activity flag (status bar to the left of "Update Manager") serves to display a current activity of the analyser. Click on the icon to display the current action of the analyser. The corresponding status codes can be found in chapter Chapter 7.15.1 on page 157.

The following 3 variants are displayed in the status bar:

1. Offline:

There is no activity sign and no status in the status bar

Fig. 59: Status bar (Offline)

2. Online (collapsed):

The activity bar is displayed in the status bar.

Fig. 60: Status bar (Activity sign)

3. Online (unfolded):

The status bar displays the activity sign and the status.

Fig. 61: Status bar (activity sign, status - single measurement sample stream 1) - Example

7.2 Home Screen

The start screen is the main menu of the analyser. This screen will take you to all accessible areas of the operating software.

From the start screen you can access the following displays:

- Reading screen
- Daily variation
- Status screen
- Vaveform
- Measurement settings
- Service
- Single measurement
- Calibration
- Database

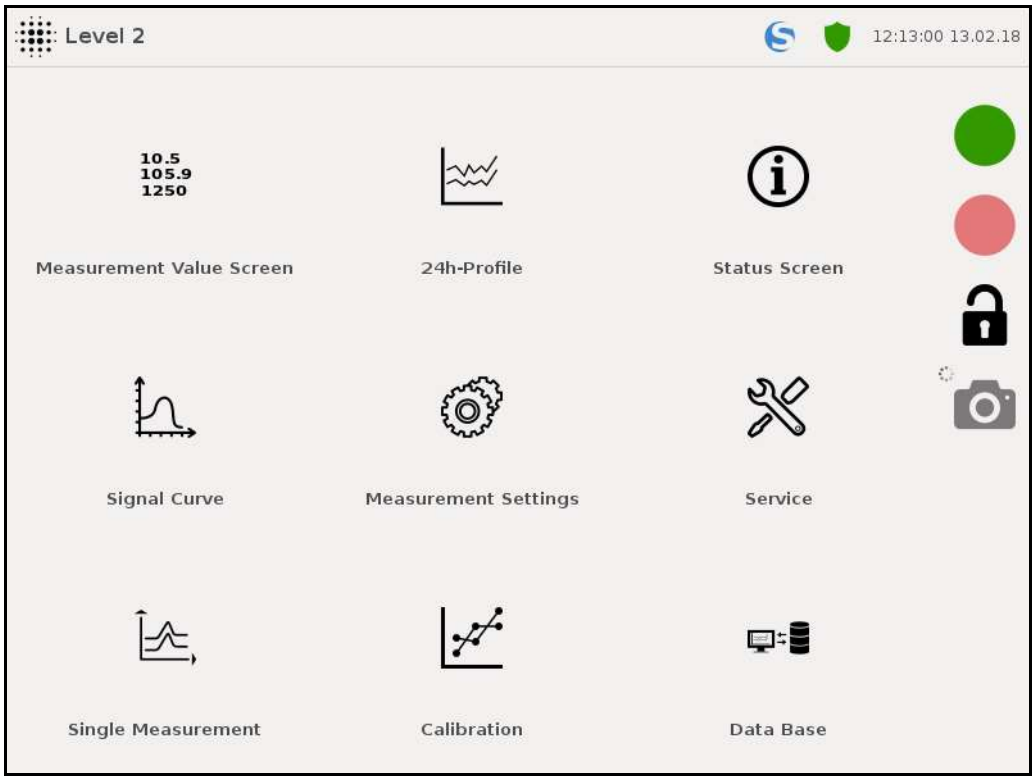


Fig. 62: Home screen(Example)

7.3 Reading Screen

In the measured value screen, the current measured values of the online measurement and, if applicable, the check function, if activated, are displayed with the associated date and time of the measurement. The measured value screen can display a maximum of 6 measured values, which can be freely selected via the channel selection as of user level 2.
The option to change the channel selection is given for 5 seconds after the display of the measured value screen. Pressing one of the empty fields will take you to the "Channel selection" display.
Furthermore, under- and / or exceeded limits are displayed with the code (e.g., L12_max) for the respective measurements

Fig. 63: Reading screen (Example)

Reading:
The left side of the display shows the channel's current reading.

Unit / name of the channel:
Directly next to the measured value is the specification of the unit and the name of the channel.

Date / time of the current measured value:
The middle of the display shows the date, time, number of the sample stream (#) and the name of the sample stream for the current measured value.

7.3.1 Channel Selection

Measurement values in the "Measurement Screen" display are based on the measurement channels displayed here that are factory set to user requirements.

Fig. 64: Reading screen - Channel selection (Example)

This display consists of the list of available channels, each associated with a sample stream. The settings of the channels can be found in Chapter 7.7.2 from page 105 and the settings of the sample streams can be seen in Chapter 7.7.4 on page 111 onwards.

7.4 Daily Variation

In the daily variation you will be shown the results of the last 24 hours. Any existing and measured sample stream and parameter can be selected and viewed here. Click on a sample stream to go to the single view.

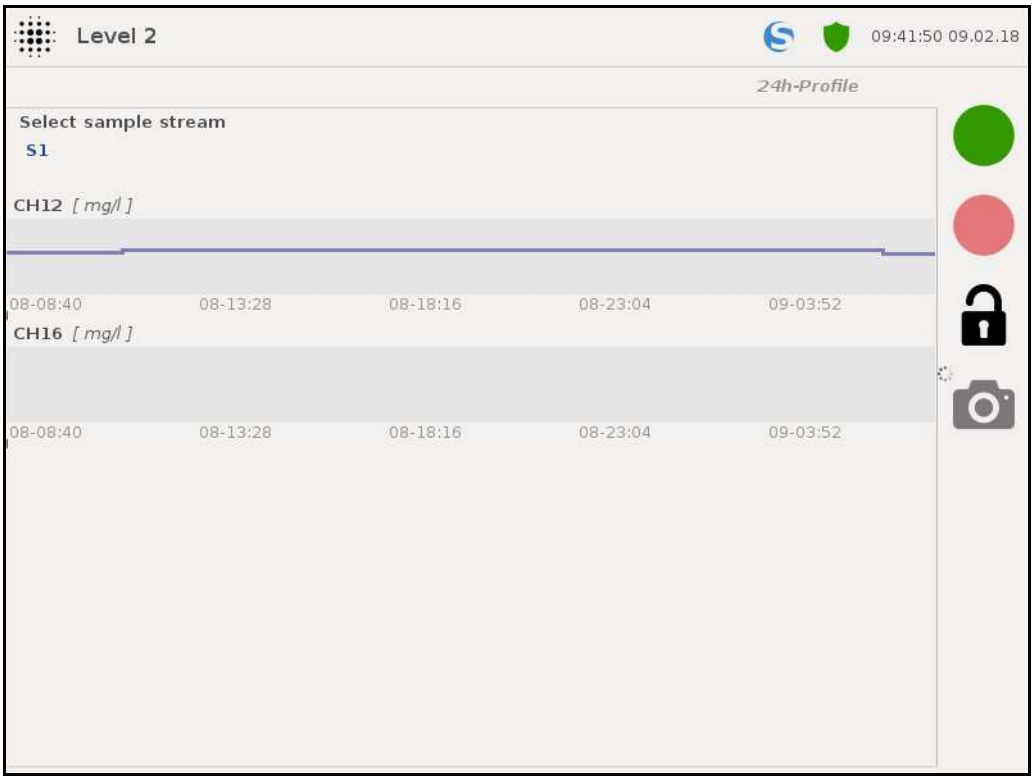


Fig. 65: Daily variation (Example)

7.4.1 Single View

The single view displays the daily response of a selected single sample stream and parameter.

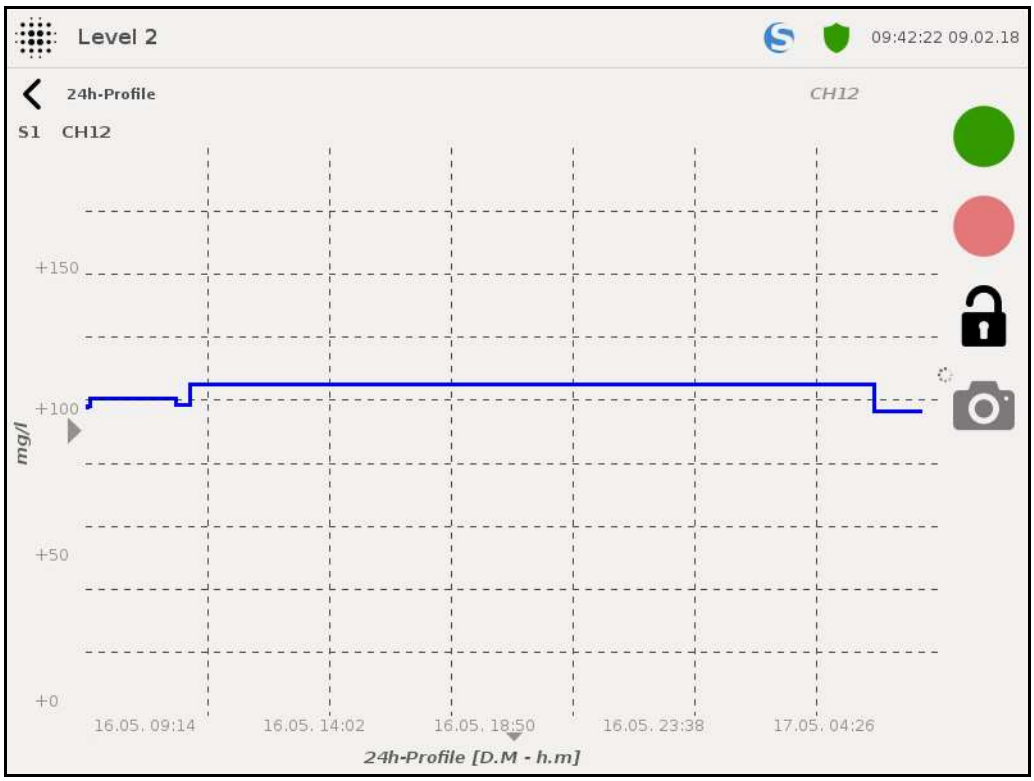


Fig. 66: Daily variation - Single view (Example)

Notice

This view supports the zoom funcionality (Chapter 7.14.1 on page 155).

7.5 Status Screen

In this two-part display, the right-hand window gives an overview of the current status of the analyser. In the left window, the last 60 measurement results of a sample stream can be viewed. In order to switch between the different sample streams in the display, the button "Sample stream selection" must be pressed. Next to the Sample Stream Selection button, you will find the time of the next measurement of the selected sample stream when the analyser is in online mode. During a measurement, "measurement" is displayed here and when the analyser is in offline mode, "offline" appears.

The display of the measurement results is divided into:

- Date
- Time of day
- Name (of the channel)
- Measured value [mg / l]

The status display is divided into:

- Oven (on / off)
- Gas cooler (on / off)
- Carrier gas IN: actual 19.9 / setpoint 20.2 l / h (± 10% max)
- Carrier gas OUT: (actual 19.4 / setpoint 20.2 l / h (± 10% max)
- Humidity: actual 6 / target <60 max % RH
- Gas pressure: actual 26 / target < 600 max mbar
- Remote control (on / off)
- Fault messages (see chapter 7.15.2 from page 169)
- Limit
- Process status
- Device ID
- Software Version

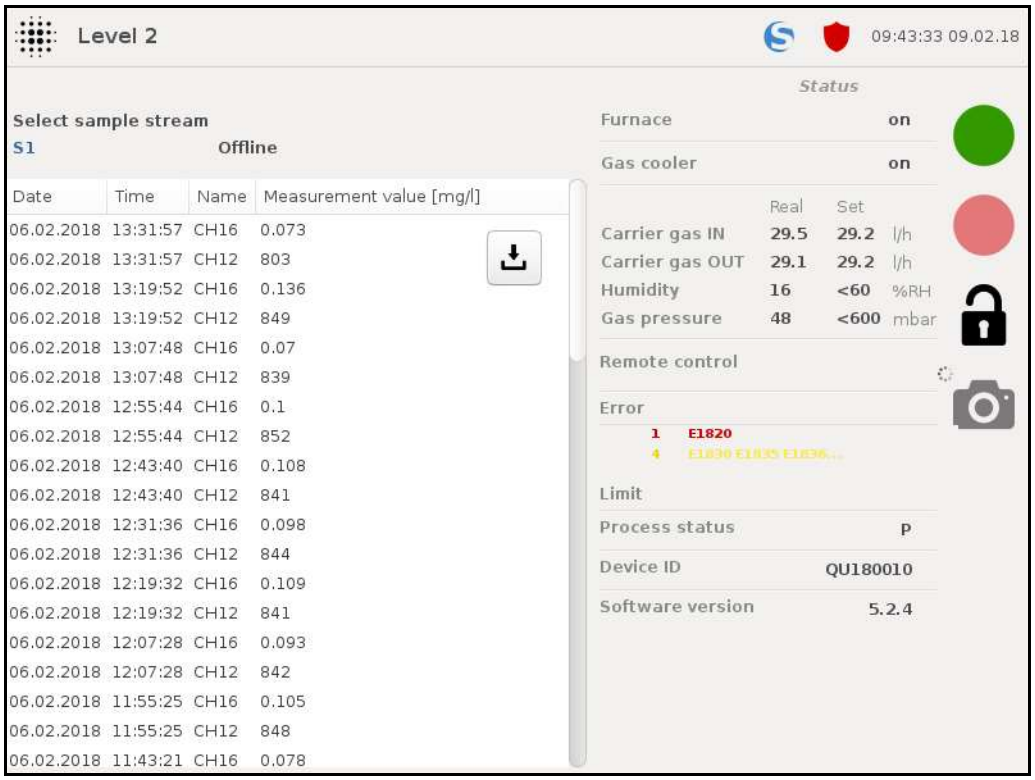


Fig. 67: Status screen (Example)

Warning

Operating error with remote control!

If the remote control is deactivated, no status "On" / "Off" is displayed.

If the remote control is activated, the status "Off" is displayed until a signal is present ("On").

If the actual data differs too much from the target specifications, contact the technical support of LAR(Chapter 15.1 on page 283).

Notice

This view supports the Export function (Chapter 7.14.2 on page 156).

7.6 Waveform

This view shows the waveforms. The "Sample stream selection" key can be used to select the signal of the desired sample stream. Furthermore, after selecting the sample stream, the individual parameters can be selected for illustration.

Fig. 68: Waveform (Example: Sample stream with one Channel / parameter)

Notice

This view supports the zoom funcionality (Chapter 7.14.1 on page 155).

Selection of sample stream:
This function selects the sample current and parameter to be displayed.

Sensor signal:
This value corresponds to the current signal of the detector during a measurement [FSR].

Integration:
This value indicates the signal area [FSR * sec].

Notice

The unit in this display is in FSR and stands for "Full Scale Range". The values are between 0 and 1 FSR and corresponding standard values 0 to 20 or 4 to 20 mA.

7.7 Measurement Settings

In this display, the following setting screens are selected:

- Measurement parameters
- Measuring channel settings
- Relay
- Sample stream settings (user level 3 only)
- Sensor settings (visible from user level 2)

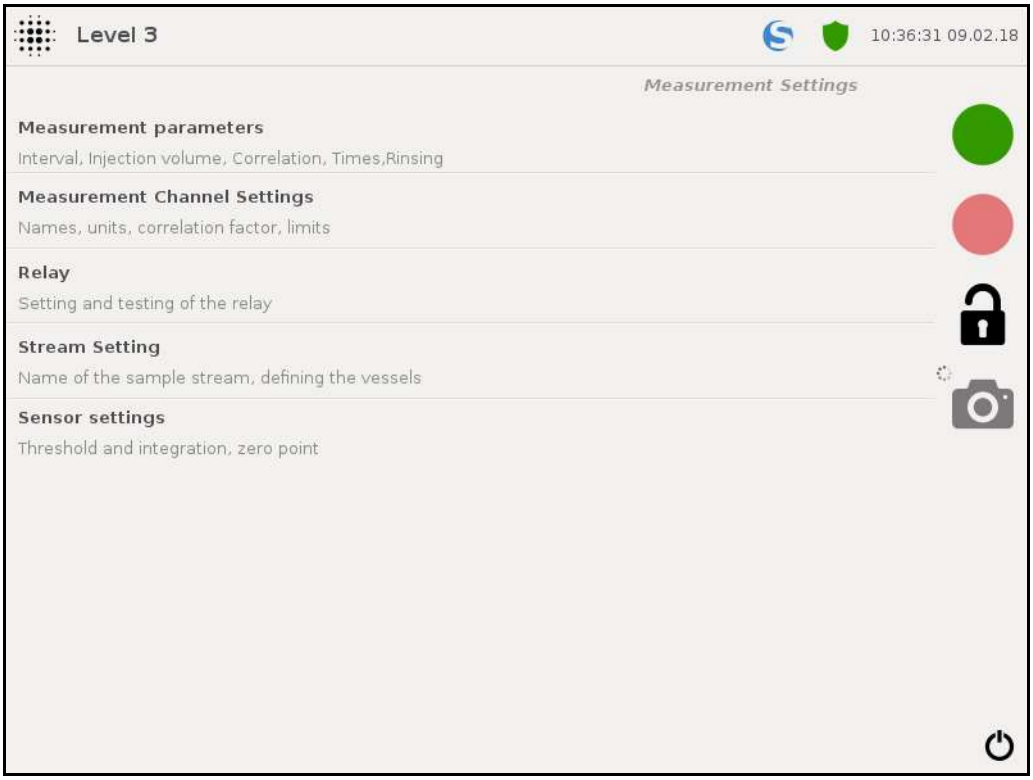


Fig. 69: Measurement settings

7.7.1 Measurement Parameters

In this display, the measurement parameters for each sample stream can be set individually. The sample stream to be set is selected via the "Sample stream selection" button. The settings made apply only to the selected sample stream.

Notice

If the analyser is in online mode, no parameter changes can be made.

Fig. 70: Measurment parameters (Example)

Measuring interval:
This value indicates the set measuring intervals for the online measurement and the check function. It also indicates whether the remote control is on or off. Clicking on these values takes you to the setting of the measuring intervals (chapter 7.7.1.1 on page 114).

Filling time of the sample storage vessel:
This value determines the duration of the filling of the sample vessel before the measurement (pumping time) [sec.].

TC delay:
This value indicates the waiting time before a TC measurement (injection) [sec.].

TIC delay:
This value indicates the waiting time before a TIC measurement (injection) [sec.].

TC injection volume:

This value indicates the reactor injection volume for a TC measurement [in µl].

TIC injection volume:
This value indicates the reactor injection volume for a TIC measurement [in µl].

Repetitions:
This value determines with how many individual measurements to be carried out in succession, the measured value of the selected sample flow is to be determined. The permissible values are between 1 and 10 repetitions. The default value is 1 (1 measurement / no repeat). If several measurements of a sample stream take place in succession, an average value is calculated from the determined measured values, which is then output as a measured value. The measurement repetition always takes place with the same sample, without refilling the sample storage vessel. The injection needle is always rinsed between the repeated measurements.

Notice

The result is only the mean value.

Outliers (only active if repeated measures take place):
With the help of this function incorrect measurements from the averaging are excluded. The permissible values are between 0 and 5 repeat measurements. To eliminate outliers, the measurements with the greatest deviation from the mean are chosen. If the deviation lies in the tolerance range of the largest permitted CV value for a measurement, the measured value of the individual measurements is used for averaging. If the deviation is outside the tolerance range, the measured value is treated as an outlier and is ignored when calculating the mean value and the coefficient of variation.

Max. CV:
The maximum CV value or coefficient of variation only becomes effective in combination with the measured value outliers. If the measured value outlier correction by entering the numbers 1 or 2 - 5 activated, the largest allowable CV value for a measurement in the determination of runaway is considered. The permissible values are between 0% and 40%. The coefficient of variation describes the repeatability or reproducibility of several consecutive individual readings taken on the same sample.

CV = standard deviation / mean * 100

Percentage for multiple determination (user level 3 only):
This value defines the maximum allowable deviation of the current measured value compared to the previously acquired value. If a measured value exceeds this deviation, the "repetitions" become active.

Moving average calculation:
The floating mean value is used to smooth the measurement series. For each sample stream, a floating mean value can be set. This requires two settings to be made visible as soon as the moving average is activated. In the moving average calculation, an average value is calculated from a certain number of the last measured values (measurement series). If the next measured value lies within the permitted deviation, it is included in the series of measurements for the mean value calculation and the oldest measured value is removed from the series of measurements. If the next measured value is outside the permitted deviation, a new series of measurements is started with this measured value.

Number of values (moving average calculation):
The permissible values are between 2 and 5 measured values, which are taken into account for the calculations.

Allowed deviation in percent (moving average calculation):
The permissible values are between 20 and 50% (in 10% increments).

Number of flushes:
This value determines the number of flushes of the injection needle after a measurement. The injection needle is rinsed after each measurement with 1 ml of rinsing water to allow good reproducibility. The allowed values are between 1 and 5. The default value is 1.

Notice

The injection needle is rinsed once at the start of online operation.

7.7.1.1 Measurement Interval

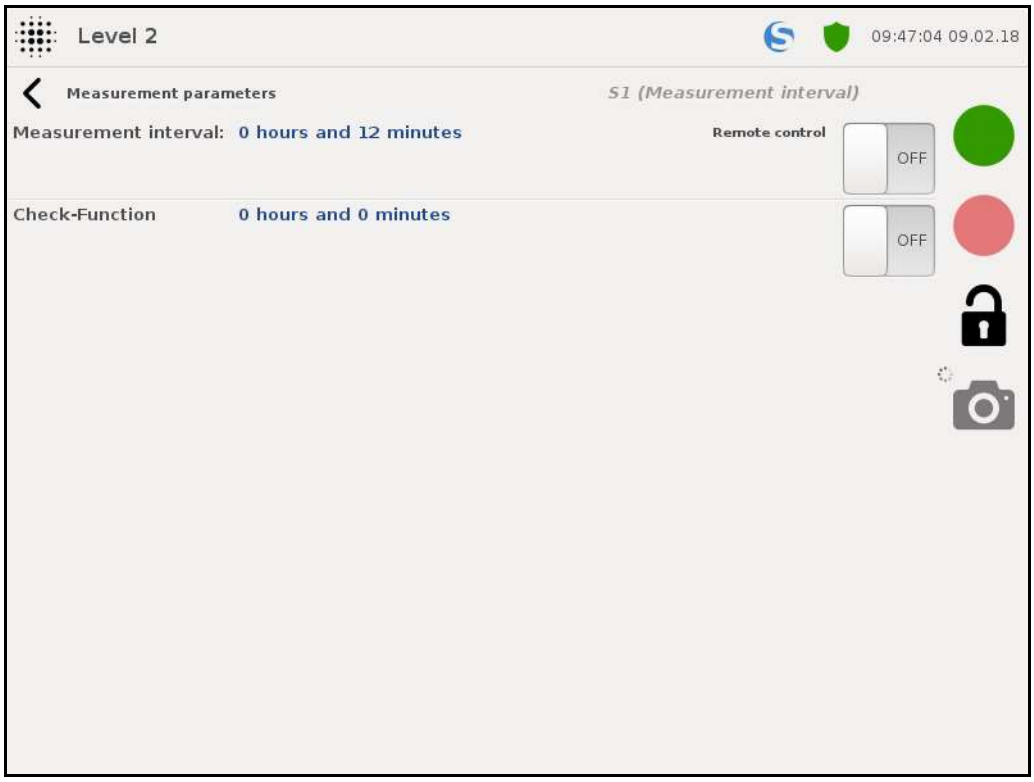


Fig. 71: Measurement parameters .- Measurement interval (Example)

Online Measurement:
This function is used to set the waiting time between measurements. The waiting time begins after completion of a measurement until the start of another measurement.

Check function:
This value determines at what intervals the analyser should perform automatic measurements and thereby self-check the functionality..

Notice

To activate the check function, contact the technical support of LAR (Chapter 15.1 on page 283).

Remote Control:
This function can be used to turn the remote control on or off. With a digital 24 V signal, a measurement is started.

Notice

If the remote control is deactivated, no status (on / off) is displayed in the status screen (Chapter 7.5 on page 97). If the remote control is activated, the "off" status is displayed in the status screen (Chapter 7.5 on page 97) until a signal is present (on).

The remote control is realized via the digital inputs of the analyser. See Chapter 3.7.2.3 on page 40.

7.7.2 Measuring Channel Settings

In this display the parameters to be measured of the measuring channels for the sample streams can be set.

Fig. 72: Measurement channel settings (Example)

Selection of sample stream:
This function can be used to select the sample flow to be set.

Channel selection:
This function allows the measurement of measurement channels / parameters to be switched on and off. Furthermore, you can click on one of the measuring channels to access the channel settings (Chapter 7.7.2.1 on page 106) of the selected measuring channel

7.7.2.1 Channel Settings

In this view, some information can be viewed and settings can be made for each sample stream and channel.

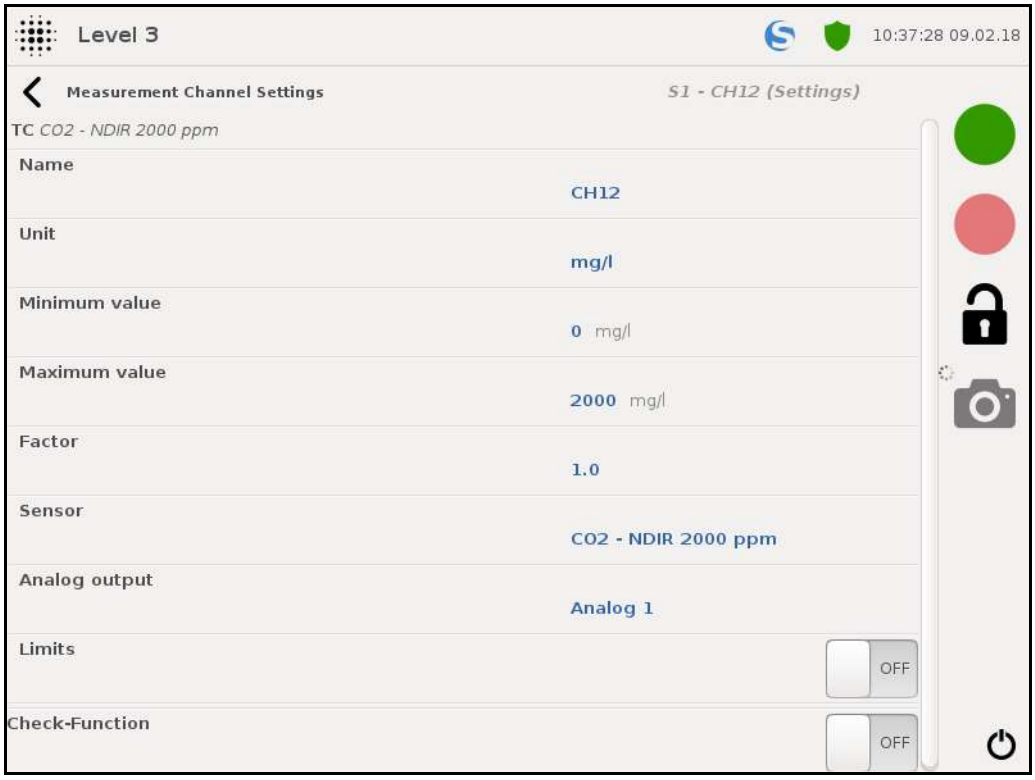


Fig. 73: Measurement channel settings - Channel settings (Example)

Name (only user level 3):
This value specifies the name of the channel.

Unit (user level 3 only):
This value indicates in which unit the measured value should be output.

Minimum value (user level 3 only):
This value indicates up to what minimum value the measured values are displayed in the diagram.

Maximum value (user level 3 only):
This value indicates up to which maximum value the measured values are displayed in the diagram.

Factor (user level 3 only):
The TOC value is correlated to calculate the COD value.

Notice

The factor can also be used to calculate other parameters.

Sensor (user level 3 only):
This value indicates which sensor detects for this channel.

Analog output (user level 3 only):
This value indicates to which analog output this channel is connected.

Limits:
To limit readings and output alarms when the readings are too high or too low, the lower and upper limits must be set. To set the limits, this function must be activated.

Min. Limit:
This function specifies the lower limit of readings that will be checked for underflow.

Max. Limit:
This function specifies the upper limit of the measured values to be checked for overshoot.

Check function (user level 3 only):
This function can be used to switch the check function on and off.

7.7.3 Relays

This display shows the status of the relays. The relays are used to output the alarm signals if the system detects a fault (see Chapter 7.15.2 on page 158), the status and the limits and can be adapted by the user. Each relay can activate a maximum of a single alarm or a collective alarm. If an alarm is activated on a relay, it will be displayed under the respective relay.

Fig. 74: Relays (Example)

After selecting a relay, you can choose between 3 options for assigning the relay:

- Collective alarm (yellow fault messages)
- Collective alarm (red fault messages)
- Custom Relay

If a bulk alarm or a custom alarm is assigned to a relay, the relay activates as soon as the bulk alarm or the custom alarm occurs. With the customer-specific relays you can set and activate a relay according to your requirements.

7.7.3.1 Setting a custom relay

Fig. 75: Relay selection (Example)

1. Select a relay.
2. Select the function "Custom Relay".
3. Enter the corresponding values or fault code via the keyboard using the programming tools from Chapter 7.7.3.2 on page 110 and the status and / or fault codes from Chapter 7.15 on page 157 onwards.
4. Then save your setting with "OK".

7.7.3.2 Programming tools (logical links)

- **!-Operator**

The ! operator is used to invert / negate 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 an AND connection of several conditions (E1835 & E1810 means that the alarm is issued by the system if both fault messages occur simultaneously).

- **|-Operator**

The | operator is used as an OR connection of several conditions (E1810 | E1844 means that the alarm is issued by the system if either or both fault messages occur).

Examples (Alarm):
If the relay is to be set as normally open, it is programmed as follows:

E1810 | E1844 | E1835

If the relay is to be set as normally closed, it is programmed as follows:

! (E1810 | E1844 | E1835)

Example (measurement finished):
The corresponding relay is programmed as follows:

! M1

This programming means that the relay is closed when the measurement of the first sample stream is completed and remains closed until the next measurement of the first sample stream begins.

7.7.3.3 Testing the Relays

There are two ways of testing the relays:

- Testing the relays using a multimeter
- Checking the programming of the relays via the control center
- **Testing the relay with the aid of a multimeter:**

1. Open the rear housing part.
2. Set the continuity test on the multimeter.
3. Connect the multimeter on the TRC board to the relay under test (Fig. 22, page 35).
4. Switch the relay under test to "ON" in the relay display.
5. A tone will sound in the "ON" state (if the multimeter can output a sound) and the resistance should be around 0 ohms.
6. If no sound is heard, check the multimeter.
7. If the multimeter is functional, contact LAR Technical Support (Chapter 15.1 on page 283).
8. After checking the relays, close the rear part of the housing.

Checking the programming of the relays via the control center:

1. Activate the relay by switching the relay to be tested to "ON" or "OFF" in the relay display (depending on the programming of the relay as make or break contact).
2. Check whether a fault message appears in the control center.
3. If no error message appears, contact LAR Technical Support (Chapter 15.1 on page 283).

7.7.4 Sample Stream Settings (only User Level 3)

With user level 3, in this view the sample streams can be specified.

Fig. 76: Sample stream settings

Selection of sample stream:
This function can be used to select the sample stream to be processed.

Name of the sample stream:
This function can be used to rename the sample stream.

Samples receiver vessel:
This feature determines which vessel is used as the sample receiver for this sample stream.

Rinsing vessel:
This function determines which vessel is used as the purge vessel for this sample stream.

Check function: Vessel:
This function determines which vessel is used for the check function for this sample stream.

7.7.5 Sensor Settings

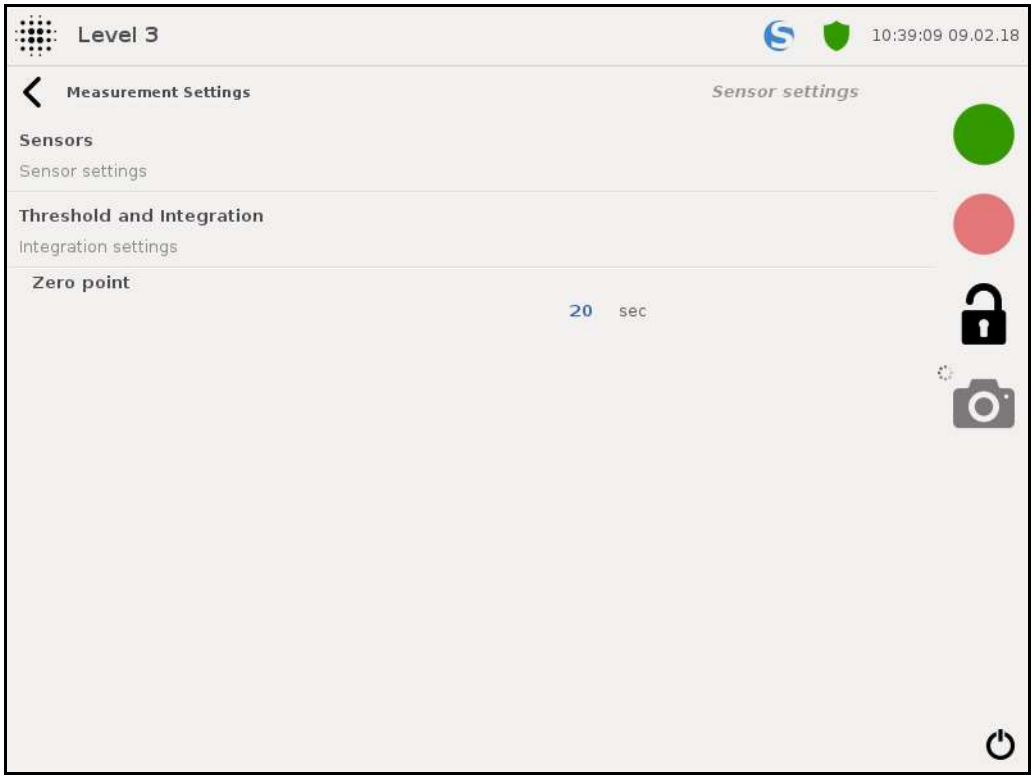


Fig. 77: Sensor Settings

Sensors:
This function takes you to the overview of the sensors.

Threshold and integration:
This function takes you to the overview of the threshold values and integration of the sensors.

Time of zero point:
This function can be used to change the time of zeroing.

7.7.5.1 Sensors

In this view you will find information about the sensors installed in the analyser.

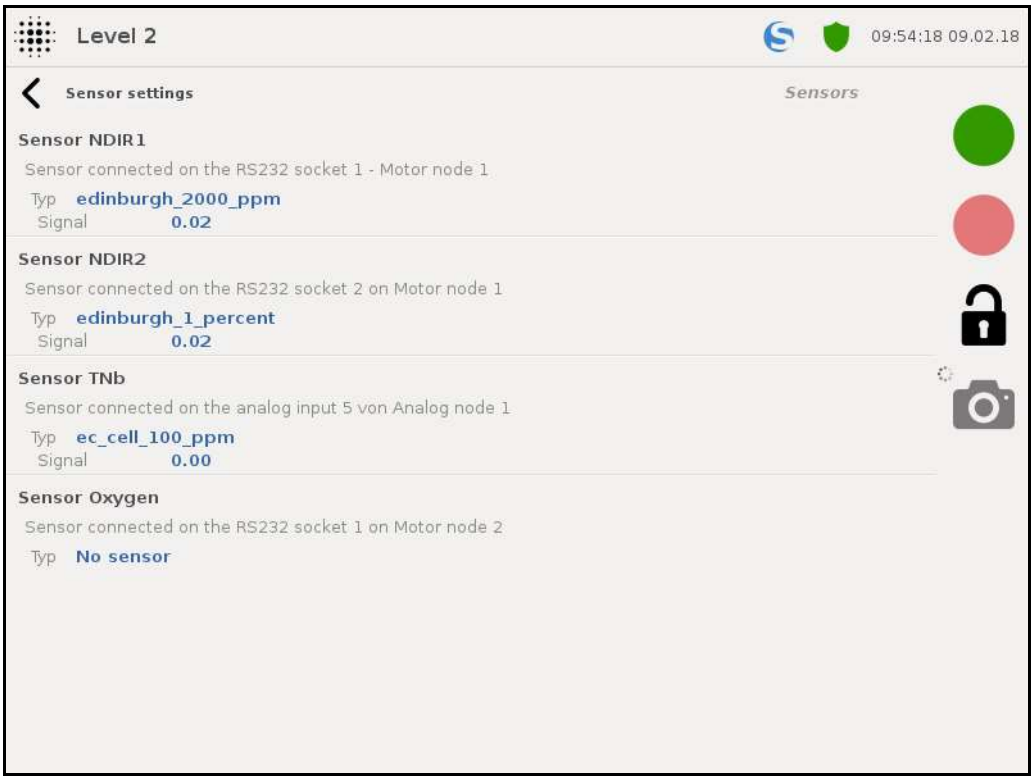


Fig. 78: Sensor Settings - Sensors (Example)

Notice

The value "Current value" outputs the zero signal of the sensor and of the respective measuring range.

7.7.5.2 Threshold and Integration

This overview provides information on thresholds and integration with the sensors installed in the analyser.

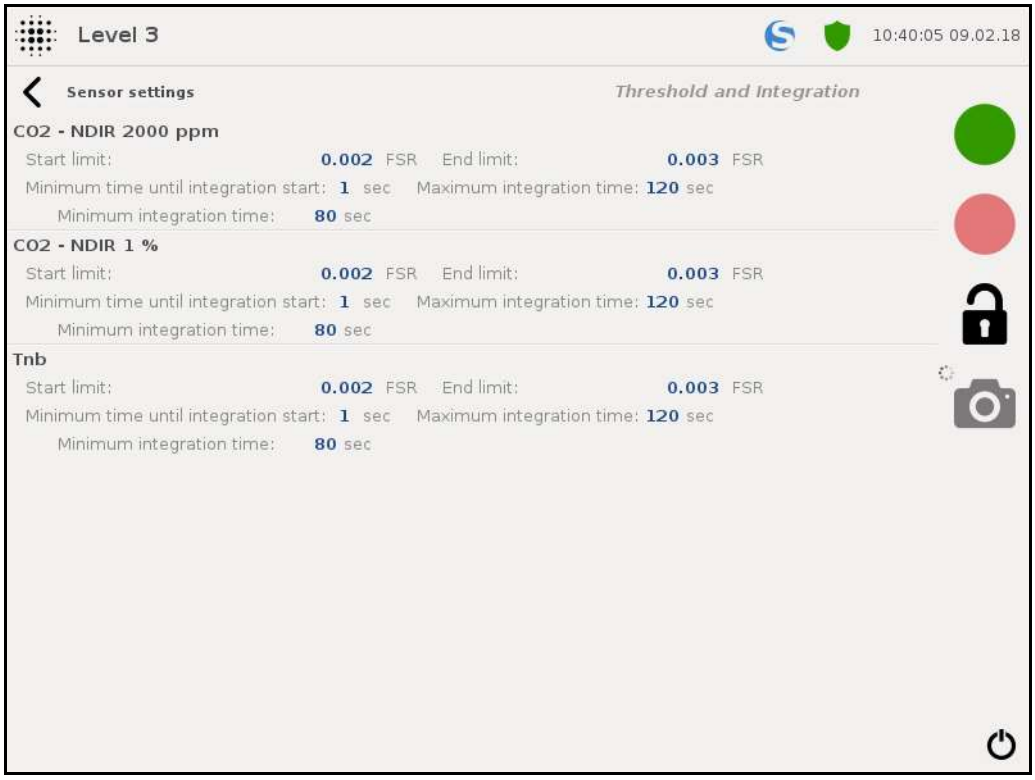


Fig. 79: Sensor Settings - Sensors (Example)

Notice

Click on one of the sensors to get to a list view of the information of the clicked sensor.

7.8 Service

This view lists specific service settings:

- Service parameters
- Service actions
- Test drive
- PC Settings
- Calibrate analog outputs
- Multi I / O

Fig. 80: Service

7.8.1 Service Parameters

In this display, parameters relating to the carrier gas can be viewed and adjusted.

Fig. 81: Service parameters (Example)

Calibration value for carrier gas stream:
This value indicates the current set point for the carrier gas flow acquired during the last calibration. If the actual value does not match the calibration value and allowable deviation, the measurement is aborted and the error must be corrected before a new measurement can be started.

Notice

The carrier gas flow calibration value defines the carrier gas inlet and outlet set point in the status screen (Chapter 7.5 on page 97).

Permitted deviation:
This value indicates the allowable deviation of the actual carrier gas flow to the calibration value of the carrier gas flow.

Also measure for gas flow errors (user level 3 only):
This feature allows the analyser to take a measurement even if the allowable deviation of the actual carrier gas flow from the calibration value of the carrier gas flow is exceeded.

Calibration of the carrier gas (user level 3 only):
With this function, deviations of the sensor signals between carrier gas ON and OFF (for example due to aging) can be compensated. Make sure the system is tight before compensating the sensor signals.

Carrier gas ON:
This value indicates the flow of carrier gas input.

Carrier gas OFF:
This value indicates the flow rate of the carrier gas outlet.

Threshold of carrier gas moisture:
This value indicates the maximum threshold value of the carrier gas moisture. If the measured value is above the set threshold, the analyser can not take a measurement until the error is corrected.

7.8.2 Service Actions

Warning

To perform the service actions, the analyser must be in offline mode (offline button). This will stop all measurements.

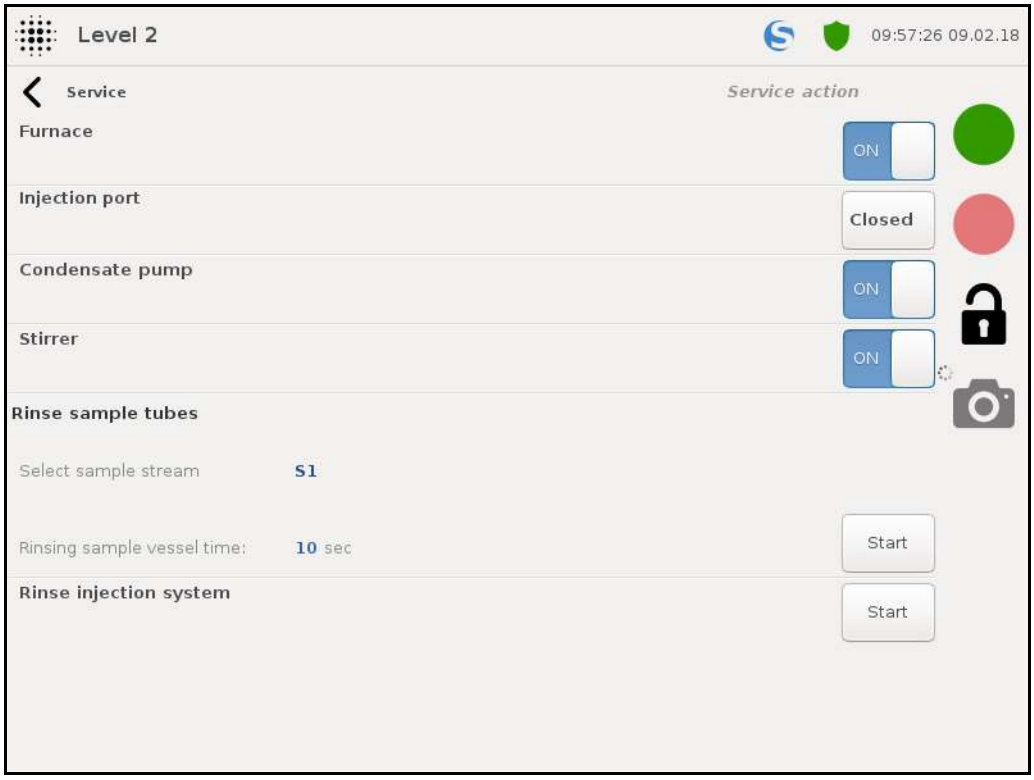


Fig. 82: Service Actions (Example)

Furnace:
This function can be used to switch the oven on and off.

Notice

The heating time of the oven is approx. 120 min. This corresponds to a heating rate of 10 ° C / min. This time is permanently configured and can not be changed.

Injection port:
This function allows the oven valve to be opened and closed.

Condensate pump:
This function can be used to switch the condensate pump on and off.

Stirrer:
This function allows all stirrers to be switched on and off together.

Rinse sample tubes:
To prepare a measurement procedure, the sample tubes and reservoirs can be rinsed with the sample. To do this, select a sample stream and set the sample purging time.

Select sample stream (rinse sample tubes):
This function can be used to select the sample stream to be purged.

Sample rinse time (rinse sample tubes):
This value indicates how long the sample tube should be rinsed.

Flush injection system:
This function starts purging the injection system.

Notice

The Purge Sample Tubes and Purge Injector functions can be terminated prematurely using either the Offline button or the Stop button, which appears next to the function after the function is activated.

7.8.3 Test Run

In this display, a check and adjustment of the needle positions can be performed.

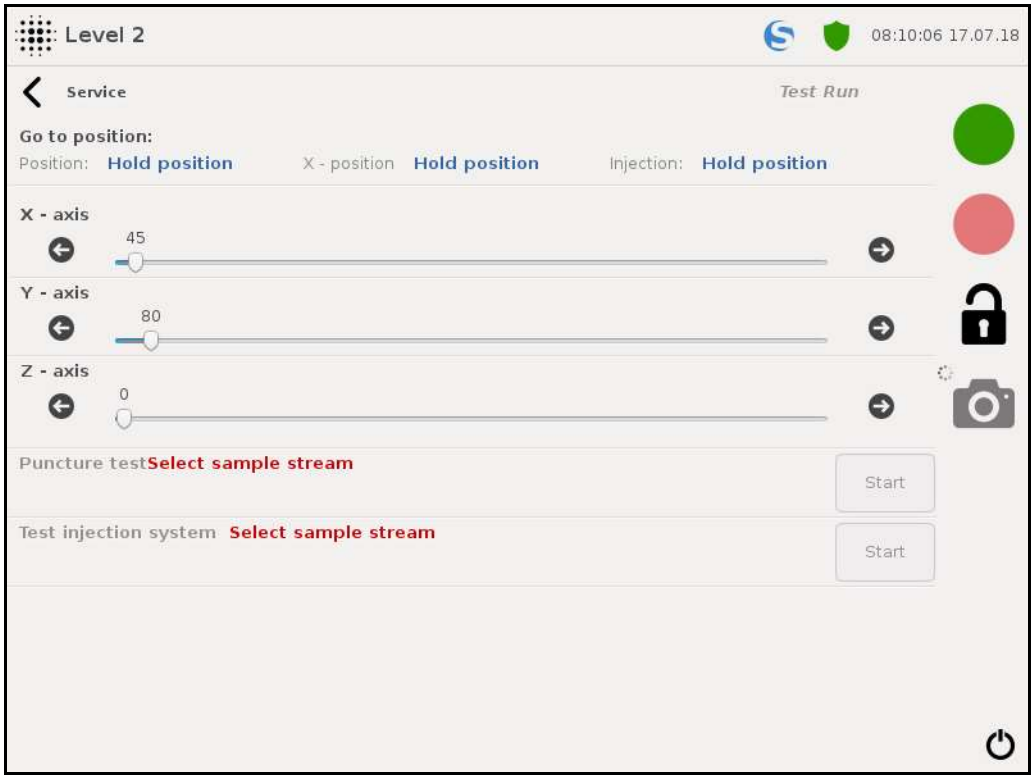


Fig. 83: Test Run (Example)

Manual test run:
To check the correct needle position, it is possible to do a manual test run. With the selection "Go to position" the needle can be moved to all positions along the X-axis. As soon as the needle stops at the entered position, pressing the start button on the function "penetration test" will be able to perform a Y-movement and thereby the insertion of the needle. As a result, the correct position setting of the injection needle can be checked. If the positions are not set correctly, the position of the needle must be positioned / adjusted on the X-axis (Chapter 7.8.3.1 on page 122).

Puncture test:
This function makes it possible to check the insertion of the needle into any vessel. Make sure that the needle punctures the center of the scraper disc. The first step is to select the vessel to be tested using the "Go to position" function. With the key "Start" the "penetration test" can be started.
.

Notice
The injection needle does not completely shut down at the "oven" position, otherwise the injection needle would hit the injection valve and destroy the injection valve.

Test of the injection system:
With this test, the injection behavior of the injection needle can be checked. If the injection jet does not run vertically, clean or replace the injection needle (Chapter 8.5.19 on page 179 or Chapter 8.7.14 on page 195). It is possible to test the injection of the sample outside the injection port (oven). To do this, the vessel to be tested must first be selected using the "Go to position" function. With the key "Start" the "Test of the injection system" can be started. For this purpose, the injection needle moves over the selec-

ted vessel, penetrates, sucks up fluid, drives up again and injects the fluid onto the scraper disc.

Notice

Dry the scraper disc after the "injection system test".

7.8.3.1 Positioning / Adjustment of the Injection Positions (only user level 3)

If the injection needle does not dip correctly into one of the vessels, user level 3 can be used to position and / or adjust the position of the needle on the X-axis.

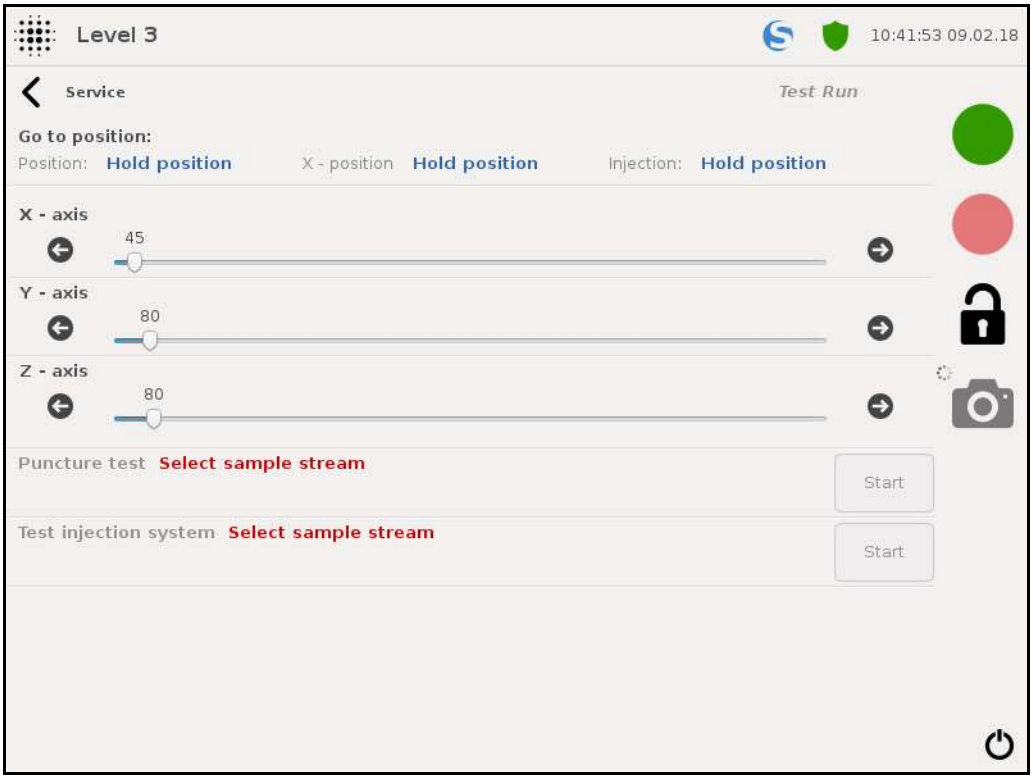


Fig. 84: Test run - Positioning and adjusting (Example)

Carrying out positioning / adjustment:

1. Select the position to be adjusted with the function "Go to position:".
2. Move the Y-axis with the + down so that it is just above the selected position.
3. Adjust the position of the needle on the X-axis with + and -.
4. Save the position of the needle on the X-axis.
5. For exact control, start the "penetration test".
6. If necessary, adjust if the position is not taken correctly.

Warning

Damage to the injection needle

A deviation of the injection position over the injection port leads to a reduction of the measuring accuracy and can lead to damage of the injection needle.

Adjust the needle position so that the injection needle is over the center of the injection port and over the centers of the vessels for the solutions.

Notice

When positioning / adjusting the injection positions, only one change of the X-axis can be saved.

7.8.4 PC Settings

Fig. 85: PC Settings (Example)

Software Version:
This value indicates which operating software version is installed.

Date and time:
This function can be used to set the date and time.

User password:
This feature allows the user level 2 password to be changed.

Notice

To enable or disable the password for user level 2, you must be logged in with user level 3.

Selection of language:
This function can be used to change the language of the software.

Notice

After changing the language, the analyser will restart the software.

7.8.5 Calibrate Analog Outputs

In this display, a quick test of the available analog outputs can be performed. In addition, an analog output can be selected to enable the Live Zero feature.

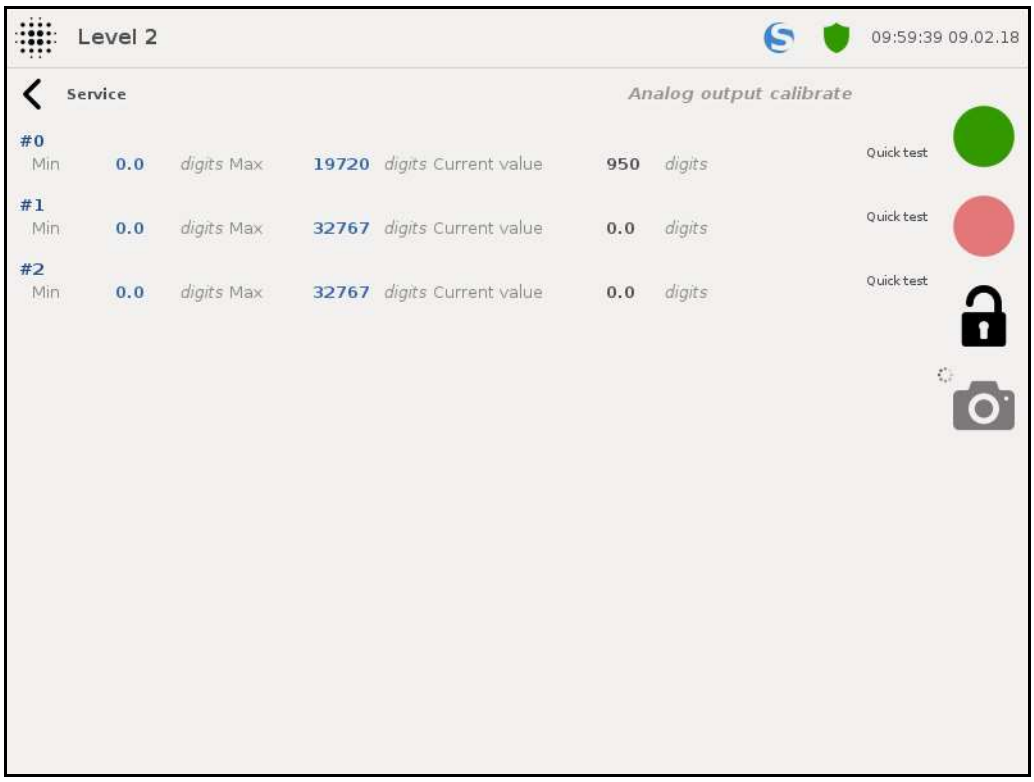


Fig. 86: Calibrate analog outputs (Example)

7.8.5.1 Quick Test (Analog Outputs):

Notice

After pressing the quick test button, the current signal is changed every 3 seconds, starting at 0 mA and ending at 20 mA.

Carry out a Quick Test:

1. Open the rear housing part.
2. Set the current measurement for direct current (DC) on the multimeter.

Warning

Damage to the process control system

Incorrect currents at the analog outputs can damage the process control system.

Disconnect all signal lines to the process control system before starting to test the analog outputs (connections to the analog outputs / to terminal X101).

3. Connect the multimeter to the analog output to be tested (Abb. 27, Seite 38).
4. Click Quick Test on the Analog Output to test.
5. Check on your multimeter whether the current changes every 3 seconds to the following values: 0,

4, 10, 12, 20.

6. If other values are displayed or values are skipped, contact LAR Technical Support (Chapter 15.1 on page 283).

7.8.5.2 Live-Zero-Feature

The Live Zero feature increases the detectability of analyser failures. The measured value zero is not transmitted as a standard signal of size zero, but receives an offset (zero error). For current loops, this offset is set to 4 mA. If a line break or a failure of the transmitter now occurs, a signal with 0 mA results, but since the start of the measuring range is 4 mA, this failure or line break can be clearly detected. Usual live zero standard signal: 4 - 20 mA.

With the live zero feature, this behavior can be used for error output / recognition.

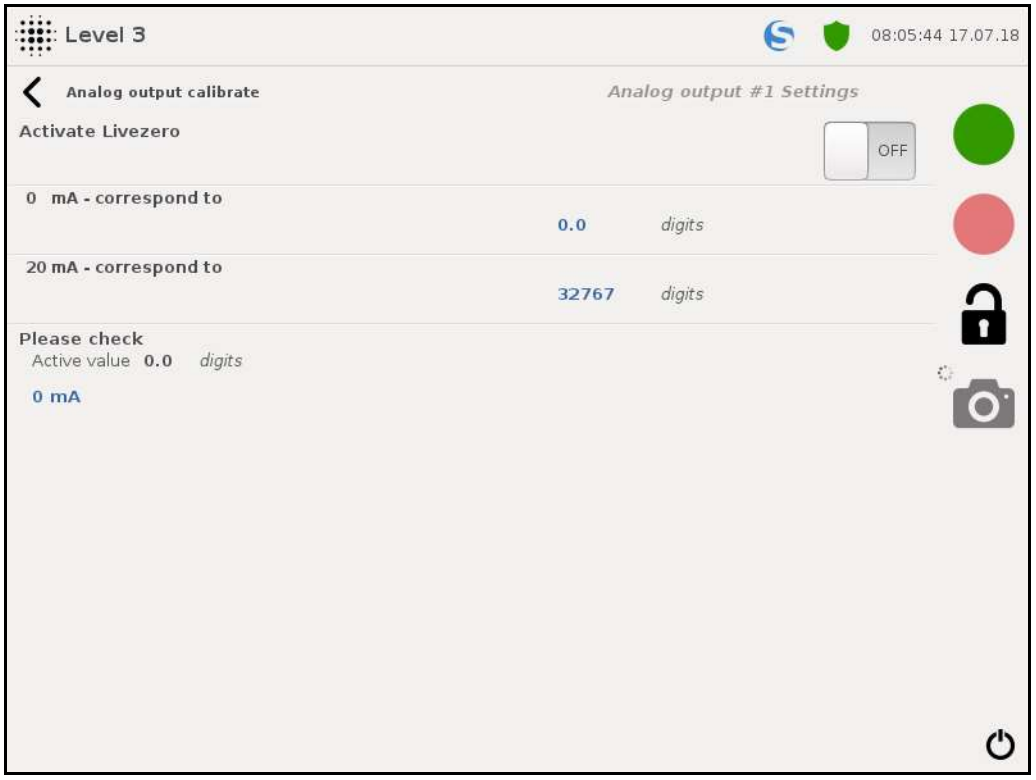


Fig. 87: Activate Live-Zero (Example)

Activate and program the live zero feature:

1. In the "Calibrate analogue outputs" display (Chapter 7.8.5 on page 124), click on the analogue output in which the live zero feature is to be activated.
2. Set the function "Live Zero" to "ON".
3. To program the live zero feature, use the programming tools in Chapter 7.7.3.2 on page 110.

7.8.6 Multi I/O

In this view certain inputs and outputs can be viewed and checked:

- Digital IN 1
- Digital IN 2
- Digital OUT 1
- Digital OUT 2
- Hardware information

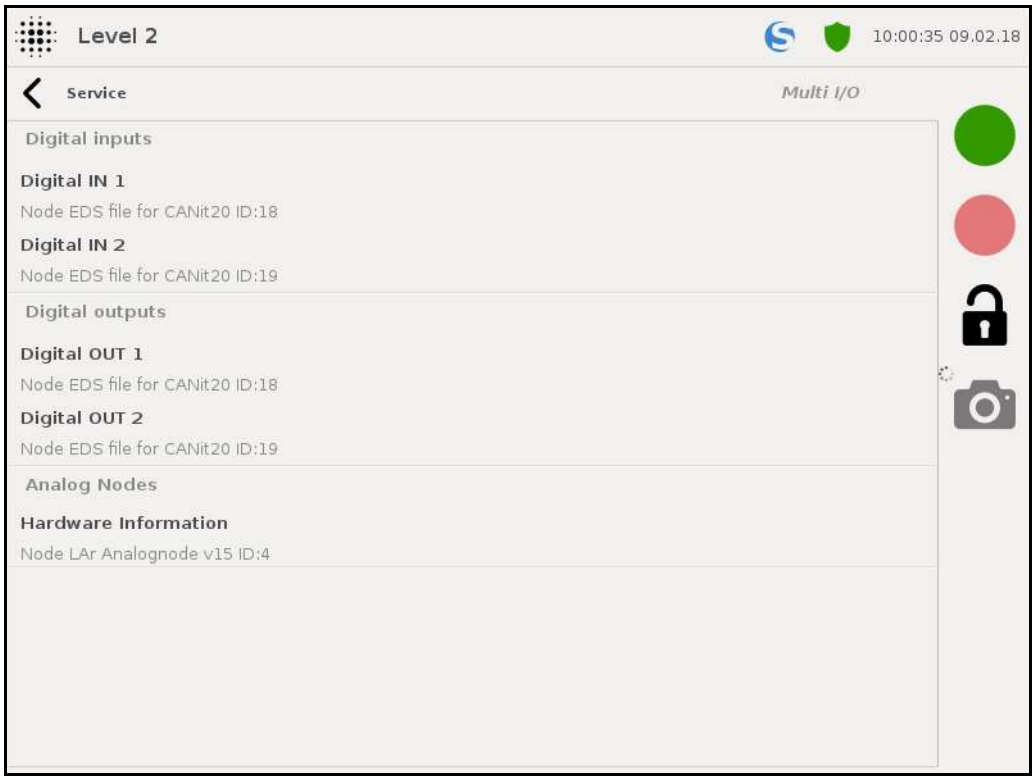


Fig. 88: Multi I/O

7.8.6.1 Digital IN

These views show the current status of the digital inputs.

Fig. 89: Digital IN 1 (Example)

Fig. 90: Digital IN 2 (Example)

7.8.6.2 Digital OUT (only User Level 3)

In these displays, the state of the digital outputs can be changed manually from user level 3 onwards.

Fig. 91: Digital OUT 1 (Example)

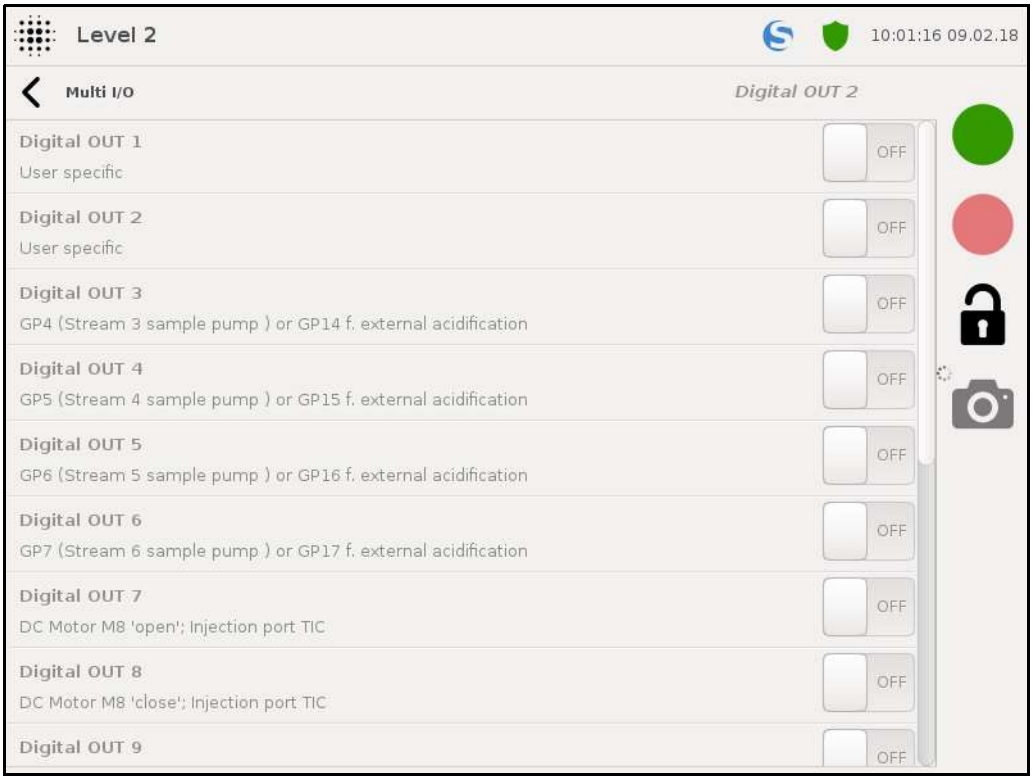


Fig. 92: Digital OUT 2 (Example)

7.9 SIngle Measurement

The single measurement can be used to measure individual calibration standards and samples.

Fig. 93: Single measurement (Example)

Notice

The measured values of the individual measurement are saved and displayed in the "Archive" display (Chapter 7.9.1 on page 130). During a measurement in the online mode of the analyser, no settings can be made or individual measurements can be started.

Note that the sample streams were previously calibrated for specific work areas and the sample flow methods are set.

7.9.1 Settings

In this display, the settings for the individual measurements can be adjusted.

Fig. 94: Settings (Example)

Repetitions:
This value determines with how many individual measurements to be carried out in succession, the measured value of the selected sample flow is to be determined. The permissible values are between 1 and 10 repetitions. The default value is 1 (1 measurement / no repeat). If several measurements of a sample take place in succession, an average value is additionally formed and output in addition to the individual measured values. The measurement repetition always takes place with the same sample, without refilling the sample storage vessel. The injection needle is rinsed between the repeated measurements.

Outlier:
With the help of this function incorrect measurements from the averaging are excluded. The permissible values are between 0 and 8 repeat measurements. To eliminate outliers, the measurements with the greatest deviation from the mean are chosen. If the deviation lies in the tolerance range of the largest permitted CV value for a measurement, the measured value of the individual measurements is used for averaging. If the deviation is outside the tolerance range, the measured value is treated as an outlier and is ignored when calculating the mean value and the coefficient of variation.

Max. CV:
The maximum CV value or coefficient of variation only becomes effective in combination with the measured value outliers. If Measured Outlier Correction is activated by entering the numbers 1 or 2 - 8, the largest allowable CV value for a measurement is taken into account when determining the outlier. The permissible values are between 0% and 100%. The coefficient of variation describes the repeatability or reproducibility of several consecutive individual readings taken on the same sample.

$$CV = \text{standard deviation} / \text{mean} * 100$$

Vessel:
With this function, the vessel can be selected, from which the sample is taken for individual measurement.

Archive:
Via the archive the results of all individual measurements can be viewed.

7.9.1.1 Archive

In this view, past individual measurements can be viewed. Click on one of the measured values to get to the single view.

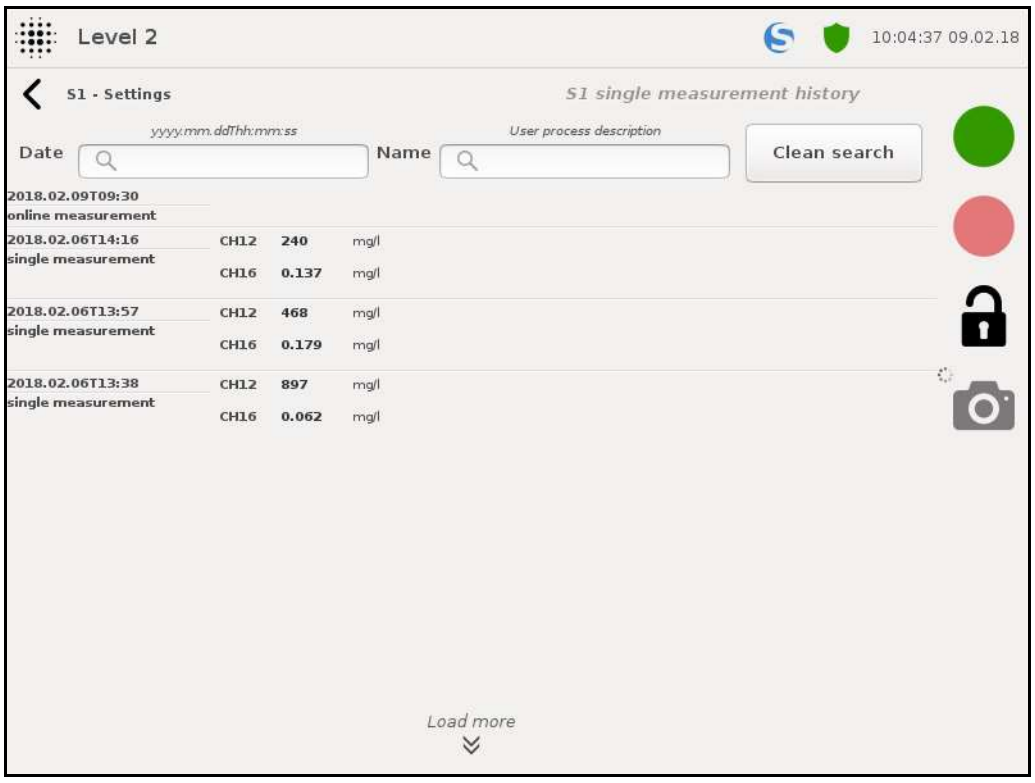


Fig. 95: Single measurement - Archive (Example)

Notice

Using the search function, individual measurements can be found faster.

7.9.1.2 Single Measurement - Single view

In this view, the measurement result in mg / l and FSR x sec can be seen on the left side and the peak curve of the detector on the right side.
About 200 signal curves are stored. For results that were previously detected, no more curves are displayed.

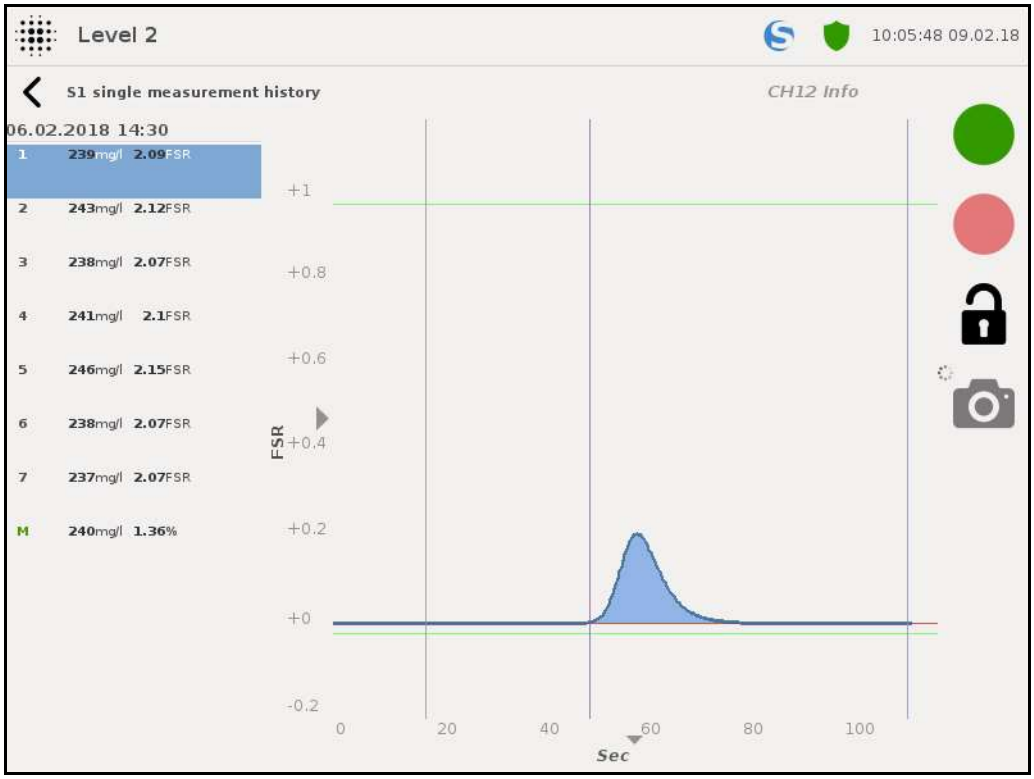


Fig. 96: Single measurement / Single view (Example)

Notice

This view supports the zoom funcionality (Chapter 7.14.1 on page 155).

7.10 Calibration

For the analyser to measure in the appropriate working area, a manual calibration must be performed. Calibrations can be started and calibration sets can be made via this view

Manual calibration should always be performed if:

- the analyser is put into operation
- the carrier gas flow was changed
- Changes were made in the measurement parameter settings (Chapter 7.7.1 on page 101)

The calibration can be ended at any time via the red "Offline" button.
With user level 2, only a pre-set two-point calibration can be performed.
In a manual calibration, the current carrier gas flow is stored as a setpoint. If, after calibration, the carrier gas flow deviates 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 restored (possibly a leak / leak repair).

Before a manual calibration can be started, the corresponding calibration standard must be provided (Chapter 6.2 on page 82) and the necessary settings adjusted.
Damit der Analysator im entsprechenden Arbeitsbereich misst, muss eine manuelle Kalibrierung durchgeführt werden.

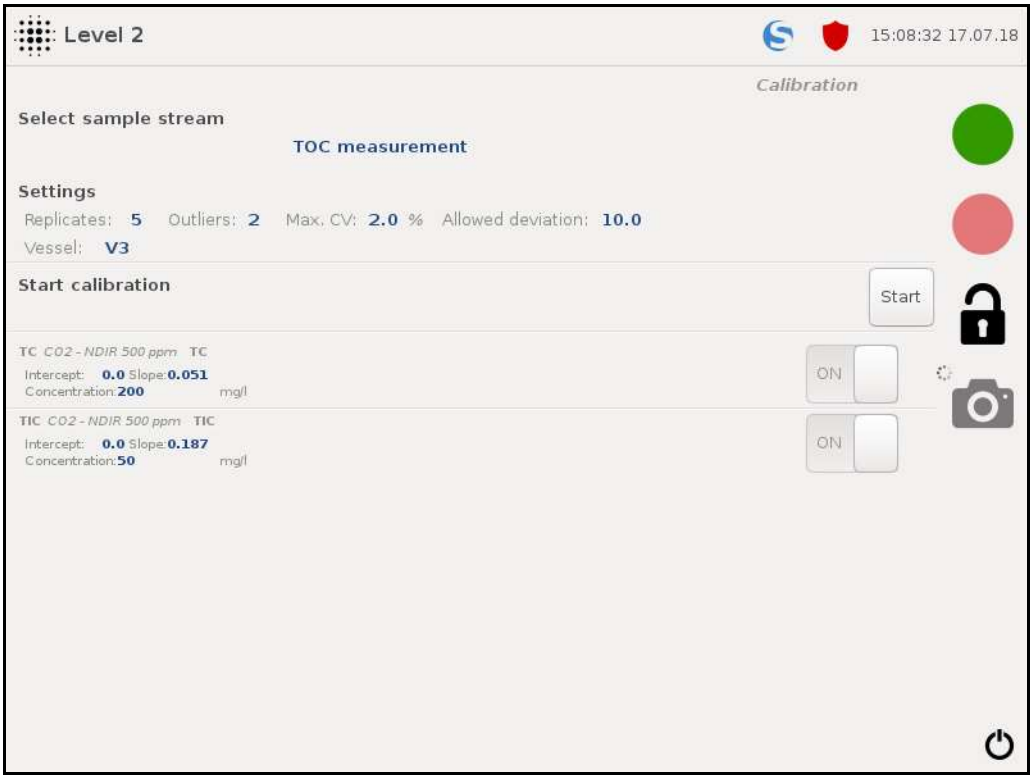


Fig. 97: Calibration (Example)

Selection of sample stream:
This function can be used to select the sample stream to be calibrated. Each sample stream must be calibrated individually.

Settings (user level 3 only):
This function takes you to the "Calibration Settings".

Begin calibration:
This function can be used to start a calibration.

Calibration parameters (user level 3 only):
This function can be used to enable or disable the calibration parameter. Click on a corresponding calibration parameter to access the calibration parameters setting (Chapter 7.10.4 on page 143).
.

Notice

The calibration parameters depend on the method used for the sample stream.

7.10.1 Calibration Settings

This display can be used to adjust the settings for a calibration.

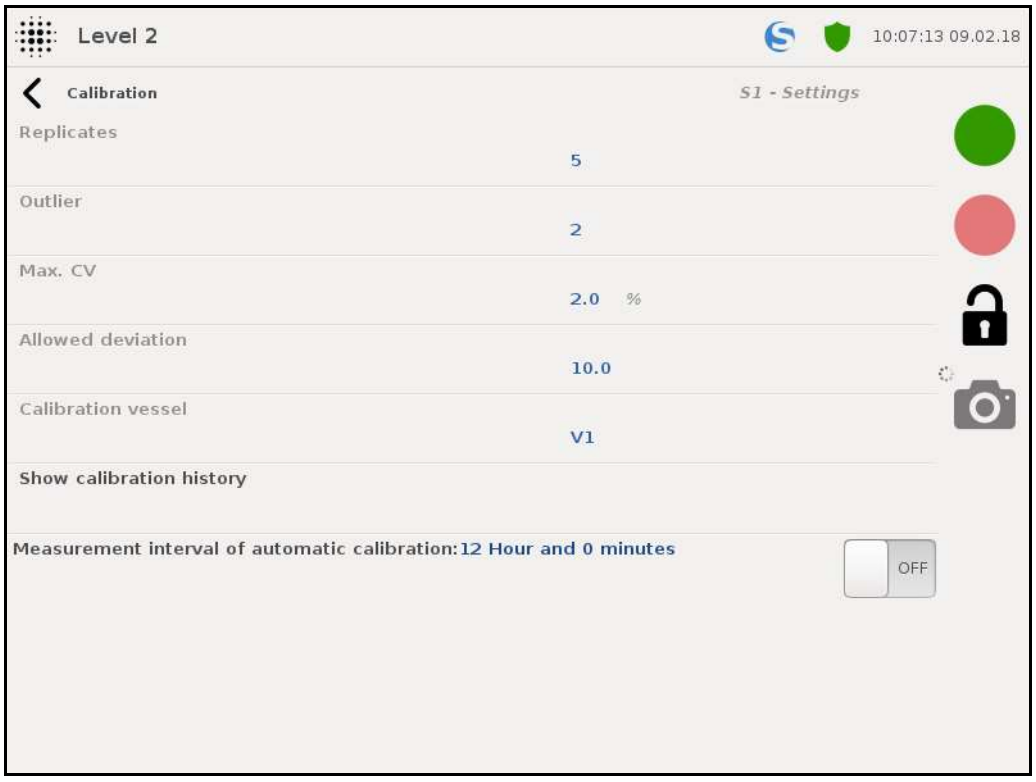


Fig. 98: Calibration settings (Example)

Repeats (user level 3 only):
This value determines with how many individual measurements to be carried out in succession, the measured value of the selected sample flow is to be determined. The permissible values are between 1 and 10 repetitions. The default value is 5 (1 measurement / 4 repetitions). If several measurements of a calibration standard are made in succession, an average value is additionally formed and output in addition to the individual measured values. The measurement repetition always takes place with the same sample, without refilling the sample storage vessel. The injection needle is always rinsed between the repeated measurements.

Outliers (user level 3 only):
With the help of this function, incorrect measurements during the calibration are excluded from the averaging. The permissible values are between 0 and 4 repetition measurements. To eliminate outliers, the measurements with the greatest deviation from the mean are chosen. If the deviation lies in the tolerance range of the largest permitted CV value for a measurement, the measured value of the individual measurements is used for averaging. If the deviation is outside the tolerance range, the measured value is treated as an outlier and is ignored when calculating the mean value and the coefficient of variation.

Max. CV (user level 3 only):
The maximum CV value or coefficient of variation only becomes effective in combination with the measured value outliers. If Measured Outlier Correction is activated by entering the numbers 1 or 2, the largest allowable CV value for a measurement is taken into account in determining the outlier. The permissible values are between 0% and 100%. The coefficient of variation describes the repeatability or reproducibility of several consecutive individual readings taken on the same sample.

$$CV = \text{standard deviation} / \text{mean} * 100$$

Permitted deviation (user level 3 only):

Notice

If you set the "allowed deviation" to 0.0, the calibration with user level 2 can not be activated..

Calibration vessel (user level 3 only):
This function determines where the calibration vessel is located.

Show calibration archive:
This function takes you to the overview of all calibrations made for this calibration parameter (Chapter 7.10.1.1 on page 137).

Measurement interval automatic calibration (user level 3 only):
This feature allows you to set the auto-calibration measurement interval and turn Auto Calibration on and off.

7.10.1.1 Calibration Archive

This display shows all calibrations of a calibration parameter. The display shows the date, the time, the deviation, the CV, the intercept and the slope of the respective calibration. Furthermore, the calibrations can be activated and deactivated via this display with user level 3.

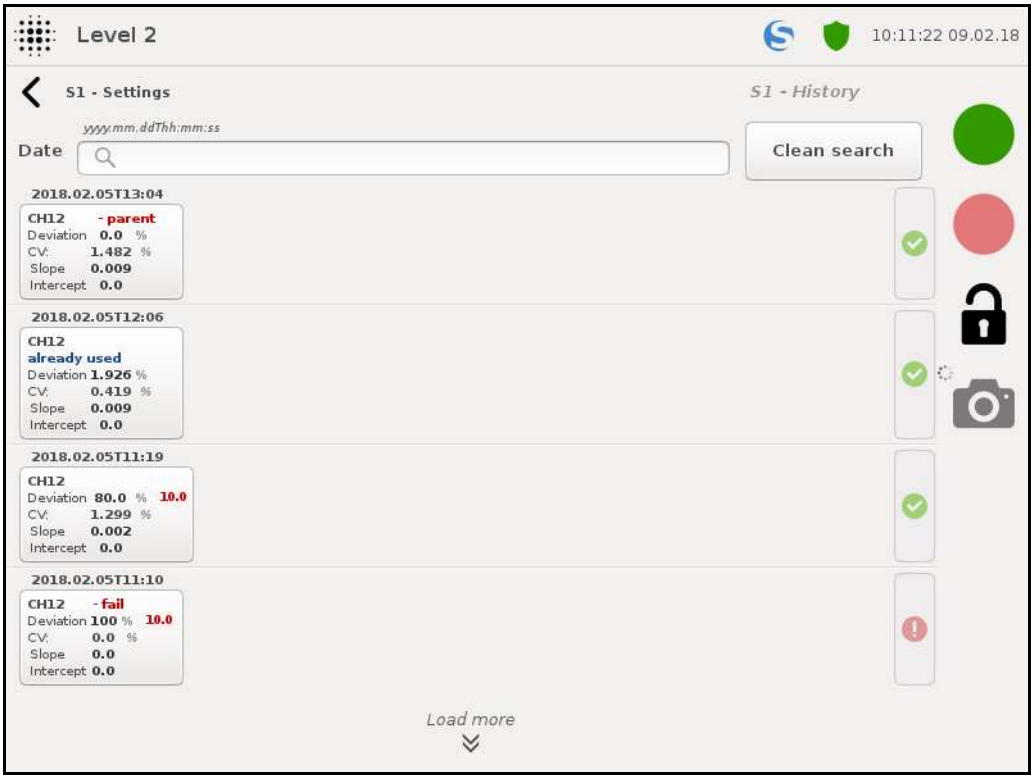


Fig. 99: Calibration archive (Example)

With the search function individual calibrations can be found faster. All calibrations carried out are stored in the archive.
All calibrations carried out with user level 3 are indicated in the archive without any deviations.
The last calibration carried out with user level 3 is saved as "master calibration" in the archive.
Failed calibrations are stored as "failed" in the archive and can not be activated.
By clicking on one of the calibrations you will get to the view of the "calibration points" of the selected calibration (Chapter 7.10.1.2 on page 138).
The activation / deactivation of a calibration is only possible with user level 3.

7.10.1.2 Calibration archive - Calibration Points (Parameter) - Info

IThis display shows all information about the calibrated parameter and the associated calibration points.

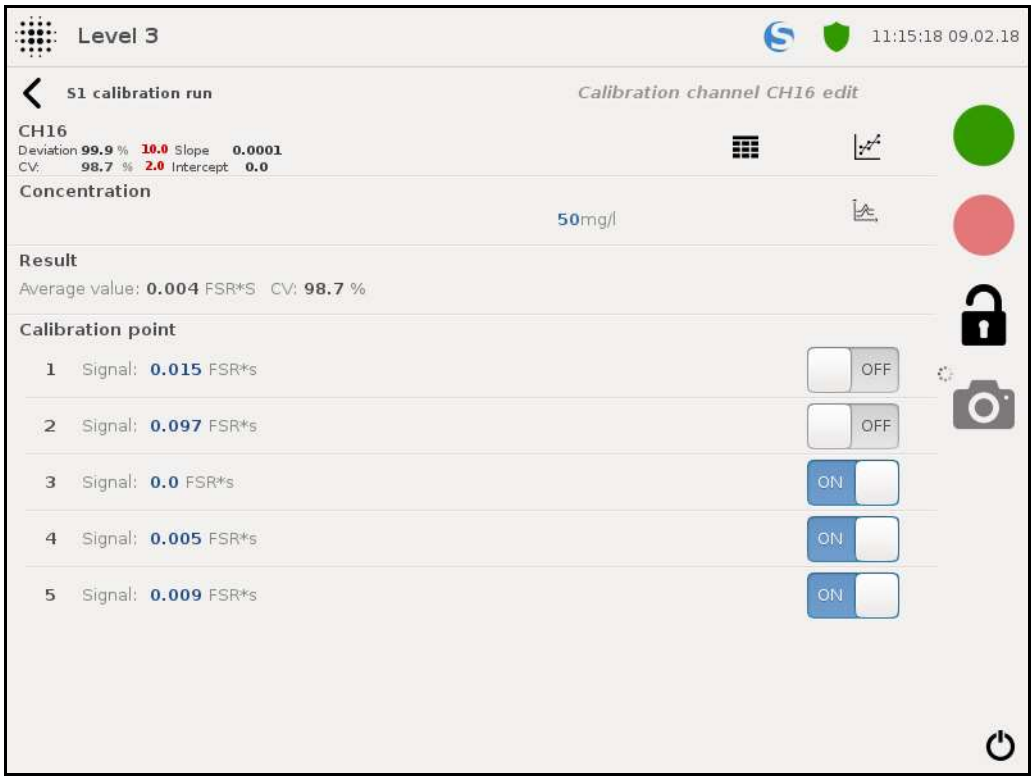


Fig. 100: Calibration archive - Calibration points (Example)

Concentration:
This value indicates the concentration at which the calibration was performed.

Result:
This value outputs the mean and CV of the measured calibration points.

Calibration points (user level 3 only):
This function can be used to activate and / or deactivate calibration points / signals. The number depends on the repeated measurements of the calibration. The signals are given in FSR * sec.

Notice

In user level 3, individual signals can be activated / deactivated.

By activating and deactivating the signals, the mean value and the CV are automatically recalculated.

7.10.1.3 Calibration archive - Calibration points (parameters) - Calibration graph

This display shows the calibration graph of the selected calibration.

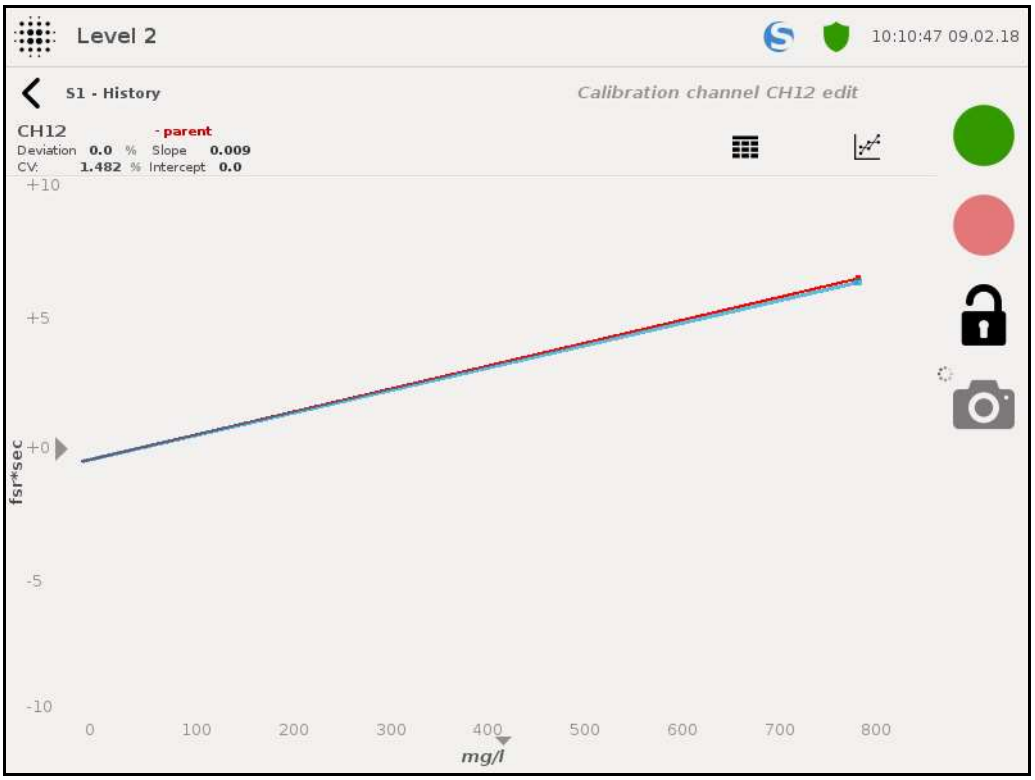


Fig. 101: Calibration archive - Calibration points - Calibration graph (Example)

Notice

This view supports the zoom funcionality (Chapter 7.14.1 on page 155).

7.10.1.4 Calibration archive - Calibration points (parameters) - Waveform

This display shows the signals along with the associated waveforms of the selected calibration.

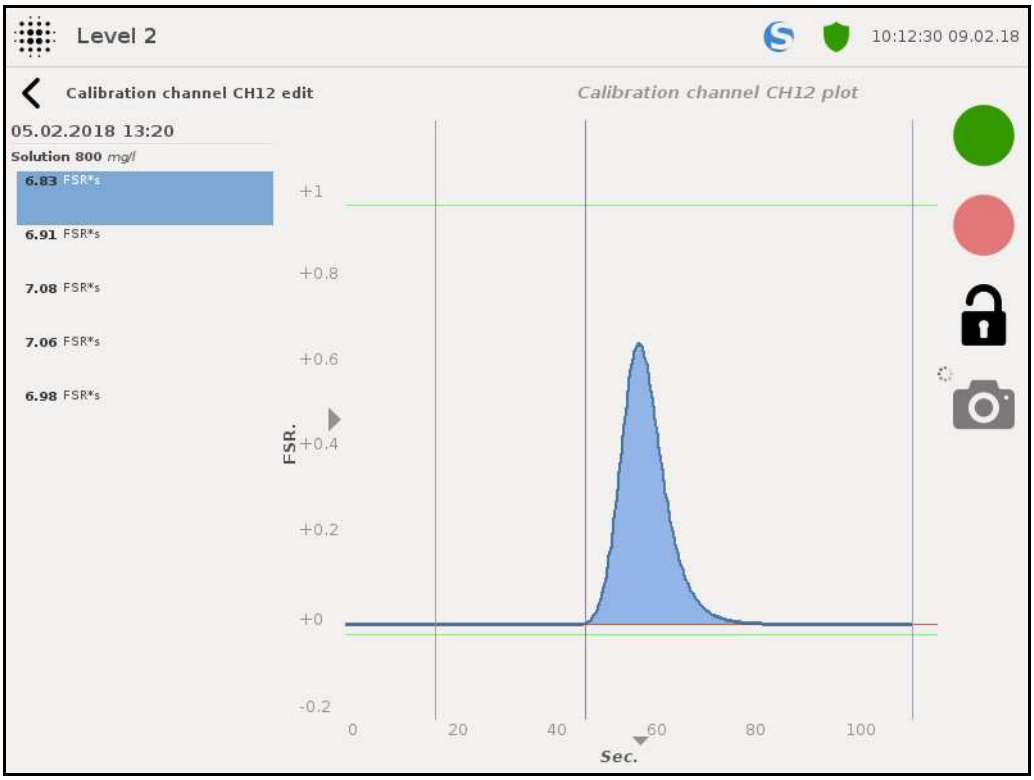


Fig. 102: Calibration archive - Calibration points - Signal waveform (Example)

Notice

Each signal can be displayed as a waveform.

This view supports the zoom funcionality (Chapter 7.14.1 on page 155).

7.10.2 Carrying out the Calibration - Info

This display appears as soon as a calibration has been started. The display contains all the information about the calibration carried out (concentration, mean of the signal, CV, calculated concentration, signal area, deviation from the master calibration, slope and section of the current and the new calibration).

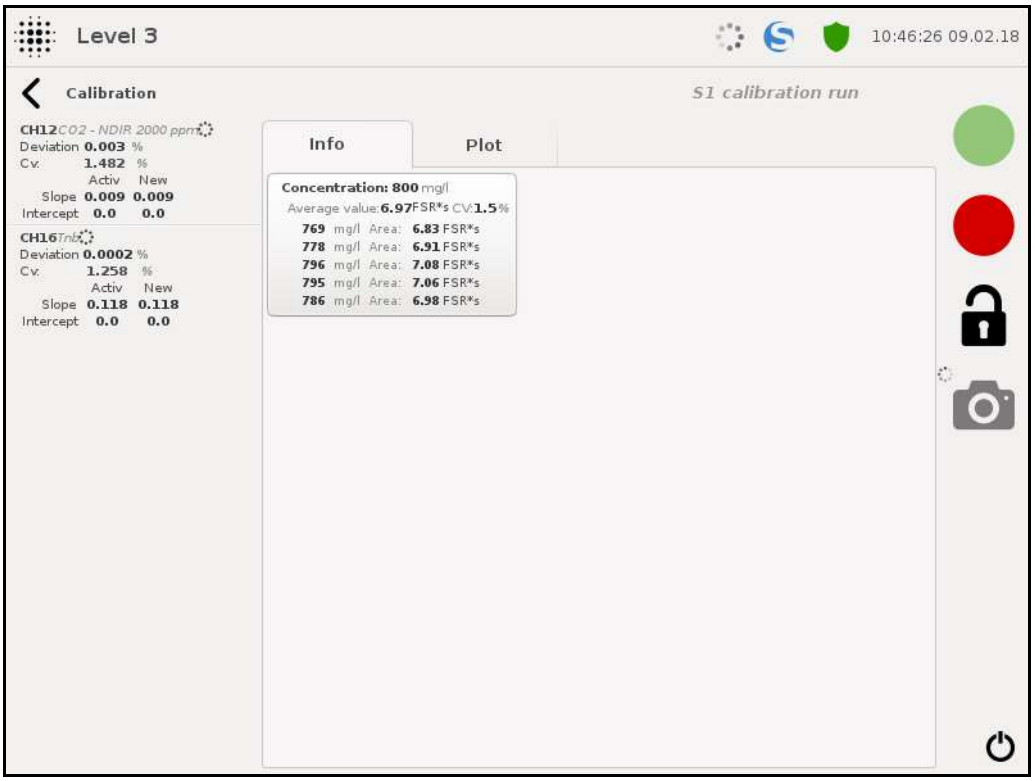


Fig. 103: Carrying out the calibration - Info (Example)

After calibration, two buttons appear in the lower display (see Fig. 104, page 142):

Delete:
This key cancels the calibration and is thus not activated. It nevertheless appears in the calibration archive and can be subsequently activated by a user with user level 3.

Activate:
This button activates the calibration if the deviation is within the allowed range.

Notice

This window appears at the start of a calibration and closes after activation or abort of the calibration.

The calibration can be stopped with the red offline button. If a calibration is stopped, it appears in the calibration archive (Chapter 7.10.1.1 on page 137) with the status "Failed". This status appears on all calibrations that were not completed.

Clicking on "Graphic" will take you to the calibration graph of the current and the new calibration (Chapter 7.10.3 on page 142).

7.10.3 Carrying out the Calibration - Graph

This display shows the calibration graph of the currently set calibration.

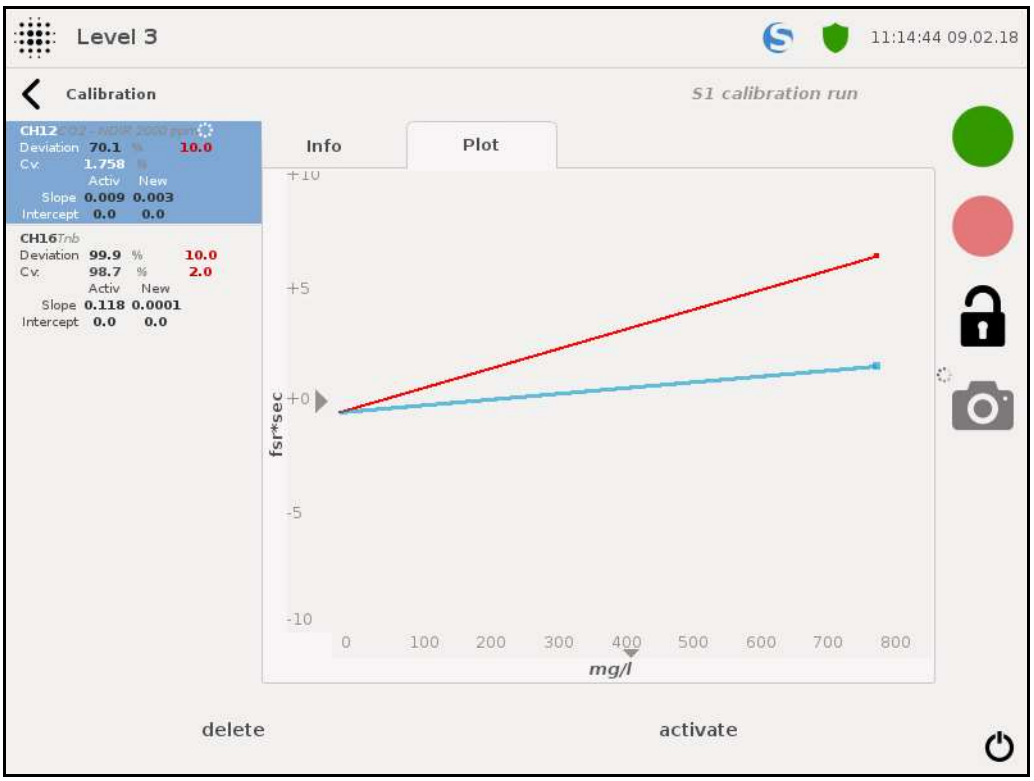


Fig. 104: Carrying out the Calibration - Graph (Example)

Color coding of the calibration graph:

Red line:
This line indicates the currently set calibration.

Blue Line:
This line indicates the newly performed calibration.

> **Notice**
>
> This view supports the zoom funcionality (Chapter 7.14.1 on page 155).

7.10.4 Calibration Parameter Settings (User Level 3)

In this view settings of the calibration parameters can be adjusted.

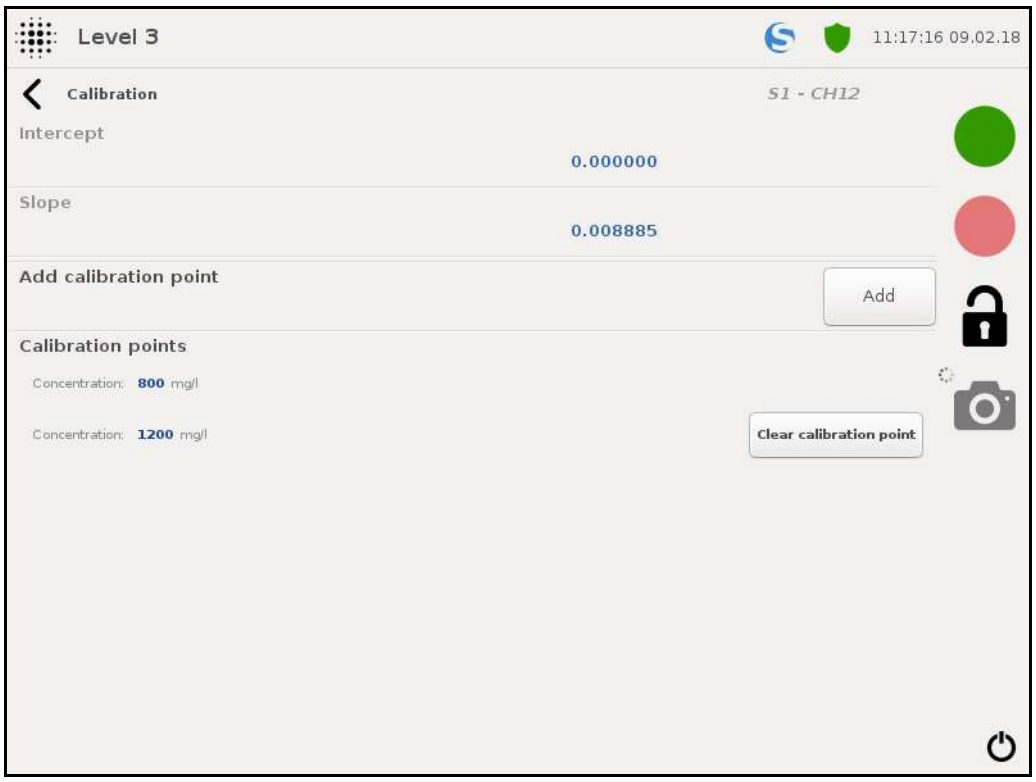


Fig. 105: Calibration parameter setting (Example)

Intercept:
This value indicates the intercept of the calibration result.

Pitch:
This value indicates the slope of the calibration result.

Add Calibration Point (User Level 3 only):
These functions can be used to add calibration points for multi-point calibration.

Concentration:
This value indicates the concentration of the calibration point in mg / l.

Calibration points (user level 3 only):
This function can be used to view and set the set concentration. In a two-point calibration, only one calibration point appears at this point, since the concentration of the first point is defined as 0 mg / l in the system. For a multi-point calibration, you can add as many calibration points as you want using the "Add calibration points" function.

7.10.5 Performing a pre-set two-point calibration (user level 2)

Notice

If the calibration does not complete successfully, contact LAR Technical Support (Chapter 15.1 on page 283).

The pre-set two-point calibration is performed with one calibration standard per sample stream, which must be provided by you (see Chapter 6.2 on page 82). The concentration of the standard is preset.

1. Provide the appropriate calibration standard (Chapter 6.2 on page 82).
2. Fill the calibration standard in a calibration vessel.
3. Open the start screen.
4. Switch to the "Calibration" display.
5. Select the sample current to calibrate.
6. Make sure at which position the calibration vessel has to be positioned (see Settings - vessel).
7. Position the calibration vessel in the analyser.
8. Start the calibration.
9. Wait for the calibration to finish.
10. Activate the calibration after successful completion (see chapter 7.10.2 on page 152).

7.10.6 Carrying out a two-point calibration (user level 3 only)

The two-point calibration is performed with one calibration standard per sample flow, which must be provided by you (see Chapter 6.2 on page 82). The concentration of the standard depends on the set work area. It should be at least 50% and max. 100% of the work area end value.

1. Provide the appropriate calibration standard (Chapter 6.2 on page 82).
2. Fill the calibration standard in a calibration vessel.
3. Position the calibration vessel in the analyser.
4. Open the start screen.
5. Switch to the "Calibration" display.
6. Select the sample current to calibrate.
7. Change to the "Calibration Settings" and adjust the values if necessary (Chapter 7.10.1 on page 146).
8. Determine in which "Calibration Settings" the appropriate calibration vessel is located.
9. Switch back to the "Calibration" screen.
10. Switch to the "Calibration parameter setting" (actuation of the corresponding parameter).
11. Adjust the "Concentration" setting to the appropriate calibration standard.
12. Perform the concentration adjustment for all displayed parameters.
13. Switch back to the "Calibration" display.
14. Start the calibration.
15. Wait for the calibration to finish.
16. Activate the calibration after successful completion.

7.10.7 Performing a multi-point calibration (user level 3 only)

The multi-point calibration is performed with any number of calibration standards per sample stream that you need to provide (Chapter 6.2 on page 82). The concentration of one of the standards should be at least 50% and max. 100% of the work area end value. All other concentrations can be chosen freely.

Notice

In user level 2, no multi-point calibration can be performed. If a multi-point calibration is set, no default two-point calibration with user level 2 can be performed.

Proceed as follows to perform a multi-point calibration:

1. Provide the appropriate calibration standards with different concentrations (see Chapter 6.2 on page 82).
2. Fill the first calibration standard into a calibration vessel.
3. Position the calibration vessel in the analyser.
4. Open the start screen.
5. Switch to the "Calibration" display.
6. Select the sample current to calibrate.
7. Change to the "Calibration Settings" and adjust the values if necessary (Chapter 7.10.1 on page 135).
8. Determine in which "Calibration Settings" the appropriate calibration vessel is located.
9. Switch back to the "Calibration" screen.
10. Switch to the "Calibration parameter setting" (actuation of the corresponding parameter).
11. Add any number of calibration points (depending on the number of calibration standards).
12. Adjust the "Concentration" setting to the appropriate calibration standard.
13. Perform the concentration adjustment for all calibration points and calibration parameters.
14. Switch back to the "Calibration" display and start the calibration.
15. Wait until calibration of the first calibration standard is completed.
16. Position the next calibration standard in the same place.
17. Perform the calibration of all provided calibration standards.
18. Activate the calibration after successful completion.

Notice

If the calibration does not complete successfully, contact LAR Technical Support (Chapter 15.1 on page 283).

7.10.8 Auto-Calibration (only User Level 3)

There is the possibility of automatic calibration at certain intervals. For this, a calibration vessel with a calibration standard must be permanently present in the analyser. For auto calibration, the settings must be made on the Calibration Settings screen and Auto Calibration must be enabled.

To enable auto-calibration, follow the instructions below:

1. Provide the appropriate calibration standard (Chapter 6.2 on page 82).
2. Fill the calibration standard in a calibration vessel.
3. Position the calibration vessel in the analyser in position "V1" (Fig. 11, page 25).
4. Open the start screen.
5. Switch to the "Calibration" display.
6. Select the sample current to calibrate.
7. Change to the "Calibration Settings" and adjust the values if necessary (Chapter 7.10.1 on page 135).
8. In the "Calibration Settings", determine that the calibration vessel is in position "V1".
9. Switch back to the "Calibration" screen.
10. Switch to the "Calibration parameter setting" (actuation of the corresponding parameter).
11. Adjust the "Concentration" setting to the appropriate calibration standard.
12. Perform the concentration adjustment for all displayed parameters.
13. Switch to the "Calibration" display.
14. Switch to the "Calibration Settings".
15. Set the interval at which the analyser should be calibrated.
16. Enable auto-calibration.
17. Change the calibration standard if necessary, paying attention to the concentrations.

Notice

If the calibration does not complete successfully, contact LAR Technical Support (Chapter 15.1 on page 283).

7.11 Database

This display shows the last measurement results of each sample stream.

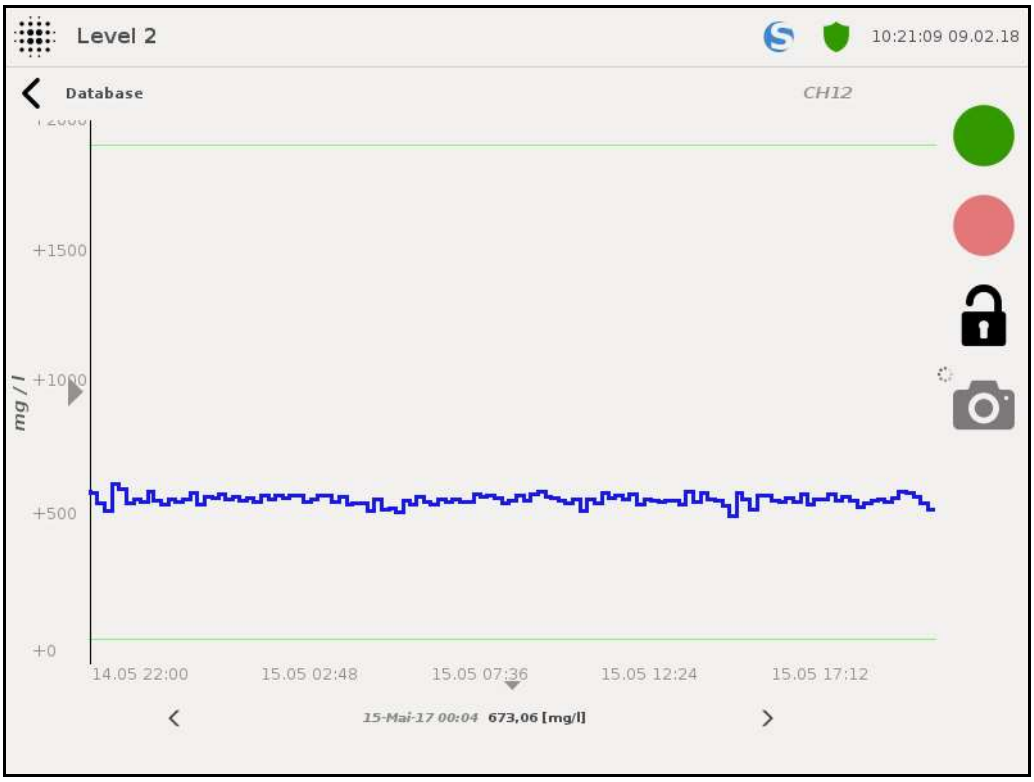


Fig. 106: Database (Example)

Notice

This view supports the Export function (Chapter 7.14.2 on page 156).

Selection of sample stream:
This function selects the sample stream to be viewed. The selected sample stream will be displayed after the selection as a graph of the measurement results of the last 24 hours.

Selection Date:
This function can be used to set the date to be viewed.

Notice

If you use the "Load next 24 hours" function to increase the display time, the time span after setting the "Search Date" will be reset to 24 hours.

Load next 24 hours:
This function can be used to extend the display time by 24 hours. The time span is extended by the previous 24 hours.

Period of time:
Using the arrows in the display of the time span, you can set the period one day or one day ahead. The

time span is always given from 23:59 to 23:59.

Table of measured values:
This function takes you to the display of the measurement results as a table.

Single view of the channel:
Pressing the graphic display will take you to an enlarged view of the graphic.

7.11.1 Table of Measured Values

In this table, the individual measurement results are sorted from top to bottom in descending order of date and time. The measurement results are output in mg / l. When you press a measurement result you get to the single view of the measured value.

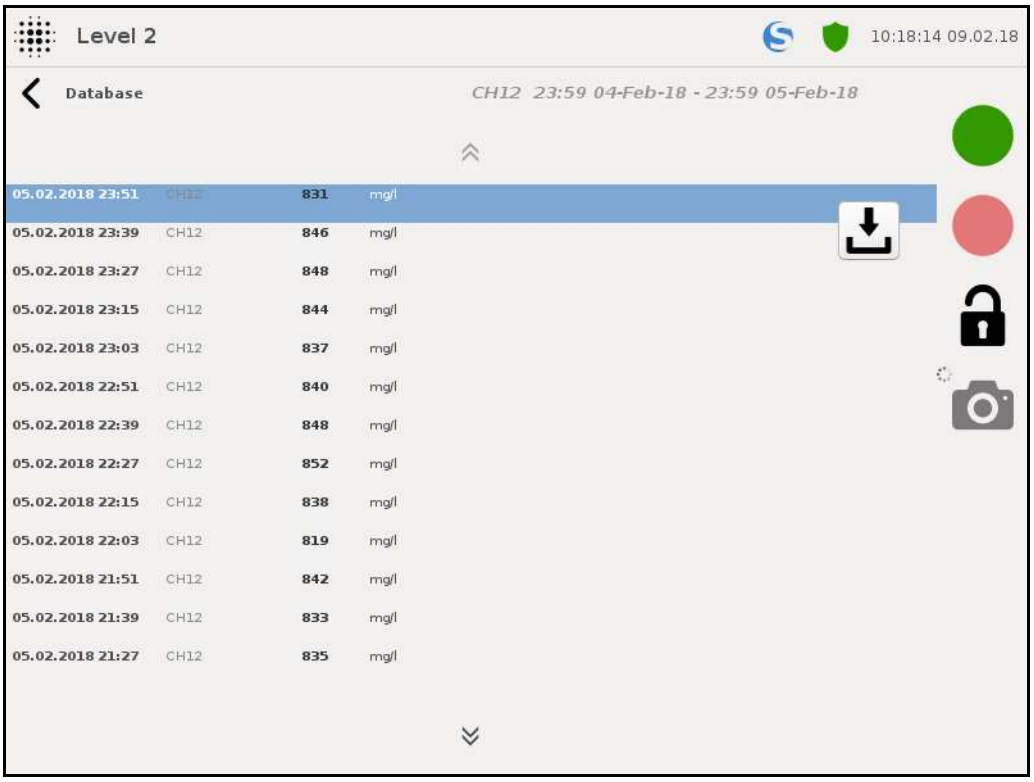


Fig. 107: Table of measured valures (Example)

Notice

This view supports the Export function (Chapter 7.14.2 on page 156)

Only the measurement results of the period previously set in the "Database" display are shown.

7.11.1.1 Single view of the measured value (Info)

In the single view of the measured value, results of individual measurements as well as the results of the repeated measurements and the calculated average value can be viewed on the left side of the display. On the right side, the waveforms associated with the measured value are graphically displayed.

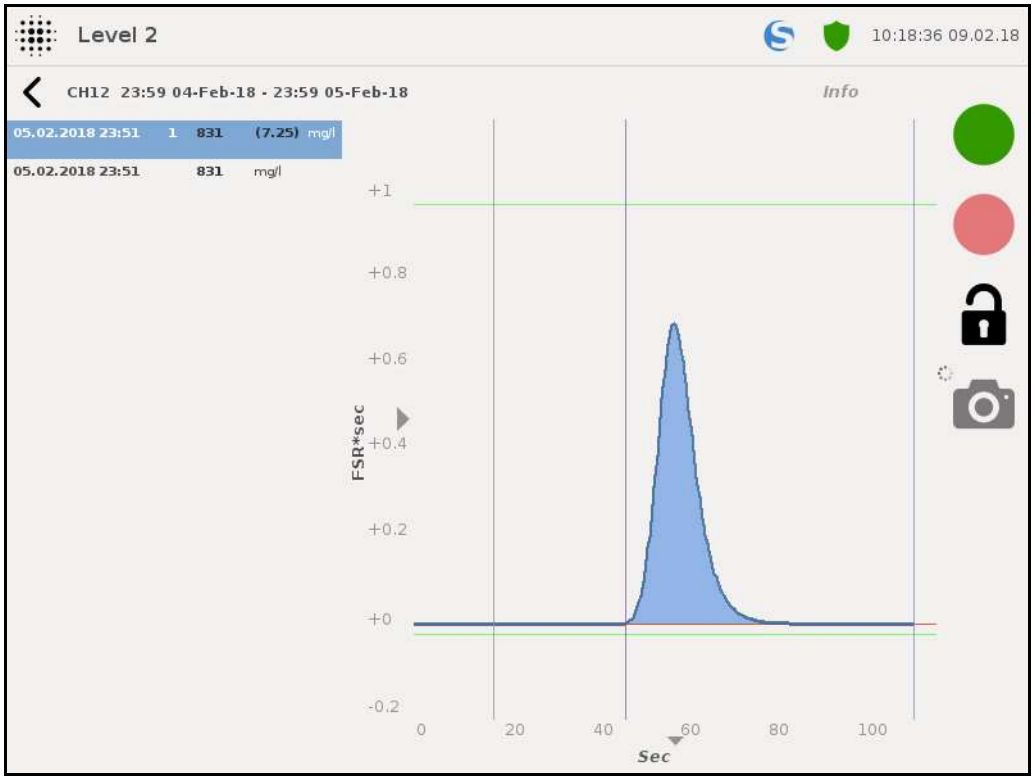


Fig. 108: Single view of the measured value *(Example)*

Notice

This view supports the zoom funcionality (Chapter 7.14.1 on page 155).
About 200 signal curves are stored. For results that were previously detected, no more curves are displayed.

7.11.2 Single view of the channel

Below the graph you will find the measurement result with the date and time of the measurement. With the arrows left and right below you can jump to the previous or next measurement result. The black bar represents which measurement result is currently being considered.

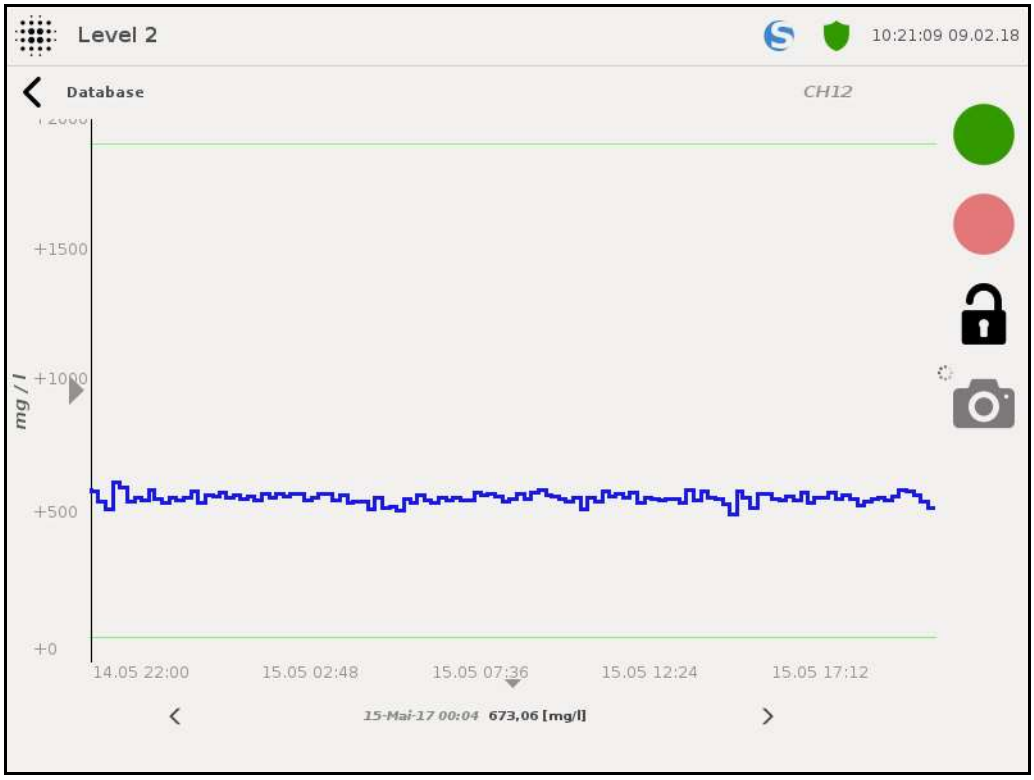


Fig. 109: Single view of the channel (Example)

Notice

This view supports the zoom funcionality (Chapter 7.14.1 on page 155).

7.12 Logbook

The shield icon in the status bar will take you to the logbook. In this display, the currently occurring faults, past faults and past activities can be viewed and exported to a USB stick.

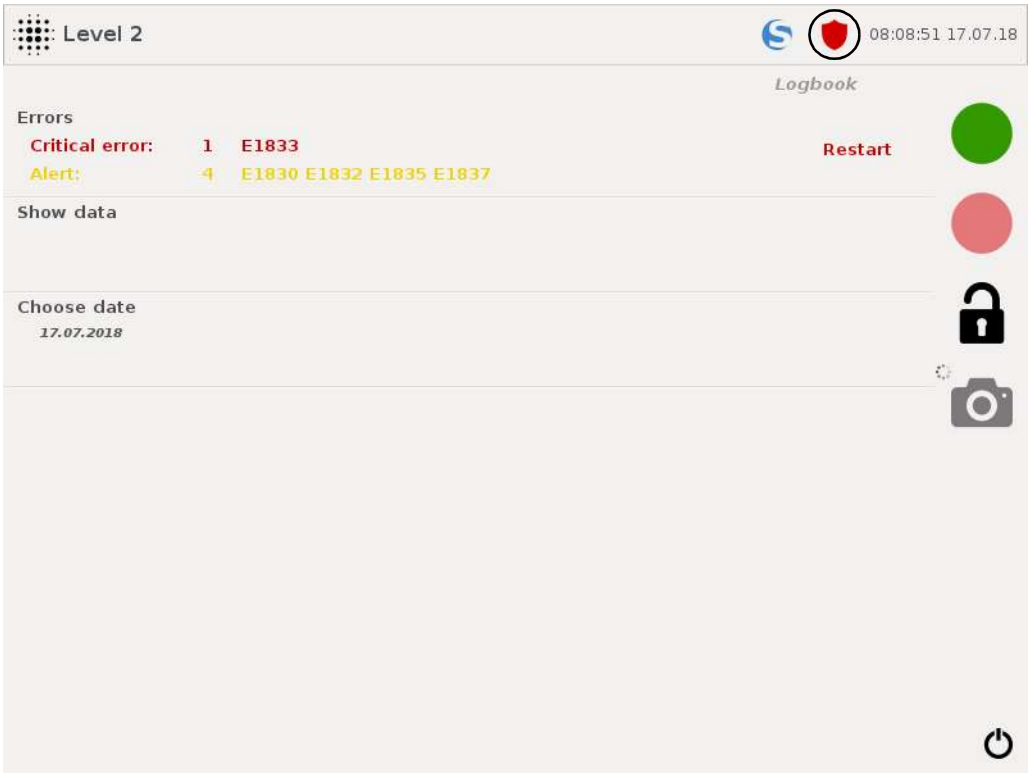


Fig. 110: Logbook (Example with fault message)

Fault messages
If an alarm occurs, the color of the shield symbol changes from green to yellow or red, whereby the color change depends on the type of malfunction that occurs (section 7.15 on page 168).
This display shows which fault is currently present. With one click you get to the overview of the error messages.

Show data
This function takes you to the overview of logbook entries.

Selection Date
This function can be used to select from which date the logbook entries should be displayed in the "Show data" display.

Restart
Press „Restart“ to quit the fault message.

7.12.1 Fault Message View

This display gives a detailed overview of the pending fault messages.

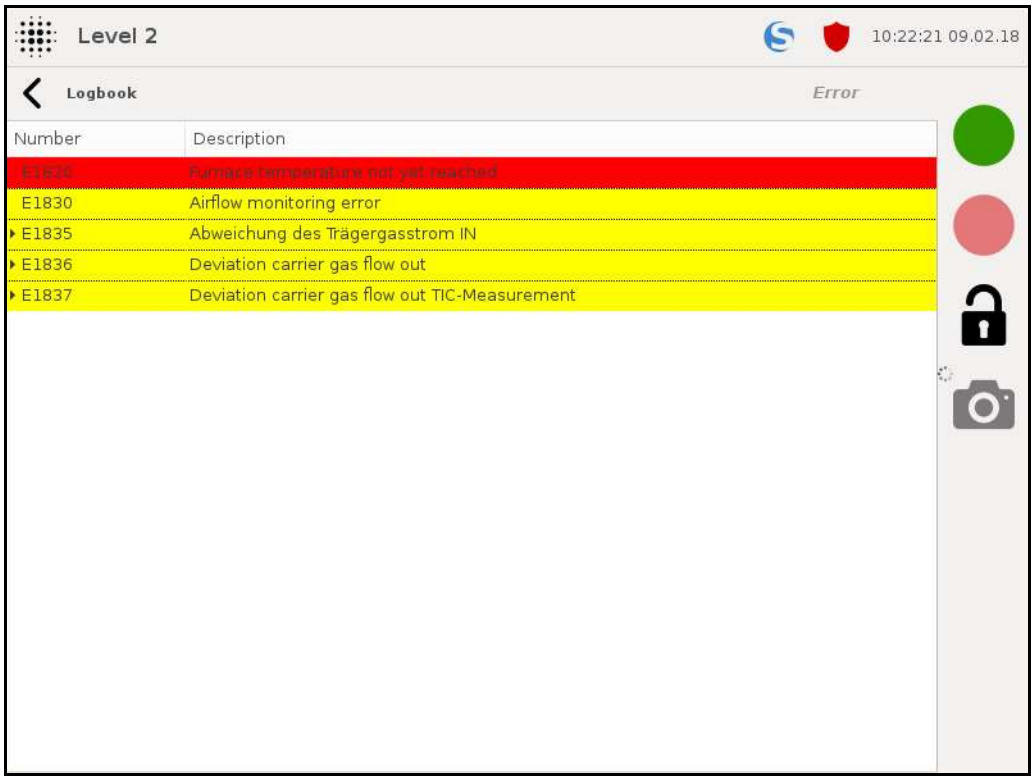


Fig. 111: Logbook - Fault message view (Example with fault messsages)

7.12.2 Activity Overview

The logbook entries and activities are sorted chronologically starting with the most recent ones. In the first column you can see which type has occurred. In the second column you can see the date and time. The corresponding message is displayed in the third column.

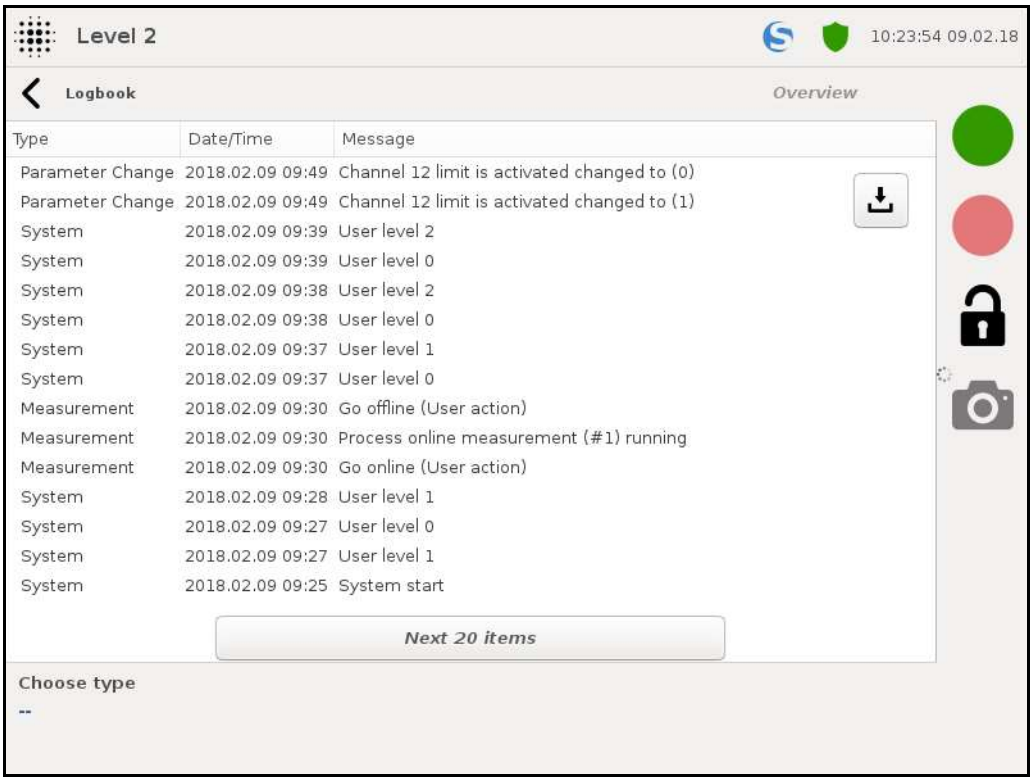


Fig. 112: Logbook - Activity overview (Example)

Notice

This view supports the Export function (Chapter 7.14.2 on page 156).

Next 20 entries:
This function can be used to display an additional 20 logbook entries.

Selection Type:
This feature allows you to view a specific type.

7.13 Update Manager

The blue circle icon in the status bar will take you to the Update Manager. In this display the last update can be viewed, an update made and related data copied to a USB stick.

Fig. 113: Update Manager (Example)

Date of last update:
This value indicates the date on which the last update was performed.

Existing software packages for installation (only by authorized personnel):
This function can be used to update the software.

Copy Update Manager data to a USB stick (user level 3 only):
This function allows the data (such as date) of past updates to be exported to a USB stick.

7.14 Additional Functions

The analyser software has some additional features that are shown below.

7.14.1 Zoom

In some views it is possible to enlarge the presentation.

To enlarge the display, you can draw a rectangle around the area of the chart you want to look at and confirm the enlargement by clicking on this rectangle. The zoom function is possible several times. To deactivate the zoom function, simply click on the reset button.

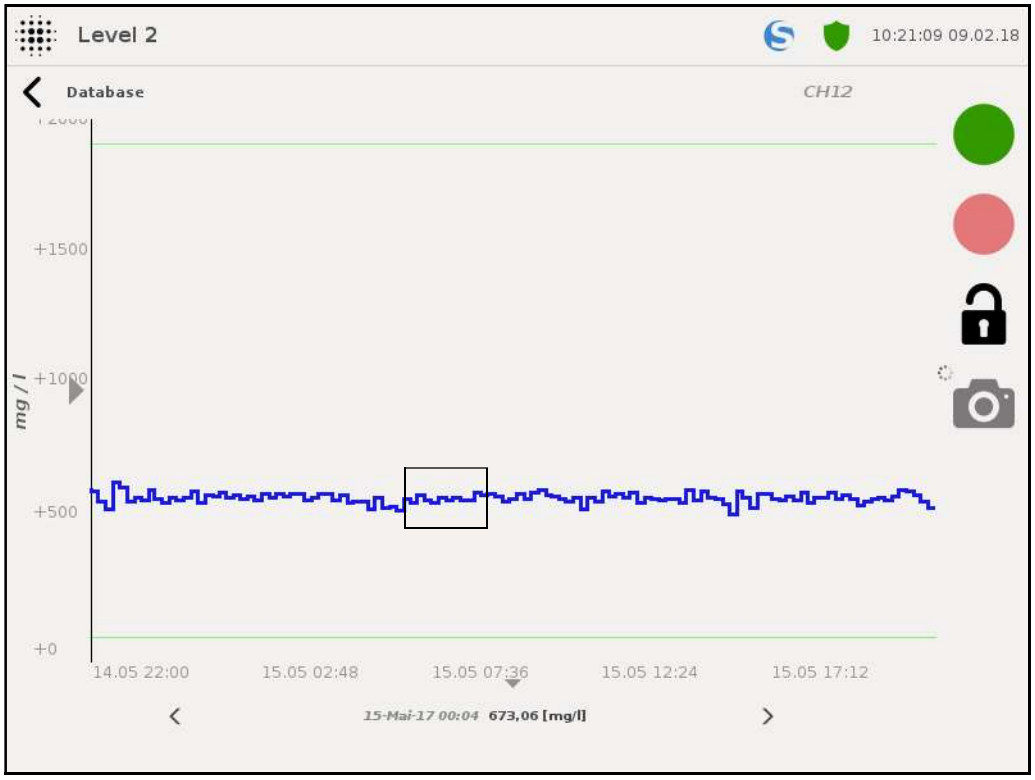


Fig. 114: Example: Zoom (marked rectangle)

Fig. 115: Reset button when zoom is active

7.14.2 Export

In some views, it is possible to export data directly to an inserted USB stick. The following symbol appears in the respective display as soon as a USB stick is inserted.

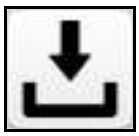


Fig. 116: Export data to a USB device

When files (for example from the database) or screenshots are exported, a folder with the serial number of the analyser is created on the used USB stick in which all data are stored.

Notice

The data are stored on the USB stick in CSV format (.csv).

The data can be opened with a calculation program (such as Microsoft Excel, LibreOffice calc).

Screenshots are saved in PNG format.

7.15 Status Recognition

Various codes are used to detect the status of the analyser. The codes are divided into status and fault codes. The activity sign is used to view the current status (Chapter 7.1.4 on page 91). Faults are displayed in color via the shield symbol and can be viewed via the "Log" or in the "Status screen". The status screen only shows the currently active error. All past faults can be displayed in the logbook and exported to a USB stick.

The colored marking of the shield symbol is used to classify the fault as follows:

Green:
- There is no fault.
- The measuring operation is not interrupted.

Yellow:
- There is a fault.
- The measuring operation is not interrupted.
- The fault must be rectified.

Red:
- There is a fault.
- The measuring operation is interrupted.
- The fault must be remedied so that measuring operation can be restarted.
- After the fault has been rectified, the fault message must be confirmed in the logbook.

Notice

When the analyser is turned on, several red fault messages appear, since e.g. the oven must first reach its temperature before the measuring operation can be started.

If the analyser is not ready for operation more than 2 hours after it is switched on, contact LAR Technical Support (Chapter 15.1 on page 283).

7.15.1 Status Codes

The following table shows all status codes (the x indicates the respective sample stream):

Table 14: Status codes

Status Code	Description
Mx	Measurement
Cx	Calibration
Mx&W	Transition from measurement to Pause
W	Pause (between measurements)
Sx	Single measurement
Dx	Check Function
P	Offline
Lx_min	Minimum limit undershot
Lx_max	Maximum limit exceeded
LVx_min	Check function: minimum limit undershot
LVx_max	Check function: Maximum limit exceeded

7.15.2 Fault Codes

The error codes are shown below depending on the color coding (yellow / red).

Notice

If you have questions about the trouble codes, contact LAR Technical Support (Chapter 15.1 on page 283).

7.15.2.1 Yellow Fault Codes

For yellow fault codes it is necessary to correct the fault promptly in order to prevent a possible stop of the measuring operation.

The table below shows all yellow fault codes:

Table 15: Yellow fault codes

Fault Code	Description	Solution
E1830	Carrier gas supply defective	• Check for tightness
E1832	Pressure hugh (> 300 mbar)	• Check reactor pipe
E1835	Deviation carrier gas input	• Check for tightness
E1836	Deviation carrier gas output	• Check for tightness
E1841 - E1846	No sample / injection (sample stream 1-6)	• Check sample supply
E1851	Zero signal outside the permitted range (CO2 detector 1)	• Check connector • Exchange soda lime
E1852	Zero signal outside the permitted range (CO2 detector 2)	• Check connector • Exchange soda lime
E1853	Zero signal outside the permitted range (NO detector)	• Check connector • Exchange soda lime
E1854	Zero signal outside the permitted range (O2 detector)	• Check connector • Exchange soda lime
E1861	Range exceeded detector (Sample stream 1)	• Check connector • Exchange soda lime • Check conentration
E1865	Range exceeded detector (Sample stream 2)	• Check connector • Exchange soda lime • Check conentration
E1869	Range exceeded detector (Sample stream 3)	• Check connector • Exchange soda lime • Check conentration
E1873	Range exceeded detector (Sample stream 4	• Check connector • Exchange soda lime • Check conentration
E1877	Range exceeded detector (Sample stream 5)	• Check connector • Exchange soda lime • Check conentration
E1881	Range exceeded detector (Sample stream 6)	• Check connector • Exchange soda lime • Check conentration
E1950	External sample supply is missing	• Check external sample supply
E1960	Reagent is missing	• Check reagent supply

7.15.2.2 Red Fault Codes

With red fault codes, it is necessary to eliminate the fault as quickly as possible, since the measuring operation is stopped.

The table below shows all red fault codes:

Table 16: Red fault codes

Fault Code	Description	Solution
E211 - E214	Detector defective / missing	• Contact support
E1650	Error opening the Auto-TIC port	• Contact support
E1660	Error closing the Auto-TIC port	• Contact support
E1700	Injection needle repeatedly did not hit the position	• Check XY axis • Check needle grommet • Check positions
E1710	Injection needle does not hit X position	• Check XY axis • Check needle grommet • Check positions
E1720	Injection needle does not hit Y position	• Check XY axis • Check needle grommet • Check positions
E1730	Injection needle does not hit Z position	• Check XY axis • Check needle grommet • Check positions
E1810	Furnace emergency shutdown (Max. temperatur exceeded)	• Contact support
E1811	Furnace room monitoring	• Contact support
E1812	Furnace room monitoring	• Contact support
E1815	Cooler temperature not reached	• Wait until temperature has been reached
E1820	Furnace temperature not reachedt	• Wait until temperature has been reached
E1821	Error opening / closing the injection ports	• Contact support
E1823	Needle sensor defective	• Contact support
E1831	Limit "humidity" exceeded	• Check humidity • Contact support
E1833	Pressure too high (> 600 mbar)	• Check reactor pipe

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 from page 249).

Notice

The scope of analyser maintenance and care work depends on the application.

All maintenance and 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 (Chapter 8.8 on page 200).

Notice

If you have any questions about maintenance and / or service, contact LAR Technical Support (Chapter 15.1 on page 283).

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.

Table 17: Recommended, regular Care and Maintenance Actions

Interval	Action	Kind of Action	Page Reference
If necessary	Replace silicon seals for glass components	Maintenance	Chapter 8.7.17 on page 196
	Replace seal for reactor foot	Maintenance	Chapter 8.7.18 on page 196
	Replace gas filter	Maintenance	Chapter 8.7.21 on page 199
1 Week	Renew calibration standard	Care	Chapter 8.5.20 on page 179
	Replace silicone seal for TIC-Port	Maintenance	Chapter 8.7.15 on page 195
1 Month	Clean needle guide seal	Care	Chapter 8.5.21 from page 179
	Replace needle guide seal	Maintenance	Chapter 8.7.16 on page 196
3 Months	Check the furnace system	Care	Chapter 8.5.22 on page 180
	Check the gas cooling pipes	Care	Chapter 8.5.23 on page 181
	Clean and oil injection port	Care	Chapter 8.5.24 on page 182
	Move pump tubes	Care	Chapter 8.5.25 on page 183
6 Months	Check the injection port	Care	Chapter 8.5.27 on page 184
	Replace pump tubes	Maintenance	Chapter 8.7.19 on page 198 and Chapter 8.7.20 on page 199

8.2 Visual Inspections

Performing regular visual inspections is recommended to guarantee trouble-free operation of your analyser. Use the following log for this:

Notice

A corresponding copy of the log can be found in Chapter 13 on page 265.

Table 18: Visual inspection log

Visual Inspection	Criteria	OK	Action
Interval: 1 Week			
Zero Signal	• 0 - 0.1 FSR	☐	☐ Check soda lime ☐ Contact support
Carrier Gas	• Carrier Gas IN / OUT: approx. 30 l/h (High Salt: approx. 20 l/h)	☐	☐ Check connections ☐ Contact support
Injection System	• no air bubbles in the tube or glass syringe	☐	☐ Rinsing necessary
Injection Needle	• no contamination • smooth surface	☐	☐ Cleaning necessary ☐ Replace needle
Glass Components	• no contamination	☐	☐ Cleaning necessary
Canisters and Supply Tubes	• fill level > 1 litre • no contamination • normal elasticity	☐	☐ Fill canister ☐ Clean canister ☐ Replace tube
Drain and Inlet Tubes	• no contamination • normal elasticity	☐	☐ Replace tube _____
Interval: 3 Months			
Injection Tube	• no contamination • normal elasticity	☐	☐ Cleaning necessary ☐ Replace tube
TIC Stripping Vessel	• no contamination	☐	☐ Cleaning necessary
Slide Rails (XY-System)	• no contamination • optimal grease state • mechanical play	☐	☐ Cleaning necessary ☐ Grease necessary ☐ Contact support
Tube Cassette Pump and Pump Tubes	• no moisture • rolls easily movable • no contamination • normal elasticity	☐	☐ Cleaning necessary ☐ Put forth tubes ☐ Replace tubes ☐ Contact support
Sample Pump and Pump Tubes	• no contamination • rolls easily movable	☐	☐ Cleaning necessary ☐ Contact support
Viton Tubes	• no contamination • normal elasticity	☐	☐ Cleaning necessary ☐ Replace tubes
Date:	**Signature**		

Visual Inspection	Criteria	OK	Action
Acid Trap	• zinc is > 1/3 shiny • brass wool > 1/3 yellow	☐	☐ Replace filling material ☐ Replace acid trap
Quartz Wool Filter	• no moisture • no discolouration	☐	☐ Replace filling material ☐ Replace filter
Date:	**Signature**		

8.3 Performing the Visual Inspections

Procedure of Visual Inspections:

- Take a log for visual inspections (Chapter 13.2 on page 267).
- Follow the instructions below for visual inspections of individual components.
- Carry out care and/or maintenance actions when test criteria are not met, and document them in the care and/or maintenance log (Chapter 8.4 on page 171 and/or Chapter 8.6 from page 185).
- After the check and any care and/or maintenance actions, conclude the documentation of the log(s).

Danger

Risk of injury due to moving parts

During operation parts of the analyser move.

For all measures, switch the analyser to offline operation with the red button before accessing the analyser.

Notice

If care and / or maintenance measures are taken, document them in the care and / or maintenance record (Tab. 19, page 171 and / or Tab. 20, page 185), as careful documentation is the prerequisite for any warranty and warranty claims.

Note that after all visual inspections, care and / or maintenance, you must perform some tests before you start the measurements again.

8.3.1 Zero Signal

- Check in the display “Status Screen” (Chapter 7.1.4 on page 91) whether the zero signal is between 0 and 0.1 FSR.
- If the signal is not within the range permitted, please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 283).
- Once the test criterion is met, proceed with the next step.

8.3.2 Carrier Gas

1. Check from the “Status Screen” display (Chapter 7.5 on page 97) using the carrier gas volume flow at the carrier gas inlet (IN) and carrier gas outlet (OUT) that the carrier gas is being transported through the system at a rate of approx. l/h (± 5 l/h) .
2. If there is too much deviation, check the individual fittings (hose connections, etc.) or contact LAR

Technical Support (Chapter 15.1 from page 283).

3. If the criterion is fulfilled, proceed to the next step.

8.3.3 Injection System

1. Ensure that the analyser is in offline mode.
2. Check the injection system for air bubbles in the tube or glass syringe.
3. Rinse the injection system if there are air bubbles in the tube or glass syringe (Chapter 8.5.1 on page 172).
4. Once the test criterion is met, proceed with the next step.

8.3.4 Injection Needle

1. Ensure that the analyser is in offline mode.
2. Check the cleanliness and smooth surface of the injection needle.
3. If contamination is ascertained, the injection needle must be cleaned (Chapter 8.5.19 on page 179).
4. If higher levels of deposits or a roughened surface are/is ascertained, the injection needle must be replaced (Chapter 8.7.14 on page 195).
5. Once all test criteria are met, proceed with the next step.

8.3.5 Glass Components

1. Check the cleanliness of all vessels.
2. If contamination is ascertained, the glass components must be cleaned (Chapter 8.5.2 on page 172).
3. Once the test criterion is met, proceed with the next step.

8.3.6 Canister and Supply Tubes

1. Check the cleanliness of the canisters and whether the fill levels of the canisters are > 1 litre.
2. If too low a fill level is ascertained, the canisters must be filled (Chapter 8.5.3 on page 172).
3. If contamination is ascertained, the canisters must be cleaned (Chapter 8.5.4 on page 173).
4. Check the cleanliness and elasticity of the supply tubes.
5. If slight contamination is ascertained, the tubes must be cleaned (Chapter 8.5.5 on page 173).
6. If a higher level of contamination or damage is ascertained, the supply tube must be replaced (Chapter 8.7.1 on page 187).
7. Once all test criteria are met, proceed with the next step.

8.3.7 Inlet and Drain Tubes

1. Check the cleanliness and elasticity of the inlet and drain tubes.
2. If slight contamination is ascertained, cleaning is necessary (Chapter 8.5.6 on page 173).
3. If a higher level of contamination or damage is ascertained, the tube must be replaced (Chapter 8.7.2 on page 187).
4. Once all test criteria are met, proceed with the next step.

1. Check the controller's inlets and outlets for contamination (oil, dust) and for corrosion. Contact LAR if you find contamination.

1. Check the fan for contamination (oil, dust) and for corrosion. If contamination is found, cleaning must be performed
2. Check the fan for ease of movement. If the fan is not running smoothly, contact LAR for replacement.
3. If the test criteria are fulfilled, proceed to the next step.

8.3.8 Injection Tube

1. Ensure that the analyser is in offline mode.
2. Check the cleanliness and elasticity of the injection tube between the solenoid valve and injection needle.
3. If slight contamination is ascertained, the injection tube must be cleaned (Chapter 8.5.9 on page 174).
4. If a higher level of contamination or damage is ascertained, the tube must be replaced (Chapter 8.7.7 on page 191).
5. Once all test criteria are met, proceed with the next step..

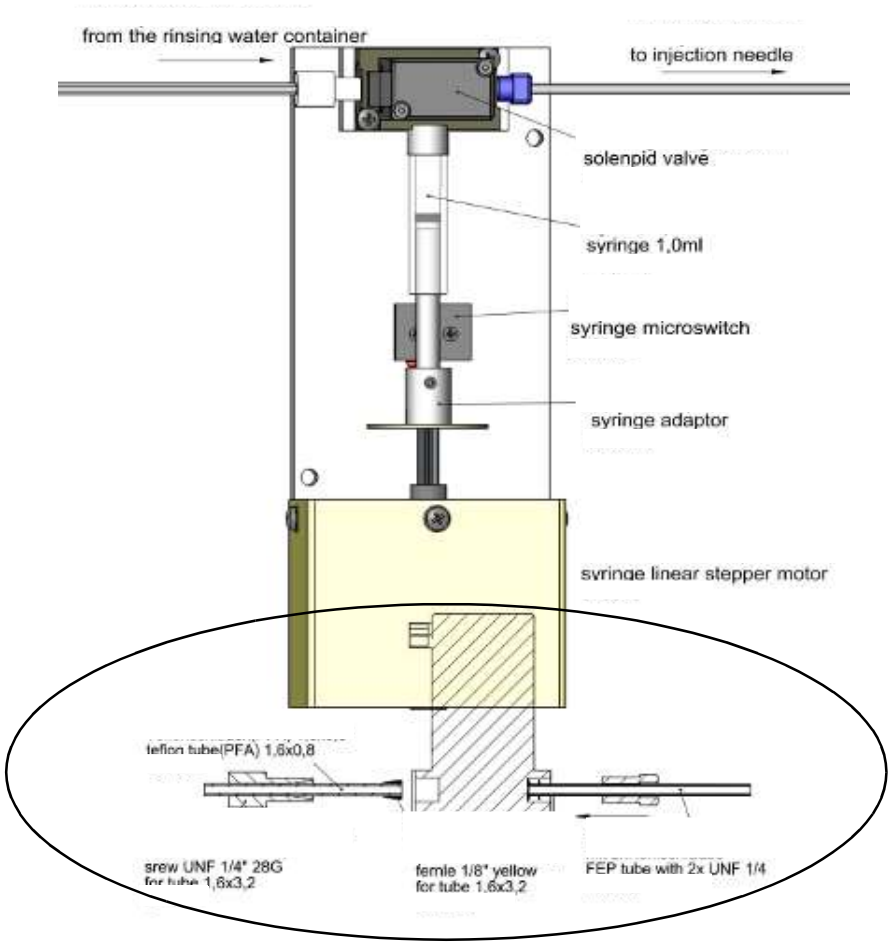


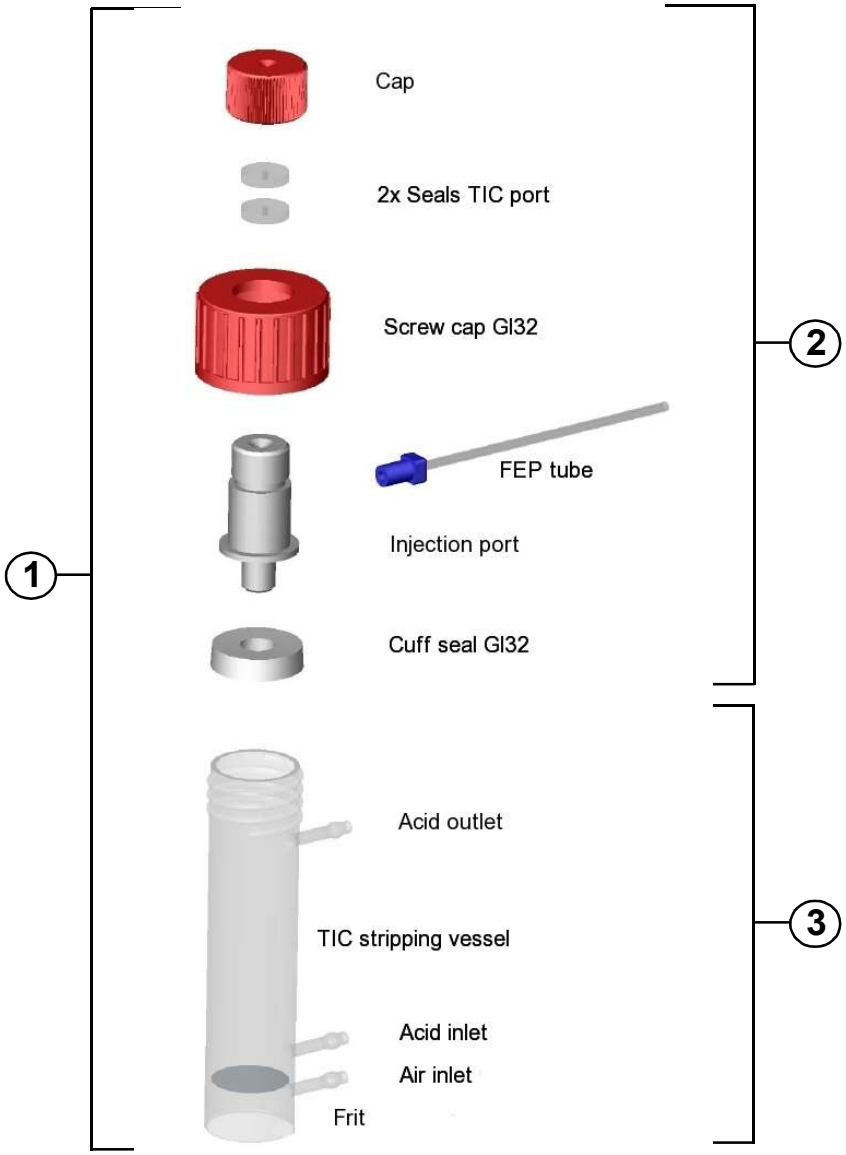
Fig. 117: Injection unit

8.3.9 TIC-Stripping Vessel

Notice

We recommend storing each individual glass component in order to shorten the care and maintenance time.

1. Check the cleanliness of the TIC stripping vessel. If contamination is ascertained, cleaning is necessary (Chapter 8.5.11 on page 176).
2. Once the test criterion is met, proceed with the next step.



1 TIC-Reactor
2 TIC-Port
3 TIC-Stripping Vessel

Fig. 118: TIC-Reactor

8.3.10 Running Rails (XY-System)

1. Ensure that the analyser is in offline mode.
2. Check the cleanliness and optimal grease state of the XY system.
3. If contamination is ascertained, the running rail must be cleaned (Chapter 8.5.13 on page 176).
4. If the running rail is too dry, it must be greased (Chapter 8.5.14 on page 177).
5. Once all test criteria are met, proceed with the next step.

8.3.11 Tube Cassette Pump and Pump Tubes

1. Ensure that the analyser is in offline mode.
2. Take the cassettes from the pump.
3. Take the tubes from the pump cassettes.
4. We recommend relocating or replacing the tubes removed (Chapter 8.5.25 on page 183 or Chapter 8.7.19 on page 198)
5. Check the cleanliness, dryness and ease of movement of the pump, pump cassettes and rollers.
6. If contamination is ascertained, the tube cassette pump must be cleaned (Chapter 8.5.15 on page 177).
7. If noticeable moisture and/or difficult movement are/is ascertained, please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 283).
8. Once all test criteria are met, fix the tubes into the pump cassette, apply a slight amount of oil to the mounted surface, insert the pump cassettes into the pump and continue with the next step.

8.3.12 Sample Pump and Pump Tubes

1. Ensure that the analyser is in offline mode.
2. Take the tubes from the pumps.
3. Check the cleanliness and elasticity of the tubes.
4. If contamination or damage is ascertained, the pump tube must be replaced (Chapter 8.7.20 on page 199).
5. Check the cleanliness, dryness and ease of movement of the pump and rollers.
6. If contamination is ascertained, the sample pump must be cleaned (Chapter 8.5.16 on page 178).
7. If noticeable moisture and/or difficult movement are/is ascertained, please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 283).
8. Once all test criteria are met, fix the tubes into the pumps and continue with the next step.

8.3.13 Viton Tubes

1. Check the cleanliness and elasticity of the black viton tubes from the gas cooler unit.
2. If slight contamination is ascertained, cleaning is necessary (Chapter 8.5.18 on page 179).
3. If a higher level of contamination or damage is ascertained, the tube must be replaced (Chapter 8.7.8 on page 191).
4. Once all test criteria are met, proceed with the next step.

8.3.14 Acid Trap

1. Check that more than 1/3 of the brass wool is light yellow.
2. Check that more than 1/3 of the zinc is shiny.
3. If strong discolouration is ascertained, the acid trap or its filling must be replaced (Chapter 8.7.9 on

page 192 or Chapter 8.7.10 on page 192)

4. Once all test criteria are met, proceed with the next step.

8.3.15 Quartz Wool Filter

1. Check the quartz wool for dryness and white colour.
2. If strong discolouration or moisture is ascertained, the quartz wool filter or its filling must be replaced (Chapter 8.7.11 on page 193 or Chapter 8.7.12 on page 193)
3. Once all test criteria are met, proceed with the next step.

8.4 Care Actions

Use the following protocol to document the care measures.
:

Notice

A corresponding copy template of the protocol can be found in Chapter 13 on page 265.

The careful documentation is precondition for any guarantee and warranty claims.

Table 19: Care Action Protocoll

Action	Done	Comment
Interval: If necessary		
Rinse the injection system	☐	
Clean glass components	☐	
Fill canisters	☐	
Clean canisters	☐	
Clean supply tubes	☐	
Cleaninlet and drain tubes	☐	
Clean Teflon tube (reactor foot)	☐	
Clean reactor foot	☐	
Clean injection tube	☐	
Adjust sample pump	☐	
Clean Viton tube	☐	
Clean injection needle	☐	
Renew calibration standard	☐	
Interval: 1 Month		
Clean needle guide (injection port)	☐	
Interval: 3 Months		
Check the furnace system	☐	
Check the gas cooling pipes	☐	
Clean and oil injection port	☐	
Move pump tubes (tube cassette pump)	☐	
Check the mechanical backlash of the XY-System	☐	
Interval: 6 Months		
Check the injection port	☐	
Date: **Signature**		

8.5 Perform Care Actions

If test criteria are not met during visual inspections, service and maintenance actions must be performed. Also, some actions must be performed at certain intervals to guarantee trouble-free operation of the analyser. Below are the instructions for care work.

Procedure for care work:

1. Always stop measurement mode before carrying out care work.
2. Take a care log (if necessary copy from Chapter 13.3 on page 268).
3. Follow the instructions below for care work for individual components.
4. Document in the care log the care actions taken.
5. Take maintenance actions as required.
6. Conclude documentation of the log once the care actions are performed.
7. Perform the function tests (Chapter 8.8 from page 200).
8. Once the care actions are concluded, start measurement mode.

Danger

Risk of injuries due to moving parts

During operation parts of the analyser are in motion.

For all measures, switch the analyser to offline operation with the red button before accessing the analyser.

8.5.1 Rinse the Injection System

Precondition: - Air bubbles in the tube or glass syringe.

1. Go to the display “Service actions” in the user interface (Chapter 7.8.2 from page 118).
2. Press there the “Rinse injection system” button.
3. Allow the rinse to run its course.

8.5.2 Clean Glass Components

Precondition: - Glass components are contaminated.

1. Unscrew the covers of the glass components to be cleaned.
2. If the level of contamination is low, the glass components can be cleaned with deionised water using a bottle brush.
3. Please follow the instructions in Chapter 6.1.5 on page 81 if contamination levels are higher.
4. Screw the covers back onto the glass components.

8.5.3 Fill Canisters

Precondition: - Fill level of the canister is < 1 litre.

1. Screw the covers back onto the glass components.
2. Prepare the right solution for your measurement method (Chapter 6.1 from page 79).
3. Fill the canister with the new solution.
4. Put the canister back into the reagent cabinet or circulation air conditioner (optional).
5. Insert the tube back into the canister down to the base.

8.5.4 Clean Canisters

Precondition: - Canister is contaminated.

1. Pull the tube from the canister.
2. Dispose of the remaining solution in the canister in an environmentally responsible way.
3. Fill commercially available cleaning or rinsing agent into the canister with 2 litres of warm water.
4. Keep the canister (with water in it) closed for about 1 minute.
5. Use a bottle brush if the contamination level is high.
6. Drain the canister.
7. Rinse out the canister using at least 1 litre of deionised water.
8. Prepare the right solution for your measurement method (Chapter 6.1 from page 79).
9. Fill the canister with the new solution.
10. Put the canister back into the reagent cabinet or circulation air conditioner (optional).
11. Insert the tube back into the canister down to the bottom.

8.5.5 Clean Supply Tubes

Precondition: - Supply tube is slightly contaminated.

1. Pull the tube for cleaning from the canister.
2. Undo the tube connector of the tube to be replaced in the analyser.
3. Pull the tube to be cleaned out of the analyser and from the reagent cabinet or circulation air conditioner.
4. Clean the tube.
5. Guide the cleaned tube into the analyser and into the reagent cabinet or circulation air conditioner.
6. Attach the tube at the tube connector in the analyser.
7. Insert the new tube back into the canister down to the bottom.

8.5.6 Clean Inlet and Drain Tubes

Precondition: - Inlet and/or drain tube are/is slightly contaminated.

1. Undo the tube connectors of the tube to be cleaned.
2. Pull the tube out of the analyser.
3. Clean the tube
4. Guide the cleaned tube into the analyser.
5. Secure the tube at the tube connectors.

8.5.7 Clean Teflon Tube (Reactor Foot)

Precondition: - Teflon tube is slightly contaminated.

1. Remove the ventilation grid on the bottom side of the analyser by pulling it forward with your hands.
2. Undo the screws of the second bottom grid behind it and detach it. Now the reactor foot is visible.
3. Unscrew the four black spacer bolts (there are two for the high salt option).
4. Unscrew the three screws from the seating of the reactor foot.
5. Undo the screwed insert with teflon tube from the reactor foot seat.
6. Clean the tube.
7. Fit the tube back on the reactor seat.

8.5.8 Clean the Reactor Foot

Precondition: - Reactor foot is contaminated.

1. Remove the maintenance flap on the bottom side of the analyser by unscrewing the four screws.
2. Undo the screws of the second bottom grid behind it and detach it. Now the reactor foot is visible.
3. Unscrew the four black spacer bolts (there are two for the high salt option).
4. Unscrew the three screws from the seating of the reactor foot.
5. Undo the screwed insert with teflon tube from the reactor foot seat.
6. Carefully pull the reactor foot from the reactor pipe end.
7. Take all individual parts of the reactor foot (reactor foot seating, screwed insert, glass insert and reactor foot seal).
8. Use a paper towel and water to clean the reactor foot seating and glass insert.
9. Use a pipe cleaner and water to clean the screwed insert.
10. Reassemble all the individual parts of the reactor foot.

Fig. 119: Clean reactor foot seating, screwed insert and glass insert (Example: high salt reactor foot)

8.5.9 Clean Injection Tube

Precondition: - Injection tube is contaminated.

1. Take the injection tube from the injection needle and the solenoid valve.
2. Clean the injection tube using a pipe cleaner or single-use syringe.
3. Refit the injection tube between the injection needle and solenoid valve.

8.5.10 Cleaning the Reactor Pipe

Precondition: - Reactor pipe is contaminated.

1. Use heat-resistant gloves for cleaning!
2.
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. 120: Manual cleaning of the reactor pipe with a drill bit

8.5.11 Clean TIC Stripping Vessel

Precondition: - TIC stripping vessel is contaminated.

1. Take the screw cap on the TIC port.
2. Suck up the acid using a syringe.
3. Take all tube connectors for the TIC stripping vessel.
4. Take the TIC stripping vessel from the pipe clamps.
5. Place the TIC stripping vessel in an ultrasonic bath for 10 minutes for cleaning.
6. Carefully rinse out the TIC stripping vessel with deionised water to remove all residues from the frit.
7. Refit the TIC stripping vessel into the pipe clamps.
8. Reconnect all tube connectors for the TIC stripping vessel.
9. Screw the screw cap back onto the TIC stripping vessel.

8.5.12 Clean Gas Cooling Pipe

Precondition: - Gas Cooling Pipe is contaminated

1. Unscrew the 3 or 6 connection pieces with the tube connectors.
2. Carefully pull the relevant gas cooling pipe upwards out of the cooler guide.
3. For cleaning, use a laboratory bottle filled with deionised water, or a single-use syringe, and as required a small bottle brush, a pipe cleaner or a moist cotton cleaning cloth.
4. Use a soft paper towel to clean the surface of the gas cooling pipe.
5. Rinse the gas cooling pipe from inside by gradually spraying deionised water into the openings of the cooling tube.
6. If contamination levels are high, glass cleaning agents can also be used (however the cooling tube must be rinsed out afterwards with at least 200 ml of deionised water).
7. Use a soft paper towel to dry the surfaces of the gas cooling Pipe.
8. Dry the side tube connectors of the gas cooling pipe using a pipe cleaner.
9. Coat the skin surfaces of the gas cooling pipe with silicone-free, heat-conductive paste.
10. Use a soft paper towel to clean the seats of the cooler.
11. Push the gas cooling pipe back into the seats of the cooler.
12. Connect the tubes correctly back to the tube connectors of the gas cooling pipe.

Warning

Damage to the gas cooling pipe

Do not pull the gas cooling tube out of the welded hose connection as the connection could break off.

The images of the gas cooler must not be cleaned with sharp objects, as otherwise the transition surface from the cooler to the gas cooling tube will be damaged.

Pay attention to the correct connections of the hose connections, since a change of the hoses can lead to wrong measuring results.

8.5.13 Clean Running Rails (XY-System)

Precondition: - Running rails are contaminated.

Use a lint-free paper towel to remove decontamination from the XY running rail.

8.5.14 Grease Running Rails (XY-System)

Precondition: - Running rails are dry.

1. Ensure that the mains supply is disconnected.
2. Open the analyser door.
3. Position a grease gun at the front grease nipple on the guide bearing (**1**).
4. Press grease into the XY system through the grease nipple.
5. Close the analyser door.
6. Open the rear part of the analyser housing.
7. Take the plug door to the compartment part.
8. Position a grease gun at the rear grease nipple on the guide bearing (**2**).
9. Press grease into the XY system through the grease nipple.
10. Insert the plug door.
11. Close the rear part of the housing.

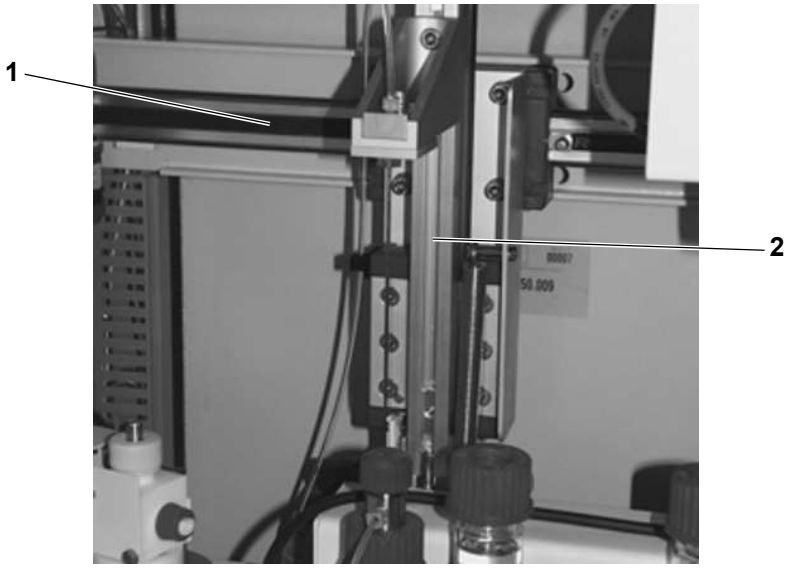


Fig. 121: Running rails of the XY system

8.5.15 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.

8.5.16 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.

8.5.17 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.

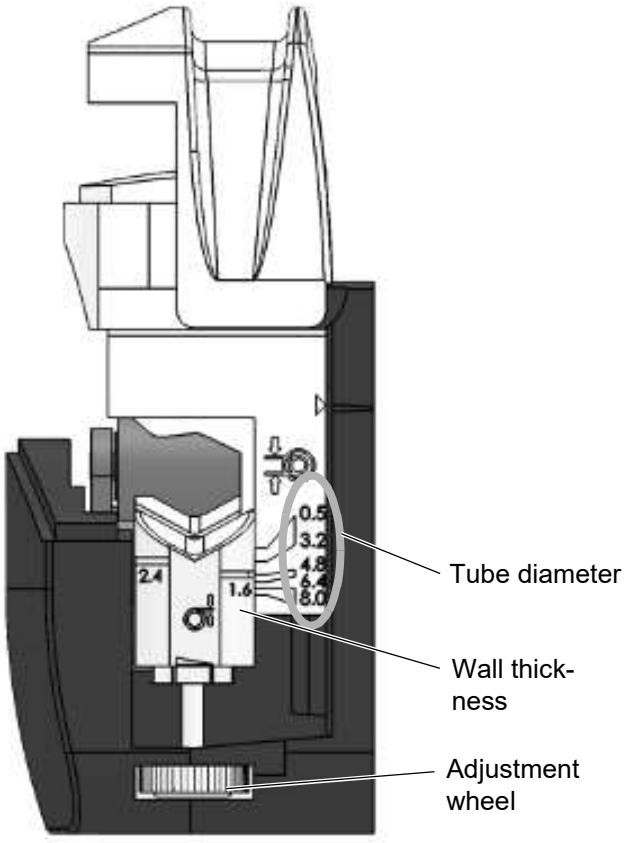


Fig. 122: Sample pump Adjustment

Warning

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.

8.5.18 Clean Viton Tube

Precondition: - Viton tube is slightly contaminated.

1. Undo the tube connectors of the tube to be cleaned.
2. Use compressed air and a pipe cleaner to clean the viton tube.
3. Reattach the tube at the tube connectors.

8.5.19 Clean Injection Needle

Precondition: - Injection needle is slightly contaminated.

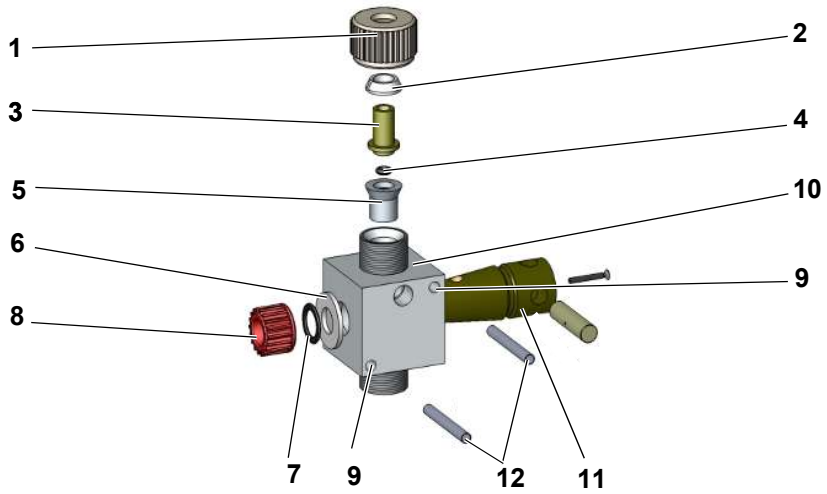
1. Use distilled water to moisten a clean cloth.
2. Use a cloth to clean the injection needle from outside.

8.5.20 Renew Calibration Standard

Precondition: - Calibration standard is empty/is older than one week.

Follow the instructions in Chapter 6.2 on page 82 to make a calibration standard. .

8.5.21 Clean Needle Guide (Injection Port)



1	Union nut	**5**	Lower needle guide	**10**	Injection port
2	Attachment for upper needle guide	**6**	Washer	**11**	Cock plug (PEEK)
3	Upper needle guide	**7**	Cock plug seal	**12**	Spacer sleeves
4	Needle guide seal	**8**	Union nut for cock plug		
		9	Holes for M3x45 screws		

Fig. 123: Injection Valve

1. Unscrew the union nut (**1**) and the attachment of the needle guide (**2**).
2. Clean the needle guides (**3**, **5**) and all individual parts with a damp paper towel and rinse water Chapter 4. on page 79
3. If heavily soiled, clean the needle guides (**3**, **5**) first mechanically and then through a bath of 1% phosphoric acid.
4. After cleaning, reassemble all parts for the complete injection port.

5. Screw the needle guides (**3**, **5**) and the union nut (**1**) back to the injection port.

8.5.22 Furnace System Check

Danger

Danger of burns

Allow the oven 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 stove.

1.
2. Undo the screws of the second bottom grid behind it and detach it. Now the reactor foot is visible.
3. Unscrew the four black spacer bolts (there are two for the high salt option).
4. Unscrew the three screws from the seating of the reactor foot.
5. Undo the screwed insert with teflon tube from the reactor foot seat.
6. Check the cleanliness and elasticity of the teflon tube.
7. If slight contamination is ascertained, the teflon tube must be cleaned (Chapter 8.5.7 on page 173).
8. If a higher level of contamination or damage is ascertained, the teflon tube must be replaced (Chapter 8.7.3 on page 187).
9. Carefully pull the reactor foot from the reactor pipe end.
10. Check the cleanliness of the reactor foot.
11. If contamination is ascertained, the reactor foot must be cleaned (Chapter 8.5.10 on page 175).
12. Once all test criteria are met, continue with the visual inspection of the reactor pipe without fitting the reactor foot.
13. Ensure that the reactor foot is already removed (Chapter 8.3.8 on page 167)
14. Look into the end of the reactor pipe and check its cleanliness (use a mirror and protective goggles as aids).
15. You can see the filter once the reactor pipe is free.
16. If contamination is ascertained, the reactor pipe must be cleaned (Chapter 8.5.10 on page 175).
17. Check whether the reactor pipe has suffered any damage.
18. If damage is ascertained, the reactor pipe must be replaced (Chapter 8.7.4 on page 188).
19. Once all test criteria are met, refit the reactor pipe and reactor foot, and continue with the next step.
20. Unplug the injection port connector.
21. Carefully undo in a crosswise sequence the screws of the furnace head.
22. Undo the tube from the tube connector (return valve).
23. Take the furnace head and injection port from the reactor pipe.
24. Undo the injection port on the furnace head by carefully turning it anticlockwise by hand.
25. Check to see whether the O-rings are in perfect condition.
26. If damage is ascertained, the respective O-ring must be renewed (Chapter 8.7.5 on page 190 and/ or Chapter 8.7.6 from page 191).
27. Place the furnace head onto the furnace and reactor pipe.
28. Connect the black tube to the tube connector provided.
29. Tighten in a crosswise sequence the attachment bolts of the furnace head with the furnace head panel.
30. Careful tighten the injection port by hand until slight resistance is felt (the injection port should point to the front left at an angle).
31. Plug the injection port connector back in.
32. Once all test criteria are met, proceed with the next step.

8.5.23 Check the Gas Cooling Pipes

1. Unscrew the 3 or 6 connection pieces with the tube connectors.
2. Carefully pull the relevant gas cooling pipe upwards out of the cooler guide.
3. Check the cleanliness of the gas cooling pipe removed (Note that the white silicone-free, heat-conductive paste is not contamination).
4. If contamination is ascertained, cleaning is necessary (Chapter 8.5.12 on page 176).
5. Once the test criterion is met, refit the gas cooling Pipe, reconnect the tubes correctly to the tube connectors and proceed with the next step.

Warning

Damage to the gas cooling pipes

Do not pull the gas cooling tubes out of the welded hose connection as the connection could break off.

The images of the gas cooler must not be cleaned with sharp objects, as otherwise the transition surface from the cooler to the gas cooling tube will be damaged.

Pay attention to the correct connections of the hose connections, since a change of the hoses can lead to wrong measuring results.

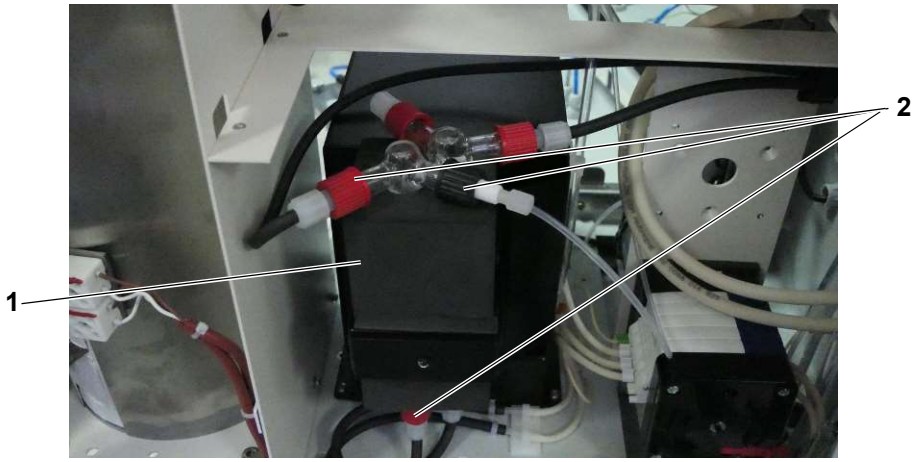


Fig. 124: Gas Cooler (Complete)

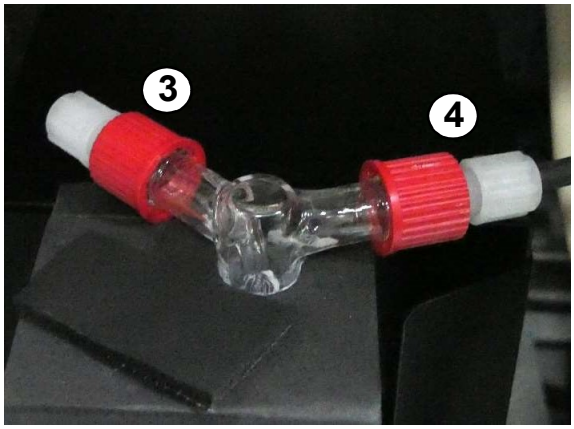


Fig. 125: Connections

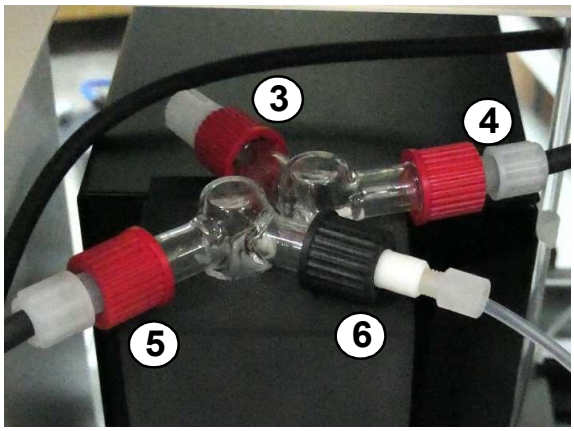


Fig. 126: Connections

1 Cooler
2 Tube connector
3 Teflon tube (from reactor foot)
4 Viton tube (to quartz wool filter)
5 Viton tube (to TIC valve)
6 Tube (from TIC reactor)

8.5.24 Clean and Oil Injection Port

1. Unscrew the cover cap to access the cock plug.
2. Undo the two screws of the attachment between motor and injection port carefully (because there is a spring between the motor and cock plug).
3. Take the motor. The injection port is now free.
4. Unscrew the union nut (red screw joint) of the cock plug.
5. Moisten a lint-free paper or cleaning cloth (you can use a pipe cleaner for openings).
6. Thoroughly clean the surface of the injection port and cock plug.
7. Apply a very thin layer of oil to the front and rear areas of the cock plug.
8. Now push the cock plug back into the opening of the injection port.
9. Turn it inside the injection port for good distribution of the oil.
10. Fit the washer in front of the cock plug seal and the union nut when the cock plug is in the injection port.
11. Screw the complete injection port onto the furnace head.
12. Secure the two M3x45 screws to attach the injection port.
13. Fit the cover cap (tighten by hand).

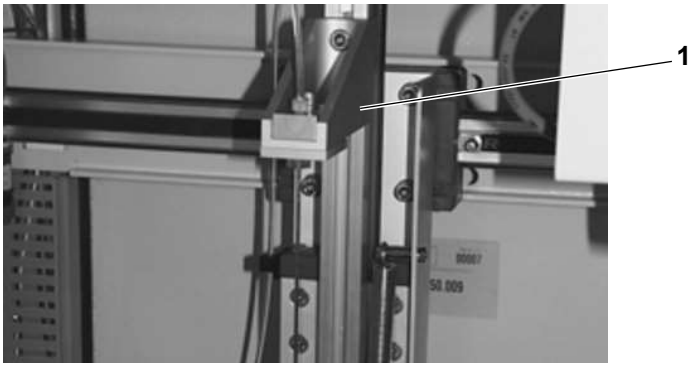
8.5.25 Move Pump Tubes (Tube Cassette Pump)

Precondition: - The area fixed in the pump is inelastic.

1. Take the pump cassettes from the pump.
2. Take the tubes from the pump cassettes.
3. Fix the tubes into the pump cassettes at the second, previously unused fixing point between the colour-coded stoppers.
4. Oil the tubes with a drop of silicone oil (available from **LAR**) at the points mounted.
5. Insert the pump cassettes into the pump.

8.5.26 Check the mechanical backlash of the XY-System

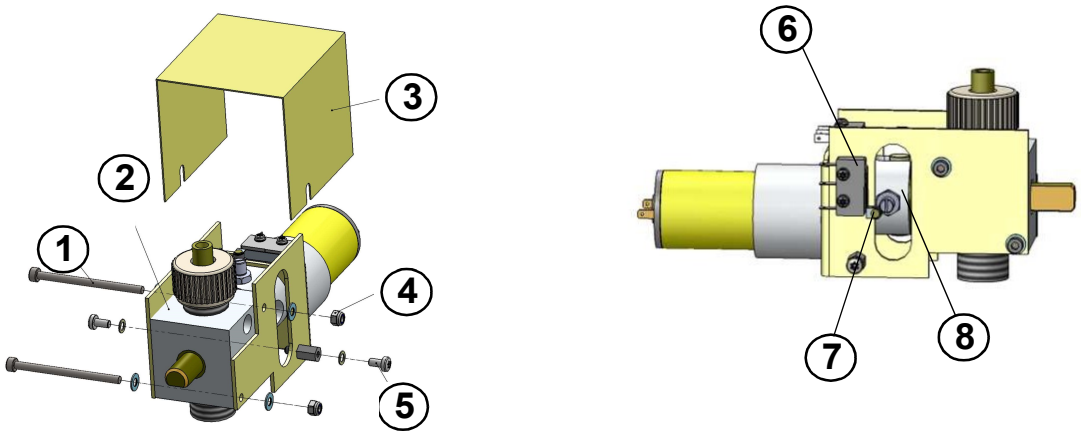
1. Wrap the needle gallows with one hand (**1**).
2. Move your hand forward and backward while watching the end of the injection needle.
3. If the injection needle moves more than 1 mm during this inspection, contact **LAR** Technical Support (Chapter 15.1 on page 283).
4. If the injection needle does not move, go to the next stept



1 Needle Gallows

Fig. 127: Mechanical backslash of the needle gallows

8.5.27 Check the Injection Port



1 2x Screws M3x45
2 Injection Port
3 Cover Cap
4 2x Nuts M3, 4x Washers M3
5 2x Screws M3x6, 2x Washers M3
6 Micro-switch housing
7 Switch lever of micro-switch
8 Switch knob on valve cock plug

Fig. 128: Injection port

1. Undo the two Torx screws (**5**) with spring washers on the cover cap (**3**).
2. Pull the cover cap (**3**) upwards.
3. Access the display “Service actions”.
4. Close and open the injection port (**2**) to test the ease of movement of the closing and opening functions for the injection port (**2**) (rotation test).

Notice

The closing and opening of the injection port causes a rotation of the valve plug.

There is a switch knob on the valve plug (**8**, Fig. 128, page 184). If the valve is closed, the valve plug rotates until the switch knob on the next selector lever of a microswitch triggers the switching process and stops the valve.

5. When turning the valve cock plug, check that the switch levers of the micro-switch (**7**) are not pressed down onto the micro-switch housing by the switch knob of the valve cock plug.
6. Ensure that the minimum distance of 1 mm between the switch levers of the micro-switches and the respective micro-switch housing (**6**) is not dropping below.
7. If the test criteria are not met, please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 283).

Warning

Damage to the valve switches

During operation the valve switches.

Do not reach into the switching range of the valve.

8. Once all test criteria are met, screw on the cover cap of the injection port (**2**).

8.6 Maintenance Actions

Use the following maintenance log for the documentation of maintenance actions:

Notice

A corresponding copy of the log can be found in Chapter 13 from page 265.

Careful documentation is a precondition for any guarantee and warranty claims.

Table 20: Maintenance log

Action	Done	Comment
Interval: If necessary		
Replace Supply Tubes	☐	
Replace Inlet and Drain Tubes	☐	
Replace Teflon Tube (Reactor Foot)	☐	
Replace Reactor Pipe Filling / Reactor Pipe	☐	
Replace Small Furnace Head Seal (upper)	☐	
Replace Big Furnace Head Seal (Silicone O-Ring with PFA coat)	☐	
Replace Injection Tube	☐	
Replace Viton Tube	☐	
Replace Acid Trap filling	☐	
Replace Acid Trap	☐	
Replace Quartz Wool Filter filling	☐	
Replace Quartz Wool Filter	☐	
Replace the scraper discs of the glass components	☐	
Replace reactor foot seal	☐	
Replace Injection Needle	☐	
Interval: 1 Week		
Replace Silicone Seal for TIC-Port	☐	
Interval: 1 Month		
Replace Needle Guide Seal (Injection Port)	☐	
Interval: 6 Months		
Replace Pump Tube (Tube Cassette Pump)	☐	
Replace Pump Tube (Sample Pump)	☐	
Date: **Signature**		

8.7 Perform Maintenance Actions

If test criteria are not observed during visual inspections, service and/or maintenance actions must be performed. Below are the instructions for the maintenance work.

Procedure for maintenance actions:

1. Always stop measurement mode before carrying out maintenance work.
2. Take a maintenance log (if necessary copy from Chapter 13.4 on page 269).
3. Follow the instructions below for maintenance work for individual components.
4. Document in the maintenance log the actions taken.
5. Conclude documentation of the log once the maintenance actions are performed.
6. Perform the function tests (Chapter 8.8 from page 200).
7. Once the maintenance actions are concluded, start measurement mode.

Danger

Risk of injuries due to moving parts

During operation parts of the analyser move.

For all measures, switch the analyser to offline operation with the red button before accessing the analyser.

Notice

After completion of the care and / or maintenance measures, some functional tests such as the test run is carried out before the measuring operation can be restarted(siehe Chapter 8.8 on page 200).

8.7.1 Replace Supply Tubes

Precondition: - Supply tubes are contaminated.

1. Pull the tube to be replaced from the canister.
2. Undo the tube connector of the tube to be replaced in the analyser.
3. Pull the tube to be replaced from the analyser and optionally from the reagent cabinet or circulation air conditioner.
4. Guide the new tube into the analyser and optionally into the reagent cabinet or circulation air conditioner.
5. Attach the new tube at the tube connector in the analyser.
6. Insert the new tube back into the canister down to the bottom.

8.7.2 Replace Inlet and Drain Tubes

Precondition: - Inlet and/or Drain tubes are/is contaminated.

1. Undo the tube connector of the tube to be replaced in the analyser.
2. Pull the tube to be replaced from the analyser.
3. Guide the new tube into the analyser.
4. Attach the new tube at the tube connector in the analyser.

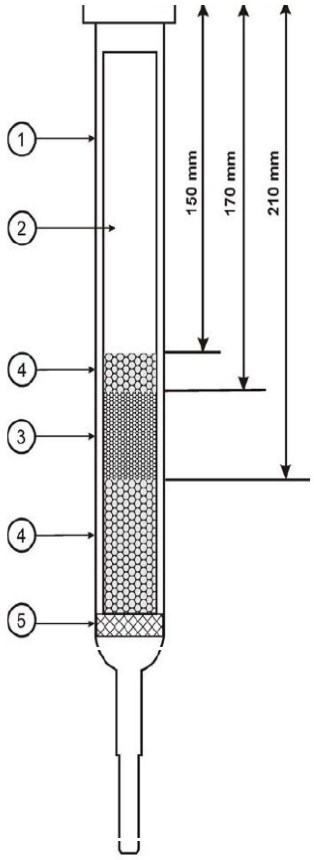
8.7.3 Replace Teflon Tube (Reactor Foot)

Precondition: - Teflon tube is highly contaminated or damaged.

1. Undo the tube connectors of the teflon tube.
2. Remove the old teflon tube and replace it with a new one having the same length.
3. Attach the new teflon tube at the tube connectors provided.

8.7.4 Replace Reactor Pipe Filling / Reactor Pipe

Precondition: - Reactor Pipe Filling is blocked or Reactor Pipe is damaged.



1 Reactor Pipe
2 Ceramic Protective Pipe
3 Ceramic Balls 1.6mm
4 Ceramic Balls 3.5 - 4.5mm
5 Ceramic Sieve

Fig. 129: Reactor pipe filling (Standard)

Danger

Danger of burns

Allow the oven 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 stove.

Warning

Correct re-assembly 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 the furnace off from the display “Service Actions” (Chapter 7.8.2 from page 118) and let it cool for two hours.
2. Move the Y arm to the right using a test run (Chapter 7.8.3 from page 120).
3. Loosen the maintenance cover screws on the bottom of the analyser and remove the maintenance cover.
4. Undo the screws of the second bottom grid behind it and detach it. Now the reactor foot is visible.
5. Unscrew the four black spacer bolts (there are two for the high salt option).
6. Unscrew the three screws from the seating of the reactor foot.
7. Undo the screwed insert with teflon tube from the reactor foot seat.
8. Carefully pull the reactor foot from the reactor pipe end and put it to one side.
9. Unplug the injection port connector.
10. Undo the injection port by carefully turning it anticlockwise by hand.
11. Carefully undo in a crosswise sequence the screws of the furnace head.
12. Undo the tube from the tube connector.
13. Take the furnace head and injection port from the reactor pipe and place both to one side.
14. Ensure that the furnace head, injection port and reactor foot are removed.
15. Once the furnace has cooled completely (after about two hours), use heat-resistant gloves to pull the reactor pipe from the furnace.
16. Place the reactor pipe onto a fire-resistant surface or put it into a bucket filled with sand (with the taper pointing downwards) and let it cool completely.

Replacement:

1. If the reactor pipe is damaged, replace it with a new reactor pipe.
2. Note the sequence for filling the reactor pipe.
3. Position the ceramic sieve (No. 5 in Fig. 129, page 188) horizontally on the taper of the reactor pipe / allow it to drop into the reactor pipe.
4. Shake the reactor pipe to move the ceramic sieve into a horizontal position. (You can use a torch to check the position).
5. Carefully insert the long protective pipe (No. 2 in Fig. 129, page 188) into the reactor pipe from above..

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.

- Fill the ceramic balls with diameters 3.5 mm - 4.5 mm (No. 4 in Fig. 129, page 188) up to the height specified (210 mm, measured from the top edge with a tape measure).
- Fill the ceramic balls with diameter 1.6 mm (No. 3 in Fig. 129, page 188) up to the height specified (170 mm, measured from the top edge with a tape measure).
- Fill the ceramic balls with diameters 3.5 mm - 4.5 mm (No. 4 in Fig. 129, page 188) up to the height specified (150mm, measured from the top edge with a tape measure).

Reassembly:

1. Place the green protective seal for the reactor pipe onto the furnace.
2. Push the filled reactor pipe into the centre of the furnace from above.
3. Place the furnace head onto the furnace and reactor pipe.
4. Connect the black tube to the tube connector provided.
5. Tighten in a crosswise sequence the attachment bolts of the furnace head with the furnace head panel.

6. Careful tighten the injection port by hand until slight resistance is felt (the injection port should point to the front left at an angle).
7. Plug the injection port connector back in.
8. Attach the reactor foot seating to the reactor footplate using three M4x30 bolts.
9. Connect the teflon tube (PFA) to the screwed insert.
10. Screw the screwed insert into the reactor foot seating.
11. Plug the reactor foot onto the reactor pipe from below.
12. Screw on the four spacer bolts.
13. Pull the reactor foot down so that the gas path is not blocked by the reactor pipe.
14. Reattach the bottom grid.
15. Reattach the ventilation grid.
16. Dispose the old reactor pipe filling and, if necessary, the old reactor pipe.
17. Switch the furnace back on from the display “Service Actions” (Chapter 7.8.2 from page 118).

Notice

The reactor tube filling shown in Fig. 129, page 188, according to experience, represents 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 (Chapter 15.1 on page 283) or with a LAR authorized service partner.

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.

8.7.5 Replace Small Furnace Head Seal

Danger

Danger of burns

Allow the oven 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 stove.

Precondition: - Small furnace head seal is damaged.

1. Wear heat-resistant gloves.
2. Unplug the injection port connector.
3. Carefully undo in a crosswise sequence the screws of the furnace head.
4. Undo the tube from the tube connector.
5. Take the furnace head and injection port from the reactor pipe.
6. Undo the injection port on the furnace head by carefully turning it anticlockwise by hand.
7. Carefully remove the old, small furnace head seal (upper) from its groove using pliers or a small slotted screwdriver.
8. Insert a new, small furnace head seal (upper) into the furnace head groove.
9. Place the furnace head onto the furnace and reactor pipe.
10. Connect the black tube to the tube connector provided.
11. Tighten in a crosswise sequence the attachment bolts of the furnace head with the furnace head panel.
12. Careful tighten the injection port by hand until slight resistance is felt (the injection port should point to the front left at an angle).

13. Plug the injection port connector back in.

8.7.6 Replace Big Furnace Head Seal (Silicone O-Ring with PFA coat)

Danger

Danger of burns

Allow the oven 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 stove.

Precondition: - Big furnace head seal is damaged.

1. Wear heat-resistant gloves.
2. Unplug the injection port connector.
3. Carefully undo in a crosswise sequence the screws of the furnace head.
4. Undo the tube from the tube connector.
5. Take the furnace head and injection port from the reactor pipe.
6. Undo the injection port on the furnace head by carefully turning it anticlockwise by hand.
7. Carefully remove the old, big furnace head seal (O-ring with PFA coat) from its groove using pliers or a small slotted screwdriver.
8. Insert a new, big furnace head seal (O-ring with PFA coat) into the furnace head groove.
9. Place the furnace head onto the furnace and reactor pipe.
10. Connect the black tube to the tube connector provided.
11. Tighten in a crosswise sequence the attachment bolts of the furnace head with the furnace head panel.
12. Careful tighten the injection port by hand until slight resistance is felt (the injection port should point to the front left at an angle).
13. Plug the injection port connector back in.

8.7.7 Replace Injection Tube

Precondition: - Injection tube is highly contaminated or damaged.

1. Undo the tube connectors of the injection tube.
2. Remove the old injection tube and replace it with a new one having the same length.
3. Attach the new injection tube at the tube connectors provided.

Notice

Only use **LAR** tubes.

8.7.8 Replace Viton Tube

Precondition: - Viton tube is highly contaminated or damaged.

1. Undo the tube connectors of the viton tube.
2. Remove the old viton tube and replace it with a new one having the same length.
3. Attach the new viton tube at the tube connectors provided.

8.7.9 Replace Acid Trap Filling

Preconditions:
- Up to 2/3 of the brass wool has a red-brown discolouration.
- The zinc is up to 2/3 matt.

Danger

Corrosive chemicals

The acid trap is filled with highly corrosive material.

Use gloves and respiratory protection when working on the acid trap

1. Use a screwdriver to open the pipe clamps.
2. Take the tubes to the acid trap.
3. Take the acid trap from the holder.
4. Remove the contents of the acid trap.
5. Fill the quartz wool into the acid trip carefully because otherwise the quartz wool becomes pulverised and a blockage of the gas paths is created when it is stuffed by too much (bottom).
6. Fill the zinc into the acid trap (middle).
7. Fill the brass wool into the acid trap (top). No brass wool may be protruding.
8. Check the order (from the bottom up): Quartz wool, zinc, brass wool.
9. Fit the filled acid trip into its holder.
10. Reconnect the tubes to the acid trap.

Notice

LAR offers filled acid traps for simple and quick maintenance.

If you have any question, please contact the **Sales Department of LAR** (Chapter 15.1 on page 283).

8.7.10 Replace Acid Trap

Preconditions:
- Up to 2/3 of the brass wool has a red-brown discolouration.
- The zinc is up to 2/3 matt.

1. Use a screwdriver to open the pipe clamps.
2. Take the tubes to the acid trap.
3. Remove the acid trap from the holder.
4. Fit the new acid trip into its holder.
5. Connect the tubes to the acid trap.

8.7.11 Replace Quartz Wool Filter Filling

Preconditions:
- Quartz wool has a grey colouring.
- Quartz wool is damp.

Danger

Corrosive chemicals

The acid trap is filled with highly corrosive material.

Use gloves and respiratory protection when working on the acid trap

1. Make a note of the gas pressure [in mbar] on the display “Status Screen” (Chapter 7.5 on page 97).
2. Put gloves on.
3. Take the tubes from the quartz wool filter.
4. If required, use a screwdriver to open the pipe clamps.
5. Take the quartz wool filter from the holder.
6. Undo the upper and lower screw connections.
7. Remove and dispose the old quartz wool.
8. Fill the quartz wool filter carefully with quartz wool because otherwise the quartz wool becomes pulverised and a blockage of the gas paths is created when it is stuffed by too much. Ensure that the quartz wool is filled loose at the bottom and a little more compact at the top. No quartz wool may be protruding.
9. Clean the red threaded connections.
10. Place the O-ring into the recess provided.
11. Screw back in the upper and lower quartz wool filters.
12. Fit the quartz wool filter into the holder.
13. Connect the tubes to the quartz wool filter.
14. Check the gas pressure on the display “Status screen”.

Notice

LAR offers filled quartz wool filters for simple and quick maintenance.

If you have any question, please contact the **Sales Department of LAR** (Chapter 15 on page 283).

8.7.12 Replace Quartz Wool Filter

Preconditions:
- Quartz wool has a grey colouring.
- Quartz wool is damp.

1. Make a note of the gas pressure [in mbar] on the display “Status screen” (Chapter 7.5 on page 97).
2. Put gloves on.
3. Take the tubes from the quartz wool filter.
4. If required, use a screwdriver to open the pipe clamps.
5. Remove the quartz wool filter from the holder.
6. Fit the new quartz wool filter into the holder.
7. Connect the tubes to the quartz wool filter.
8. Check the gas pressure on the display “Status screen”

8.7.13 Replace Injection Needle

Precondition: - Injection needle is damaged.

1. Undo the injection tube from the injection needle.
2. Use a spanner to detach the injection needle.
3. Fit the new injection needle.

8.7.14 Replace Silicone Seal for TIC-Port (TOC-Difference Method)

Precondition: - Seal on TIC port is one week old.

1. Unscrew the cover of the TIC port (Fig. 118, page 168).
2. Use a thin object (such as 2 mm diameter screwdriver) to puncture the cover from above to press out the old TIC seal.
3. If the inner surfaces are contaminated, clean the cover and screw cap.
4. Insert a new seal.
5. Screw the cover with the new seal onto the TIC reactor.

Notice

We recommend keeping TIC port seals in stock.

If you have any question, please contact the **Sales Department of LAR** (Chapter 15 on page 283).

8.7.15 Replace Needle Guide Seal (Injection Port)

Precondition: - Needle guide seal (injection port) is one month old.

- Unscrew the union nut of the injection port.
- Lift the top part of the needle guide and remove the old needle guide seal (Fig. 132, page 196).
- Insert the new needle guide seal into the clean groove.
- Place the top part of the needle guide onto the lower part of the needle guide.
- Tighten the union nut again.

Warning

Do not remove the needle guide seal with a screwdriver or other sharp object because this could scratch the groove, thereby causing leaks. Instead, use a soft object like a wooden toothpick or pencil to lever out the seal.

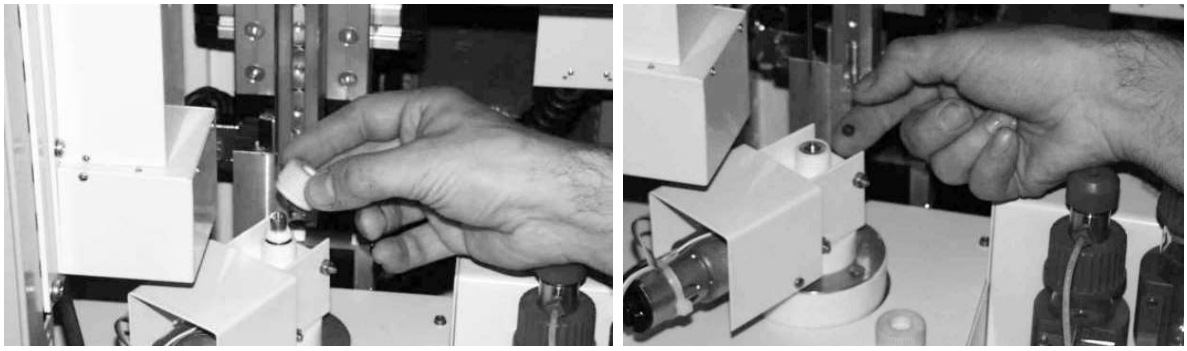


Fig. 130: Replace needle guide seal

8.7.16 Replace Silicone Seals for Glass Components

Precondition: - Silicone seals are 1 month old.

1. Unscrew the screw caps of the glass components.
2. Remove the old silicone seals from the cover.
3. Insert a new silicone seals into the cover.
4. Note its position. If the silicone seals has a teflon-coated side, it must face the glass.
5. Hand tighten the screw caps.

Notice

We recommend keeping silicone seals in stock.

If you have any question, please contact the **Sales Department of LAR** (Chapter 15 on page 283).

8.7.17 Replace Reactor Foot Seal

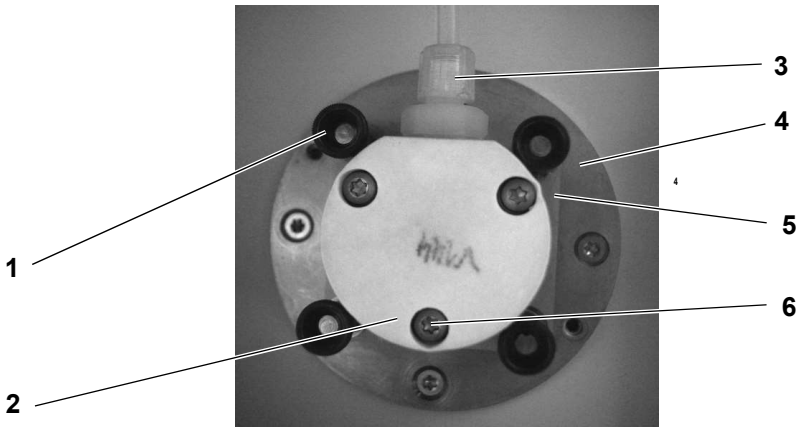
Danger

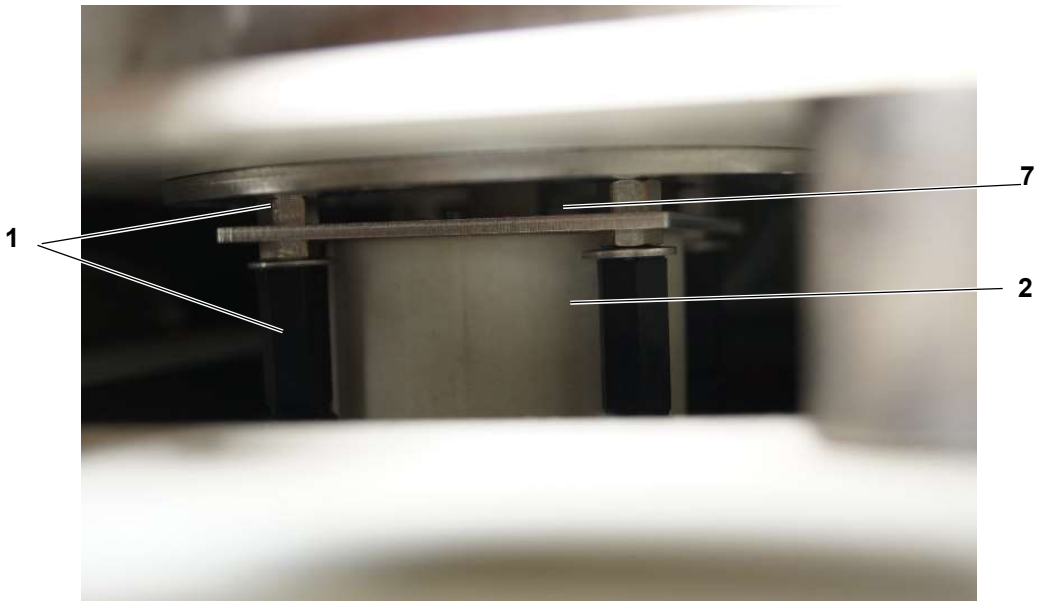
Danger of burns

Allow the oven 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 stove.

6. Disassemble the ventilation grid on the bottom of the analyser by gently pulling it forward with your handsUndo the screws of the second bottom grid behind it and detach it.
7. Now the reactor foot is visible.
8. Unscrew the four black spacer bolts (**1**) (there are two for the high salt option).
9. Unscrew the three screws from the seating of the reactor foot.
10. Undo the screwed insert with teflon tube (**3**) from the reactor foot seat (**2**).
11. Carefully pull the reactor foot from the reactor pipe end.
12. Remove the old reactor foot seal and replace it with a new one.
13. Reconnect the screwed insert with teflon tube (**3**) to the reactor foot seating (**2**).
14. Screw back in the three screws (**6**) for seating the reactor foot.
15. Screw on the four black spacer bolts (**1**) (there are two for the high salt option).
16. Pull the reactor foot with disc onto the spacer bolts so that the gas path is not blocked by the reactor pipe.
17. Use the screws to attach both bottom grids.
18. Mount the maintenance cover.





1 4 Spacer bolts
2 Cylindric reactor foot seat
3 Teflon pipe with screwed insert
4 Reactor foot disc
5 Reactor foot plate
6 3 screws M4x30
7 Minimum distance between reactor foot disc and reactor foot plate

Fig. 131: Side view of the Reactor Foot

8.7.18 Replace Pump Tube (Tube Cassette Pump)

Precondition: - Both fixing points are inelastic.

1. Take the pump cassettes from the pump.
2. Remove the tubes from the pump cassettes.
3. Fix the new tubes into the pump cassettes between two colour-coded stoppers.
4. Oil the tubes with a drop of silicone oil (available from LAR) at the points mounted.
5. Insert the pump cassettes into the pump.

8.7.19 Replace Pump Tube (Sample Pump)

Precondition: - Pump tube is highly contaminated or damaged.

1. Remove the tubes from the sample pump.
2. Fix a new tube having the same length into the sample pump.

8.7.20 Replace Gas Filter

Precondition: - Gas filter is contaminated.

1. Open the rear part of the housing.
2. Open the pipe clamp in the top right, in which the gas filter (**1**) is attached.
3. Pull the connection tubes (**2**) of the old filter from the connectors.
4. Note the direction of the volume flow (see black arrow).
5. Insert the new filter (**1**) and connect the connection tubes (**2**) to the connector.
6. Close the pipe clamp.
7. Close the rear part of the housing

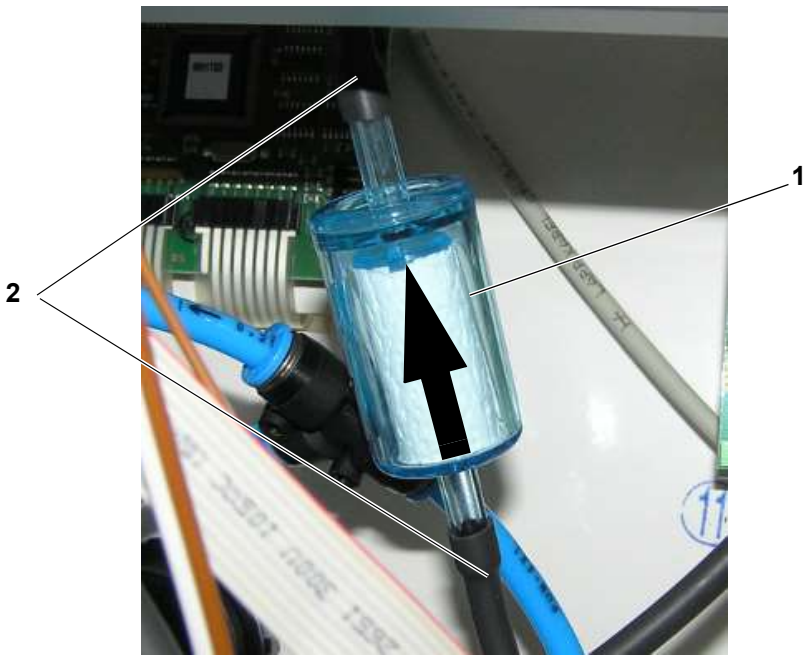


Fig. 132: Gas filter

8.8 Function Tests

Notice

A corresponding copy of the log is in Chapter 13 from page 265.

If you have any question to function test, please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 283).

After care and maintenance work, some tests should be carried out to ensure perfect functioning of the

analyser.

Use the following log for the documentation of the function tests:

Table 21: Function test protocol

Visual Inspection	Criteria	OK	Action
Analyser status	• Zero signal is between 0 - 0.1 FSR • Carrier Gas IN / OUT: approx . l/h.	☐	☐ Contact support _____ _____ _____
Tightness Test	• Carrier gas volume flow falls to < 5 l/h	☐	☐ Contact Support _____
Test Run (XY-System)	• All positions are hit by the injection needle	☐	☐ Contact Support _____
Checking the Measurement Results	• Measurement results matches the calibration standard	☐	☐ Contact Support _____
Checking the Measurement Process	• Measurement Process goes on without complications	☐	☐ Contact Support _____
Date:		Signature:	

8.8.1 Check Analyser Status

1. Check the view „Sensors“ (Chapter 7.7.5.1 on page 113), if the Zero signal lies between 0 - 0,1 FSR.
2. If the signal is not within the permitted range, contact LAR Technical Support (Chapter 15.1 on page 283).
3. Check from the “Status Screen” display (Chapter 7.5 on page 97) using the carrier gas volume flow at the carrier gas inlet and carrier gas outlet that the carrier gas is being transported through the system at a rate of approx. l/h (+/- 5 l/h) (High Salt Option 15 l/h).
4. If too high a difference is ascertained, check the individual attachments (tube connections, etc.) or please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 283).
5. Once all test criteria are met, proceed with the next step.

8.8.2 Tightness Test

1. Access the “Status Screen” display (Chapter 7.5 on page 97).
2. Set the pressure on the pressure regulator to 0.5 bar.
3. Disconnect the black viton tube at the output of the cooler with a tube clamp.
4. Check in the Status display whether the carrier gas volume flow falls to below 5 l/h.
5. If a discrepancy is ascertained, please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 283).
6. Once the test criterion is met, undo the tube clamp again, set the pressure to 1.2 bar and proceed with the next step.

8.8.3 Test Run (XY-System)

1. Perform a test run of the XY system (Chapter 7.8.3 from page 120).
2. If some of the positions are not hit properly, reposition the injection needle and repeat the test run (Chapter 7.8.3 on page 120).
3. If the situation persists as regards positions not being hit, please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 283).
4. Once the test criterion is met, proceed with the next step.

8.8.4 Checking the Measurement Results

1. Make available a standard solution (Chapter 6.2 from page 82).
2. Fill the standard solution into a clean calibration vessel.
3. Fit the calibration vessel at any position.
4. Perform a single measurement (Chapter 7.9 from page 129).
5. Check the results.
6. If the results differ, please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 283).
7. Once the test criterion is met, proceed with the next step.

8.8.5 Checking the Measurement Process

1. Start the analyser Online mode.
2. Watch the first measurement process.
3. If irregularities occur, please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 283).
4. Once the test criterion is met, finish the documentation.

8.9 Short-Time- and Long-Time Interruptions

8.9.1 Switching On/Off for Short-Time-Interruptions (<1 Week)

Switching off:

1. End measurement mode.
2. Close your sample feed.
3. Allow your sample to drain.

Switching on:

1. Open your sample feed.
2. Prepare calibration solutions (Chapter 6.2 from page 82).
3. Perform a calibration if required (Chapter 7.10 from page 133).
4. Start measurement mode.

Notice

The analyser is not switched off for short-term interruptions.

8.9.2 Switching On/Off for Long-Time Interruptions (>1 Week)

Switching off:

1. End measurement mode.
2. Close your sample feed.
3. Empty the tube system and glass components.
4. Clean the glass components if required.
5. Close the carrier gas supply.
6. Switch the analyser off.
7. Depressurise the pump tubes.

Switching on:

1. Have acid and reagent solution ready (Chapter 6.1 from page 79).
2. Open your sample feed.
3. Insert the tubes.
4. Leave the bypass mode on the control unit
5. Switch the analyser on.
6. Open the carrier gas supply.
7. Prepare calibration solutions (Chapter 6.2 from page 82).
8. Perform a calibration (Chapter 7.10 from page 133).

9. Start measurement mode.

Notice

For long-term interruptions, the pump tubes must be depressurised to prevent long-term deformation of the tube material and a reduction of delivery rate.

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
- FlowSampler®
- Overflow Sampler
- Mounting rack
- Trackball

Options:

- Multi Stream Option
- Multi Parameter Option
- Automatic Ranging
- High Salt Option
- Auto-TIC-Port (only for TOC Difference Method)
- Internal Sample Dilution

Notice

If you have any questions, contact the **distributor of LAR** (Chapter 15.1 on page 283).

9.2 Reagent Cabinet

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

- Acid
- Rinsing Water

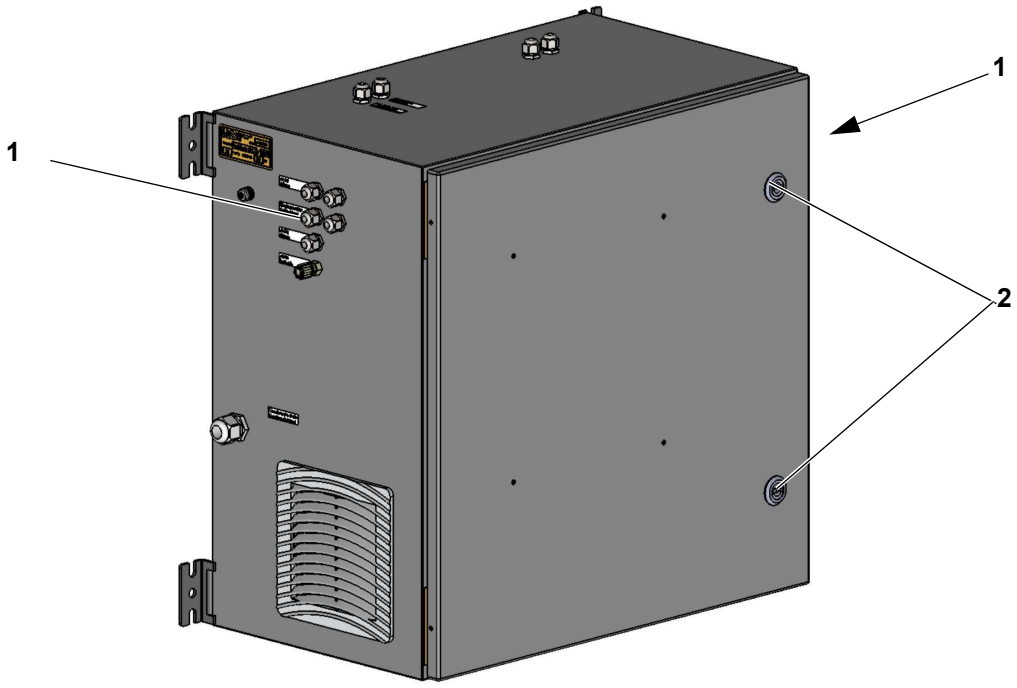
For the dimensions of the reagent cabinet, see chapter 11.3 on page 252.

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. 135: 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.

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 9.6 from page 235).

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. 136, page 208). The O-ring should be fitted about 6 cm from the end of the tube.

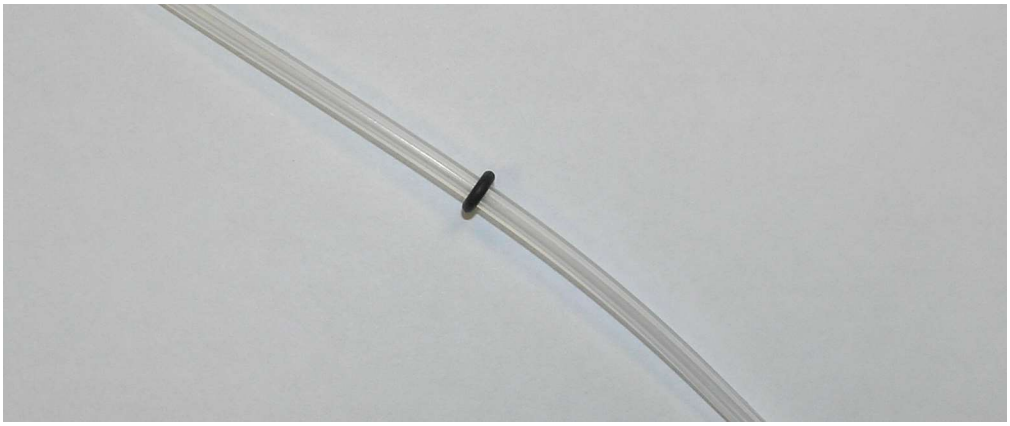


Fig. 136: Tube with O-Ring

The ambient air preparation is used to treat the ambient air, which can then be used as a carrier gas. The number of connecting hoses between analyser and ambient air preparation depends on the method. A maximum of three connecting hoses and one cable are attached:

- Connecting hose for rinsing water
- Connecting tube for carrier gas
- Connecting tube for acid
- Cable for power connection

9.2.3.1 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 in the cabinet on the right side.

9.2.3.2 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.

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 checked in the view „Sensors“ (Chapter 7.7.5.1 on page 113).

9.2.4 The carrier gas for the measurements must meet certain criteria (). Ambient air must be conditioned accordingly if used. The tubing for the Ambient Air Preparation Unit is shown below.

The installation of the air preparation unit depends on the installation variant carried out.

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

Variant 2 (wall mounting):
Mount the recirculation system with the heavy duty anchors on the wall underneath the analyzer ().
Variant 3 (mounting rack):

9.2.4.1 Use the holes Q1 and Q2 of the mounting rack and the air preparation brackets Q1 and Q2 for mounting on the LAR mounting rackThe air preparation is supplied with a bypass 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.

Proceed with the tubing of the air preparation as shown in the tubing diagram and in :

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

9.2.5 Mount hose (**D**) on the fine filter HQ14 in the recirculating air treatment ()**Care and Maintenance**

The air preparation unitFilter cartridge requires only a small amount of care and maintenance. 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 22: Visual Inspection Log (Ambient Air Preparation Unit)

Interval	Visual Inspection	Criteria	OK	Action
1 Week	Fine Filter Element	• no contamination	☐	☐ Contact Support _____ _____
3 Months	Filter Unit	• condensate drains normally	☐	☐ Contact Support _____ _____
	Soda Lime	• no discolouration (purple/violet)	☐	☐ Replace _____
	Tube Connections	• connected handtightened	☐	☐ Fix tubes _____
	Pre Pressure of the Carrier Gas	• still at 2 - 3 bar	☐	☐ Contact Support _____
Date:		Signature:		

Interval	Visual Inspection	Criteria	OK	Action
3 Months	Soda lime pellets	• no 75% discolouration (purple/violet)	☐	☐ Replacement _____
Date:		Signature:		

Table 23: Care and maintenance log

Interval	Action	Kind of Action	OK	Comment
If necces-sary	Replace soda lime pellets	Maintenance	☐	
Date:		Signature:		

Notice

A corresponding copy of the log is in Chapter 13 from page 265.

If you have any question to visual inspections, please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 283).

9.2.6 Perform Visual Inspection

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).
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.

9.2.6.1 Once all test criteria are met, proceed with the next step**Soda Lime**

1. Look at the left cartridge filled with soda lime pellets.
2. Check the white colour of the soda lime pellets.
3. If up to 75% of the soda lime pellets are discoloured (purple/violet), they must be replaced (Chapter 9.2.7.1 on page 213).
4. Once the test criterion is met, proceed with the next step.

9.2.6.2 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.

9.2.6.3 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.

9.2.7 Perform Care and Maintenance Actions (Ambient Air Preparation Unit)

Procedure for care and maintenance actions:

1. Disconnect the electrical connection of the Ambient Air Preparation Unit to the analyser for care and maintenance actions.
2. Use a care and maintenance log (Ambient Air Preparation Unit) (if necessary copy from Chapter 13.7 on page 272) for documentation.
3. Follow the instructions below for care and maintenance actions for individual components.
4. Document in the care and maintenance log the care and maintenance actions taken.
5. Conclude documentation of the log once the care and maintenance actions are performed.
6. Reconnect the electrical connection of the Ambient Air Preparation Unit to the analyser.

9.2.7.1 Replace Soda Lime

Precondition: - Soda lime is more than 75% discoloured (purple/violet).

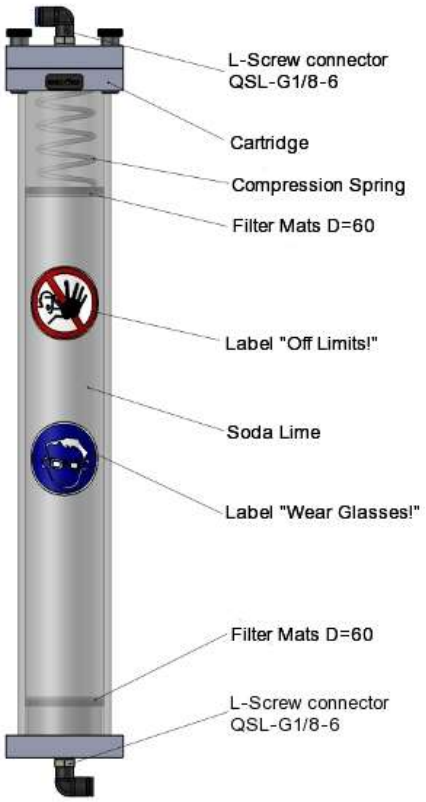


Fig. 137: Soda Lime Cartridge

1. Take the upper and lower tubes of the filter cartridge.
2. Use a screwdriver to open the pipe clamps.
3. Take the filter cartridge from the Ambient Air Preparation Unit.
4. Carefully open the filter cartridge from the top. Mind out for the spring in the filter cartridge (Fig. 137, page 213).
5. Take the cover, O-ring, filter mats, perforated disc and spring.
6. Dispose of used soda lime pellets in an environmentally responsible way.
7. Fill new soda lime pellets into the filter cartridge, leaving enough space to fit the spring.
8. Place the following components onto the soda lime pellets in this order - the filter mats, the perforated disc, the spring and the O-ring into the groove of the filter cartridge. (Fig. 137,

page 213).

9. Now fit the cover by hand and attach it using the four screws.
10. Fit the filter cartridge back into the pipe clamps.
11. Reconnect the upper and lower tubes to the filter cartridge.

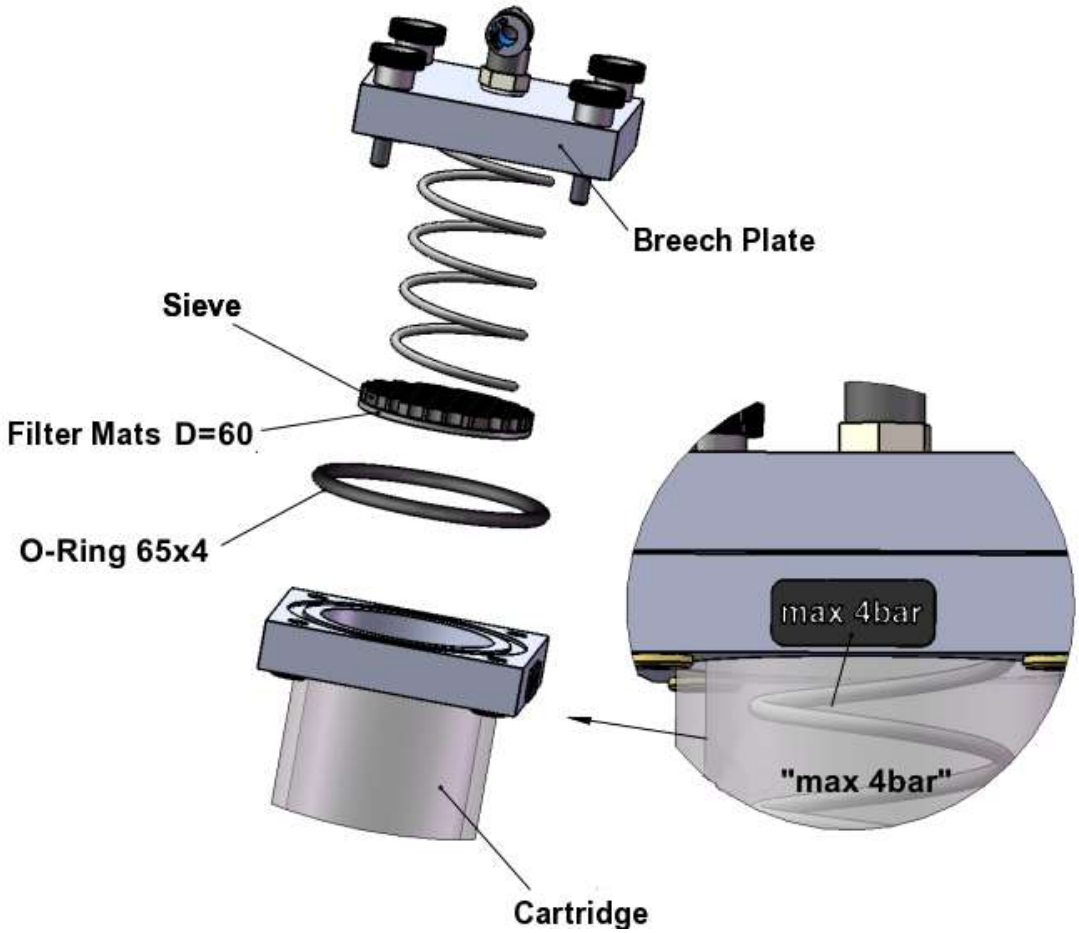


Fig. 138: Filter Cartridge (exploded assembly drawing)

9.2.7.2 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).

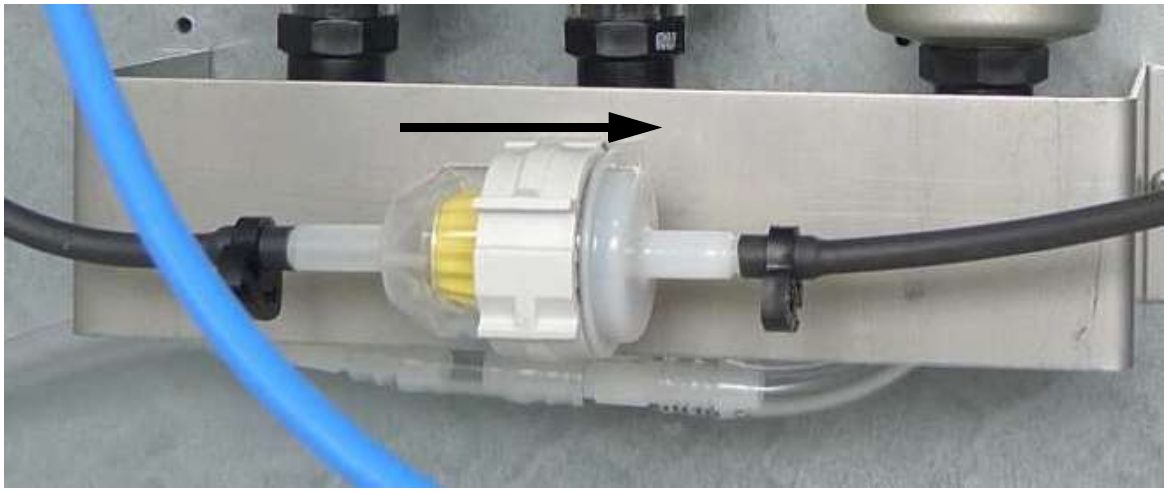


Fig. 139: Gas Filter (Ambient Air Preparation Unit)

9.2.7.3 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. 140, page 216).
2. Replace the filter mats.
3. Close the ventilation grids.

Notice

- The Ambient Air Preparation Unit has two filter mats. One on the right and one on the left side.

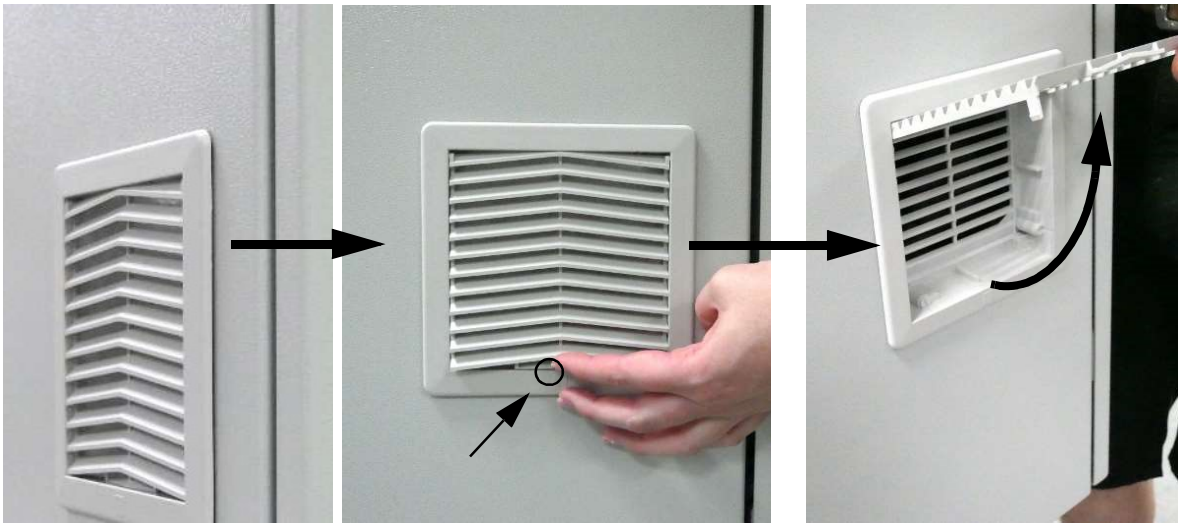


Fig. 140: Replace the Filter Mats on both sides of the Ambient Air Preparation Unit

9.2.7.4 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.

9.2.7.5 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.

9.2.7.6 Replace Activated Carbon

Recommendation: - Replace the activated carbon every 12 months.

9.3 Proceed analogously to the replacement of the soda lime in Chapter 9.2.7.1 from page 213FlowSampler®

The FlowSampler® is a sample feed, which works without filtration according to the principle of inertia separation because the sample is extracted in the centre of the sample flow in the opposite direction to the main flow of the waste water. This means all solid and heavy coarse materials (such as sand) are reliably removed. Smaller solid particles are caught, whereby the sample enters the analyser in its pure form. The FlowSampler® can also master the most difficult challenges - including sample taking at a clarification plant inlet in front of the coarse screen.

9.3.1 Variants of FlowSampler®

LAR offers two variants which differ by diameter size:

- FlowSampler® DN25
- FlowSampler® DN17

Notice

The diameter size is dependent on the realisable flow rate of the sample.
If you have any question, please contact the **Sales Departement of LAR** (Chapter 15 on page 283).

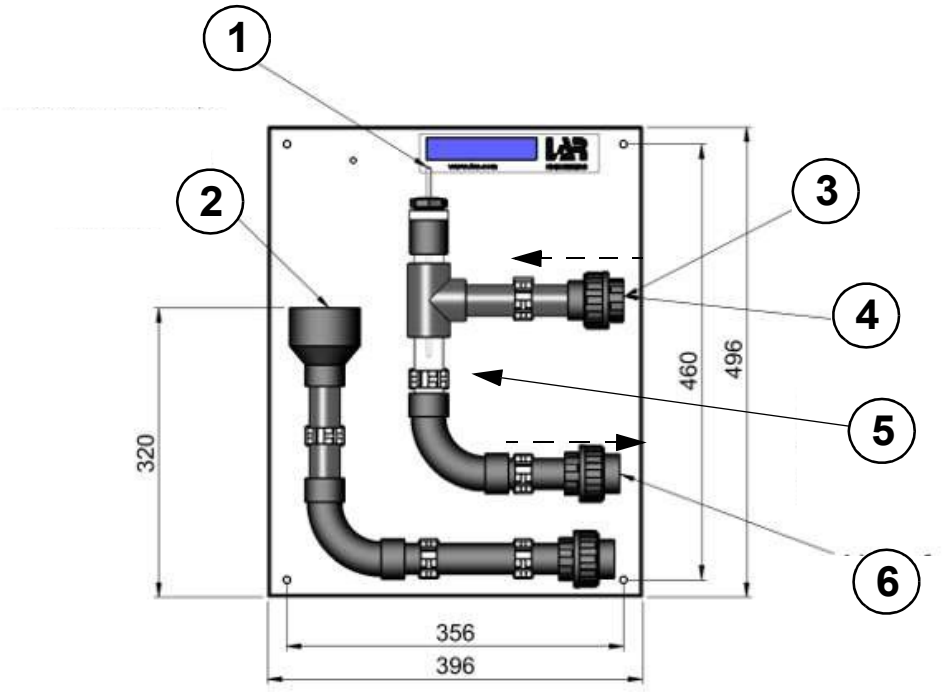
Material (depends on the temperature of the sample):

- from 00°C to 50°C: Polyvinylchloride (PVC)
- from 50°C to 90°C: Polypropylene (PP)

Number of sample streams:

- The FlowSampler® can be used for a maximum of six sample streams.

9.3.2 FlowSampler® DN25

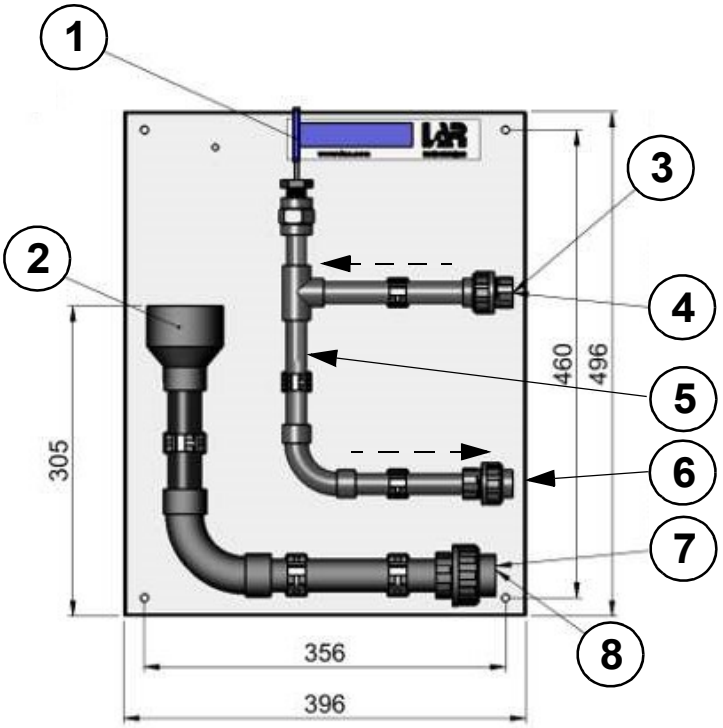


1 Sampling Pipe (Needle)
2 Analyser Outlet (depressurized)
3 Tube fitting (DN25)
4 Sample Inlet
5 Window
6 Sample Outlet (DN25)

Fig. 141: FlowSampler® DN25

- Tube fitting (Sample Inlet and Outlet): DA = 32 mm
- Tube fitting (Analyser Outlet): DA = 32 mm
- Required Flow: 1.0 - 3.0 m^3/h
- Sample backpressure on Outlet: depressurized (max. < 0.2 bar)

9.3.3 FlowSampler® DN17



1 Sampling Pipe (Needle)
2 Analyser Outlet In (depressurized)
3 Tube fitting (DA=20 mm)
4 Sample Inlet
5 Window
6 Sample Outlet (DA=20 mm)
7 Tube fitting (DA=32 mm)
8 Analyser Outlet Out

Fig. 142: FlowSampler® DN17

- Tube fitting (Sample Inlet and Outlet): DA = 20 mm
- Tube fitting (Analyser Outlet): DA = 32 mm
- Required Flow: 0.3 - 1.5 m^3/h
- Sample backpressure on Outlet: depressurized (max. < 0.2 bar)

9.3.4 Installation of the FlowSampler®

Ideally, LAR's FlowSampler® should be mounted immediately to the right of the analyser (e.g. on the wall). So that the analyser drain inlet is at least 30 cm beneath the analyser.

The sample can be pumped for example with an immersion pump provided by the user. Depending on the sample composition a cutting unit may be required. The immersion pump must ensure the required flow rate of the FlowSampler® regarding to the distance.

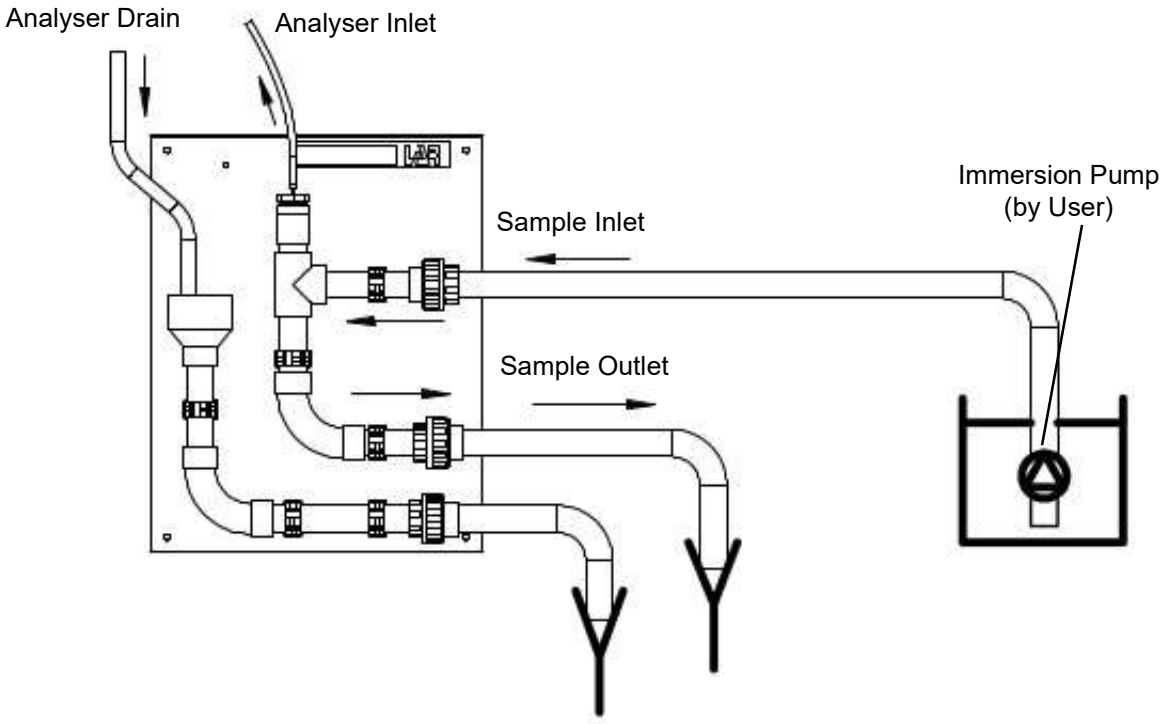


Fig. 143: Installation of the FlowSampler®

Warning

The drain should be at least 30 cm beneath the analyser.

At the sampling pipe (needle) the sample must not be pressed out. Ideally, air should be sucked into the FlowSampler® through the sampling pipe.

9.3.5 Start-Up of the FlowSampler®

1. Establish all connections to the analyser and sample.
2. Open the sample feed.

9.3.6 Care and Maintenance Actions (FlowSampler®)

Only minor effort is required to service and maintain the FlowSampler®. This section shows the best way to look after your FlowSampler® 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 249).

Table 24: Visual Inspection Log (FlowSampler®)

Interval	Visual Inspection	Criteria	OK	Action
1 Week	Flow	• Transport of Liquids	☐	☐ Contact Support _____ _____
3 Months	Sampling Pipe (Needle)	• no contamination	☐	☐ Cleaning necessary _____ _____
Date:		Signature:		

Table 25: Care and Maintenance Log (FlowSampler®)

Interval	Action	Kind of Action	OK	Comment
If necessary	Clean Sampling Pipe (Needle)	Care	☐	
3 Months	Clean FlowSampler®	Care	☐	
Date:		Signature:		

Notice

A corresponding copy of the log is in Chapter 13 from page 265.

If you have any question, please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 283).

9.3.7 Perform Visual Inspections (FlowSampler®)

Procedure for visual inspections:

1. Use a visual inspection log (FlowSampler®) (Chapter 13.8 on page 273) 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 (FlowSampler®).
4. After the check and any care and/or maintenance actions, conclude the documentation of the log(s).

9.3.7.1 Flow

1. Look through the window to check if a steady, continuous liquid flow can be seen (**5**, Fig. 141, page 219 or **5**, Fig. 142, page 220).
2. Once the test criterion is met, proceed with the next step.

9.3.7.2 Sampling Pipe (Needle)

1. Check the cleanliness of the sampling pipe (needle) of the FlowSampler®.
2. Once the test criterion is met, proceed with the next step.

9.3.8 Perform Care and Maintenance Actions (FlowSampler®)

Procedure for care and maintenance actions:

1. Stop the Measurement Mode of the analyser with the Offline-Button.
2. Close the sample inlet.
3. Disconnect all connections of the FlowSampler®.
4. Use a care and maintenance log (FlowSampler®) (if necessary copy from Chapter 13.9 on page 274) for documentation.
5. Follow the instructions below for care and maintenance actions for individual components.
6. Document in the care and maintenance log the care and maintenance actions taken.
7. Conclude documentation of the log once the care and maintenance actions are performed.
8. Reconnect all connections of the FlowSampler®.
9. Open the sample inlet.
10. Start the Measurement Mode of the analyser with the Online-Button.

9.3.8.1 Clean Sampling Pipe (Needle)

Precondition: - Sampling pipe (needle) is contaminated.

1. Detach the sampling pipe (needle) with a spanner.
2. Clean the sampling pipe (needle).
3. Fit the sampling pipe (needle).

9.3.8.2 Clean FlowSampler®

Recommendation: - Clean the FlowSampler® every 3 months

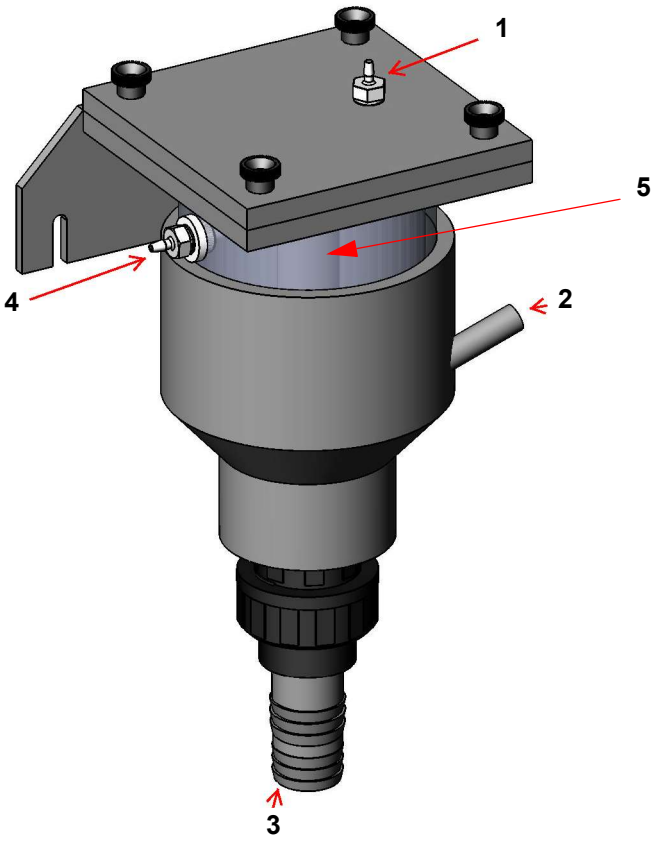
1. Clean the FlowSampler® thoroughly.
2. Clean the sample pipe with a pipe cleaner.
3. Replace the tube to the analyser if necessary.

9.4 Overflow Sampler

The overflow sampler system is a sample supply for clear or slightly contaminated waters, in which the sample is kept homogeneous by a special feeder. The swirling of the sample reduces heavy soiling and debris within the container.

The sample storage system consists of a sturdy container with wall mounting and a removable lid.

9.4.1 Construction of the Overflow Sampler



1 Vent
2 Inlet
3 Drain
4 Sample outlet for analyser
5 Overflow drain

Abb. 144: Overflow sampler

9.4.2 Connections

- Sample inlet connection for hose ID 8mm / OD 12mm
- Sample drain (free drain) - hose nozzle DN25 / 32 mm
- Sample outlet for analyser with 4x1 PVC or 3.2 * 1.6 mm Prene or silicone hose

9.4.3 Set-Up

1. Install the LAR overflow sampler on the wall immediately to the right of the analyser. In this case, the overflow sampler should be mounted so that the sample inlet of the analyser is approximately at the same level as the sample outlet (4, Fig. 144, page 225) of the overflow sampler.
2. Set the sample purging time in the software under "Service actions" (see Chapter 7.8.2 from page 118) in the menu item "Rinse sample tubes" to a minimum rinse time of 30 seconds.

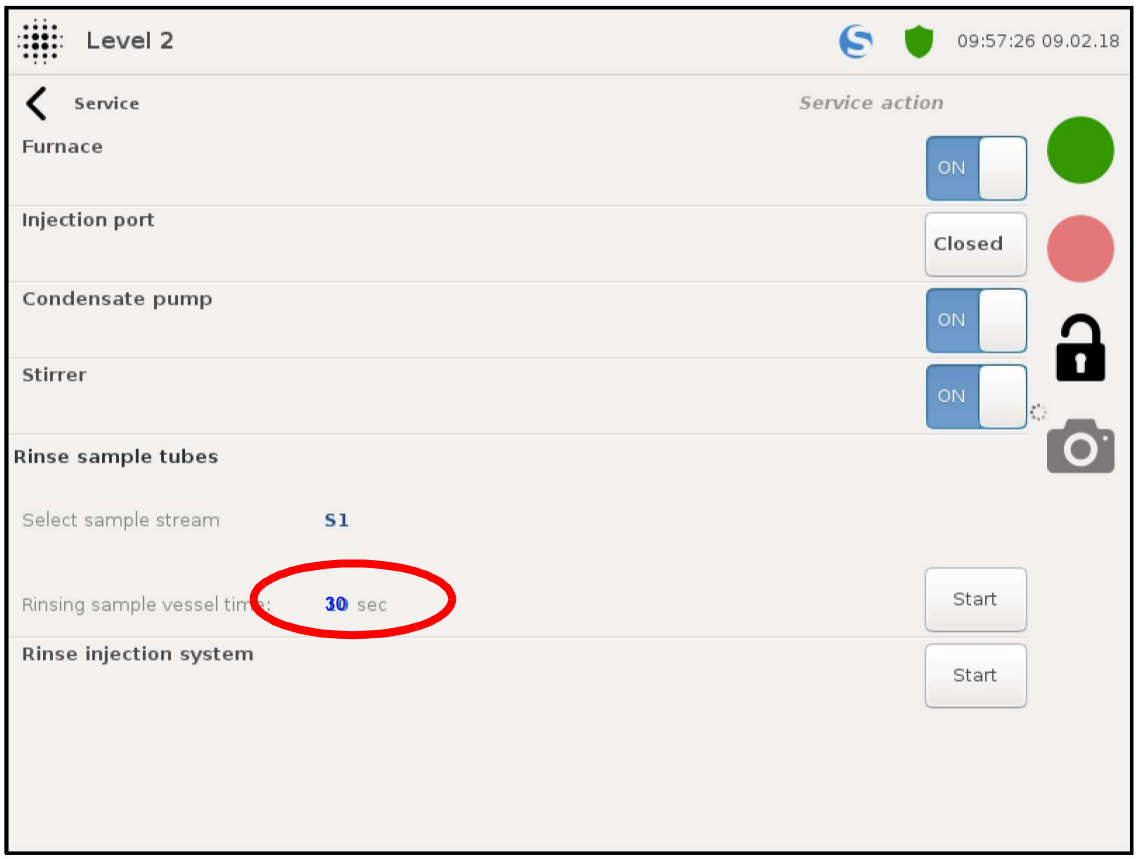


Abb. 145: Setting the purge time

1. Connect the inlet (**2**) with the sample tube.
2. Connect the sample outlet (**4**) of the overflow sampler with the sample inlet of the analyser.
3. Open the sample supply.

9.4.4 Care and Maintenance (Overflow Sampler)

The overflow sampler requires only little care and maintenance. This chapter will show you how to best maintain your overflow sampler to ensure proper operation. The documentation of the care and maintenance measures is a prerequisite for any warranty and warranty claims and a valuable help in finding a solution in the event of a malfunction (Chapter 10 from page 249).

*Table 26: Protocol for visual inspection (*overflow sampler)

Interval	Visual Inspection	Criteria	OK	Action
Weekly	Check sample flow	• Transport of liquids	☐	☐ Contact support _____ _____
Date:		Signature:		

Table 27: Care and maintenance protocol (overflow sampler)

Interval	Action	Type of Action	OK	Notes
If necessary	Clean overflow sampler	Care	☐	
Date:		Signature:		

Notice

A copy of this protocol can be found in Chapter 13.10 on page 275.

For any questions regarding visual inspection, care and maintenance please contact the LAR technical support (Chapter 15.1 on page 283).

9.4.5 Perform Visual Inspection (Overflow Sampler)

Procedure of the Visual Inspection:

1. Obtain a protocol for visual inspection (overflow sampler) (copy from chapter 13.9 on page 289, if necessary).
2. Follow the instructions below for visual inspections for each component.
3. Carry out care or maintenance measures if the test criteria have not been met to and document them in the care and maintenance log (overflow sampler).
4. After inspection and any maintenance and service procedures (overflow sampler), complete the documentation of the protocol (s).

9.4.5.1 Flow

Check at the see-through area of the lid of the overflow sampler if the sample flows in and out correctly.

9.4.6 Perform Care and Maintenance (Overflow Sampler)

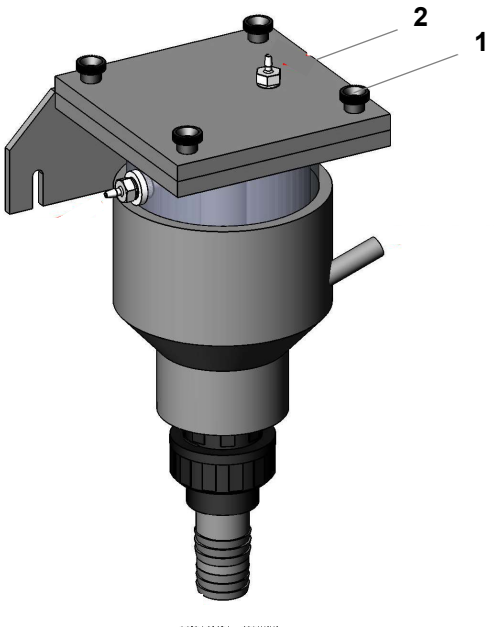
Procedure for Care and Maintenance Measures:

1. Stop measuring operation of the analyser via the offline button.
2. Close the sample feed.
3. Disconnect all connections of the overflow sampler
4. Obtain a care and maintenance protocol (sample storage vessel) (copy from chapter 13.8 on page 289 if necessary).
5. Follow the instructions below for the care and maintenance for the component.
6. Document the actions taken in the care and maintenance log.
7. After the inspection and the care and maintenance, complete the documentation of the logs.
8. Restore all connections of the overflow sampler.
9. Open the sample feed.
10. Start measuring operation of the analyser via the online button.

9.4.6.1 Clean Overflow Sampler

Precondition: - Overflow sampler is contaminated.

1. Loosen the four knurled screws (**1**).
2. Remove the cover (**2**).
3. Pull off the overflow plug. The contents of the overflow sampler are draining downwards.



1 Knurled screws
2 Lid

Abb. 146: Clean overflow sampler

3. Clean the overflow sampler thoroughly with water.
4. Insert the overflow plug back into the drain opening.
5. Attach the lid (**2**) with the four knurled screws (**1**).

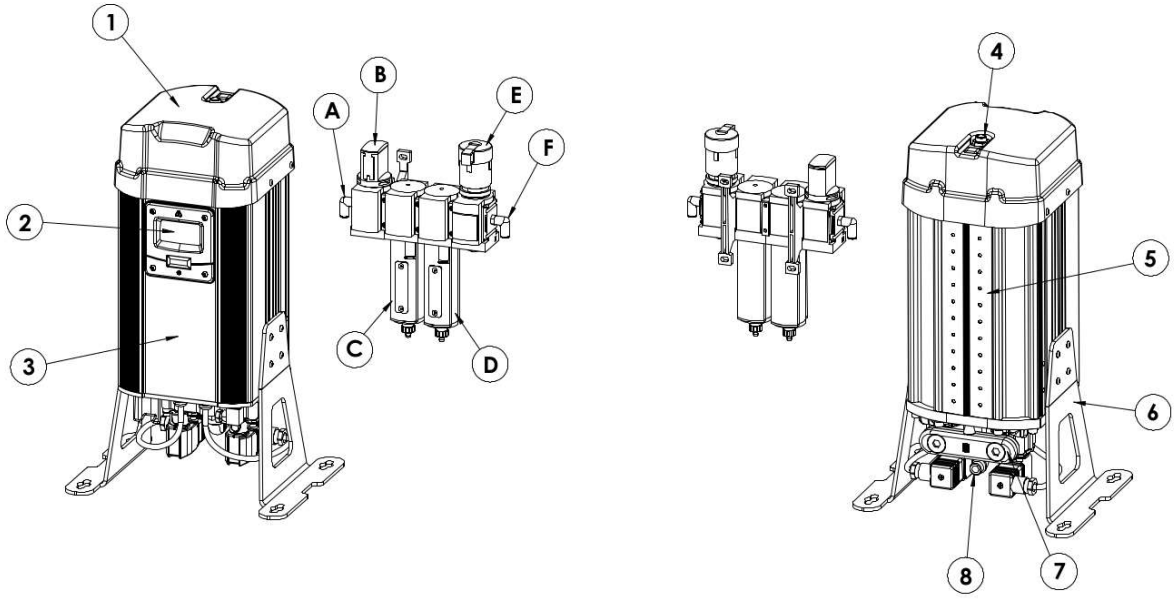
9.5 CO_2-Remover

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.

9.5.1 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.

9.5.2 Construction of the CO_2-Remover



No.	Description
1	Top cover
2	Controller display
3	Front cover
4	Air outlet
5	Silencer stripes
6	Pedestal
7	Silencer box
8	Air inlet

No.	Description
A	Filter and pressure regulator unit inlet
B	Manual on/off valve
C	Fine filter 0.1 µm
D	Fine filter 0.01 µm
E	Pressure regulator 4 bar (58 psi)
F	Filter and pressure regulator unit outlet

Fig. 147: Construction of the CO_2-Remover

9.5.3 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.

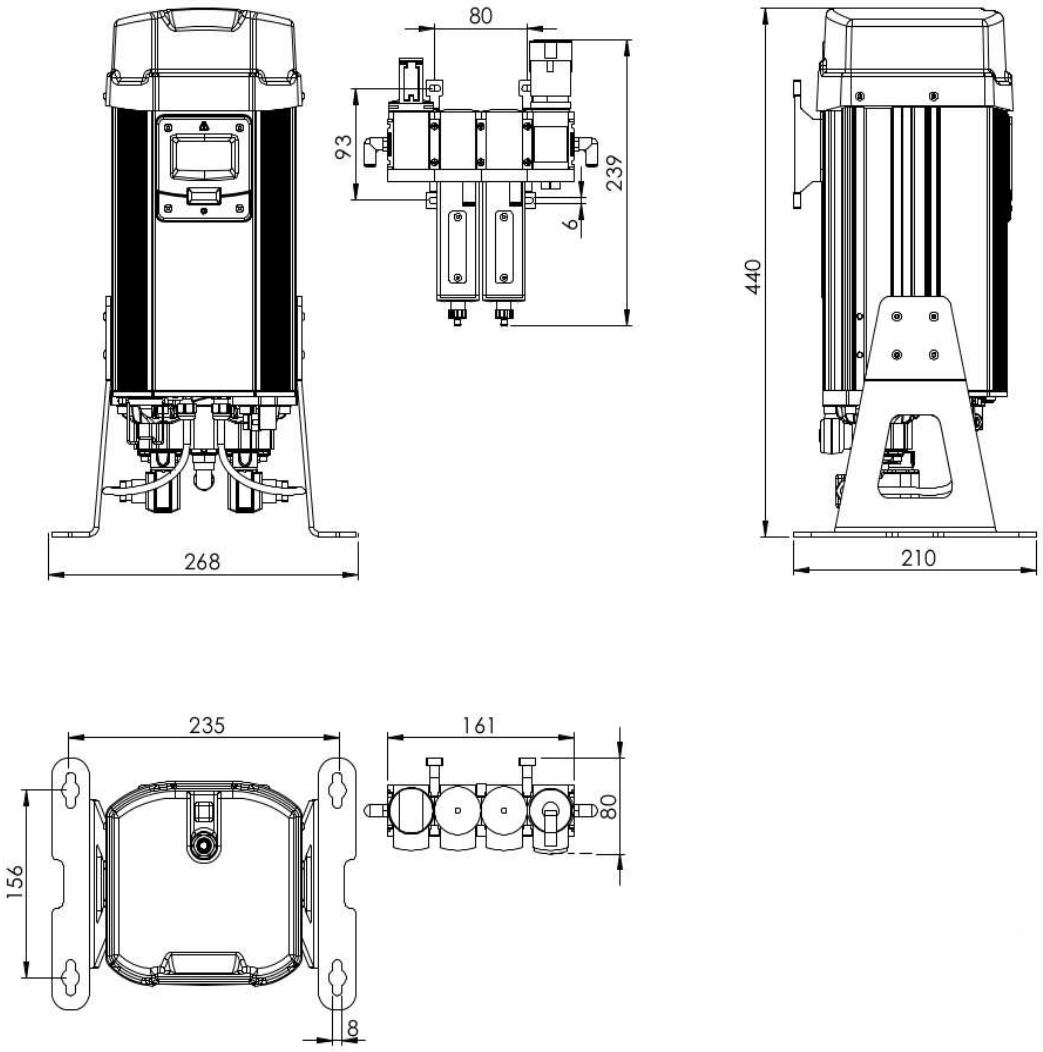


Fig. 148: Dimensions of the CO_2-Remover

9.5.4 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.

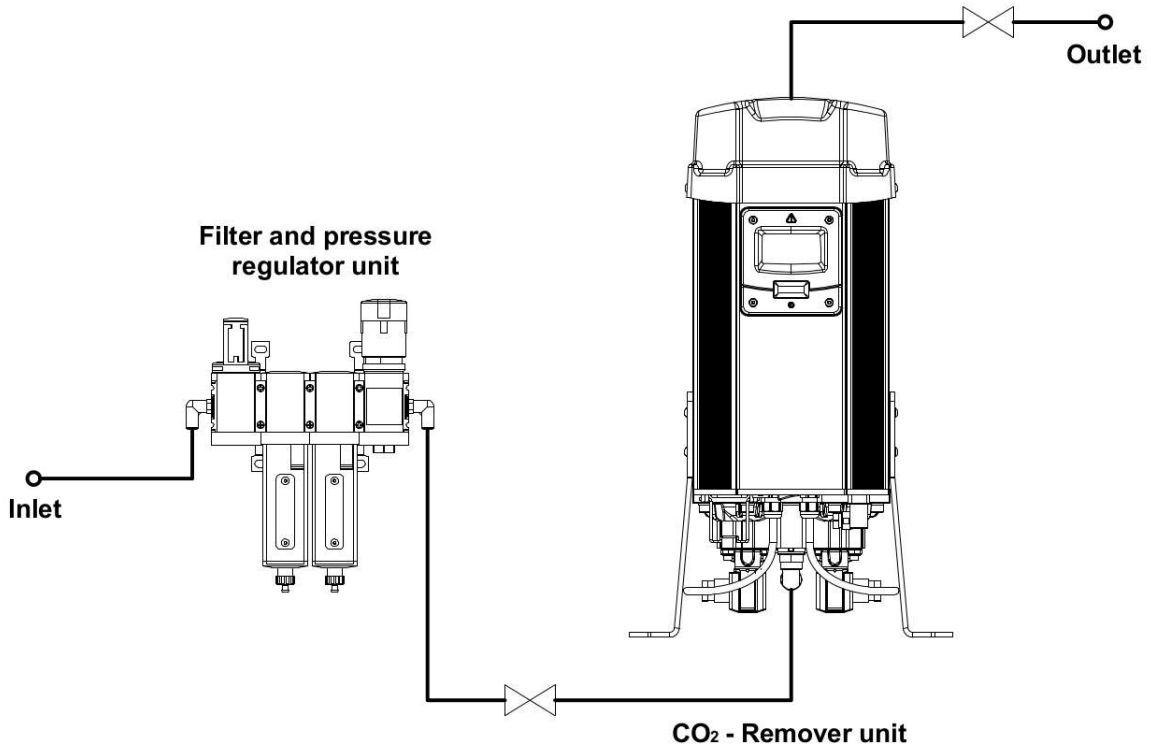


Fig. 149: Start-Up of the CO_2-Remover

1. Connect all pipelines as shown in Fig. 149, page 232 to the CO_2-Remover.
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.

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

9.5.5 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 249).

Table 28: Visual Inspection Log (CO_2-Remover)

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

Table 29: 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 265.

If you have any question, please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 283).

9.5.6 Perform Visual Inspections (CO_2-Remover)

Procedure for visual inspections:

1. Use a visual inspection log (CO_2-Remover) (Chapter 13.11 on page 276) 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).

9.5.6.1 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

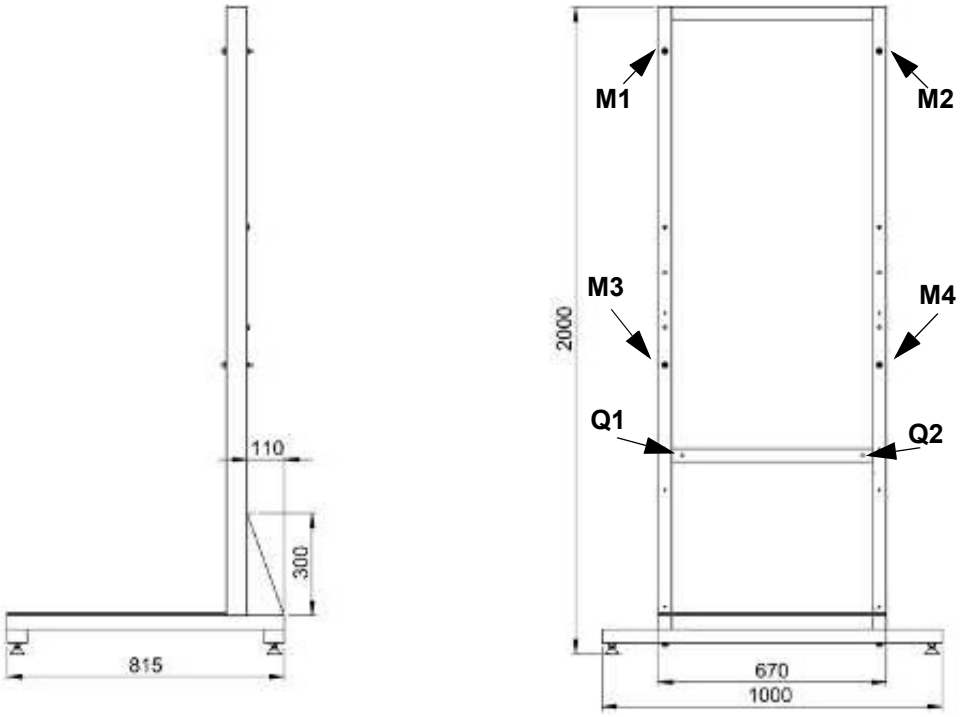
Do not clean the CO_2-Remover with abrasives or solvents. Use only a mild detergents.

9.5.6.2 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 283).
3. Once the test criterion is met, proceed with the next step.

9.6 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. 150: 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.

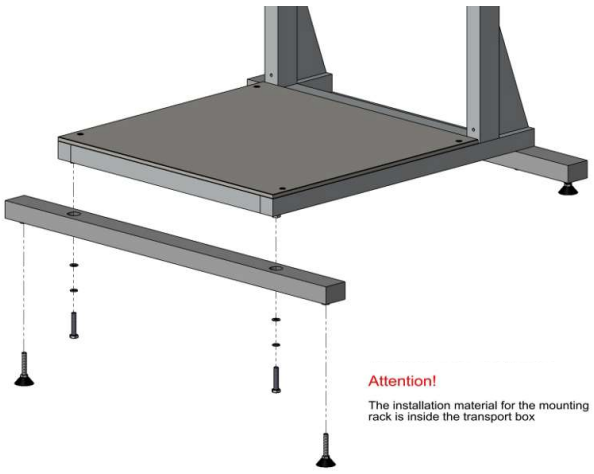


Fig. 151: Mounting of the LAR Mounting Rack

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.

9.7 Trackball

.

9.8 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 (Chapter 7.8.3 from page 120). 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.

9.9 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 283).

9.10 High Salt Option

In contrast to many other analysers the QuickTOC®$_{ultra}$ can also work with salt loads up to 10 g/l without problem, even up to 300 g/l cooking salt (NaCl) with the high salt option available additionally. This means that the sample needs not be diluted, not even for the highest salt concentrations. This in turn has a positive effect on the accuracy of measurement results.

When fitting the high salt option, you have instead of a standard reactor foot a high salt reactor foot - which can be screwed off and is used for quick removal of salt residues. Also, the analyser has instead of a standard reactor pipe a high salt reactor pipe which has a larger taper so that the salt residues do not block the reactor pipe.

Notice

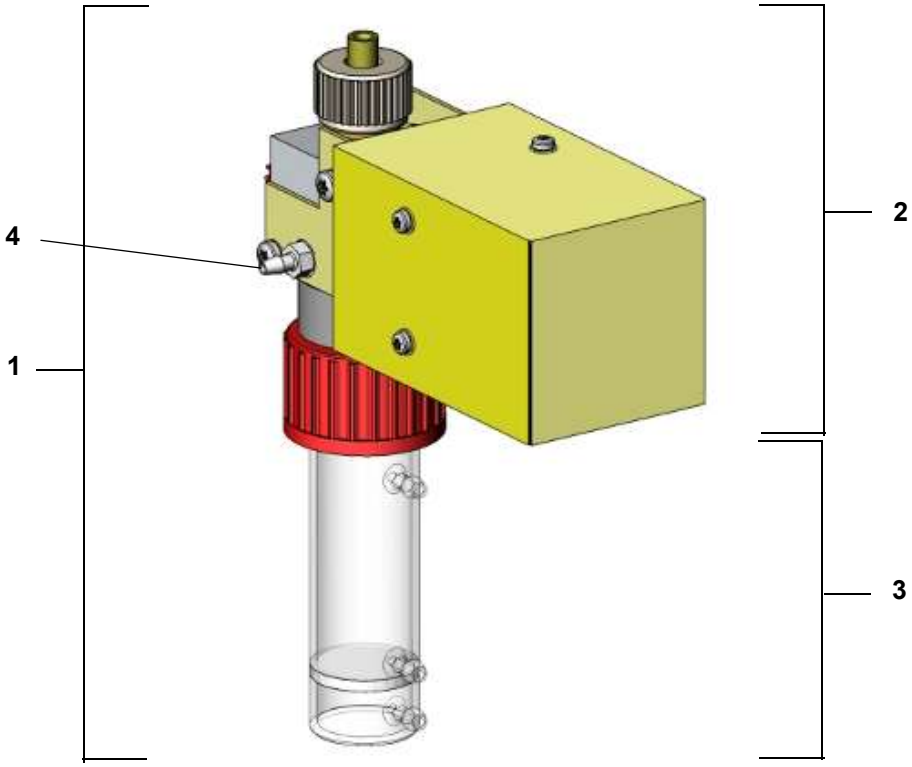
If you have any question, please contact the **Sales Department of LAR** (Chapter 15 on page 283).

9.11 Auto-TIC-Port

An Auto-TIC-Port considerably reduces the efforts for care and maintenance work of the analyser. The injection by the Auto-TIC-Port is effected automatically by a mechanical motor which can open and close the injection channel (similiar to the injection port on the furnace head).

The benefits here are increased level of sealing which will result in increased measurement accuracy and less maintenance.
.

9.11.1 Construction of the TIC Reactor with Auto-TIC-Port



1 TIC reactor with Auto-TIC-Port
2 Auto-TIC-Port
3 TIC stripping vessel
4 Tube connections

Fig. 152: TIC Reactor with Auto-TIC-Port

9.11.2 Start-Up of the TIC Reactor with Auto-TIC-Port

If ordered, the TIC reactor with Auto-TIC-Port is delivered with the analyser preconfigured by the manufacturer.

Notice

If you want to add this option to an existing analyser, please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 283).

9.11.3 Care and Maintenance Actions (Auto-TIC-Port)

Only minor effort is required to service and maintain the Auto-TIC-Port. This section shows the best way to look after your Auto-TIC-Port 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 249).

Table 30: Visual Inspection Log (Auto-TIC-Port)

Interval	Visual Inspection	Criteria	OK	Action
6 Months	Micro-switch on Auto-TIC-Port	• Ease of movement of the closing and opening function • Observance of the minimum distance	☐	☐ Contact support _____ _____
Date:		Signature:		

Table 31: Care and Maintenance Log (Auto-TIC-Port)

Interval	Action	Kind of Action	OK	Comment
1 Month	Replace needle guide seal	Maintenance	☐	
	Clean needle guide	Care	☐	
3 Months	Clean and oil the Auto-TIC-Port	Care	☐	
Date:		Signature:		

Notice

A corresponding copy of the log is in Chapter 13 from page 265.

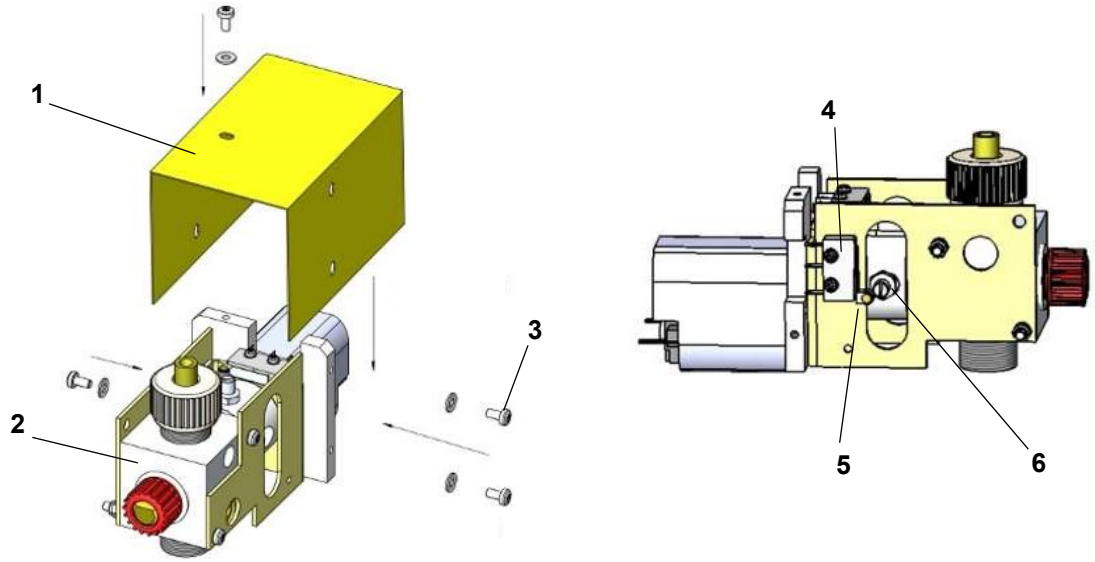
If you have any question to visual inspections, please contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 283).

9.11.4 Perform Visual Inspections (Auto-TIC-Port)

Procedure for visual inspections:

1. Use a visual inspection log (Auto-TIC-Port) (Chapter 13.13 on page 278) 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 observed, and document them in the care and/or maintenance log (Auto-TIC-Port).
4. After the check and any care and/or maintenance actions, conclude the documentation of the log(s).

9.11.4.1 Microswitch on Auto-TIC-Port (6 Months)



1 Cover Cap
2 Injection Valve
3 4x Screws M3x6, 4x Washers M3
4 Micro-switch housing
5 Switch lever of micro-switch
6 Switch knob on valve cock plug

Fig. 153: Injection valve

1. Stop the Measruement Mode of the Analyser with the Oflline-Button.
2. Undo the two Torx screws (No. 3 in Fig. 153, page 243) with spring washers on the cover cap.
3. Pull the cover cap upwards.
4. Access the “Service actions” display.
5. Close and open the injection port to test the ease of movement of the closing and opening functions for the injection port (rotation test).

Notice

Closing and opening effects rotation of the valve cock plug.

There is a switch knob on the valve cock plug (No. 6 in Fig. 153, page 243). When the valve is closed, the valve cock plug turns until the switch knob on the next switch lever of a micro-switch triggers the switch process and ends rotation of the valve.

6. When turning the valve cock plug, check that the switch levers of the micro-switch are not pressed down onto the micro-switch housing by the switch knob of the valve cock plug.
7. Ensure that a minimum distance of 1 mm between the switch levers of the micro-switches and the respective micro-switch housing is not dropping below.
8. If the test criteria are not met, please contact **your local partner** or the **Technical Support of LAR**

(Chapter 15 on page 283).

Warning

Keep away fingers from the switch area when the valve switches (as there is a crushing risk).

9. Once all test criteria are met, screw on the cover cap of the Auto-TIC-Port.

9.11.5 Perform Care and Maintenance Actions (Auto-TIC-Port)

Procedure for care and maintenance actions:

1. Stop the Measurement Mode of the analyser with the Offline-Button.
2. Take a care and maintenance log (Auto-TIC-Port) (if necessary copy from Chapter 13.14 on page 279).
3. Follow the instructions below for care and maintenance actions for individual components.
4. Document in the care and maintenance log the care and maintenance actions taken.
5. Conclude documentation of the log once the care and maintenance actions are performed.
6. Start the Measurement Mode of the analyser with the Online-Button.

9.11.5.1 Replace Needle Guide Seal (Auto-TIC-Port) (1 Month)

Recommendation: - Replace needle guide seal (Auto-TIC-Port) every month.

1. Unscrew the union nut of the Auto-TIC-Port (Fig. 154, page 245).
2. Lift the top part of the needle guide and remove the old needle guide seal (Fig. 154, page 245).
3. Insert the new needle guide seal into the clean groove.
4. Place the top part of the needle guide onto the lower part of the needle guide.
5. Tighten the union nut again.

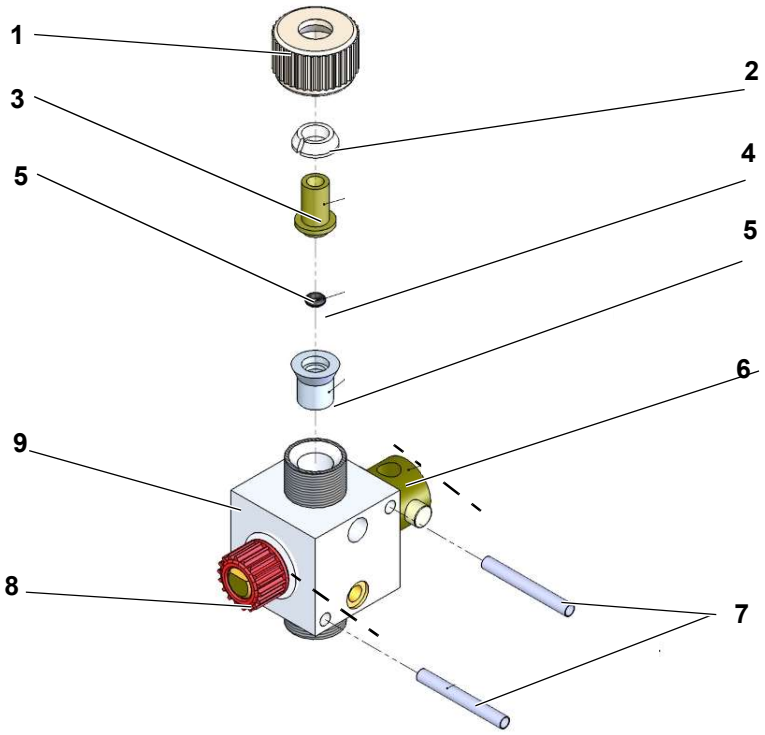
Caution

Do not remove the needle guide seal with a screwdriver or other sharp object because this could scratch the groove, thereby causing leaks. Instead, use a soft object like a wooden toothpick or pencil to lever out the seal.

9.11.5.2 Clean Needle Guide (Auto-TIC-Port) (1 Month)

Recommendation: - Clean the needle guide every month.

1. Detach the Auto-TIC-Port from the TIC stripping vessel.
2. Unscrew the cover cap.
3. Unscrew the union nut and the attachment of the needle guides (**1**, **2**).
4. Use a moist paper towel and rinsing water (Chapter 6.1.2 on page 79) to clean the needle guides and all individual parts.
5. If the level of contamination is high, first clean the needle guides mechanically and then in a bath (with 1% phosphoric acid).
6. After the cleaning process, refit all individual parts for the complete injection port.
7. Screw the needle guides and union nut back onto the Auto-TIC-Port.
8. Fix the cover cap (handtightened).
9. Check the position. If necessary adjust (Auto-TIC-Port should point to the front left at angle).
10. Perform a test run (Chapter 7.8.3 from page 120).



1 Union Nut
2 Attachment for upper needle guide
3 Upper needle guide
4 Needle guide seal
5 Lower needle guide
6 Cock plug
7 Spacer sleeves
8 Union nut for cock plug
9 Injection valve (Auto-TIC-Port)

Fig. 154: Injection valve (Auto-TIC-Port)

9.11.6 Clean and oil Auto-TIC-Port (3 Months)

Recommendation: - Clean and oil the Auto-TIC-Port every 3 months.

1. Unscrew the Auto-TIC-Port from the TIC stripping vessel.
2. Unscrew the cover cap to access the cock plug.
3. Undo the two screws of the attachment between motor and injection valve carefully (because there is a spring between the motor and cock plug).
4. Take the motor. The injection valve is now free.
5. Unscrew the union nut (red screw joint) of the cock plug.
6. Moisten a lint-free paper or cleaning cloth (you can use a pipe cleaner for openings).
7. Thoroughly clean the surface of the injection valve and cock plug.
8. Apply a very thin layer of oil to the front and rear areas of the cock plug.
9. Now push the cock plug back into the opening of the injection valve.
10. Turn it inside the injection valve for good distribution of the oil.
11. Fit the washer in front of the cock plug seal and the union nut (No. 6 and No. 8 in Fig. 154, page 245) when the cock plug is in the injection valve.
12. Screw the complete injection valve onto the Auto-TIC-Port.
13. Secure the two M3x45 screws to attach the injection valve.
14. Fit the cover cap (tighten by hand).

Fig. 155: Clean valve

Fig. 156: Apply a thin layer of oil on the cock

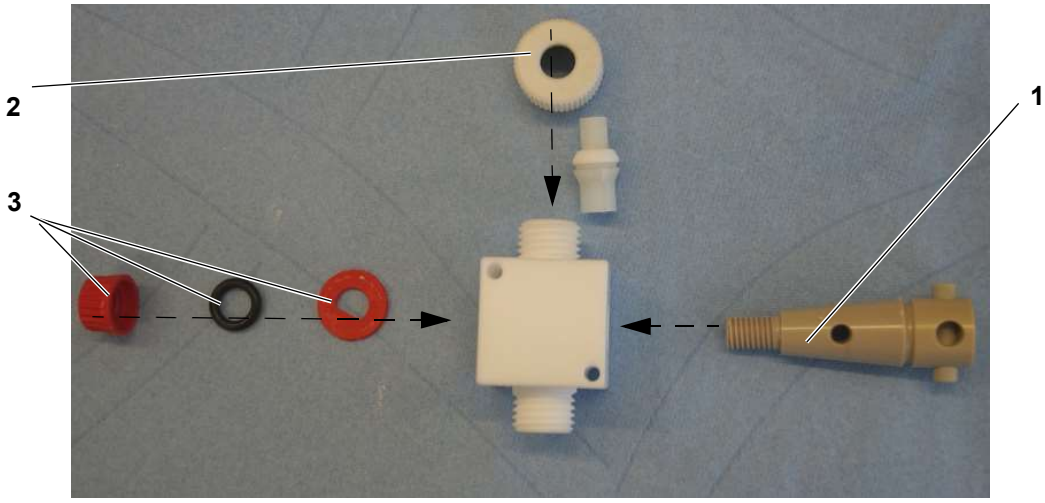


Fig. 157: Three steps for assembling

9.12 Internal Sample Dilution

Complex sample matrices and/or very high salt concentrations can have a strong impact on the sample properties and the system, and/or seriously load individual components - something which can entail higher maintenance effort. The “Internal sample dilution” option can be of assistance in these cases. Here the sample is diluted with deionised water at an adjustable ratio. If ordered, the internal sample dilution will be factory-preconfigured in the analyser.

Notice

- With „Internal Sample Dilution“ the position for vessel V6 is used for the sample dilution vessel. The pump GP7 transports the deionised water in this vessel. Another position (Vx) is occupied with the rinsing vessel. Thus, when using this option a maximum of 4 sample streams will be measured/are realized in the analyser.

9.12.1 Software Settings for the Internal Sample Dilution

The setting for the internal sample dilution can be configured in the “Measurement Parameters” display (Chapter 7.7.1 on page 101) with User Level 3.

Notice

For appearance of this option in the software, it must be activated by LAR or an authorized partner.

Users wanting to use the functions on User level 3 must have undergone training beforehand at LAR. If you are interested in technical training, please contact the **Technical Support of LAR** (Chapter 15 on page 283).

Fig. 158: Measurement Parameters - Internal Sample Dilution (Example)

Dilution factor (only Level 3):
This factor can be set from 1:5, 1:10, 1:15, 1:20 by the user. If one of the settings is changed, a new calibration must be carried out.

Fill time of the dilution vessel (only Level 3):
This parameter shows how long the pump is active in order to pump sufficient distilled water into the dilution vessel. This parameter can only be viewed.

Dilution time (only Level 3):
Afte the sample has been injected into the sample dilution vessel, the dilution (mixing the sample and water) will start. After this the sample is taken from the vessel. This parameter can only be viewed.

9.12.2 Flow Diagram with Internal Sample Dilution

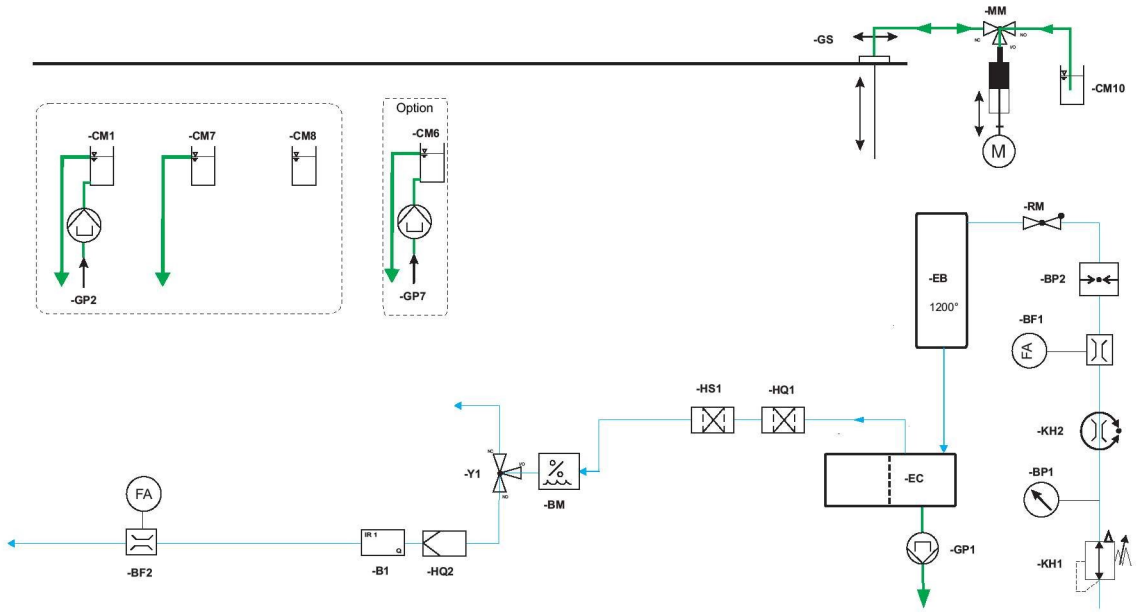


Fig. 159: Flow Diagram with Internal Sample Dilution (TConly Method - 1 Sample Stream)

Notice

The care and maintenance of the internal dilution option includes the visual inspection of the glass components (Chapter 8.3.5 from page 166), the cleaning of the glass components (Chapter 8.5.2 from page 172) as well as the replacement of the silicone seals for glass components (Chapter 8.7.17 on page 196).

Note that for the dilution vessel special silicone seals are used.

If you are interested to upgrade your analyser with this option, please contact the **Sales Department of LAR** (Chapter 15 on page 283).

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 283). 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 283).

Table 32: Troubleshooting

Problem	Possible cause	Actions
Analyser does not start after connecting the power supply plug and switching the main switch to „ON“	• No voltage • No power	• Check the fuses (Chapter 10.3 on page 251). • Switch on if necessary.
Software does not start/ Screen is black	• Main siwitch off • Blown fuse(s)	• Switch on the analyser using the main switch on the left side of the analyser. • Check the fuses (Chapter 10.3 on page 251).
Cooler temperature is too low or high	• Ambient temperature is too low or high • Cooler fuses are blown • Cooler is out of order	• Ensure the ambient temperature is between 5 °C - 35 °C. • Replace the fuses • Contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 283)
Furnace temperature is too low or high	• Furnace fuse is blown • Connecting cable is defective • Furnace is defective	• Switch on the fuses • Check the connections • Contact **your local partner** or the **Technical Support of LAR** (v)
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 283)
Calibration values are not plausible	• Calibration standard empty or prepared false	• Produce a new calibration standard • Perform a new calibration
Measurement values sway strongly	• Sample vessels are contaminated • High particle density • Bubbles in the injection system • System leaky	• Clean sample vessels • Check injection system (glass syringe) • Check tightness and rectify leaks
Measurement cannot start	• Temperature of cooler or furnace is not in the allowed range • Analyser is in maintenance mode	• Check the temperature of the cooler and the furnace
Error E1810 is shown	• Emergency shutdown of the furnace • Error in the position of the injection system	• Contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 283) immediately!

Table 32: Troubleshooting

Problem	Possible cause	Actions
Needle is dripping	• Injection system leaky	• Check the tubing of the injection system. • Contact **your local partner** or the **Technical Support of LAR** (Chapter 15 on page 283)
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 7.8.3 from page 120).

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. 25, page 36). If a fuse has blown, tilt the lever back up to its original position.

Table 33: Check the Fuses

Fuses	115 V AC Power Supply	230 V AC Power Supply
Analyser (F1)	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 283).

10.4 Breakdowns of the Temperature Regulators

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 283).

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 34: 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. • If the temperature regulator is still inactive after the thermocouple is replaced, go to display “Service actions” (Chapter 7.8.2 on page 118) and activate „furnace“.

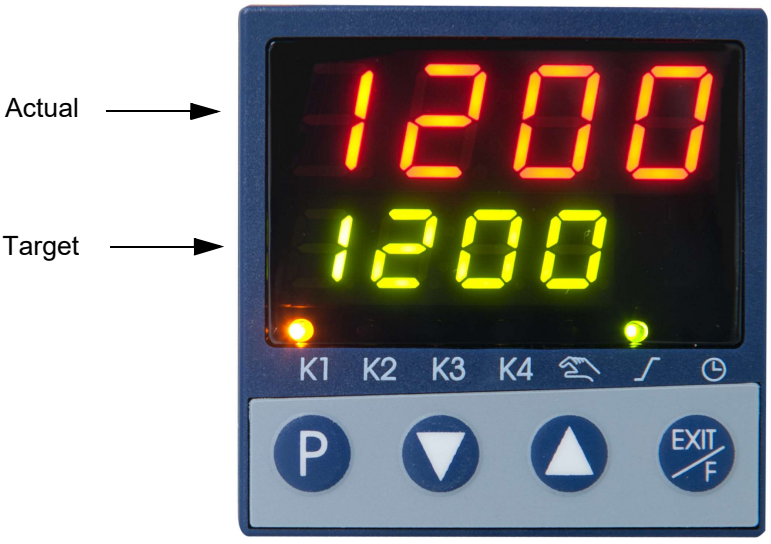


Fig. 160: Temperature Regulator on the Front Plate

11 Technical Information

Notice

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

11.1 Device Specifications

Table 35: Device Specifications

Type	Dimensions / Description
Casing	Splash-proof steel housing
Ex-type	Explosion-proof IECEx overpressure enclosure with flushing
Dimensions	ca. 1.078 x 1.060 x 635 mm
Casing volume	1 Channel 300 l 6 Channels 360 l
Weight	ca 180 kg
Mains voltage (Note information on rating plate)	115/230 V/AC, 50/60Hz Fusing min. 16A (K-characteristics)
Power input	ca. 1,2 KW
Signal outputs	**Numer:** Depending on configuration 2 - 33 analog outputs **Warning:** Each analog output is galvanically isolated from the other analog outputs and the analog outputs are galvanically isolated from the housing. 0 – 20mA or 4 – 20mA max. load 500 Ohm
Interface	serial interface RS 232
Noise levell	max. 70 dB
Potential-free contactors	8 programmable relays (NO or NC) Voltage: max. 24 V=, 24 V~ Amperage: max. 1 A=, 1A~
USB interface	USB 2,0
Display	10,4“ resistive Touchscreen, TFT Display
Carrier gas consumption	Standard: ca. l/h (Nitrogen 5.0)
External air supply (optional)	Dew point max. -5°C
Digital inputs	8

11.2 Ambient conditions

Table 36: Ambient conditionsAmbient 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
Mounting dimensions (**LAR** mounting rack)	min. 1.070 x 2.000 x 1.440 mm

11.3 Specifications for Accessories and Options

Table 37: Specifications for accessoories and options

Type	Dimensions / Description
Carrier gas purification	ca. 630 x 500 x 100 mm
LAR mounting rack	ca. 1.000 x 2.000 x 815 mm Weight: ca.65 kg
Reagent closet	ca. 500 x 500 x 300 mm space for 3x 5l canisters
FlowSamplers	• FlowSampler® mounting plate: ca. 400 x 500 x 120mm • FlowSampler® mounting plate , 2 sample streams ca. 400 x 500 x 240 mm

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 283).

12.1 Component Labelling

Table 38: Component labelling

Component	Labeling
NDIR 1	B1
NDIR 2	B2
NO detector	B3
O2 detector	B4
Flow sensor	BF1 - BF2
Humidity sensor	BM
Pressure display	BP1
Pressure sensor	BP2
Pressure gauge (Ambient Air Preparation Unit)	BP10
Sample vessels	CM1 - CM6
Rinsing vessel	CM7
Calibration vessel	CM8
TIC reactor	CM9
Canister (rinsing water)	CM10
Canister (phosphoric acid)	CM11
Canister (hydrochloric acid)	CM12 - CM16
Furnace	EB
Gas cooler	EC
Air pump (Ambient Air Preparation Unit)	GQ
Condensate pump	GP1
Sample pump	GP2 - GP7
External acidification	GP12 - GP17
XY-System	GS
Quartz wool filter	HQ1
Fine filter	HQ2
Activated carbon filter	HQ3
Gas filter (Ambient Air Preparation Unit)	HQ10
Air-water separator (Ambient Air Preparation Unit)	HQ11

Component	Labeling
Compressed air filter 1 (Ambient Air Preparation Unit)	HQ12
Compressed air filter 2 (Ambient Air Preparation Unit)	HQ13
Gasfilter (Ambient Air Preparation Unit)	HQ14
Acid trap small	HS1
Acid trap big	HS2
Activated carbon (Ambient Air Preparation Unit)	HS11
Soda lime (Ambient Air Preparation Unit)	HS12
Pressure regulator	KH1
Flow regulator	KH2
Pressure regulator (Ambient Air Preparation Unit)	KH10
Syringe unit	MM
Check valve furnace	RM1
Check valve NPOC	RM12 - RM17
Restrictors	RN1 - RN7
Humidity valve	Y1
TIC valve	Y2Y1 - Y2Y2

12.2 TOC-Difference Method (1 Sample Stream)

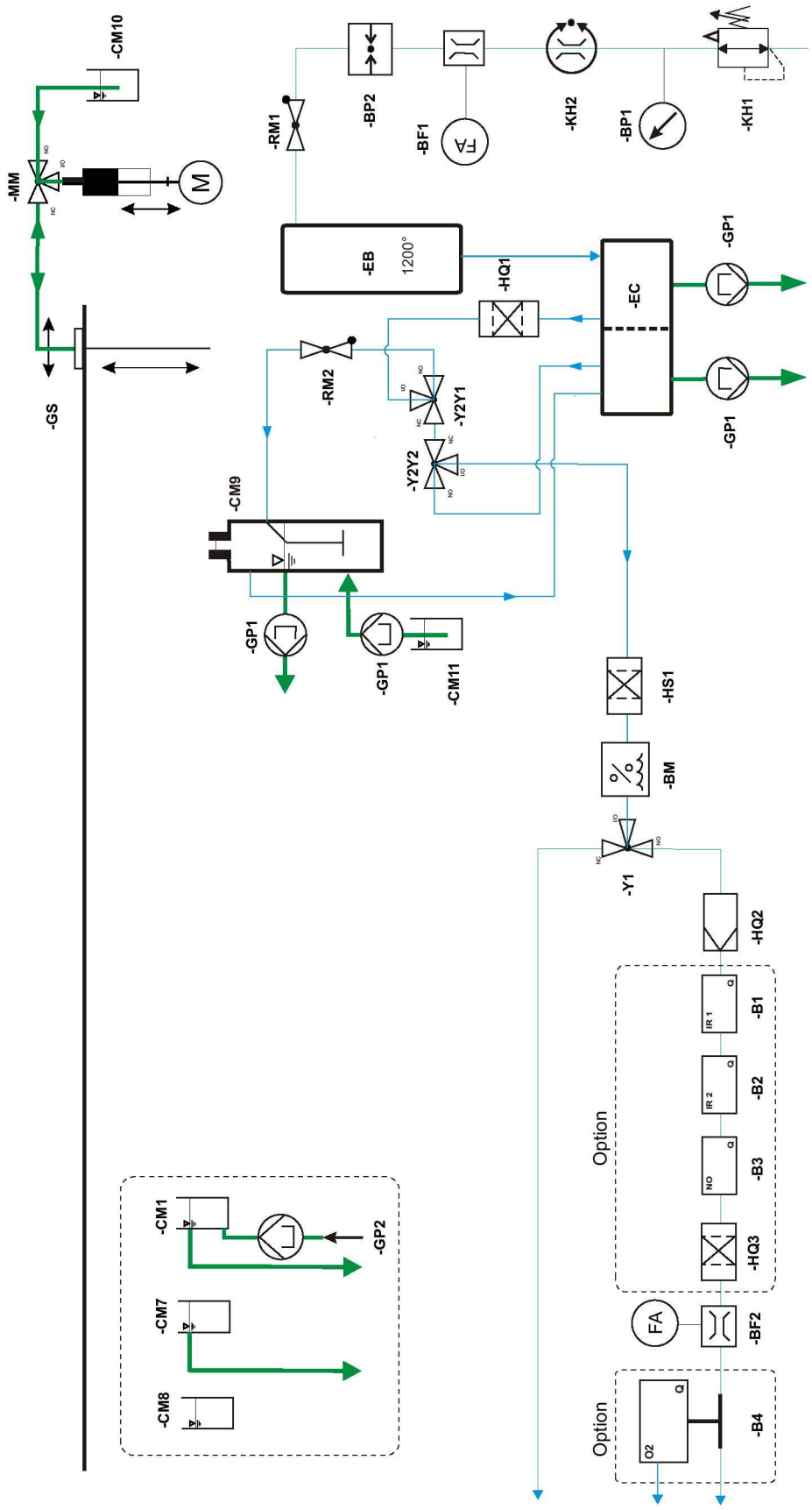


Fig. 161: Flow diagram for TOC-Difference Method (1 Sample stream)

12.3 TOC-Difference Method (3 Sample streams)

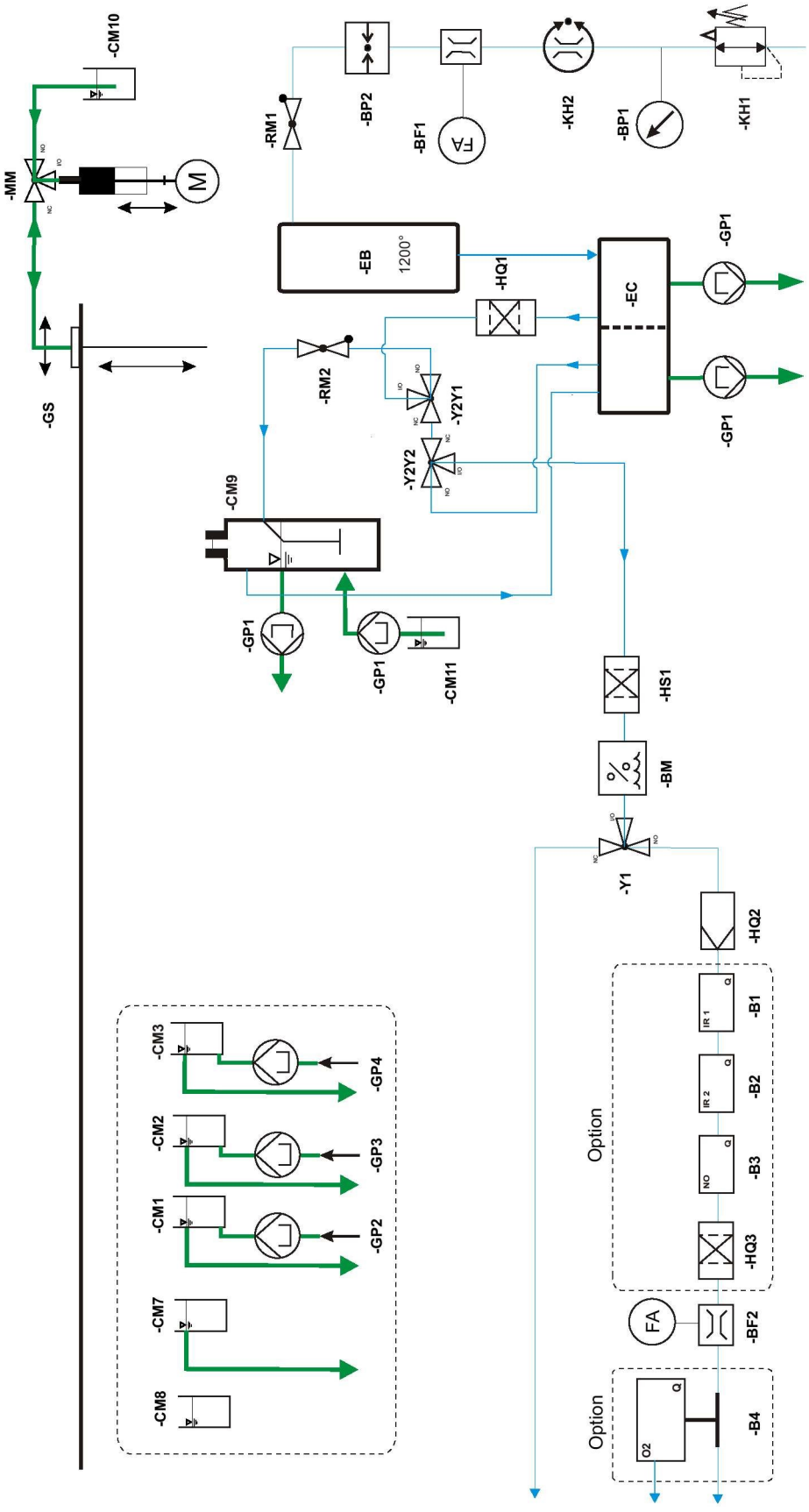


Fig. 162: Flow diagram for TOC-Difference Method (3 Sample streams)

12.4 TOC- Direct Method (1 Sample stream)

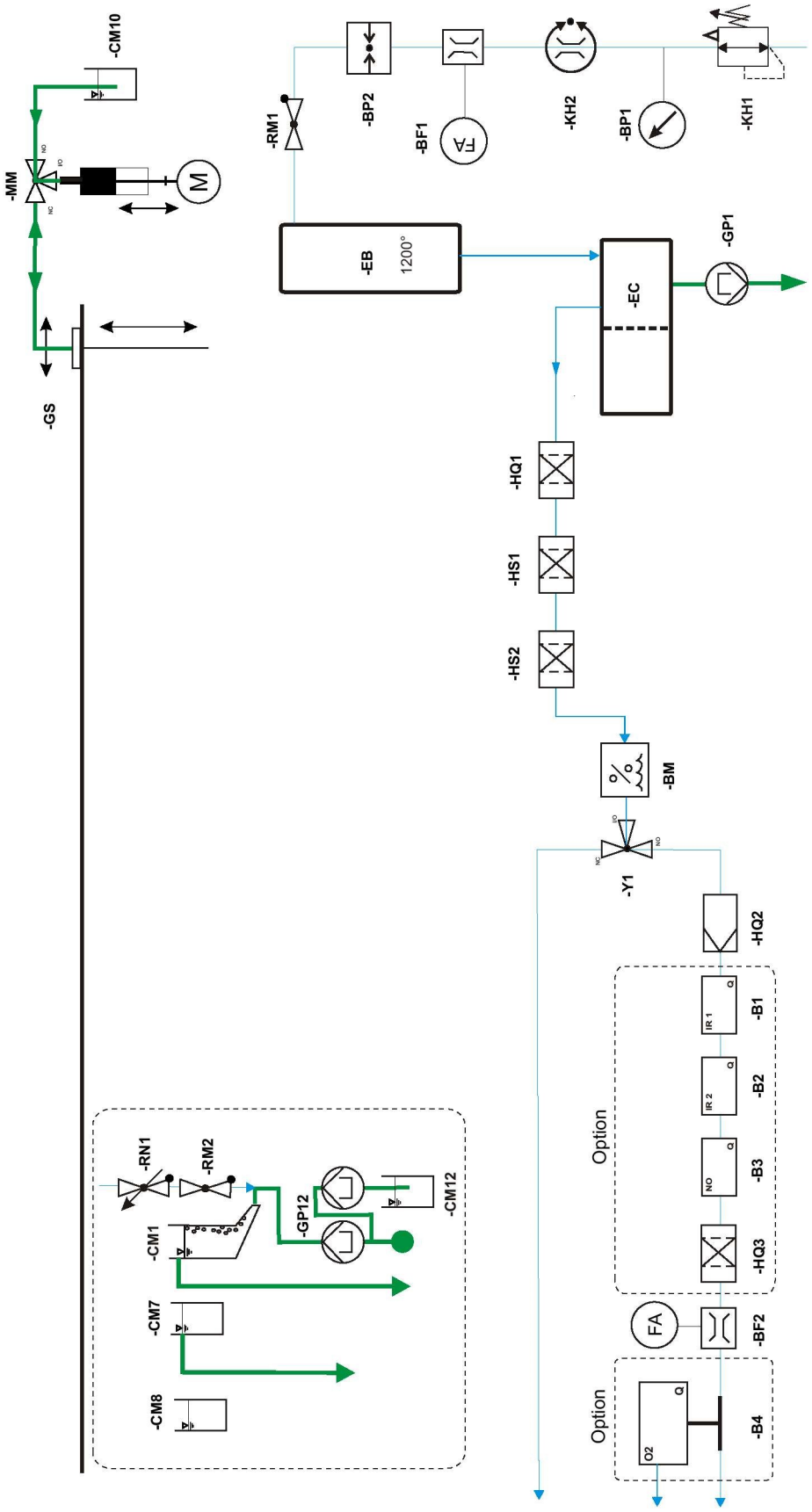


Fig. 163: Flow diagram for TOC-DIrect Method (1 Sample stream)

12.5 TOC-Direct Method (2 Sample streams)

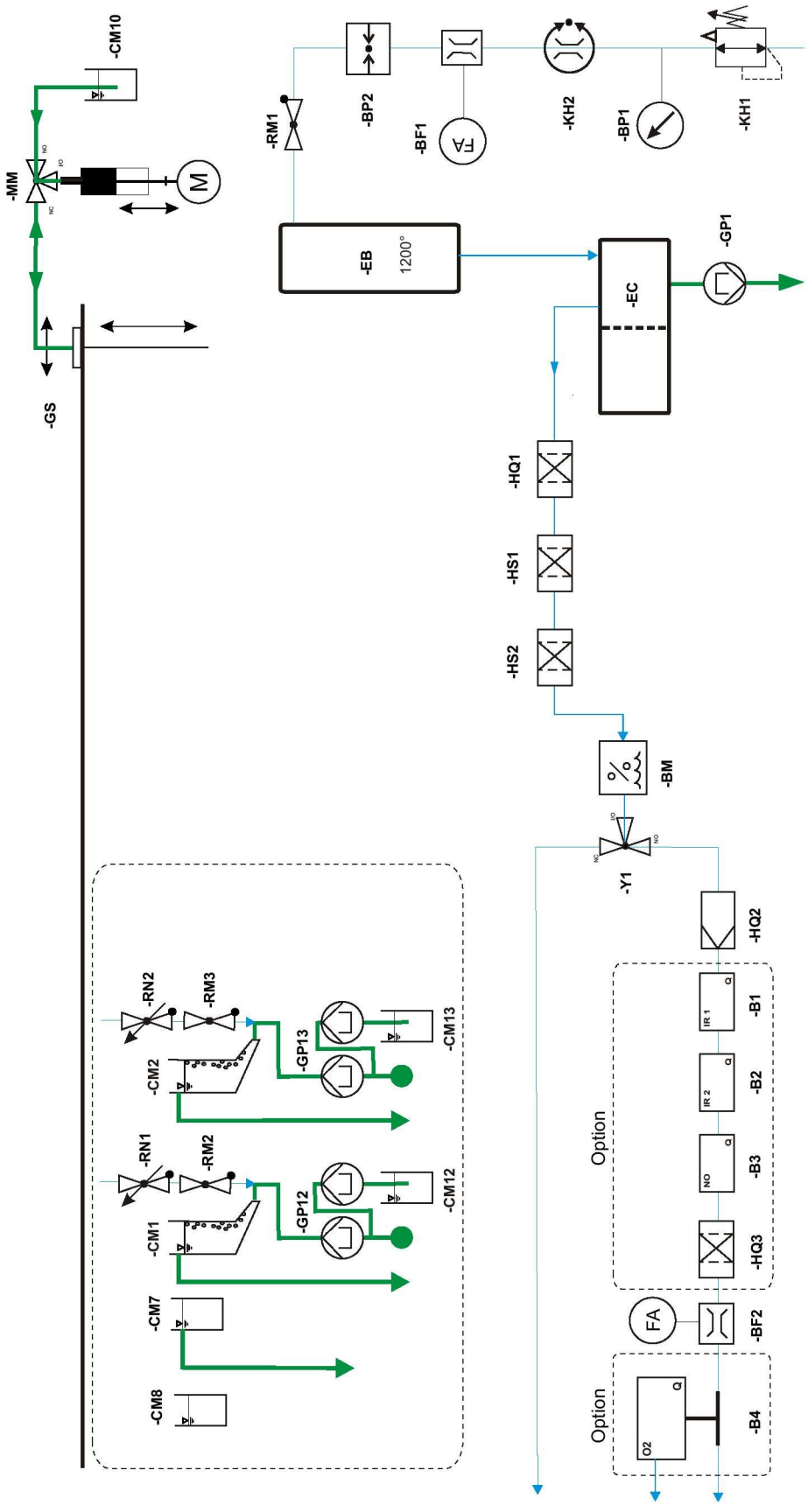


Fig. 164: Flow diagram for TOC-Direct Method (2 Sample streams)

12.6 TConly-Method (1 Sample stream)

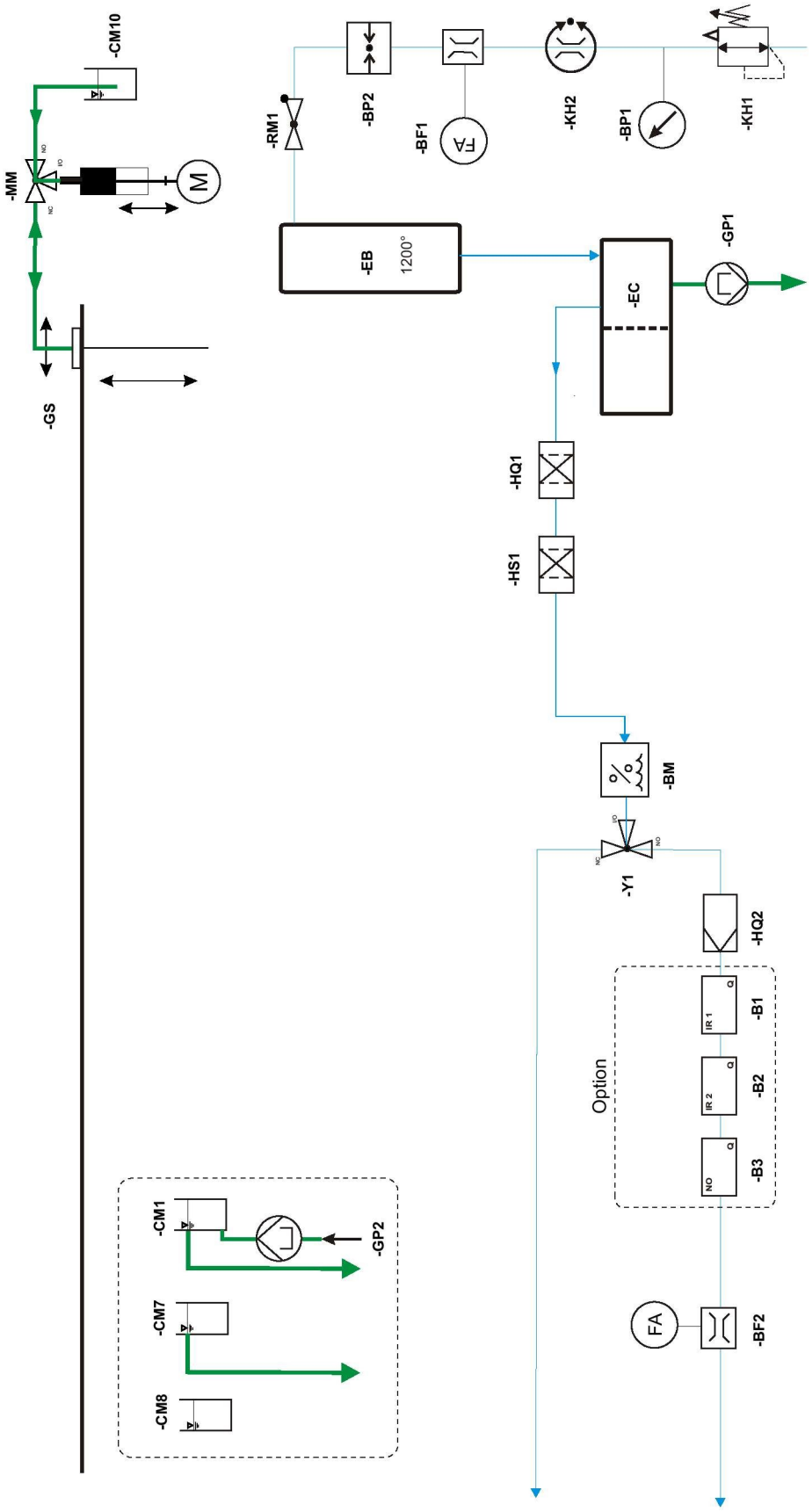


Fig. 165: Flow diagram for TConly-Method (1 Sample stream)

12.7 TConly-Method (2 Sample streams)

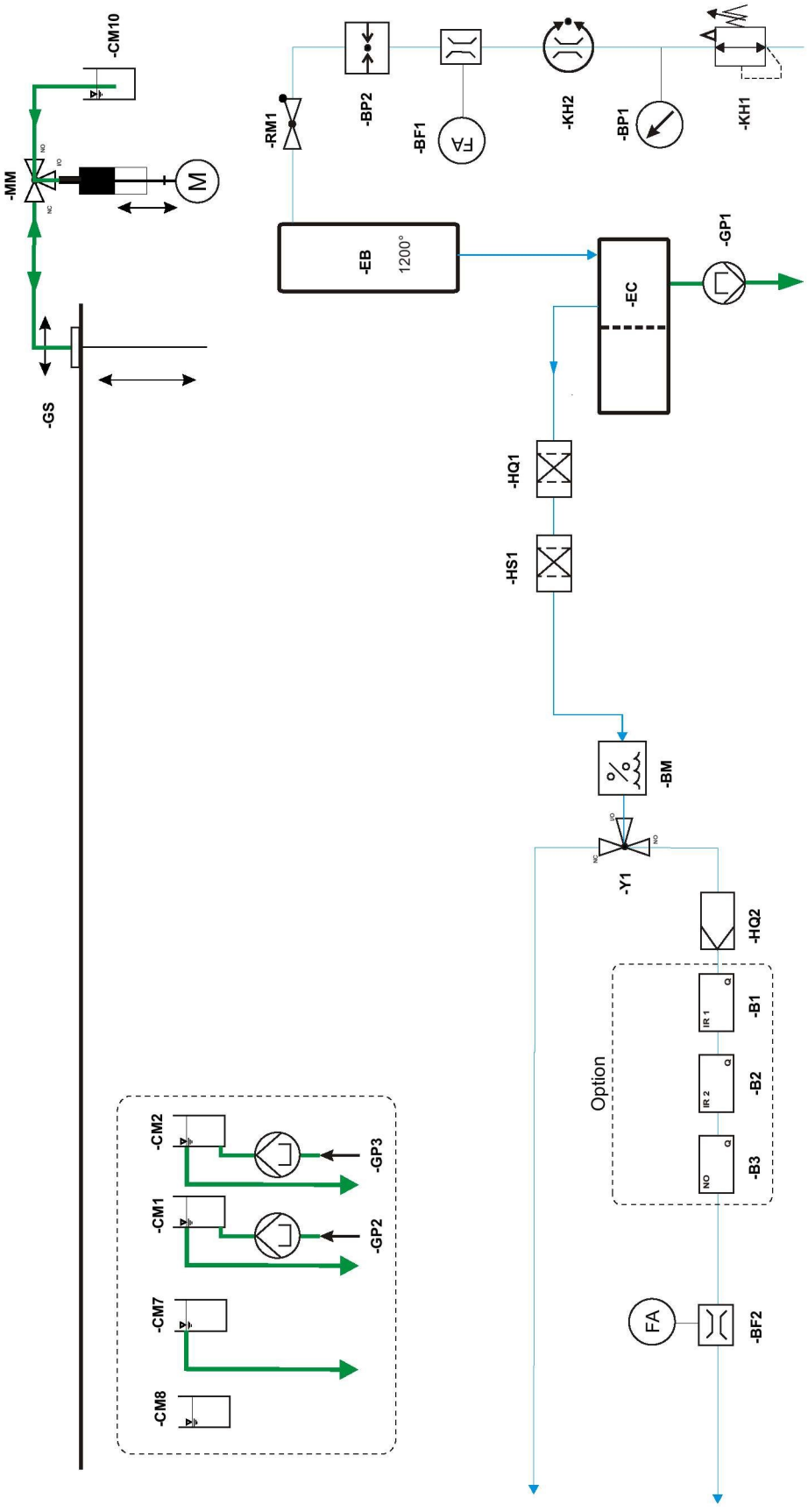


Fig. 166: Flow diagram for TConly-Method (2 Sample streams)

12.8 Flow Diagram with Internal Sample Diluition (Option)

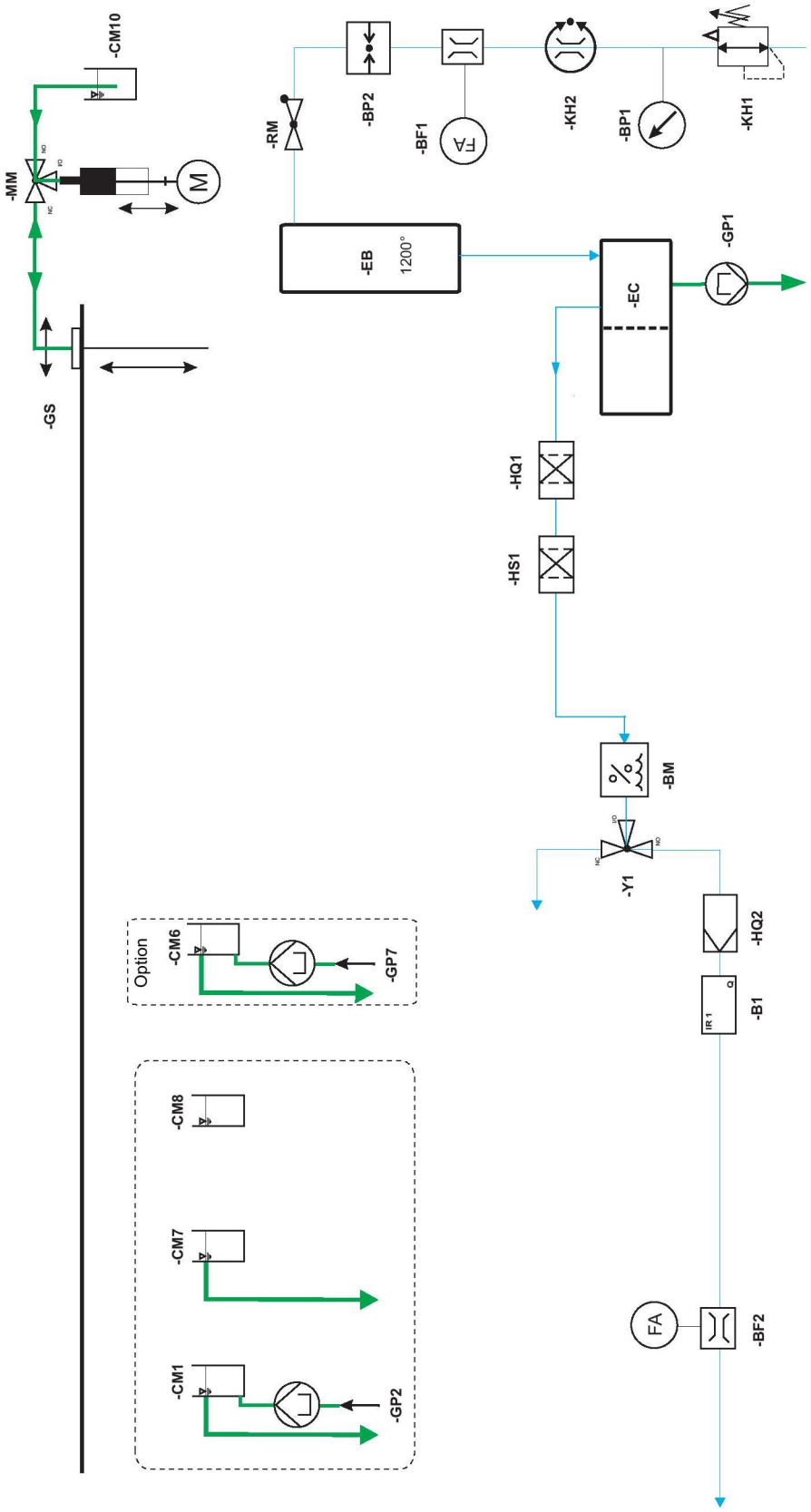


Fig. 167: Flow Diagram with Internal Sample Diluition (TConly-Method - 1 Sample stream)

13 Operating, Care and Maintenance Logs

The following pages contain the logbook and the logs mentioned in the operating manual (as a copy). We recommend to make copies and include them at the end of this operating manual or separately in a folder.

Warning

Do not write in the templates in this section.

Please copy the logs you need for documentation.

13.1 Operating Log

Page		Organiser		Deputy		Device Number	

Date	Start	End	Time	Device Error		Action	Maintenance		Ready		Signature
				Occurence	Error No.		Company	LAR	Yes	No	

13.2 Visual Inspections Log (Analyser)

Interval	Visual Inspection	Criteria	OK	Action
1 Week	Zero Signal	• 0 - 0.1 FSR	☐	☐ Check soda lime ☐ Contact support
	Carrier Gas	• Carrier Gas IN / OUT: approx. 30 l/h (High Salt: approx. 20 l/h)	☐	☐ Check connections ☐ Contact support
	Injection System	• no air bubbles in the tube or glass syringe	☐	☐ Rinsing necessary
	Injection Needle	• no contamination • smooth surface	☐	☐ Cleaning necessary ☐ Replace needle
	Glass Components	• no contamination	☐	☐ Cleaning necessary
	Canisters and Supply Tubes	• fill level > 1 litre • no contamination • normal elasticity	☐	☐ Fill canister ☐ Clean canister ☐ Replace tube
	Drain and Inlet Tubes	• no contamination • normal elasticity	☐	☐ Replace tube _____
3 Months	Injection Tube	• no contamination • normal elasticity	☐	☐ Cleaning necessary ☐ Replace tube
	TIC Stripping Vessel	• no contamination	☐	☐ Cleaning necessary
	Slide Rails (XY-System)	• no contamination • optimal grease state • mechanical play	☐	☐ Cleaning necessary ☐ Grease necessary ☐ Contact support
	Tube Cassette Pump and Pump Tubes	• no moisture • rolls easily movable • no contamination • normal elasticity	☐	☐ Cleaning necessary ☐ Put forth tubes ☐ Replace tubes ☐ Contact support
	Sample Pump and Pump Tubes	• no contamination • rolls easily movable	☐	☐ Cleaning necessary ☐ Contact support
	Viton Tubes	• no contamination • normal elasticity	☐	☐ Cleaning necessary ☐ Replace tubes
	Filter Mats	• no discolouration	☐	☐ Replace filter mats
	Acid Trap	• zinc is > 1/3 shiny • brass wool > 1/3 yellow	☐	☐ Replace filling material ☐ Replace acid trap
	Quartz Wool Filter	• no moisture • no discolouration	☐	☐ Replace filling material ☐ Replace filter
Date:		Signature:		

13.3 Care Log (Analyser)

Interval	Action	Done	Comment
If necessary 1 Week	Rinse the Injection System	☐	
	Clean Glass Components	☐	
	Fill Canisters	☐	
	Clean Canisters	☐	
	Clean Supply Tubes	☐	
	Clean Inlet and Drain Tubes	☐	
	Clean Teflon Tube (Reactor Foot)	☐	
	Clean Reactor Foot	☐	
	Clean Injection Tube	☐	
	Clean Reactor Pipe	☐	
	Clean TIC Stripping Vessel	☐	
	Clean Gas Cooling Pipe	☐	
	Clean Running Rails (XY-System)	☐	
	Grease Running Rails (XY-System)	☐	
	Clean Tube Cassette Pump and Pump Cassettes	☐	
	Clean Sample Pump	☐	
	Adjust Sample Pump	☐	
	Clean Viton Tube	☐	
	Clean Injection Needle	☐	
	Renew Calibration Standard	☐	
1 Month	Clean Needle Guide (Injection Port)	☐	
3 Months	Check the Furnace System	☐	
	Check the Gas Cooling Pipes	☐	
	Clean and oil the Injection Port	☐	
	Move Pump Tubes (Tube Cassette Pump)	☐	
	Check the mechanical backlash of the XY-System	☐	
6 Months	Check the Injection Port	☐	
Date:		Signature:	

13.4 Maintenance Log (Analyser)

Interval	Action	Done	Comment
If necessary	Replace Supply Tubes	☐	
	Replace Inlet and Drain Tubes	☐	
	Replace Teflon Tube (Reactor Foot)	☐	
	Replace Reactor Pipe Filling / Reactor Pipe	☐	
	Replace Small Furnace Head Seal (upper)	☐	
	Replace Big Furnace Head Seal (Silicone O-Ring with PFA coat)	☐	
	Replace Injection Tube	☐	
	Replace Viton Tube	☐	
	Replace Acid Trap filling	☐	
	Replace Acid Trap	☐	
	Replace Quartz Wool Filter filling	☐	
	Replace Quartz Wool Filter	☐	
	Replace Filter Mats	☐	
	Replace Injection Needle	☐	
	Replace Gas Filter	☐	
	Replace Silicone Seals for Glass Compo-nents	☐	
	Replace Seal for Reactor Foot	☐	
1 Week	Replace Silicone Seal for TIC-Port	☐	
1 Month	Replace Needle Guide Seal (Injection Port)	☐	
6 Months	Replace Pump Tube (Tube Cassette Pump)	☐	
	Replace Pump Tube (Sample Pump)	☐	
Date:		Signature:	

13.5 Function Test Log (Analyser)

Visual Inspection	Criteria	OK	Action
Check Analyser	• Zero signal is between 0 - 0.1 FSR • Carrier Gas IN / OUT: approx. 30 l/h (high salt: approx. 20 l/h)	☐	☐ Contact Support _____ _____ _____ _____
Tightness Test	• Carrier gas volume flow falls to < 5 l/h	☐	☐ Contact Support _____
Test Run (XY-System)	• All positions are hit by the injection needle	☐	☐ Contact Support _____
Checking the Measurement Results	• Measurement results matches the calibration standard	☐	☐ Contact Support _____
Checking the Measurement Process	• Measurement Process goes on without complications	☐	☐ Contact Support _____
Date:		Signature:	

13.6 Visual Inspection Log (Ambient Air Preparation Unit)

Interval	Visual Inspection	Criteria	OK	Action
1 Week	Fine Filter Element	• no contamination	☐	☐ Contact Support _____ _____
3 Months	Filter Unit	• condensate drains normally	☐	☐ Contact Support _____ _____
	Soda Lime	• no discolouration (purple/violet)	☐	☐ Replace _____
	Tube Connections	• connected handtightened	☐	☐ Fix tubes _____
	Pre Pressure of the Carrier Gas	• still at 2 - 3 bar	☐	☐ Contact Support _____
Date:		Signature:		

13.7 Care and Maintenance Log (Ambient Air Preparation Unit)

Interval	Action	Kind of Action	OK	Comment
If necessary	Replace Soda Lime	Maintenance	☐	
	Replace Gas Filter	Maintenance	☐	
	Replace Filter Mats	Maintenance	☐	
	Replace Fine Filter Element	Maintenance	☐	
	Replace Coarse Filter Element	Maintenance	☐	
	Replace Activated Carbon	Maintenance	☐	
Date:		Signature:		

13.8 Visual Inspection Log (FlowSampler)

Interval	Visual Inspection	Criteria	OK	Action
1 Week	Flow	• Transport of Liquids	☐	☐ Contact Support _____ _____
3 Months	Sampling Pipe (Needle)	• no contamination	☐	☐ Cleaning necessary _____ _____
Date:		Signature:		

13.9 Care and Maintenance Log (FlowSampler)

Interval	Action	Kind of Action	OK	Comment
If necessary	Clean Sampling Pipe (Needle)	Care	☐	
3 Months	Clean FlowSampler®	Care	☐	
Date:		Signature:		

13.10 Care and Maintenance Log (Overflow Sampler)

Table 39: Care and maintenance log (overflow sampler)

Interval	Action	Type of Action	OK	Notes
If neces-sary	Clean overflow sampler	Care	☐	
Date:		Signature:		

13.11 Visual Inspection Log (CO_2-Remover)

Interval	Visual Inspection	Criteria	OK	Action
1 Day	Housing	• no damage • no contamination	☐	☐ Contact Support _____
	Service Lamp	• red service lamp is inactive	☐	☐ Contact Support _____
Date:		Signature:		

13.12 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:		

13.13 Visual Inspection Log (Auto-TIC-Port)

Interval	Visual Inspection	Criteria	OK	Action
6 Months	Micro-switch on Auto-TIC-Port	• Ease of movement of the closing and opening function • Observance of the minimum distance	☐	☐ Contact support _____ _____
Date:		Signature:		

13.14 Care and Maintenance Log (Auto-TIC-Port)

Interval	Action	Kind of Action	OK	Comment
1 Month	Replace needle guide seal	Maintenance	☐	
	Clean needle guide	Care	☐	
3 Months	Clean and oil the Auto-TIC-Port	Care	☐	
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 40: LAR *Contact Details*

Kontakt Contact	Telefon Telephone	E-Mail E-Mail
Technical Support	+49 30 278958 - 55	service@lar.com
Sales Department	+49 30 278958 - 31 +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**..

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