User Manual

Analytical-IMS

Version 2.1.5 10/2017

G.A.S. reserves the right to realize technical changes of the product due to improvements without explicitly mentioning them**.**

CE-Marking according to European Directives EN ISO 17050-1:2004 in accordance with 2006/95/EC The Low Voltage Directive and 2004/108/EC The Electromagnetic Compatibility Directive.

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1 General Information

1.1 Information about the Manual

This manual describes a safe and adequate handling of the . Following the instructions of the indicated safety aspects and instructions as well as the national and/or local rules and general safety regulations concerning the prevention of accidents are absolutely imperative.

Before starting the work with the device read the manual completely and thoroughly particularly the chapter *security* and respective safety references. Assure that you/the operator comprehend the terms described.

The manual is part of the device. It has to be stored together with and next to the device at any time.

1.2 Explanation of Symbols

Important and safety-relevant references in this manual are characterized by symbols. These indications which are in-line with industrial safety must be respected and followed at any time.

INFORMATION!

This symbol calls information, which are to be considered for efficient and perfect handling of the equipment.

NOTE! Danger for real values!

This symbol indicates references, which can lead to damages, malfunctioning and/or loss of the device.

DANGER – High Voltage!

This symbol marks references, which can lead to health impairments, injuries, lasting body damages or to death due to electric current.

DANGER - Radioactivity!

This symbol marks paragraphs, which describe potential dangers and damage due to exposure to radioactive radiation.

1.3 Scope of Supply

Assure that you have received the full scope of supply. If there is any part missing, please contact the GAS-hotline immediately.

The scope of supply consists of:

- Device
- Power Supply Cable
- Gas tubes with accessories for gas connection
- Documents
- Technical approval certificate
- Analytical quality approval
- Declaration of Conformity
- Transport case
- IMS-Software-Suite
- Moisture-Trap

Accessories available as an option

- Big Moisture-Trap
- Notebook to share folders including configuration

1.4 Liability and Guarantee

All data and reference within this manual are compiled under the valid regulations, the state- of-the-art as well as G.A.S. experiences of several years.

The manual has to be stored together with and close to the device at any time and accessible to all persons, who work with it.

This manual must be read carefully before starting to work with the equipment! G.A.S. does not overtake any liability for damage and disturbances, resulting from neglect or ignorance of the manual's instruction.

INFORMATION!

The graphics in this user manual are schematic and may differ from the actual conditions. The firmware and PC software screen shots in this user manual may differ from the actual conditions.

INFORMATION!

The actual scope of supply might deviate from special (customized) equipments, the recourse of additional order options or due to newest technical changes concerning the data and references described herein as well as the graphic representations. For questions please contact the G.A.S.-hotline.

G.A.S. reserves the right to realize technical changes of the product due to improvements without explicitly mentioning them.

1.5 Copyright

The manual is confidential. It is beyond doubt exclusively made and also meant for the personnel directly dealing with the equipment. All data, texts, designs, pictures and other representations within this manual are protected in the sense of the copyright law and are subject to further commercial patent rights. Each abuse is liable to prosecution.

Passing it on to third persons as well as duplications in any kind and form - also in part - as well as the use and/or report of contents are not permitted without written agreement of the manufacturer. Offences lead to payment of damages. We reserve ourselves the right for further legal actions as well as all further rights according to the practice of commercial patent rights.

1.6 Return and Disposal

For a professional redemption, the device or/and its equipment must be returned to the manufacturer or to a third party authorized by the manufacturer!

1.7 Customer Service

For questions concerning the equipment a customer service is available:

G.A.S. Gesellschaft für analytische Sensorsysteme mbH
Otto-Hahn-Straße 15
44227 Dortmund
http://www.gas-dortmund.de
Phone: +49 231 / 97 42 - 6550
Fax: +49 231 / 97 42 - 6555
E-Mail: info@gas-dortmund.de

The telephone hotline is reachable Monday to Friday from 9:00 to 16:00 hours (CET). In urgent cases or if you use fax or e-mail, please also provide your telephone number.

2 Transport, Packing and Storage

2.1 Inspection after Transport

Check the supply immediately after delivery concerning its completeness and/or transport damages. If you detect externally visible transport damage, do not receive the supply, or only under reservation. State the extent of the damage on the provided delivery note and/or the transportation documents of the feeder. Generate a complaint. Lodge a complaint of covered defect immediately after recognizing, as claims due to transport damages can only be made valid within the complaint periods (usually 7 days).

2.2 Transport

The equipment should be moved only within the provided carrying case. By this means, transport damages can be avoided.

2.3 Packing

If no redemption agreement concerning the packing was agreed upon, separate the different materials according to kind and size and supply it to further use or recycling.

Information!

Dispose the packaging material always environmentally friendly and according to the valid local regulations. If necessary, ask a recycling company.

2.4 Storage

Store the device only under the following conditions:

- Until the use of the equipment keep the provided suit-case locked
- Do not store unsecured
- Do not store outside
- Store only dry and dust free
- Avoid mechanical vibrations
- Do not expose the device to aggressive media
- Protect the device against sun exposure
- Storage temperature: 15 to 40 °C
- Relative air humidity: max. 60%
- If you do not use the device, check the storage condition, regularly
- Protect against unauthorized access

3 Cleaning and Maintenance

Natural aging and the wear of certain components of the equipment require a regular cleaning and maintenance.

3.1 Cleaning

Clean the device only with a dry or easily damp cloth.

NOTE! Danger for real values!

Do not use cleaning agents, which contain solvents, acids or bases.

3.2 Maintenance

Maintenance of the device should only be carried out at G.A.S. or through specially trained and by G.A.S. authorized personnel.

4 Security

This section gives an overview of all important safety aspects for an optimal protection of the personnel as well as for the safe and trouble free use of the device. Additionally, the individual chapters contain concrete safety references with respect to the prevention of direct dangers which are indicated by symbols.

4.1 Intended Use

The device may **not** be operated by introducing aggressive gases or liquids!

NOTE! Danger for real values!

Under no circumstances any liquid or aggressive may be introduced into the device!

The working reliability is only ensured when the equipment is applied for its purpose:

Gas analysis of Volatile Organic Compounds.

NOTE! Danger for real values!

Each use of the device, that differs from the intended use is forbidden and will be regarded as “out of purpose”.

All claims or requirements of any kind against the manufacturer and/or its authorized persons that arise due to damages from a not intended use of the device will be rejected. All damages that arise from a not intended use are of the operator’s responsibility.

The intended use of the equipment and its correct handling according are described in the operating instructions of this manual. Other parts than the parts belonging to the scope of supply, may only be used after G.A.S. approval.

4.2 Responsibility of the Operator

The device may only be operated in a perfect technical condition. Before putting the device into operation the condition of the device and its equipment must be checked. The information and instructions provided in this manual have to be followed at any time.

Besides the instructions provided in this manual the local rules for the prevention of

accidents, general safety regulations - valid for the area of application of the device - as well as the valid environmental-protection regulations must be considered and respected.
The responsible technicians and operators have to make sure a failure-free use of the device. Responsibilities among the involved persons regarding installation, operation, maintenance and cleaning must be made clear.

4.3 Requirements of Personnel

Only authorized and trained technical personnel may work with the instruments. The operator must have received an instruction over existing and all possible dangers and should be regularly instructed in safety procedures and environmental protection and that this personnel is fully aware of the complete operating instructions and particularly the safety notes. Personnel that might be under the influence of drugs or alcohol are to be kept off the device at any time.
Technical personnel in this context are defined as skilled employees who are knowledgeable due to their educational background. In case the foreseen personnel do not have the necessary qualifications to operate the instrument, it must be trained. Further to that non-authorized personnel should not operate the device.
The competencies for the work on and with the device must be specified and kept undoubtedly at any time so that with respect to security issues no unclear situation might come up.
Any changes of the equipment, which impair security of the personnel must immediately be reported to the operator and every person dealing with it.

4.4 Dangers

The device and its equipment was subject to an endangerment analysis. The construction and execution of the device corresponds to the today's state of the art. The device is reliable in service when operated according to its intended use.

Danger - Radioactivity!

The device contains a radioactive radiation Tritium source of <300 MBq (which in all EURATOM countries is below the exemption limit of 1 GB).

However, do not open the device! Do not try to recover malfunctions of the device! Malfunction recovery, repairs and any maintenance work may only be performed by G.A.S. or by qualified personnel authorized by G.A.S.

Danger – Threat to Life or Physical Condition!

The and its equipment is not certified for the employment in areas with explosive gas air mixtures (Zone 0).

Danger – High Voltage!

Exercise great care in handling current-carrying parts like the power supply cord. Do not get directly in touch with current-carrying parts. Do not open the housing. Do not use damaged parts.

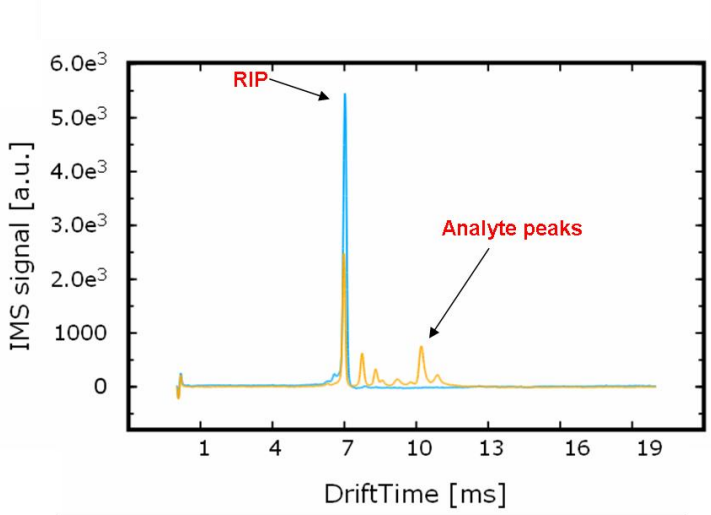
When the housing of the device is damaged, the device must not be used any more and must be returned to the G.A.S. by using the original transportation case.

5 Introduction

5.1 Working principle of the IMS technology

Ion Mobility Spectrometry (IMS) is an analytical technology to separately detect gaseous compounds in a mixture of analytes. The separation is based on the specific *drift times*, that ionized compounds need to pass a fixed distance (*drift tube*) in a defined electric field. Compared to other techniques e.g. TOF-MS, ions travel at atmospheric pressure versus a flow of inert *drift gas*. The drift time of each substance is determined by its ion‘s mass and geometric structure, as slowing collisions with the drift gas molecules are more frequent for sterically demanding structures. Therefore IMS can even differentiate isomeric molecules. For detection, the resulting ion current is measured by an electrometer as a function of time.

Atmospheric Ionization of molecules can be obtained by several techniques. G.A.S. uses photo-ionization with a 10.6eV UV-lamp or soft chemical-ionization initiated by a low-radiation tritium (H3) source (below exemption limits of EURATOM). While the first directly produces positive ions, the latter generates *reactant ions* with the gas atmosphere by a cascade of reactions following the collision of a fast electron emitted from the *β*-radiator H3. The so-called Reaction Ion Peak (RIP) representing the total of all ions available is formed as a first step. In nitrogen and air, resp., the *reactant ions* can be described as $H^+(H_2O)_n$ and $O_2^-(H_2O)_n$. Chemical ionization of analytes by *reactant ions* then result in the formation of specific analyte ions, when the affinity of the analyte towards the reactant ion is higher in case compared to water (using the positive ionization mode). The proton affinity of water is 691kJ/mol, so all molecules with a higher proton affinity will be ionized by a proton transfer, which is typically given for all heteroatom-organic compounds. The ionization takes place at ambient pressure, so that the analyte concentration is not diluted as compared to other analytical methods where a vacuum has to be applied. Therefore IMS is extremely sensitive. The detection limits typically are in the low ppb-range for *volatile organic compounds* (VOC).



The above figure exemplarily shows the IMS spectrum without analyte (blue) and with analyte (orange). The RIP is formed as a sharp signal proving the cleanliness of the system and at a specific position that is used as internal standard. The spectrum containing analytes shows a decreased RIP, while new (analyte) peaks – typically monomer and dimer depending on the concentration- are correspondingly formed. The drift time is specific for an ion, therefore analyte identification is possible. The peak height and area correlate to the analyte concentration, so that a quantification is also possible too.

Complex analyte mixtures, like e.g. food flavours, often demand a second and independent separation step in order to separately analyse the multiplicity of compounds at low concentrations. Therefore G.A.S. -according to application- equips its IMS systems with gas chromatographic (GC) columns. The volatile compounds of samples under testing are pre-separated in time by a GC column. The discrete compounds are consecutively fed into the IMS ionization chamber, so that analyte and/or ion interactions are avoided.

Furthermore a competition of analytes on the reactant ions is excluded, enhancing the sensitivity of the system for individual compounds.
The IMS setup enables a twofold separation of analyte mixtures and the detection by the IMS electrometer. Since the IMS measurements are extremely fast (21ms / spectrum) a continuous and high-resolution recording of analyte signals is provided.

5.2 Purpose of the device

The offers excellent features for fast and sensitive detection of gaseous traces of Volatile Organic Compounds (VOCs). Thus traces of VOCs become detectable without any special sample preparation.

Results are available within a few seconds and compounds are typically detectable at low ppb-level. The technical configuration, its menu as well as operation is extremely easy. Depending on the technical set up a specific architecture of the gas samples inlet are available for the using an overpressure gas flow or sucking them with an internal pump into the device.

NOTE! Danger for real values!

The device must not be operated by introducing aggressive gases or any kind of liquids or solids. The operational reliability is only ensured when the equipment is applied for this intended purpose.

Information!

Any use of the device, that differs from the intended purpose will be regarded as “out of purpose”. Any claims of any kind against G.A.S. or her associates that are related to damages from an use not covered by the aforesaid will be rejected.

The contains several parameterized components that can be modified for optimizing measurement data in terms of separability of substances and clarity of resulting peaks.

The can be operated in negative or positive drift voltage mode. The reactant ion peaks (RIPs) and analyte ion peaks (AIPs) in the positive drift voltage mode will be displayed as maxima in the spectra. In the negative drift voltage mode both will be shown as minima. One of these modes may be more suitable to detect the specific substances of interest.

Measurement data can be acquired automatically by employing user-defined measurement programs. In these programs the operational parameters of various

components of the can modified at defined sequences of the measurement run.

Alternatively measurement data can be acquired in a manual way using the “Recording” mode.

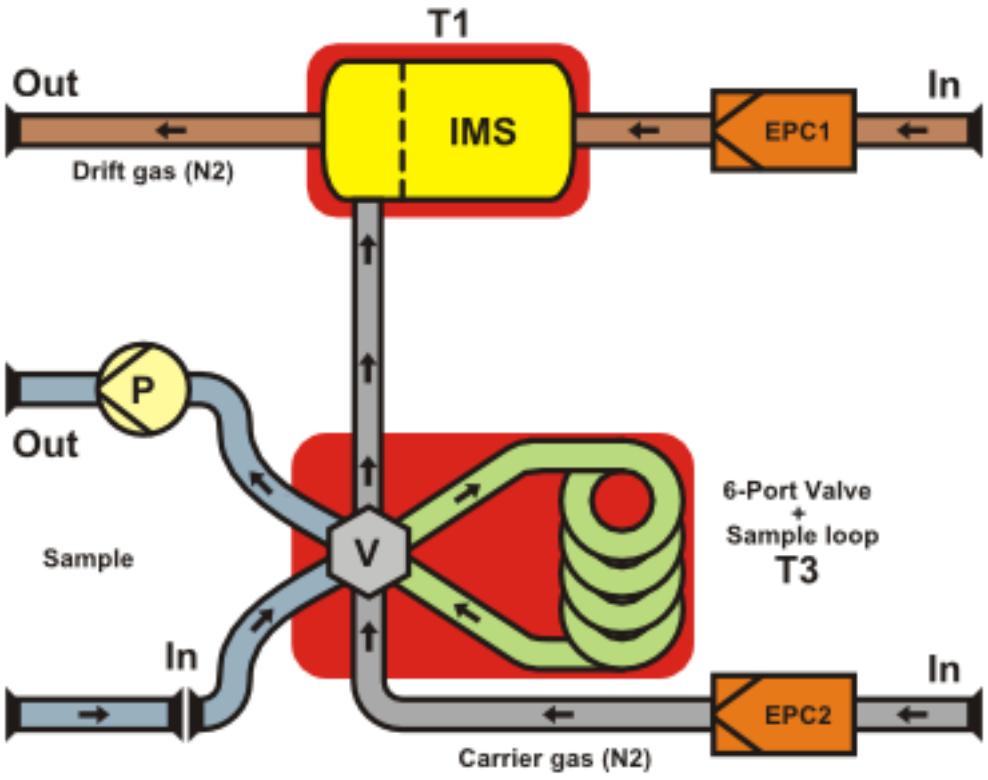
Acquired measurement data are stored in measurement files either on the internal storage volume of the or – when activated – in a shared net-work folder. Stored measurement files can further be copied to a connected USB volume.

For using a shared network folder the can be integrated into a local area network (LAN) by using the Ethernet socket at the rear side of the device.

5.3 Principal setup and internal gasflow

5.3.1 A-IMS with 6-port valve

The schematic drawing shows the principle structure of the gas flow system of the with 6-port valve.



The drift gas for the IMS is supplied using an electronic pressure control unit (EPC1). The carrier gas for the external gas circuit of the 6-port valve is supplied using a second electronic pressure control unit (EPC2). Both gases (carrier and drift gas) leave the device at the gas out, which should be connected to an exhaust. IMS and 6-port valve with sample loop are heated (T1 and T3).

The gas sample is introduced into the system by sucking it into the sample in port at the front of the housing. The sample is carried via the heated 6-port-valve (T3) to the IMS.

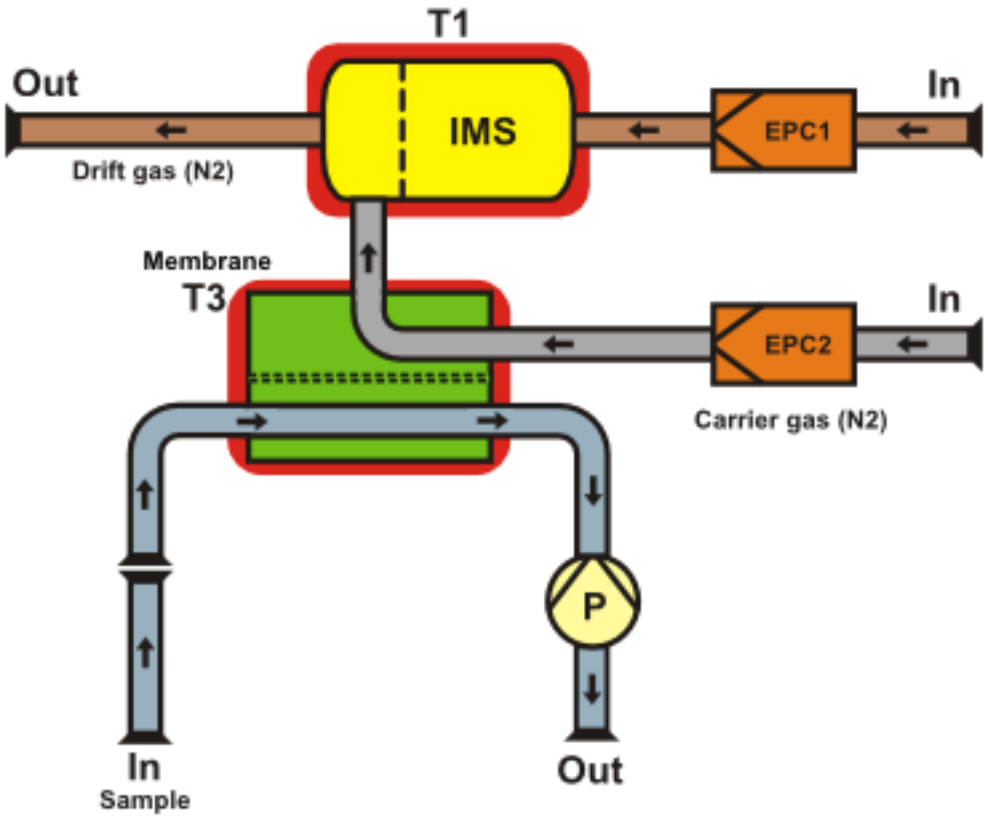
In the default position of the 6-port-valve the carrier gas permanently flushes the IMS. The sample gas is pumped through the loop by the pump *P*. This phase is called “Fill Loop”. In this position the sample gas from the Sample In socket is directly routed to the Sample Out socket.

For routing the sample gas in the loop to the IMS the 6-port-valve is switched to the

second position. The carrier gas now transports the sample gas into the loop and further to the IMS. The substances are introduced into the ionization region of the IMS and leave the system via the Gas Out socket.

5.3.2 A-IMS with membrane

The schematic drawing shows the principle structure of the gas flow system of the with membrane.



The drift gas for the IMS is supplied using an electronic pressure control unit (EPC1). The carrier gas for the external gas circuit is supplied using a second electronic pressure control unit (EPC2). Both gases (carrier and drift gas) leave the device at the gas out, which should be connected to an exhaust. IMS and membrane are heated (T1 and T3).

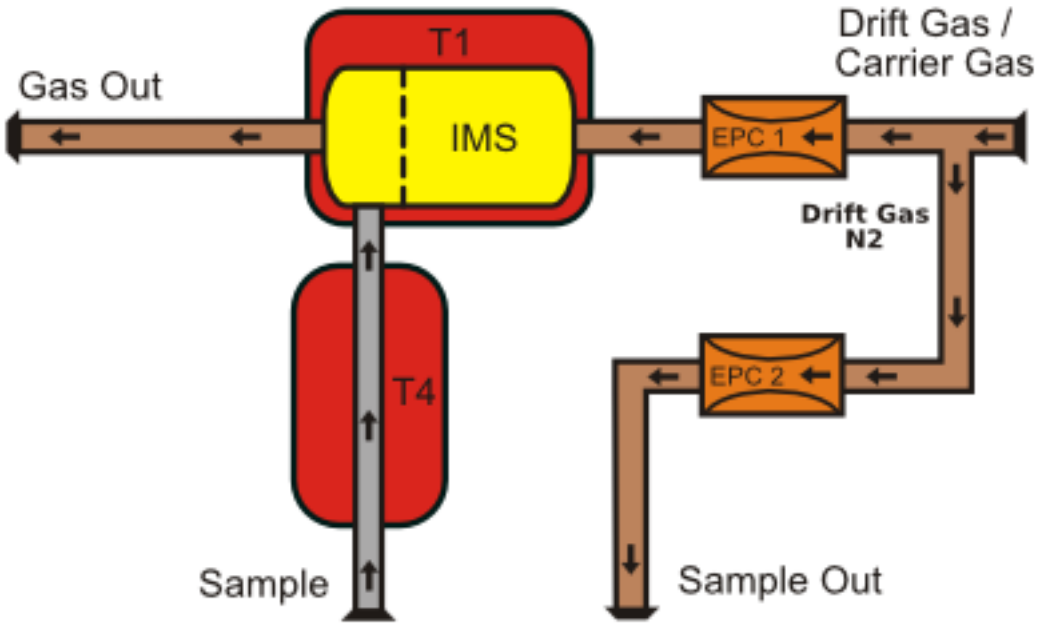
The gas sample is introduced into the system by sucking it into the sample in port at the front of the housing. The sample diffuses through the heated membrane (T3) to the IMS.

The sample gas is sucked through the membrane by the pump *P*. The sample gas from the Sample In socket is directly routed to the Sample Out socket. The Sample gas also diffuses freely through the semi-permeable membrane. The carrier gas now

transports the sample gas to the IMS. The substances are introduced into the ionization region of the IMS and leave the system via the Gas Out socket.

5.3.3 A-IMS with heated transfer line

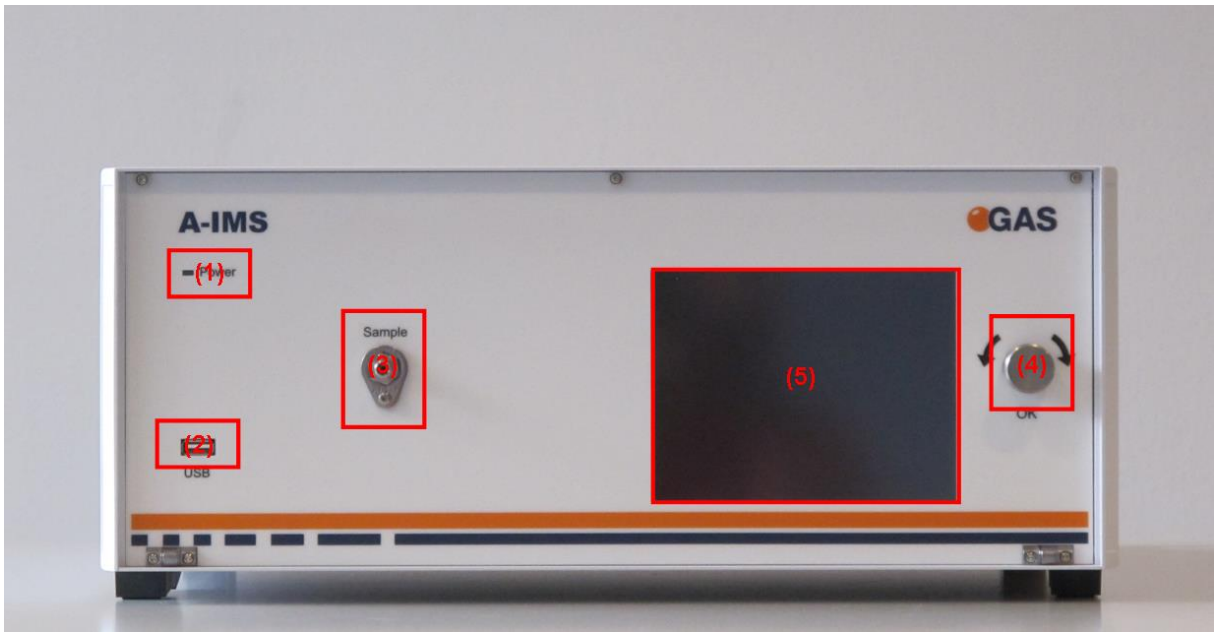
The schematic drawing shows the principle structure of the gas flow system of the with direct sample.



The drift gas for the IMS is supplied using an electronic pressure control unit (EPC1). The drift gas leaves the device at the gas out, which should be connected to an exhaust. The gas flow from the second EPC2 unit is guided to the Sample Out and can e.g. be used as carrier gas for an external permeation system.
IMS is heated (T1). The heating of the transfer line is optional (T4).
The gas sample is introduced into the system by using a necessary overflow. The hose is connected to the Sample-in port at the front of the housing. The sample is carried via the heated transfer line to the IMS. The substances are introduced into the ionization region of the IMS and leave the system via the Gas Out socket.

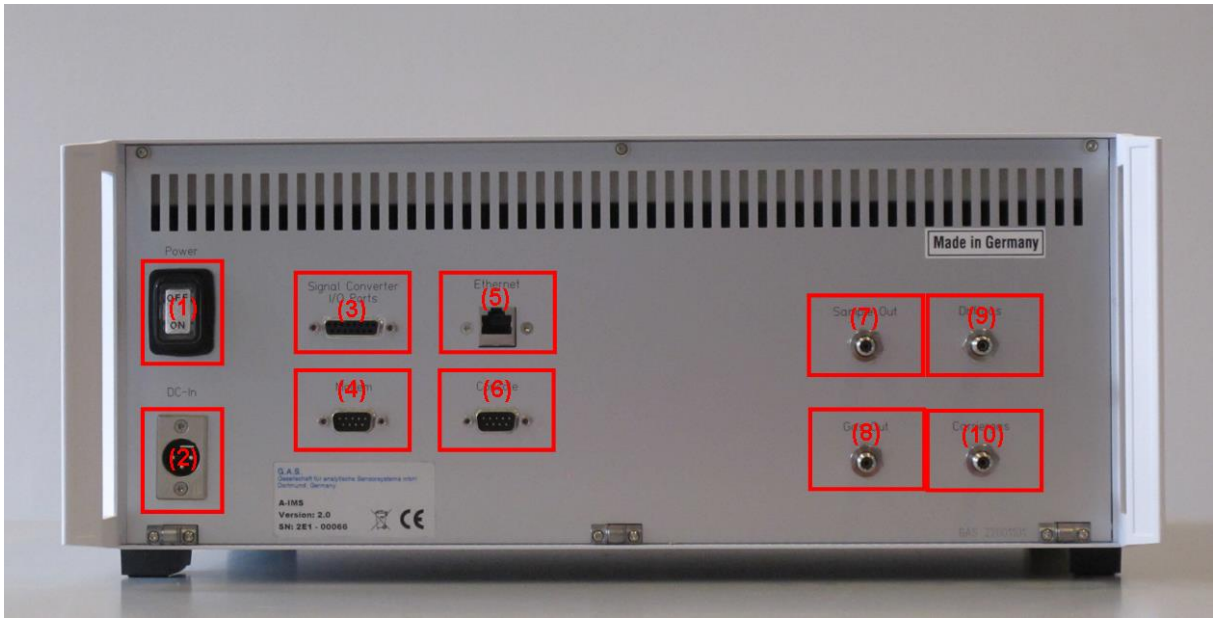
5.4 Housing of the device

5.4.1 Front



(1)	**Power LED**	Indicates whether or not the device is connected to a power supply and is switched on
(2)	**USB Socket**	USB socket for connecting external USB storage volumes. These volumes can be used for exporting measurement files, for importing sample name lists, for upgrading the device's firmware and for saving or loading system settings.
(3)	**Sample in socket**	3 mm Swagelok inlet plug for connecting the device to a sample gas source.
(4)	**Pushable Rotary Knob**	Input control for cycling through and activating the control elements of the graphical user interface displayed on the TFT-display.
(5)	**6,4" TFT VGA-Display**	Displays the graphical user interface.

5.4.2 Rear



(1)	**Power Switch**	Switch on or off of the device.
(2)	**DC-In Socket**	24V XLR-Connector for connecting the power supply.
(3)	**Signal Converter – I/O Socket**	Socket for connecting an PLC (Programmable Logic Controller) or other devices (e.g. current loop).
(4)	**Modem Socket**	Socket for connecting an external modem. For service purposes only.
(5)	**Ethernet Socket**	Socket for connecting the to a local area network (LAN) for using a shared folder as storage location for measurement files.
(6)	**Console Socket**	Console interface socket. For service purposes only.
(7)	**Drift gas Socket**	3 mm Swagelok inlet plug for connecting the to a drift gas source.
(8)	**Carrier gas Socket**	3 mm Swagelok inlet plug for connecting the to a carrier gas source *(with 6-port valve or with membrane)*.
(9)	**Gas Out Socket**	3 mm Swagelok plug for connecting the to an adequate laboratory waste gas ventilation system/fumehood.
(10)	**Sample Out Socket**	3 mm Swagelok plug for connecting the to an adequate laboratory waste gas ventilation system/fumehood *(with 6-port valve or with membrane)*.

6 Installation

6.1 Unpacking the device

The device is delivered in a transport box. The box contains the device with the full scope of supply and accessories.

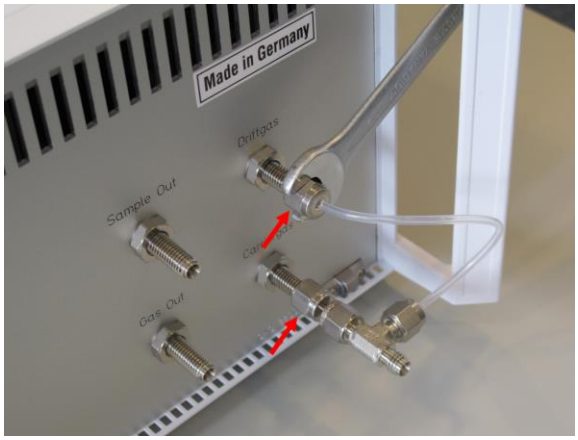
Unpack the device and place it on a robust table of minimum size 60 cm x 70 cm.
Ensure to reach the connection on the rear side of the device.

6.2 Installing the gas supply

Information!

The number of gas-in and gas-out plug in varies depending on the model or specific set up of the . The pictures below refer to an with membrane inlet or 6-port-valve. An with heated transfer line only has one Gas-in and one Gas-out plug.

Remove the red plugs on the front and the rear panel of the device.

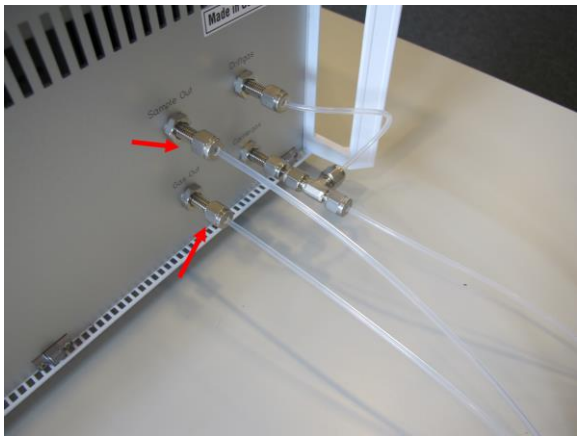


Connect the Driftgas/Carriergas-adaptor to the Driftgas- and Carriergas-Connector (3 mm Swagelok) on the rear panel of the device.

Connect the the Driftgas/Carriergas-adaptor to a nitrogen gas supply (e.g. a gas cylinder with pressure reducer).
Set up the back pressure to 3.0 bar (rel.).

Only use Nitrogen 5.0 or better.

It is recommended to use the delivered molecular sieve.

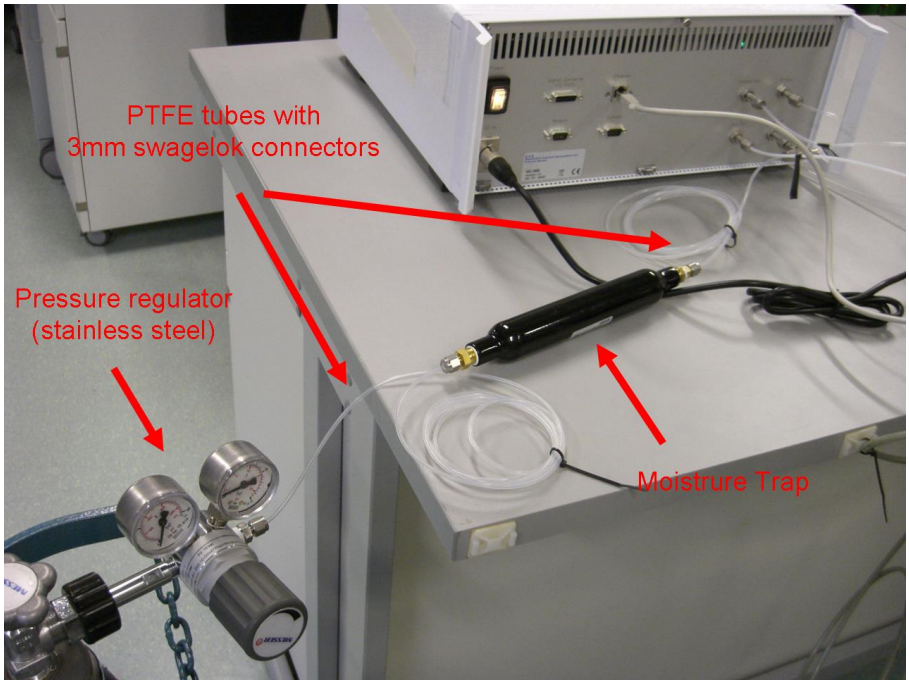


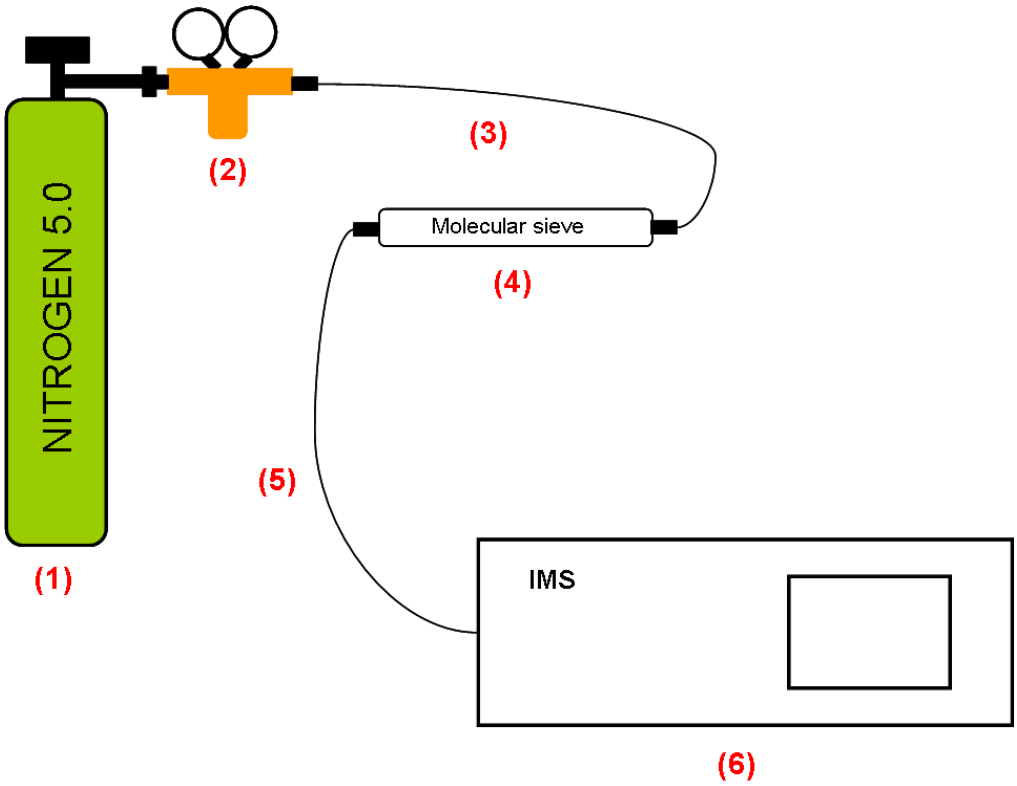
Connect a waste-tube to Gas-out and Sample-out connection and to an adequate laboratory waste gas ventilation system.

Information!

Only use stainless steel pressure reducer, PTFE tubes with 3 mm outer diameter and 3 mm swagelok connectors.

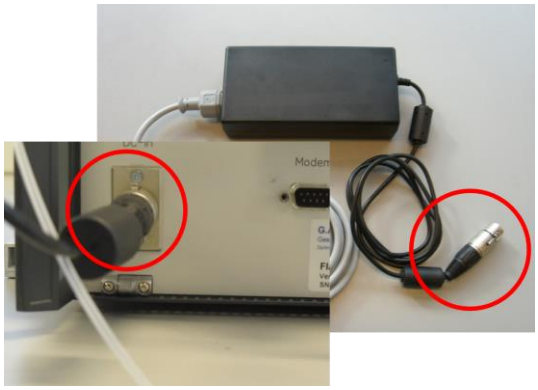
To ensure a high purity of the gas install the provided moisture trap.





(1)	Gas supply e.g. gas bottle with Nitrogen 5.0 ***(provided by customer)***
(2)	Pressure reducer ***(provided by customer)***
(3)	2 m PTFE gas tube with 3 mm Swagelock connector ***(provided by G.A.S.)***
(4)	Molecular sieve with 3 mm connection ***(provided by G.A.S.)***
(5)	2 m PTFE gas tube with 3 mm Swagelock connector ***(provided by G.A.S.)***
(6)	Device ***(provided by G.A.S.)***

6.3 Installing the power supply



Connect the power supply unit with the DC power cable to the .

Connect the AC power cable to the power supply unit and to the power supply.

Switch the device on.

6.4 Initial Operation

As a first step the device has to be cleaned to reach proper condition. The cleaning period is depending on how long the device was switched off. Therefore start the cleaning procedure (see chapter 7.1.7.7 and 8.5 Cleaning mode).
To speed up this process, increase flow rate of EPC1 and EPC2 to their maximum values directly after the successful installation.
After a recommended duration of 18 hours of cleaning the RIP in the positive drift voltage mode should reach ~80% of the RIP height displayed in the delivered Analytical Approval of the device under same measurement conditions of G.A.S..
If this is not the case check the quality of your gas and/or install additional purification cartridges and start the cleaning procedure again.

Information!

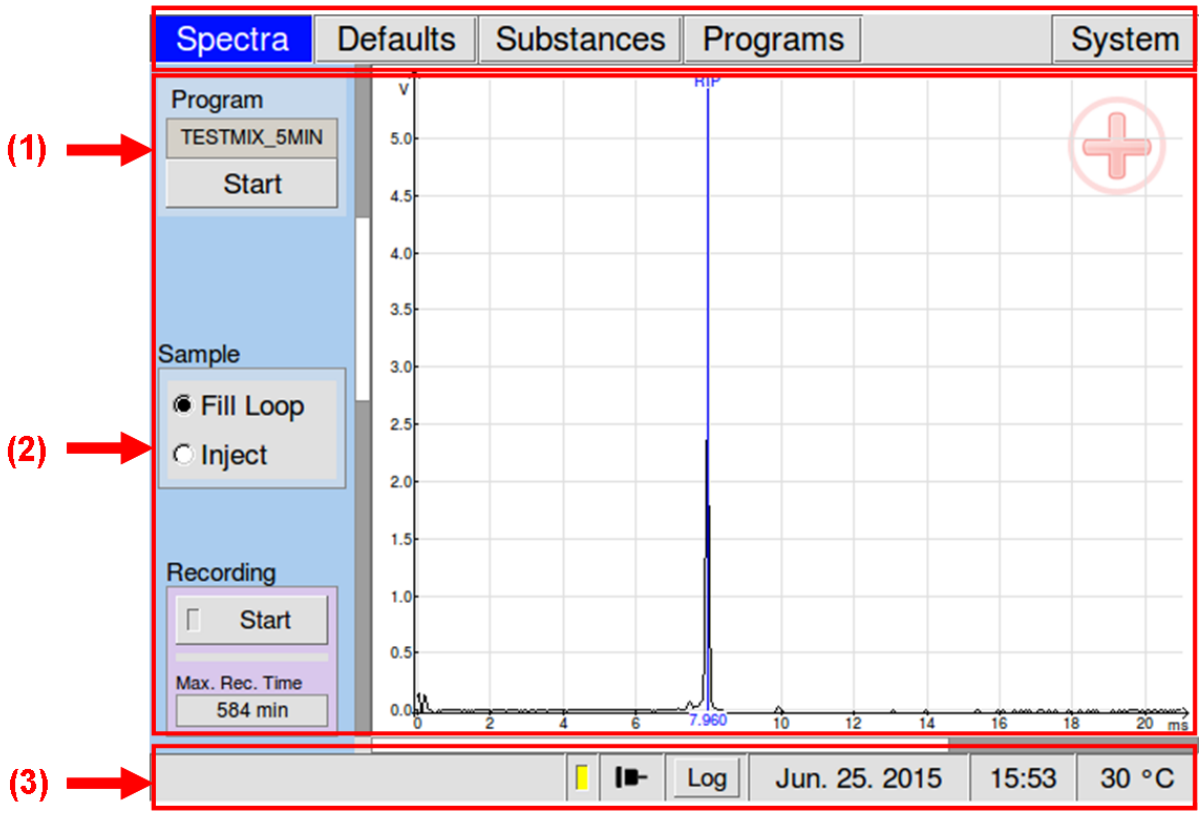
Only use stainless steel pressure reducer, PTFE tubes with 3 mm outer diameter and 3 mm Swagelok connectors.
Ensure that you use Nitrogen 5.0.
To ensure a high purity of the gas install the provided moisture trap.

7 Operating Interface

7.1 Graphical User Interface

7.1.1 Overview

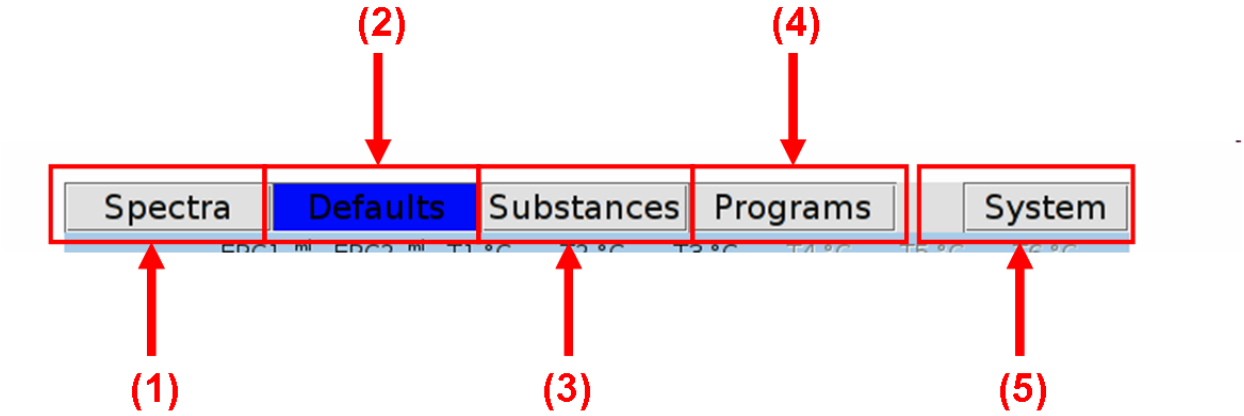
The graphical user interface is displayed on the TFT screen on the front of the device. The screen of the graphical user interface consists of the Window Selection Bar at the top, the Status Bar at the bottom and the large Window Display Area in the centre in which one of five main windows is displayed. After the start of the the Spectra window will appear.



(1)	**Window Selection Bar**	In the window selection bar the five main windows can be activated.
(2)	**Window Display Area**	The content of the selected window will be displayed here.
(3)	**Status Bar**	Various information like status messages are displayed in the status bar.

7.1.1.1 Window Selection Bar

In the Window Selection Bar the five main windows are listed. They can be selected and activated using the rotary knob or simply the touch-screen.



(1)	**Spectra Window**	In the Spectra Window the data acquisition process is controlled.
(2)	**Defaults Window**	The Defaults window allows the monitoring and modification of various device parameters and the monitoring of effects of these changes on the currently recorded spectra.
(3)	**Substances Window**	In the Substances Window a substance list containing up to 25 different substances with assigned search parameter sets can be managed.
(4)	**Programs Window**	The Programs Window allows to manage user-defined measurement programs.
(5)	**System Window**	In the System Window application and system specific information are displayed.

7.1.1.2 Window Display Area

In the Window Display Area one of the following windows is displayed:

Spectra Window

The Spectra Window is displayed after the device start. In the Spectra Window the data acquisition process is controlled. The current spectrum is displayed. The Recording Mode can be activated. The measurement selected program can be started.

Defaults Window

The Defaults window allows the monitoring and modification of various device component parameters. The electronic pressure controllers (EPC 1 and EPC 2) and the heating modules of the device can be controlled (T1 – T6). Further, basic data acquisition parameters can be set. For an automatic detection of the reactant ion peak (RIP) a RIP detection area can be set.

Substances Window

In the Substances Window a list of up to 25 different substances with assigned search parameter sets can be managed. This substance list is used for analysing the measurement data during a measurement program run. The result of this analysis is a subset of the substances in this list detected in the respective gas sample. It is stored along with the measurement data.

Programs Window

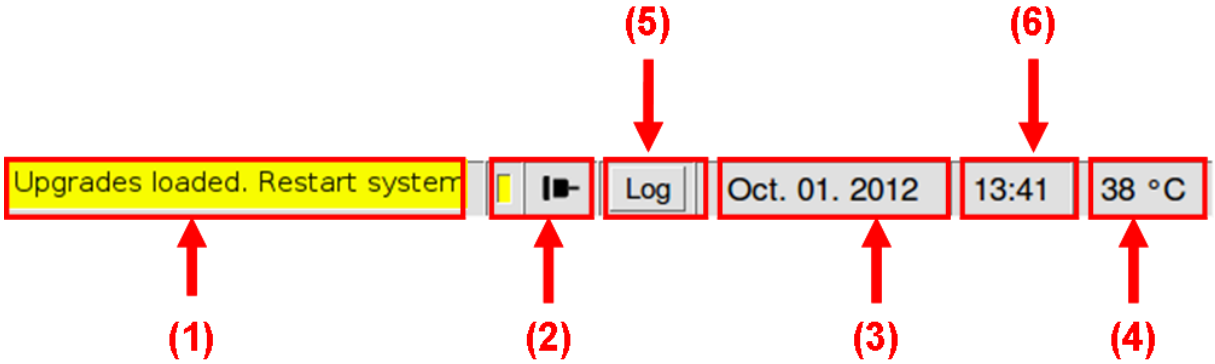
In the Programs Window user defined measurement programs can be managed. Various device parameters can be modified here and the recording of spectra can be started or stopped at defined spectra numbers and their corresponding points in time.

System Window

In the System Window application and system specific information are displayed. Besides the location for data storage of measurements (internal storage volume or shared network folder) can be set. Parameters such as display brightness, system date and time and cooler fan operation thresholds can also be set here.

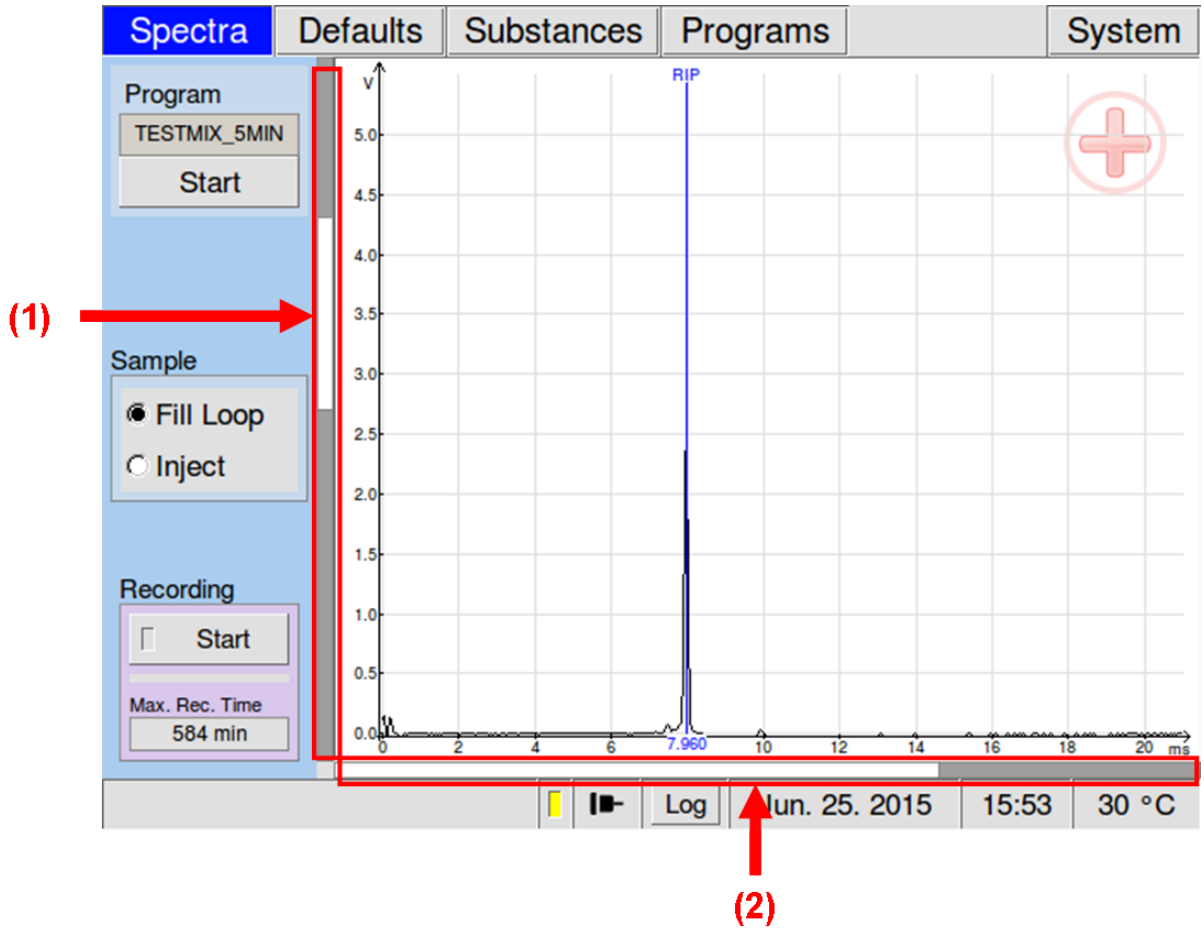
7.1.1.3 Status Bar

The Status Bar at the bottom of the screen consists of six sections.



(1)	**Status Message Section**	In the status message section information regarding device events and processes in textual form are displayed.
(2)	**Export Message Section**	In the export message section information about the export status is displayed. (Yellow = Export on; Grey = Export off)
(3)	**Date Section**	In the date section of the status bar the current date of the device clock are displayed. The clock can be set in the System Window.
(3)	**Temperature Section**	In the temperature section of the status bar the current device housing temperature is displayed. The cooler fan regulation parameters and the threshold for the overheat alarm which are related to this temperature can be set in the System Window.
(4)	**Log Section**	In the log section a chronological list of system events can be displayed.
(5)	**Time Section**	In the time section of the status bar the current time of the device clock is displayed. The time can be set in the System Window.

7.1.1.4 Scrollbars, sliders, zooming

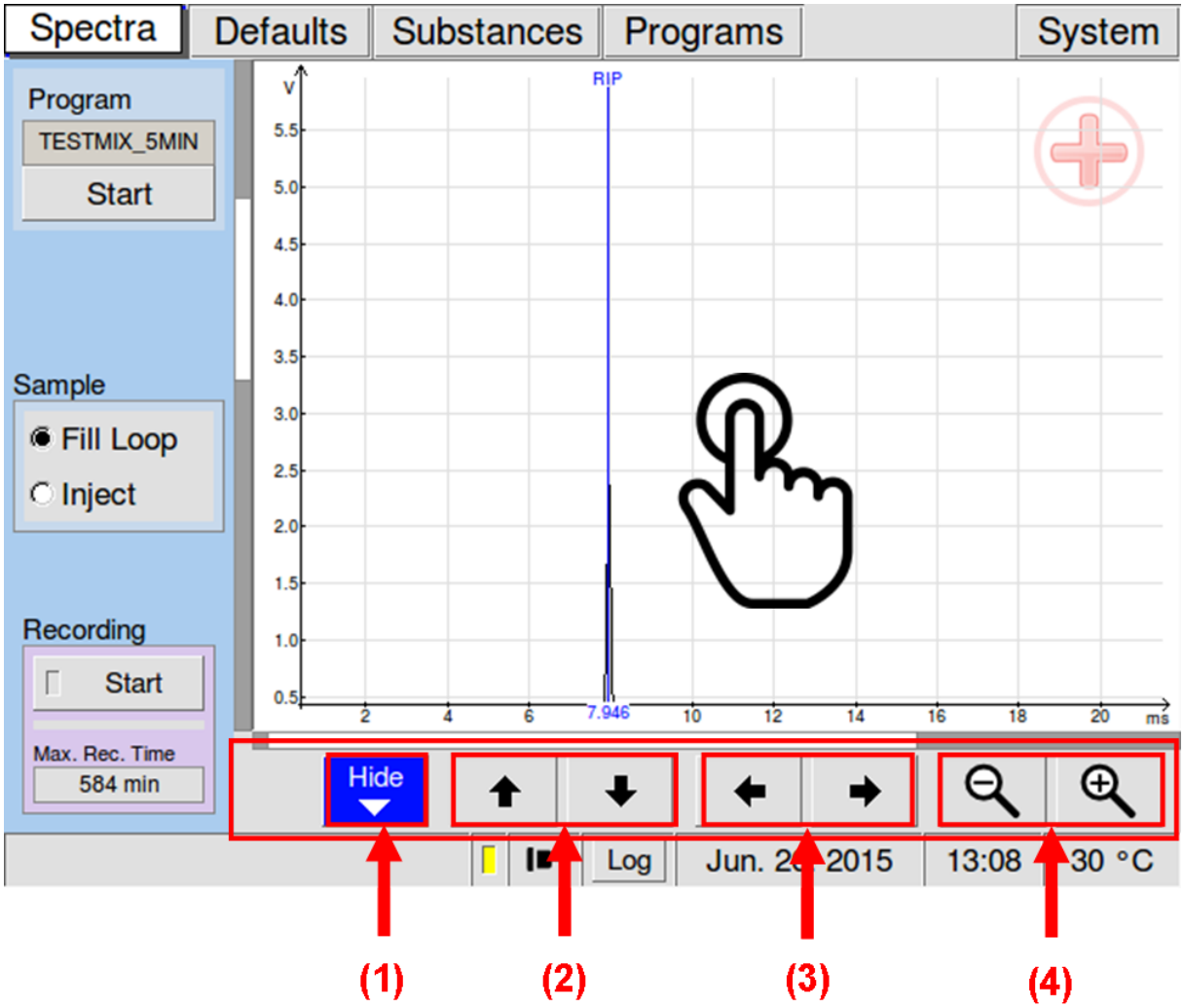


(1) **Vertical Scrollbar** — Shifts the current view area on the currently displayed spectrum up or down along the signal strength axis.

(2) **Horizontal Scrollbar** — Shifts the current view area on the currently displayed spectrum to the left or to the right along the drift time axis.

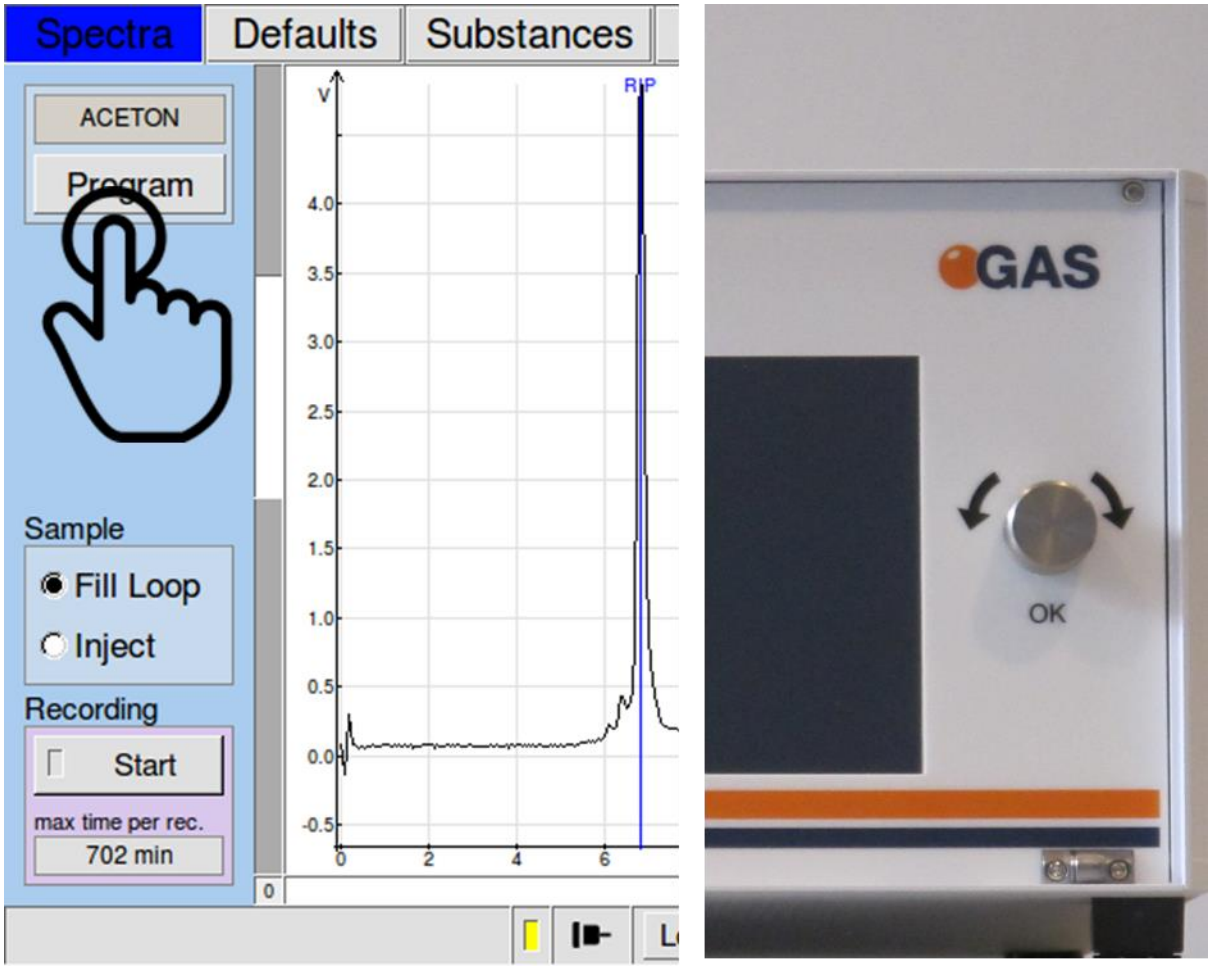
7.1.1.5 View Control bar

The view control bar function is available in the Spectra window and in the Defaults window. By touching the screen the control bar is displayed underneath the displayed spectra. Alternatively it can be activated by selecting the scrollbar and pressing the rotary knob.



(1)	**Hide Button**	The control bar can be hidden manually. After 3 seconds of inactivity it disappears automatically.
(2)	**Vertical Control Buttons**	Moves the vertical position of the display area on the screen up or down.
(3)	**Horizontal Control buttons**	Moves the horizontal position of the display area on the screen left or right.
(4)	**Zoom Control buttons**	Reduces or enlarges the view of the display area on the screen

7.1.2 Input methods



The graphical user interface of the device can be controlled by using the **rotary knob** on the front and can also be operated using its **touch-screen display**.

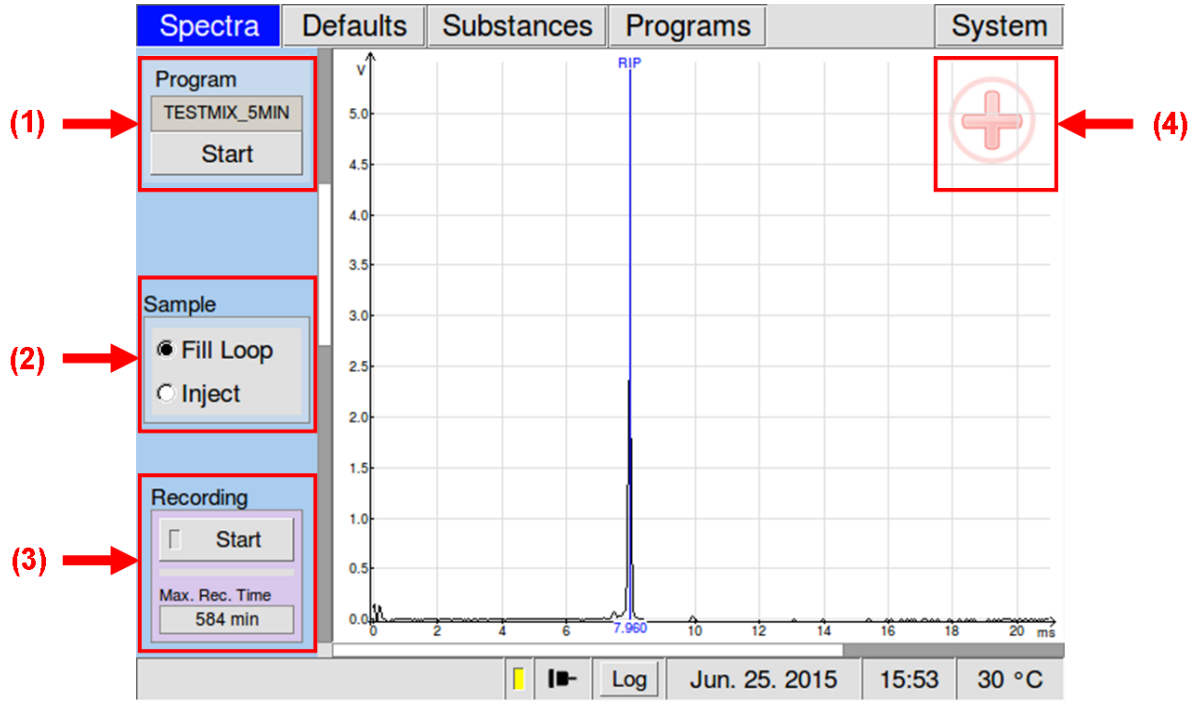
The rotary knob is used to cycle through the panels in the window selection bar, the various buttons on the window pages or in dialogue windows, input fields and panels. The current selection is marked blue. The underlying control element can be activated by pressing the knob.

Activated input fields are highlighted yellow. Input fields values are modified by activating the field and by cycling through the value choices by rotating the rotary knob. The modified value is set by pressing the rotary knob again.
Scrollbars and sliders activated for user inputs are highlighted yellow as well. Their movable parts are moved by rotating the knob.

7.1.3 Spectra Window

7.1.3.1 Overview A-IMS with 6-port valve

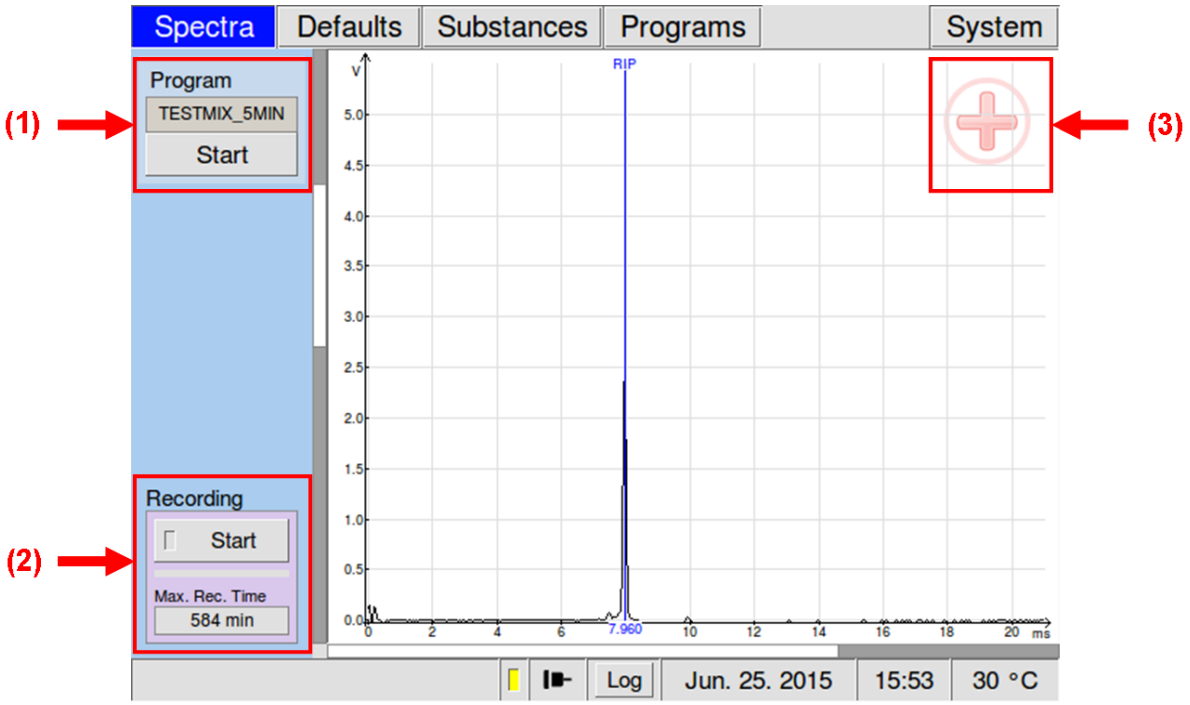
After the device is switched on and the system start is completed the graphical user interface with the Spectra Window is displayed on the TFT screen. In the Spectra Window the data acquisition can be controlled.



(1)	**Program Start Button with selected program**	The currently selected program is started. This is only available when the monitoring mode is deactivated.
(2)	**Switching Valve Button**	By activating these buttons the 6-port-valve can be toggled manually. This feature is only available in an with 6-port valve.
(3)	**Recording Check Box**	With this check box the live monitoring of measurements can be recorded manually.
(4)	**Active Drift Voltage**	Indicates whether the positive or negative voltage mode is activated.

7.1.3.2 Overview A-IMS with membran or heated transferline

After the device is switched on and the system start is completed the graphical user interface with the Spectra Window is displayed on the TFT screen. In the Spectra Window the data acquisition can be controlled.



(1)	**Program Start Button with selected program**	The currently selected program is started. This is only available when the monitoring mode is deactivated.
(2)	**Recording Check Box**	With this check box the live monitoring of measurements can be recorded manually.
(3)	**Active Drift Voltage**	Indicates whether the positive or negative voltage mode is activated.

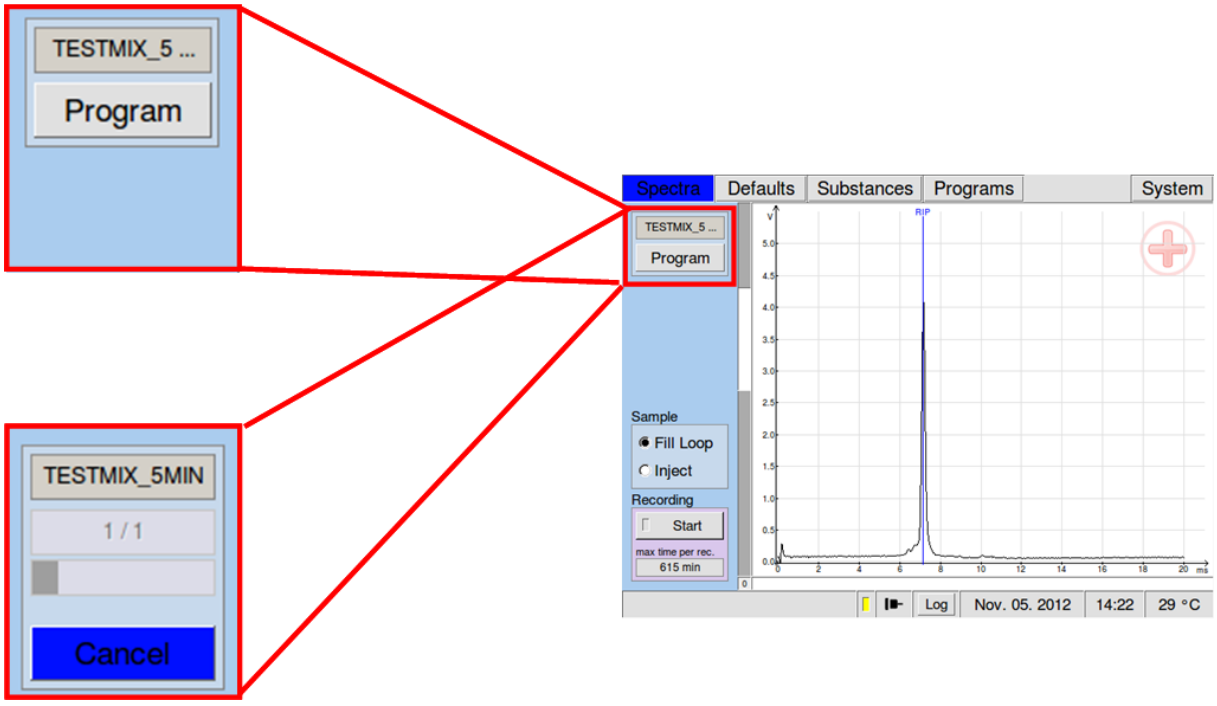
7.1.3.3 Acquisition modes

There are two data acquisition modes:

- Standard Mode - Measurement programs can be executed
- Recording Mode – manually operated measurement

Standard Mode

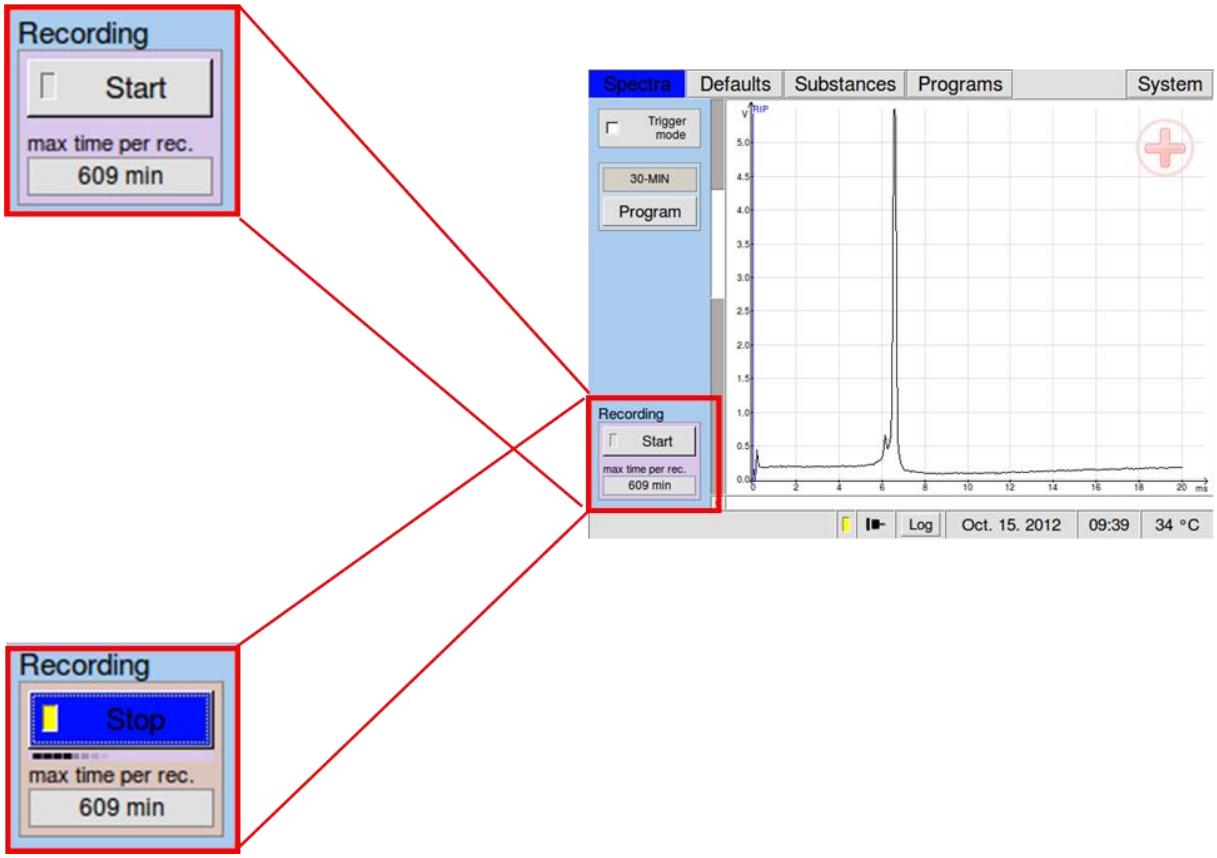
In the Standard Mode of data acquisition user-defined measurement programs can be started. The executable measurement program can be created and selected in the Programs Window. Its name is displayed in the upper left of the Spectra Window. The selected measurement program can be started by activating the Program button in the upper left of the Spectra Window.

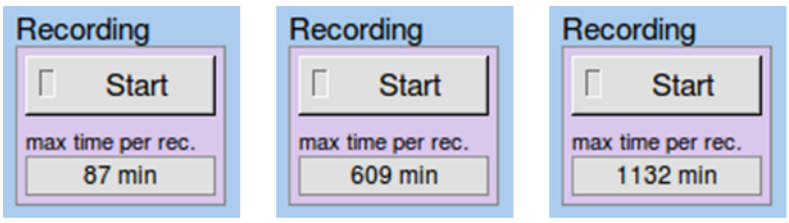


Recording Mode

To record a measurement manually the **Recording** button has to be switched on. If recording is not active the button is set to START and the checkbox is grey. If recording is active the button is set to STOP and the checkbox is yellow.

In this case a measurement file is generated from the recorded data and saved to the internal flashcard. Also the remaining time for data storage to the internal flashcard is shown. It depends on the number of measurement data that were released for export but were not yet exported and their file size depends on the value of spectra averages that are used..



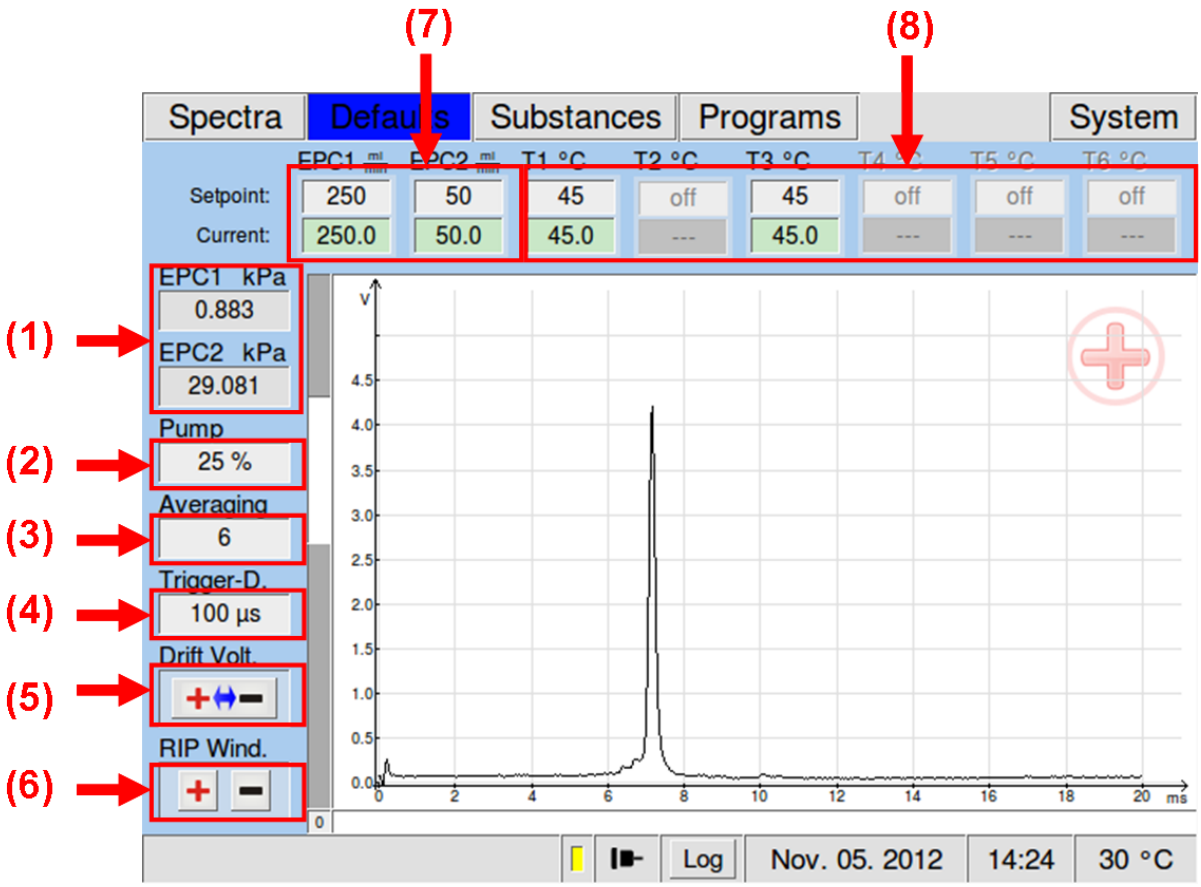


Averaging 0 Averaging 6 Averaging 12

7.1.4 Defaults Window

7.1.4.1 Overview

The Defaults Window allows the modification of various parameters of all relevant components. The influence of such modifications can be monitored. The selection of affected the system performance.



(1) Pressure display

The pressure display shows the relative overpressure of the gas flow. EPC1 represents the overpressure of the drift gas flow which is necessary to get a drift gas flow into the IMS and EPC2 the overpressure of the carrier gas flow which is necessary to get a carrier gas flow through the column.

(2) Pump

The sample-in flow in percent of the pump power can be set here *(with membrane or with 6-port valve).*

(3) Averaging

The averaging value determines how many raw spectra are averaged to generate one single spectrum as result in the stored measurement file. Signal averaging increases the signal to noise ratio. A value of “0” (Off) disables averaging. A

value of “n” will result in an averaging of n+1 spectra. Modifying the averaging parameter affects the number of recorded spectra per time period. A typical average value is 6. The maximum is set to 99.

(4) Trigger-Duration

This value is the shutter grid opening time of the IMS sensor. This value is optimized for every IMS and should not be changed by the user. The standard trigger duration value is 100 µs.

(5) Drift-Voltage (positive/negative)

Toggles the negative and positive drift voltage mode. Spectra are shown in the Spectrum View either in the positive or in the negative voltage mode. It is indicated in the upper right corner of the spectrum view.

(6) RIP Window

Drift time intervals for RIP detection in the positive and negative drift voltage mode can be set here.

(7) Flow

Input fields Setpoint / Current flow rates; EPC 1 for the drift gas flow and EPC 2 for the carrier gas flow.

(8) Active / Inactive Temperatures

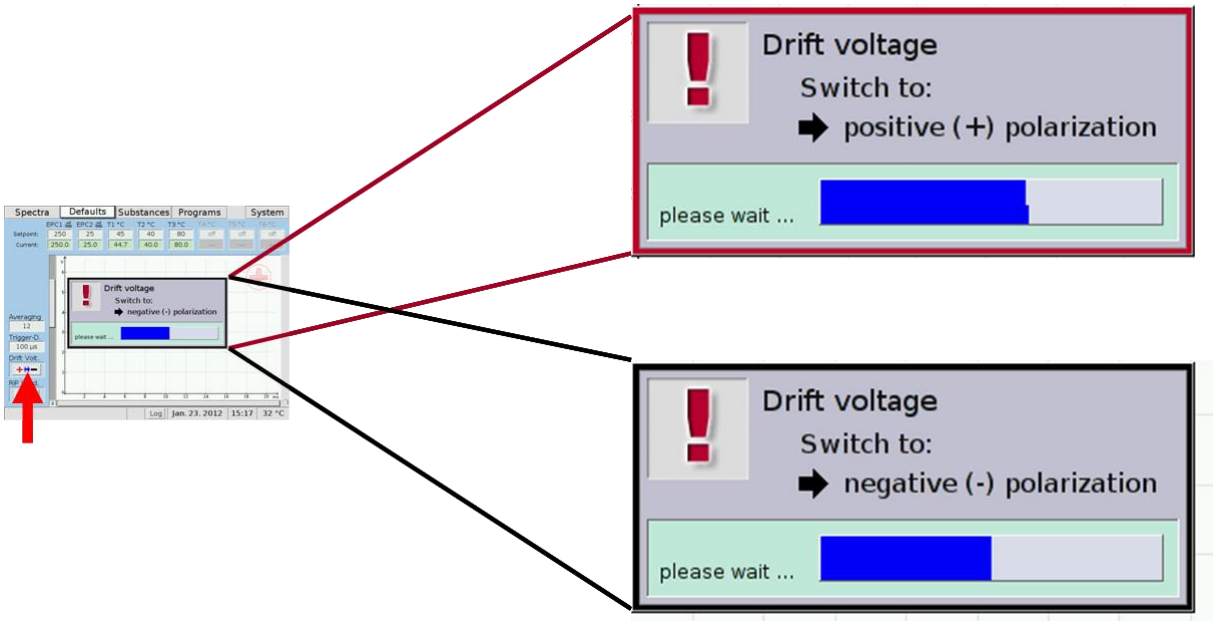
Setpoint temperature values and current temperature values of the heating modules IMS (T1), 6-port valve with loop, or membrane (T3), heated transfer line (T4). Inactive fields are shown greyed out.
The number of active temperatures may vary depending on the type of

Active temperatures:

(6-port-valve):	T1 (IMS)
	T3 (6-port valve with loop)
(membrane):	T1 (IMS)
	T3 (semi-permeable membrane)
(transferline):	T1 (IMS)
	T4 (heated transfer line)

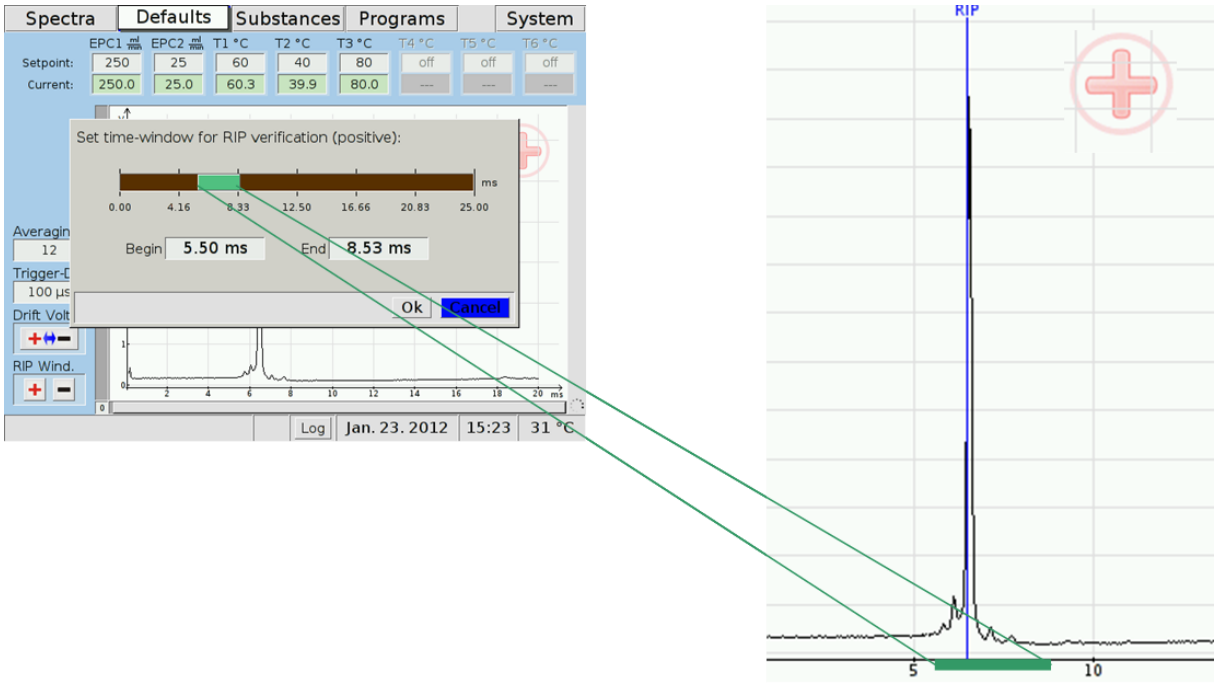
7.1.4.2 Drift Voltage

The button Drift Voltage switches between positive and negative drift voltage mode. The RIP and AIPs in the positive drift voltage mode will be maxima. In the negative drift voltage mode it will be minima. One of these two modes may be more suitable for specific substances.



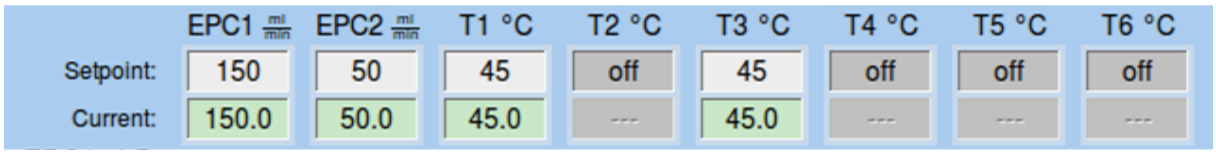
7.1.4.3 RIP-Window

Activating the buttons RIP Wind. +/- opens a dialogue in which RIP detection intervals can be set for the positive and negative drift voltage mode:



The detected RIP position is displayed in the spectrum view of the Spectra Window. The actual RIP drift time is determined by the ion mobility spectrometer of the but the user can specify time intervals in which the RIP can be expected. Each polarization mode has its specific RIP detection interval. Each time the dialog box is closed by pressing the OK button the system will reinitialize the determination of RIP drift times. Modifying these detection intervals is useful in cases when there are impurities in the sample gas.

7.1.4.4 Flow Controls and Heating Modules

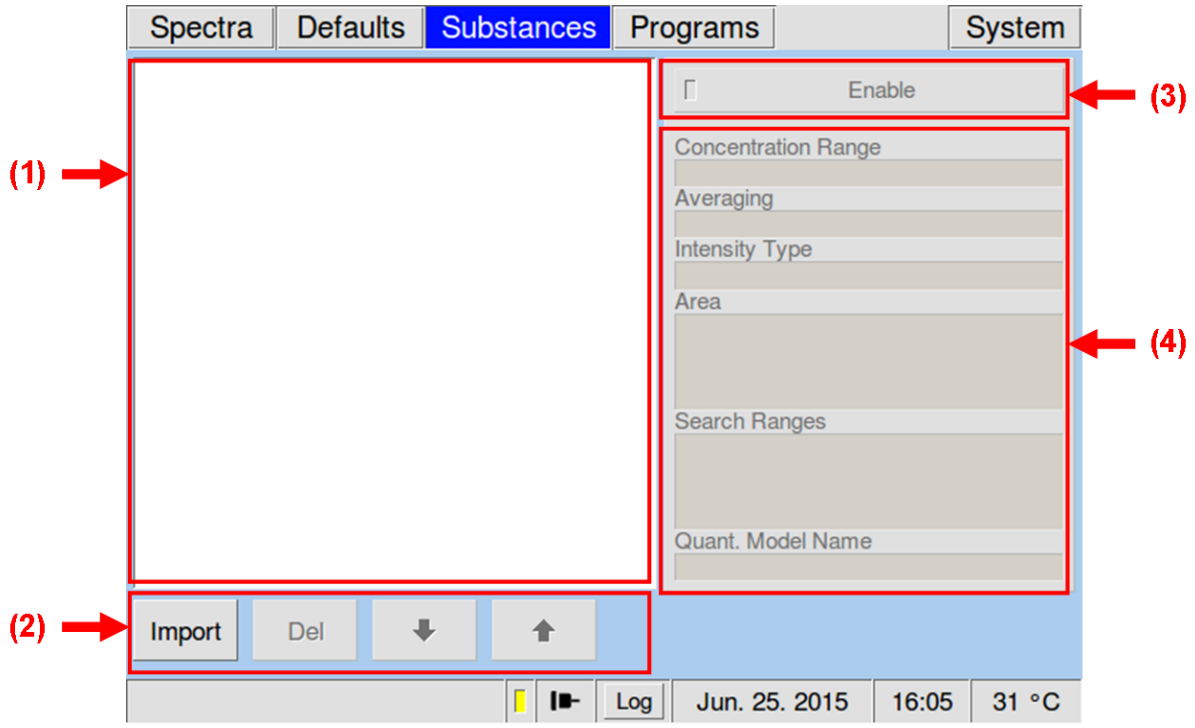


Depending on the specific set up of the device the component parameters are displayed and can be modified in the upper section of the window and in the left section of the window.

Above the spectra chart the flow rates of the drift and carrier gas controlled by the two electric pressure controllers (EPC 1 and EPC 2) as well as the temperatures of the three heating elements in the device are managed. The current flow rates and set-points for EPC 1 (drift gas) and EPC 2 (carrier gas) are displayed. The maximum value for EPC 1 is 500 ml/min. The maximum value for EPC 2 is 150 ml/min. The current temperatures and the set points of the IMS (T1), the MCC (T2)(when installed), the membrane or the 6-Port valve with loop (T3) and the heated transfer line (T4) are displayed in the middle. The set points can be set using these controllers. The maximum adjustable temperature value is 80 °C. During the cleaning process the heating modules can reach temperatures up to >100°C. These will be displayed as “> 80 °C”. Heating modules can be turned off by decreasing the respective value to “off”. Not available functions are greyed out.

7.1.5 Substances Window

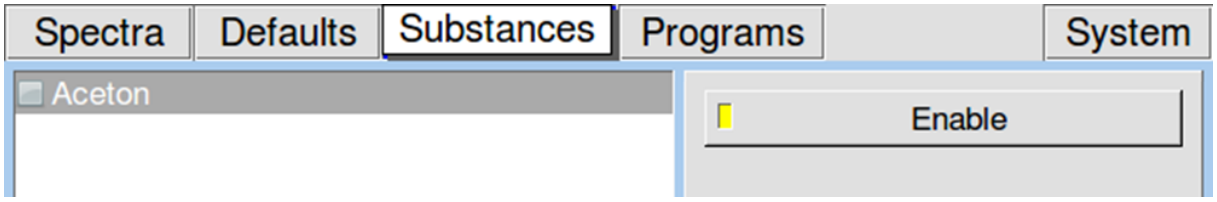
7.1.5.1 Overview



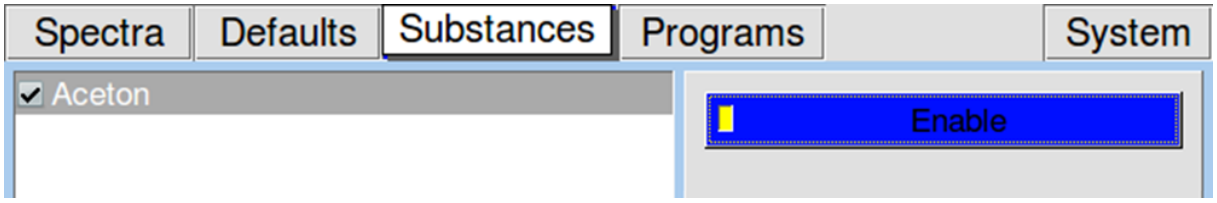
(1)	**Substances List window**	All created substance entries are listed in this box by name. The highlighted substance is selected for modification.
(2)	**Substances List Control Panel**	Buttons for creating, changing or deleting substances and for changing the list order.
(3)	**Enable Button**	Enables or disables the selected substance as a candidate for the detection process.
(4)	**Substance Calibration Information Area**	Displays the substance specific calibration information such as used concentration range, average, intensity type, area, search ranges and the quantification model name.

7.1.5.2 Managing Substance Entries

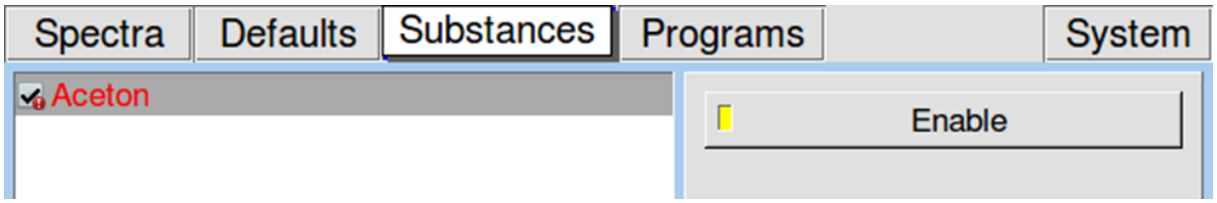
The Substance List Control Buttons Panel contains buttons for importing (**Import**) and deleting (**Del**) substance entries. By pressing the buttons **Up** and **Down** the position of a selected entry in the substances list can be changed.
After importing a substance calibration file it is available in the Substance List window.



To make the substance active it has to be activated by pressing the Enable Button. The activated substance is marked.



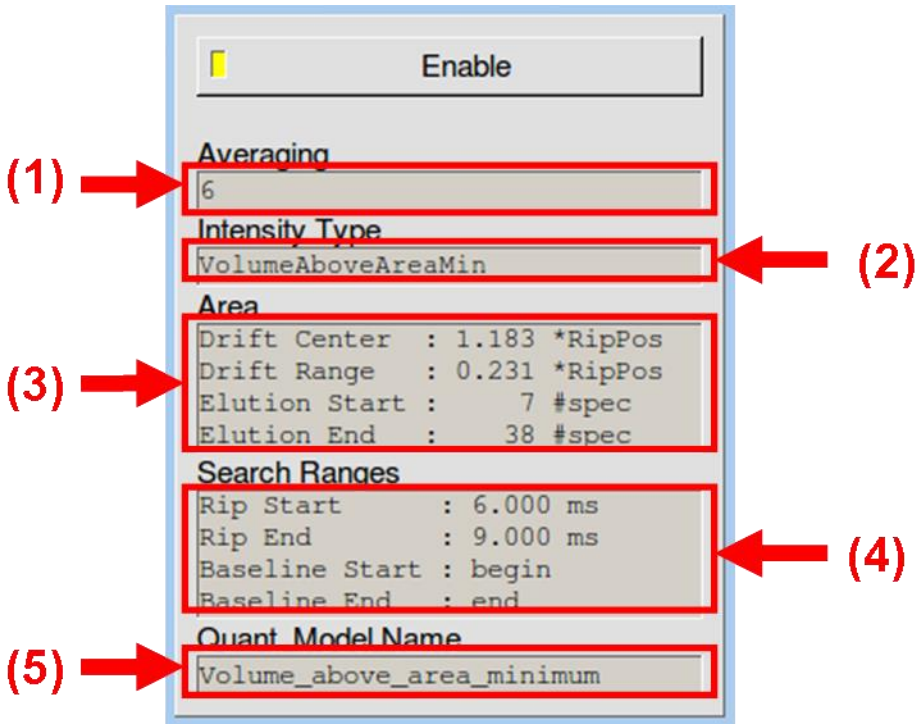
In case that the average value of the System settings and of the Substances calibration file differ the relevant substance entry is labelled red und marked with an error symbol.



If the **Enable Button** for the selected substance is checked the substance entry will be included in the substance recognition process during the next measurement program run.

7.1.5.3 Substance Calibration Information Area

Substance specific calibration information such as used Average, Intensity type, Area, Ranges and the Quantification model name of the selected Substance in the substance window are shown.



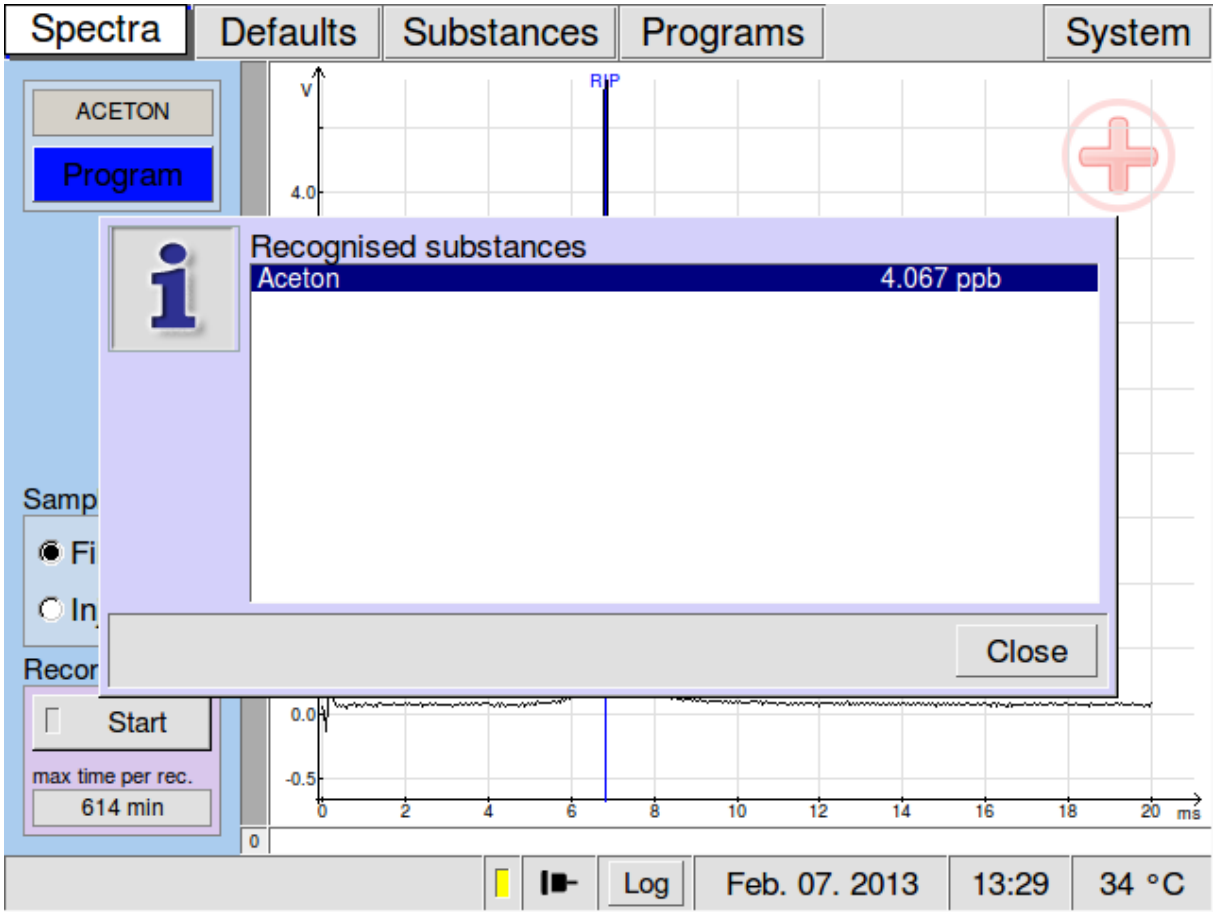
(1)	**Averaging**	Displays the used average of the actual substance calibration file.
(2)	**Intensity Type**	Displays the used intensity type of the actual substance calibration file.
(3)	**Area**	Displays the used area parameter of the actual substance calibration file.
(4)	**Search Ranges**	Displays the used search ranges of RIP and baseline of the actual substance calibration file.
(5)	**Quant Model Name**	Displays the quantification model name of the actual substance calibration file.

Information!

All substance calibration information are part of the calibration file set in the G.A.S. software LAV which is part of the G.A.S. IMS Software Suite.

7.1.5.4 Recognised substances window

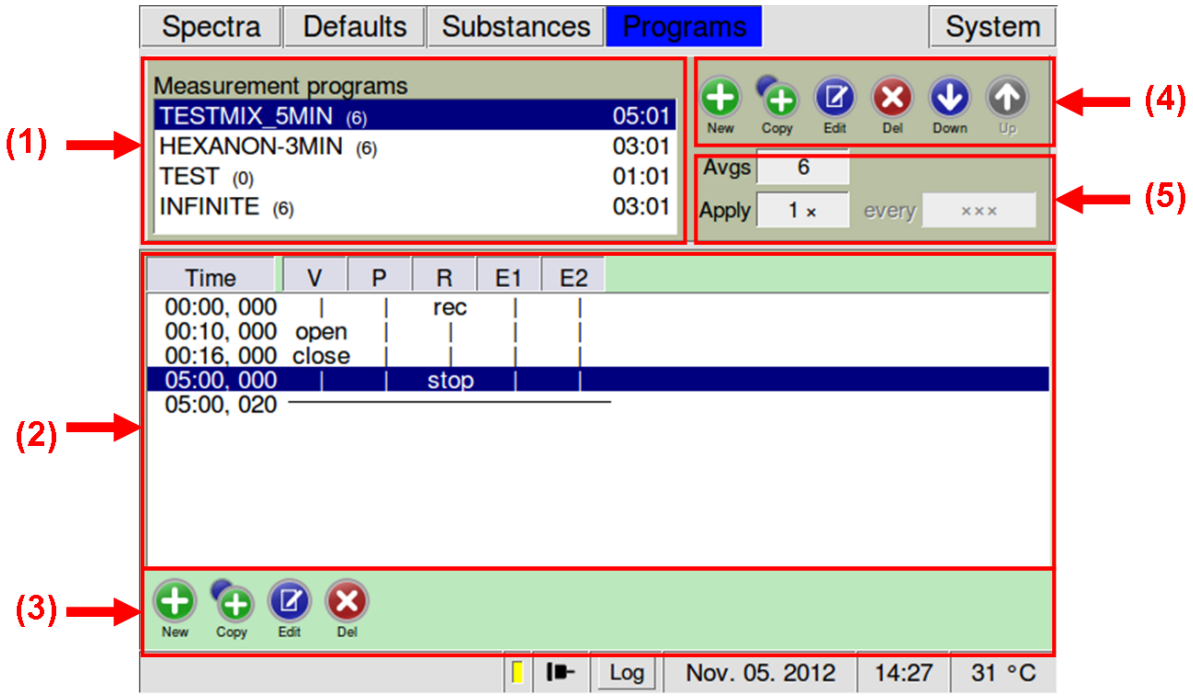
When substances are enabled in the substance window the recognised substances window appears at the end of every measurement. This screen displays a list with the results in a concentration unit which is defined in the valid calibration curve. When a current loop is available the last result of this list will be overwritten. By starting the next measurement this window disappears until the next measurement will be finished..



7.1.6 Program Window

7.1.6.1 Overview

The device is able to set up and execute user-defined measurement programs. These measurement programs are managed in the Programs Window.



(1)	**Measurement program List window**	All created programs are listed in this box by name. The highlighted program is selected for execution or modification.
(2)	**Selected Program Window**	All instructions of a selected program are listed here in a chronological order. For every component that can be controlled by a program a separate column is displayed.
(3)	**Selected Program Window Control Panel**	Buttons for creating, changing or deleting actions of the selected program.
(4)	**Measurement Program Control Panel**	Buttons for creating, changing or deleting programs and for changing the programs list order.
(5)	**Program Repetition and Average Settings**	The entries “Apply” and “every” determine how often and in which time-intervals the selected program is executed. In the “Average” field the average of the actual selected program can be set. The actual average is appended to the name of the measurement program.

7.1.6.2 Creating Measurement Programs

The Measurement Program List window displays all measurement programs currently existing in the . The actual average value is part of the program name. The selected program can be edited.

With the buttons in the Measurement Control Panel Program entries can be created, copied, edited or deleted. The list order can be changed by using the Up and Down buttons. By pressing the "**Edit"** button the program name for the selected entry can be edited into a keyboard window. The measurement programs list can contain up to 100 entries. A new entry is added when pressing the "**New"** button which will open a keyboard window for entering the program name at first:

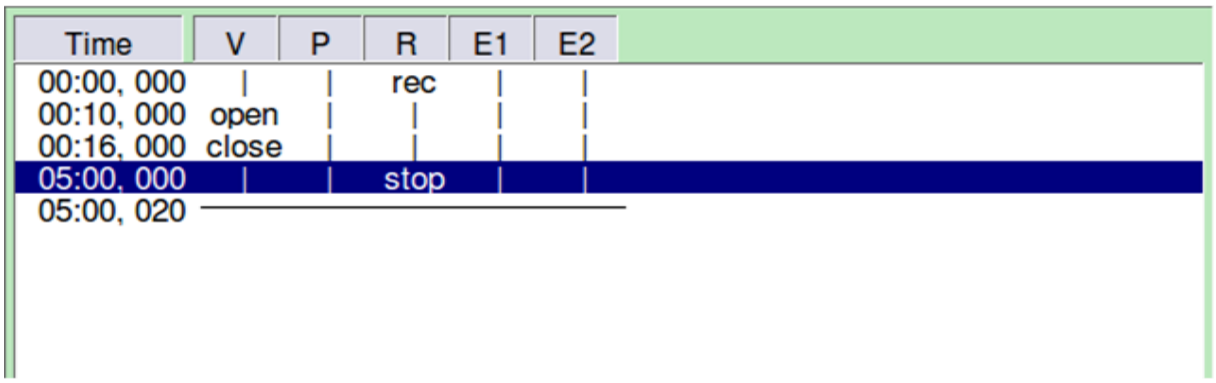
Measurement programs can be set for repeated execution. Execution rules can be defined for each program in the "**Apply"** and "**every"** fields.

Valid values for the "Apply" field range from 1x (once, the default) up to 9,999 repetitions or infinite, which means the program will be repeated endlessly. In the "Average" field the average of the actual selected program can be set. The actual average is appended to the name of the measurement program.

The time span (hours, minutes and seconds) between two program runs - more exactly between two program starts - is set in the “every” field. Hence the minimum time span to be entered here is the duration of the currently selected measurement program as displayed in the programs list. Depending on the used average the acquisition of spectra produces a large amount of data. The processing of this data can cause a latency between program end and program restart of up to about 1 second.

7.1.6.3 Editing Measurement Programs

Each program consists of a list of chronological ordered steps, so called actions. The Selected Program Window displays the list of actions for the currently selected program. Each row in this list represents a step in the measurement program in which various commands to the device components are given.

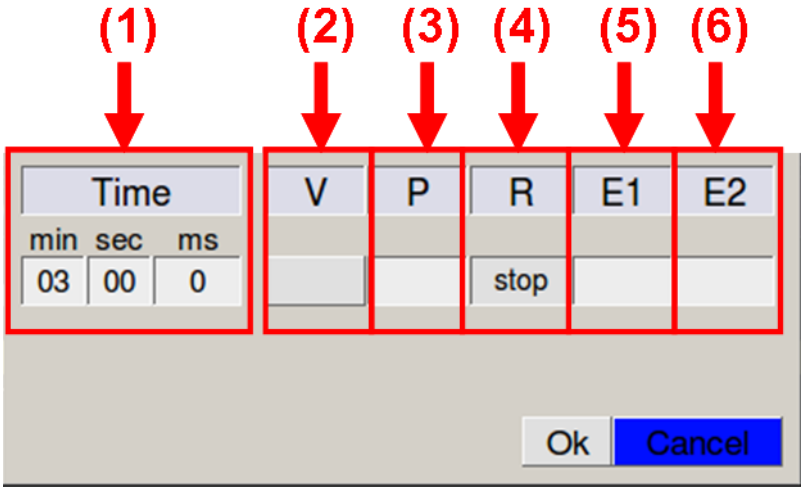


A value here determines the new state of the respective device component. A vertical line “|” indicates that the respective device component is not involved into this action.

The last row in this action list contains horizontal lines only. It indicates the end-of-program. The point of time of this end-of-program marker can be increased. This determines the duration of the program run.

The first column (Time) displays the time in which the action takes place. In the second column (V) the 6-Port valve can be switched. In the third column (P) the actual sample flow can be set in percent of the pump power. In the fourth column (R)

the recording is started and stopped. In column 5 (E1) the flow rate of the drift gas and in column 6 (E2) the flow rate of the carrier gas can be set.



(1)	**Time**	Time point of action start
(2)	**Valve**	Open / Close 6-port valve `(open / close)`
(3)	**Pump**	Pump capacity `(%)`
(4)	**Recording**	Start / Stop recording spectra `(rec / stop)`
(5)	**Electronic pressure control 1**	Flow rate control for drift gas `(0-500 ml/min)`
(6)	**Electronic pressure control 2**	Flow rate control for carrier gas `(0-150 ml/min)`

With the buttons in the Selected Program Window Control Panel the currently displayed program can be created, modified or deleted. A newly created action is positioned after the currently selected action. Pressing the **Copy** button copies the selected action and orders the copy behind the selected action. To maintain the chronological order of the actions the system may rearrange the actions by ordering them according to their numbers later on. By pressing the **Del** button the currently selected action is deleted. Pressing the **Edit** button or the **New** button opens the Edit Action dialogue.

7.1.6.4 Measurement Programs in detail

The duration of a spectrum is not fixed. It depends on the averaging value as set in the Defaults window. With averaging turned off (Averaging value 0) a resulting spectrum takes 30 ms. Each averaging increases the recording time of a resulting spectrum by 30 ms. E.g. an averaging of 16 results in a recording time of (16+1) • 30 ms = 510 ms. This is the fundamental time strcuture all actions have fit in.
Therefore modifying the "**Averaging"** value affects the system time structure.

All device components can be controlled within a program action. A blank component field in this dialogue will leave the respective component unchanged in this particular action.

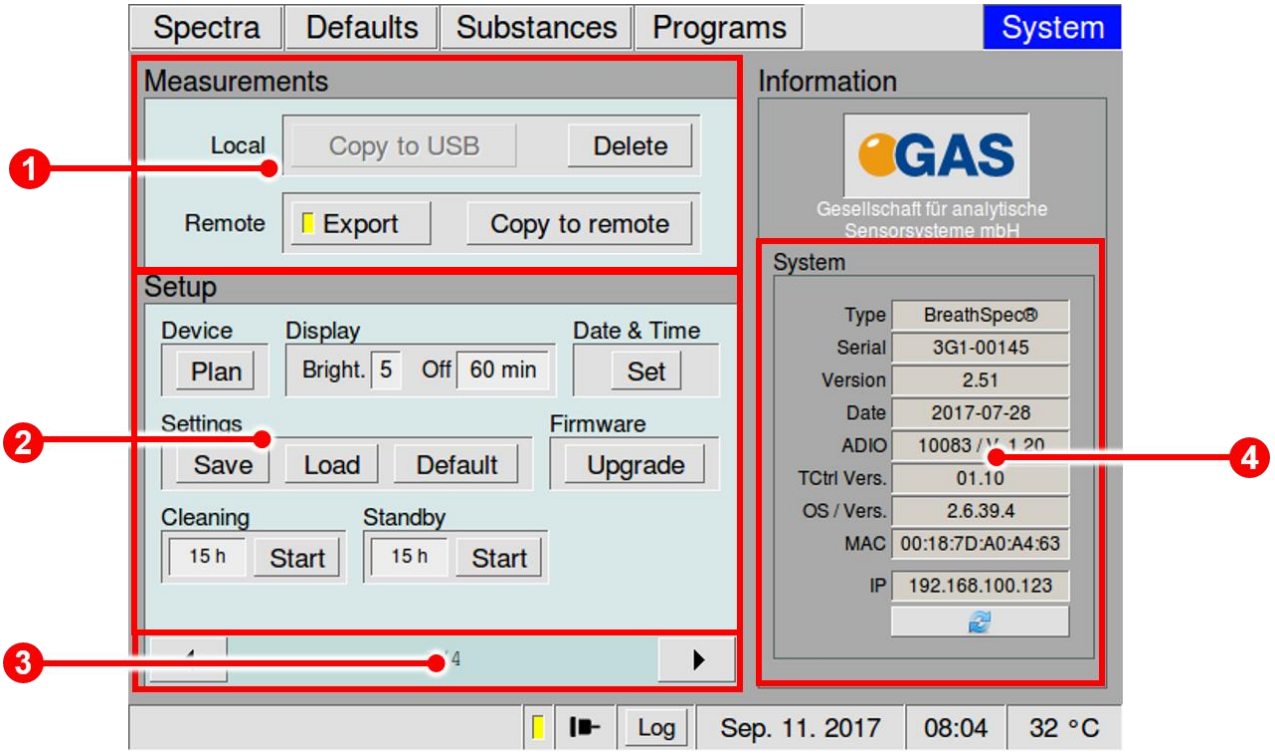
Measurement files will be generated only when the spectra recorder (R) has been actived (action "rec") during program execution. When the spectra recorder R has not been activated during the complete program execution time no measurement file is created.
When a measurement program contains the recording action "rec" but not the action to terminate it with the value "stop", the recording is automatically terminated at the end of the measurement program.

7.1.7 System Window

7.1.7.1 Overview

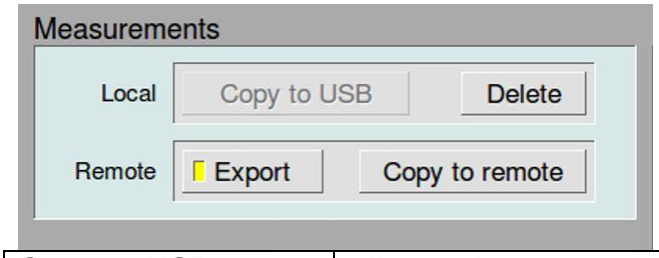
In the System Window application and system specific information are displayed. Further storage location for measurements (internal GC-IMS storage volume or shared network folder) can be selected. Measurement files in the primary storage location can be exported to a connected USB volume. Parameters such as display brightness, system date and time and cooler fan operation thresholds can be set.

The firmware can be upgraded and the system settings can be exported or imported in this window.



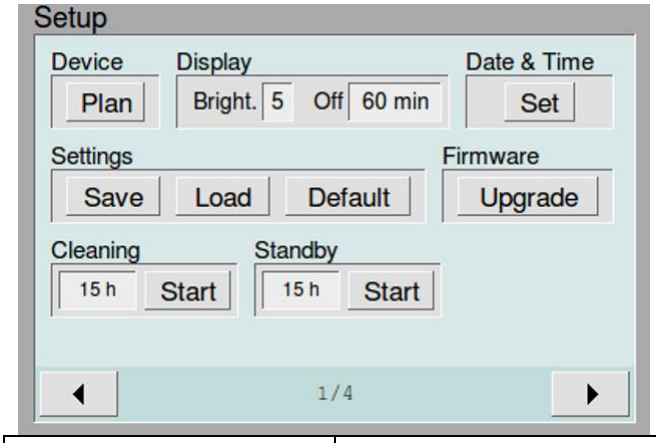
1	**Measurement Area**	Setup Local and Remote Export Settings
2	**Setup Area**	Is divided into four pages. Parameters such as display brightness, system date and time and cooler fan operation thresholds can be set.
3	**Setup Area Page Selector**	Displays the current page number and toggles between the four Setup Area Pages.
4	**System Information Panel**	Displays application specific information such as software version numbers, device identifiers and IP-address of a connected network

1.1.1 Measurement Area

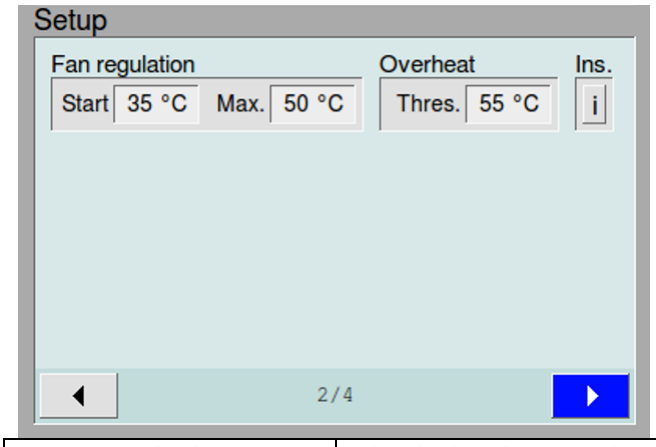


Copy to USB…	All stored measurements will be copied to a
Delete	Deleting Measurements. All internal stored
Export	Activating and setting up an shared folder on a network as storage location for measurements
Copy to Remote	All internal stored measurements will be copied to the connected shared folder

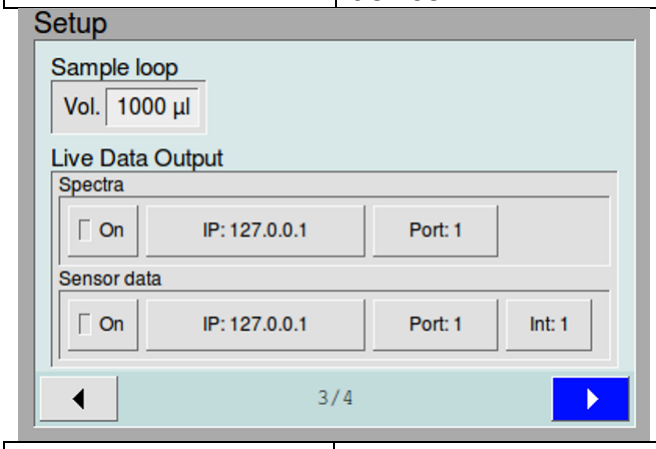
1.1.2 Setup Area



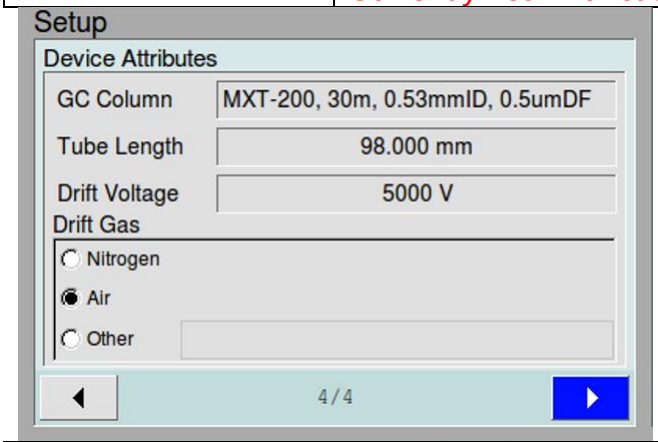
Device Plan	Opens a dialogue window in which a device overview plan is displayed.
Display	The display brightness and a screen-saver time-out can be set.
Date & Time	Pressing this button opens a dialogue in which date and time of the device clock can be set.
Save Settings Button	The system settings can be saved to a connected USB volume.
Load Settings	The system settings can be loaded from a connected USB volume.
Default Settings	Resets all system settings to factory default values. All stored measurement programs and substance entries will be erased.
Firmware Upgrade	Performs a system and firmware upgrade from a connected USB volume.
Cleaning	Starts the cleaning function. The temperatures are set up to their maxima.
Standby	Reduces the drift gas flow to 10 ml/min and the carrier gas flow to 5 ml /min.



Fan regulation	The behaviour of the cooling fan can be controlled. When the temperature inside the device reaches the temperature in the field Start the cooler fan starts working. The power of the cooler fan is increased up to the desired temperature of the value in the field Max.
Overheat Alarm	The threshold temperature for the overheat alarm can be set.
Inspection (I)	Accesses the inspection and diagnostic functions of the device.



Sample Loop setting	The volume of the used loop can be set here. This data is stored in the metadata of the measurement. The standard value is 1000 µl.
Live Data Output	Prepared for further use! Currently not in function!



GC-Column	Input filed for Column ID. The value is stored with the measurement file.

Tube Lenght	Prepared for further use! Currently not in function!
Drift Voltage	Prepared for further use! Currently not in function!
Driftgas	Selection field for operating gas type.

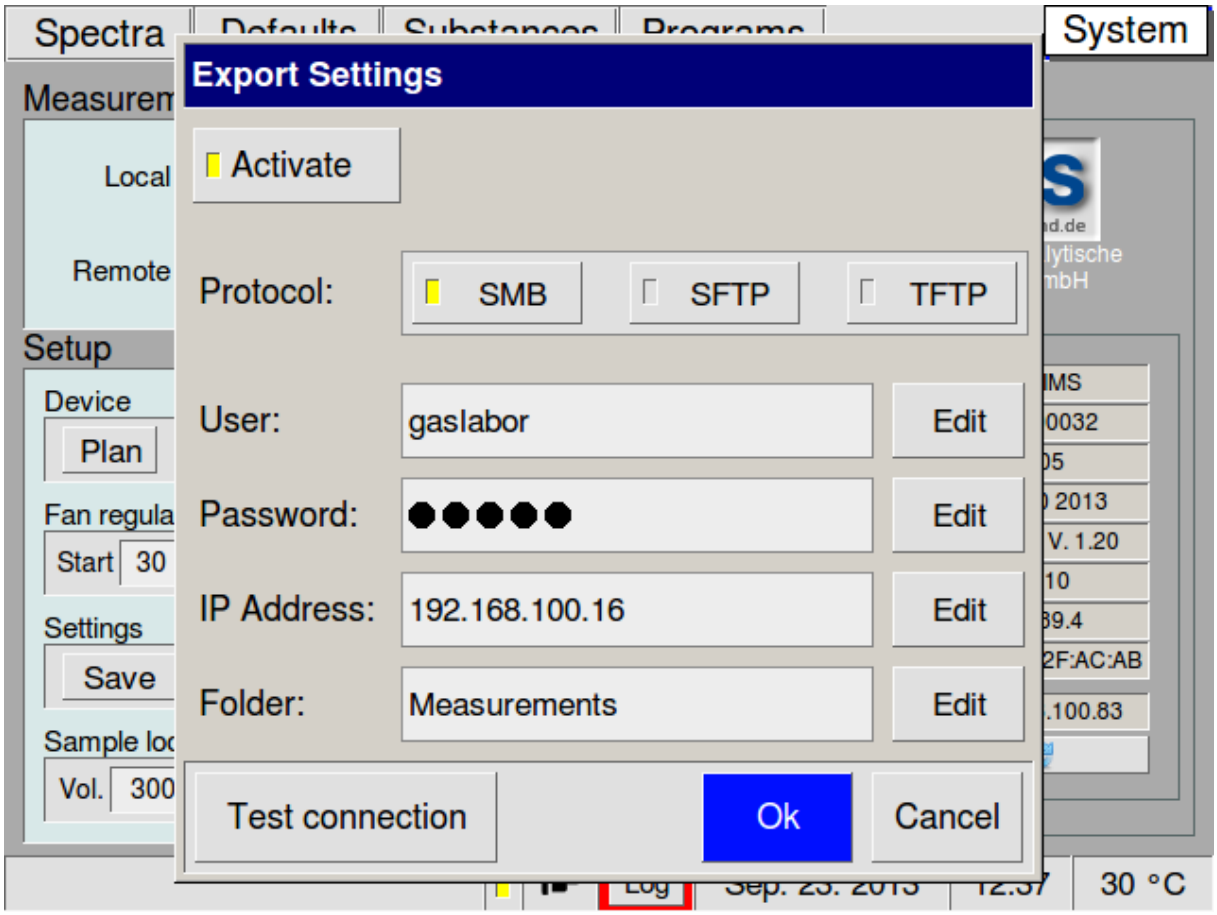
7.1.7.2 Storage Locations

Generated measurement files are stored on the internal storage volume of the A-IMS or to a shared network folder in a LAN environment. The set default value is depending on the specified value when the device is switched off.
Changed settings will be continuously requested and saved. This may take up to 2 minutes.

Measurement data are generally stored on a internal compact flash card to avoid a loss of data in case of loosing the network connection. In case that the export is activated the measurement data will be transmitted to the set up shared folder. Transferred data to a LAN also to a connected USB-Stick will be marked as *"can be overwritten".* Those measurement data can be overwritten in case of insufficient storage capacity. In general unmarked data will never be overwritten.

The **Export** setting buttons allow the management of stored measurement files. By using the button "Delete" all measurement files stored on the device volume can be deleted. Measurement files stored in a shared network folder or on a USB volume will not be deleted.

A shared folder in a LAN can be set as storage location by using the **Export** button. Selecting this button will open the Export Setup Window.

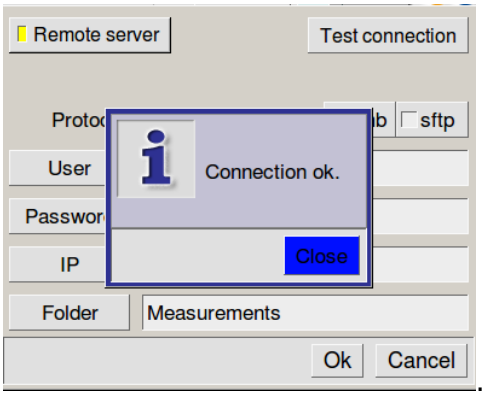


Activating the **Remote server** button established the connection to a shared folder in a LAN. The button is marked yellow. When the shared folder mode is already activated, selecting this button will deactivate the shared folder mode and Measurement files will be stored on the internal device volume.

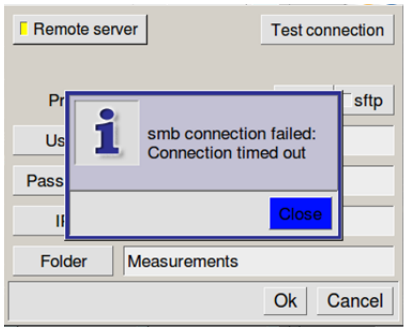
In order to setup or adjust the connection to a shared network folder the network IP address of the host device, the used protocol, the shared name of the shared folder on the host device, the account data for the host device login and the password have to be entered. This information is stored in the system settings.

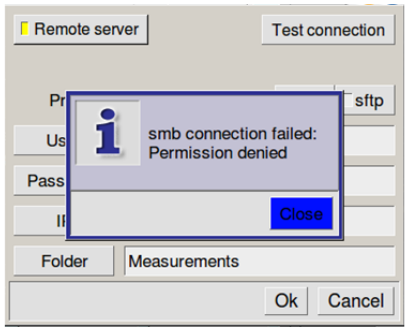
By default the Service Message Block Protocol (smb) also known as Common Internet File System (CIFS) is used. A Secure File Transfer Protocol (sftp) and a Trivial File Transfer Protocol (tftp) can also be used.

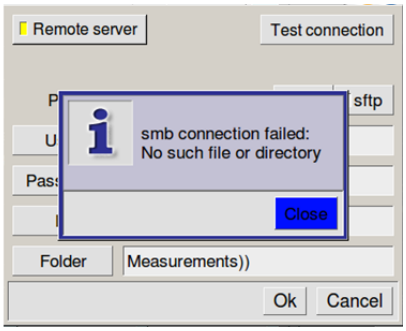
When activating the **Test connection** button the A-IMS tries to establish the connection to the shared folder. When the connection is successful the following message window appears.



When the connection could not be established one of the following message windows appears.







In this case check the network IP address of the host device, the used protocol, the shared name of the shared folder on the host device, the account data for the host device login and the password.

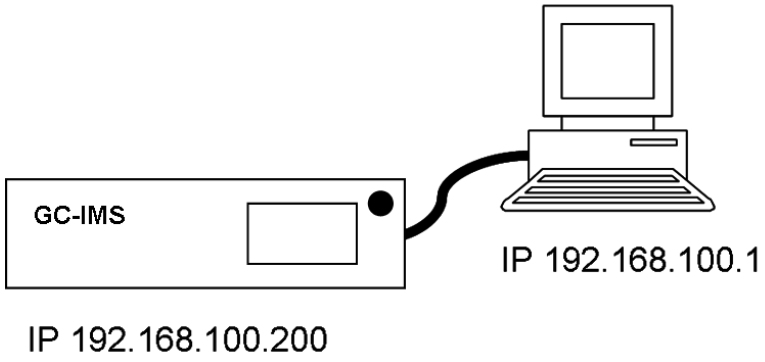
Information!

In case of network share connection problems consult the manuals of your operating system and /or ask your administrator.

Stored measurement files can be copied to an USB volume connected by using the **Copy to USB** button. The USB volume must be connected to the USB socket at the front side of the device housing. All stored measurement files will be written to the

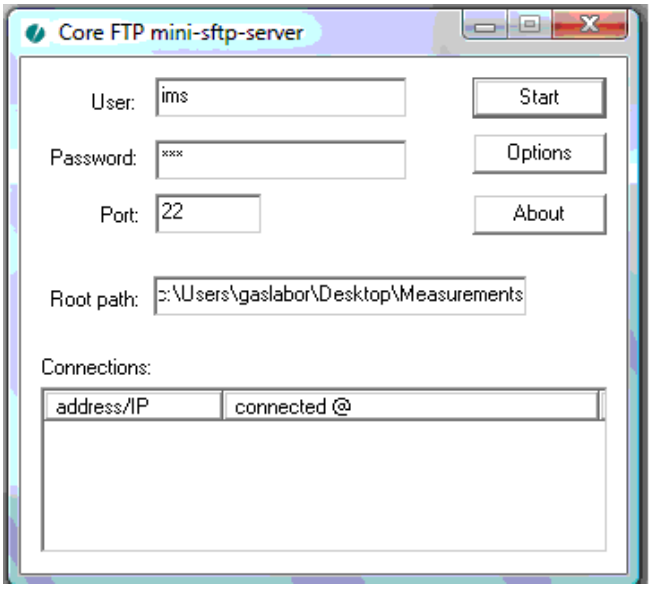
connected volume. Using the Copy to remote button will copy all internal stored measurement files directly to the shared folder.

To establish a peer to peer (P2P) connection between the A-IMS and a computer the devices must have fixed IP addresses (Computer IP: 192.168.100.1; A-IMS IP: 192.168.100.200).



7.1.7.2.1 Direct connection to a windows PC using sftp

The device and the computer are connected directly by a standard Ethernet Cable (LAN cable). Please make sure that you are logged on the system with administrator rights. To setup a local SFTP-Server on the computer copy the program file **msftpsrvr.exe** from the USB stick to the computer and start the program.



Then

- enter a user name, e.g. `ims`
- enter a password, e.g. `ims`
- set the port to `22` (*default*) and
- enter a folder path as root path for communication with the GAS IMS device e.g. `C:\Users\gaslabor\Desktop\Measurements`

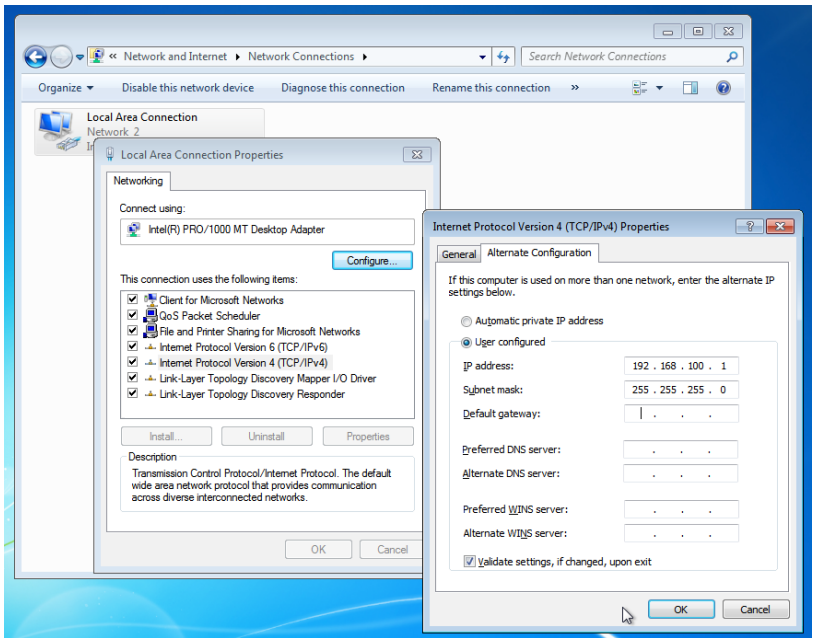
Start the program by pressing the *Start* button.

Information!

In order to run and start the SFTP-Server on Windows startup, create a **Windows** shortcut to the file ***msftpsrvr.exe*** and move or copy it to the **Autostart** folder in the **Windows Start** menu. Open the **Properties** dialog of the shortcut accessible from the right click context menu. In the input field **Target** the path to the file ***msftpsrvr.exe*** enclosed in quotation marks is displayed. Add **–start** behind the last quotation mark.
For example when the file ***msftpsrvr.exe*** is located in **C:\Programs\SFTP-Server** the text line must be:
"C:\Programs\SFTP-Server\ msftpsrvr.exe" –start

Configure the “Alternative Configuration” of the internet protocol (TCP/IPv4 to the following values:

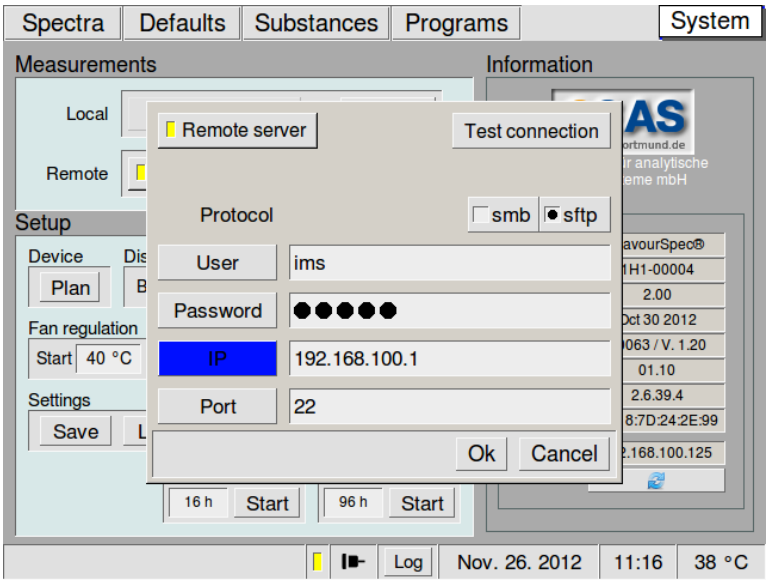
IP address: **192.168.100.1** Subnet mask: **255.255.255.0**



The A-IMS IP adress must be set to a static IP address to **192.168.100.200** by pressing the refresh button in the system window below the IP label.

Open **Export**,switch on **“sftp”**and enter the same user name (here *ims*), password (here *ims*), IP adress (**192.168.100.1)** and port 22 (default) as chosen for the FTP

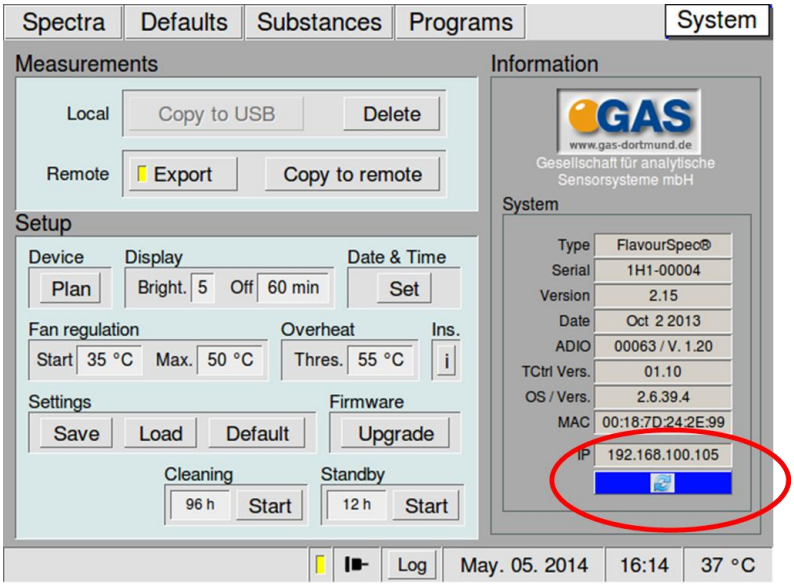
Test the connection by pressing the respective button and close the dialog using OK button.

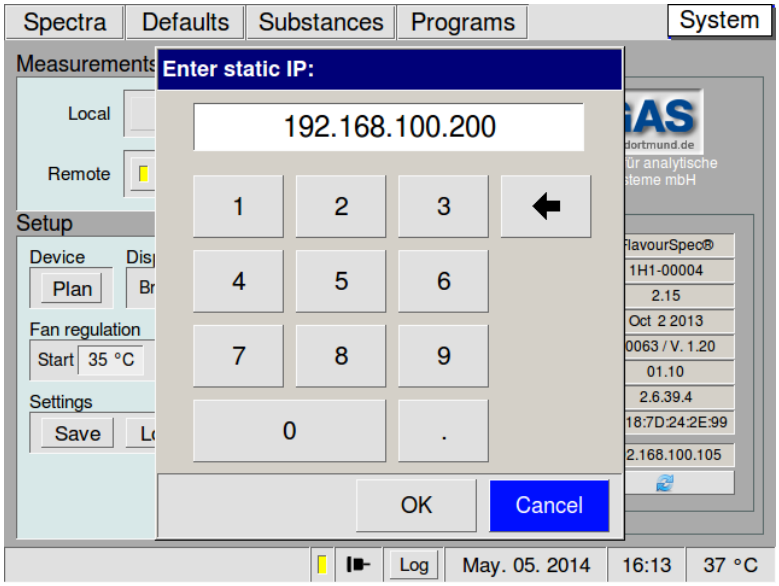


7.1.7.2.2 Direct connection to a windows PC using tftp

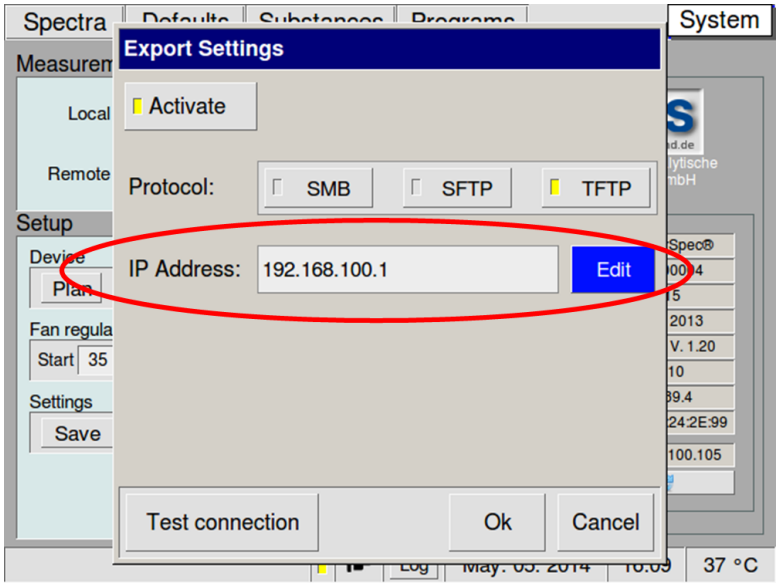
The device and the computer are connected directly by a standard Ethernet Cable (LAN cable). Please make sure that you are logged on the system with administrator rights. Install the IMS-Control TFTP-Server Software For detailed information see the IMS Software Suite IMScontrol TFTP-Server manual.

The FlavourSpec-IP-adress must be set to a static IP address to **192.168.100.200** by pressing the refresh button in the system window below the IP label.



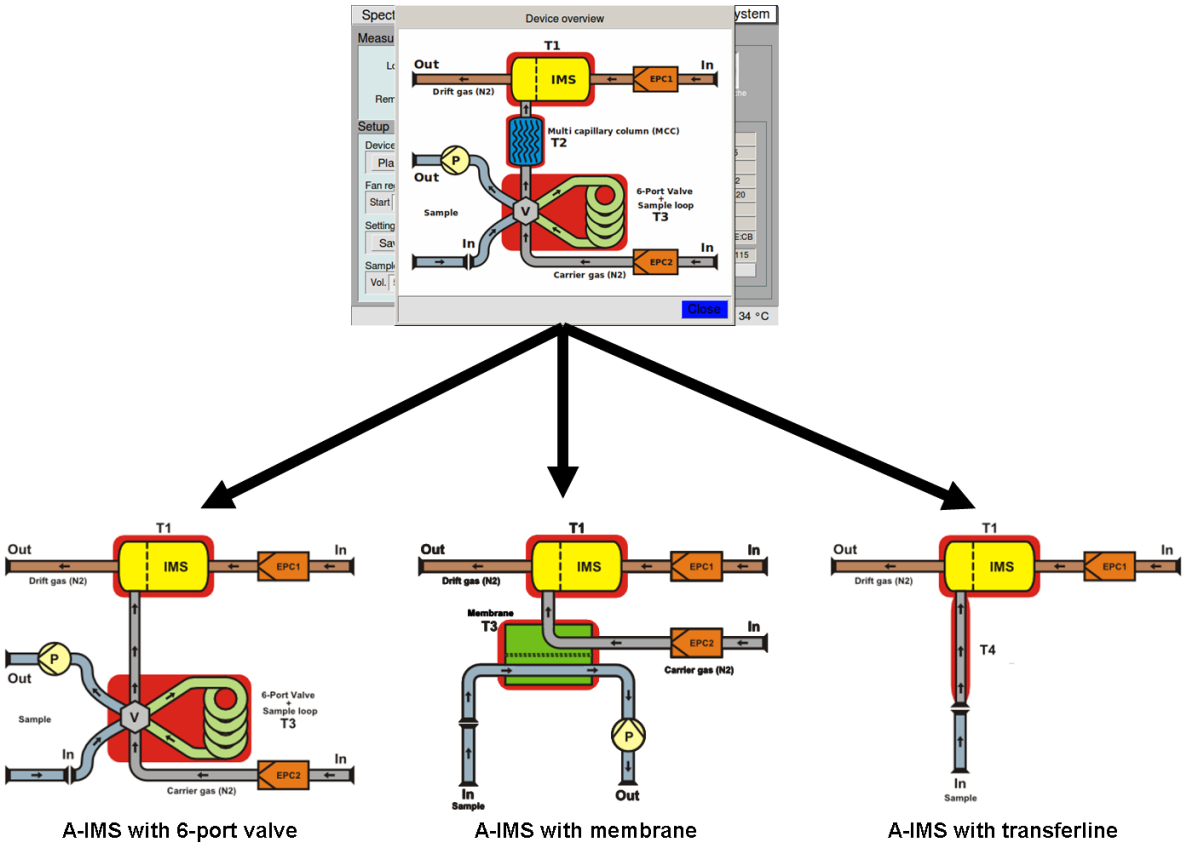


Open **Export**, switch on **“tftp”** and enter the IP adress (**192.168.100.1)** and test the connection by pressing the respective button and close the dialog using OK button.



7.1.7.3 Device Plan

Pressing the “**Device Plan”** Button displays an overview plan of the device:



7.1.7.4 Display Brightness and Screensaver

In the “**Display Settings”** the display brightness and the screen-saver time-out can be set.

When the screen-saver function has darkened the TFT screen at the front side of the housing the screen can be reactivated by pressing the rotary knob or the Escape button at the front of the device.

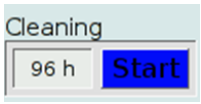
7.1.7.5 Date and Time Setup

When the “**Date & Time Set”** button is activated a dialogue is opened in which the internal clock can be set. It is recommended to specify the local time zone in the dialogue so that the generated measurement files contain valid time-stamps.

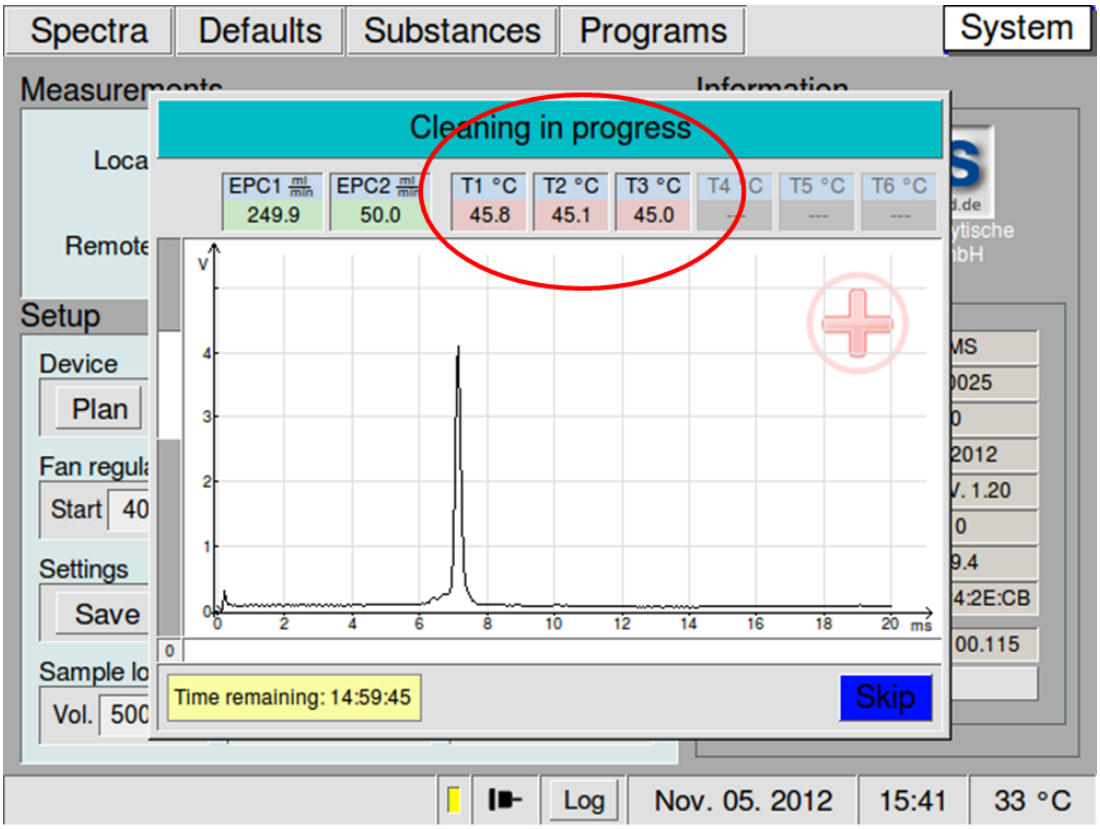
7.1.7.6 Fan Regulation

The “**Fan Regulation”** Setting determines the behaviour of the cooling fan. When the internal temperature reaches the “Start” temperature the fan starts working. The power is increased up to the point where the “Max” in-housing temperature value is reached. When the overheat temperature specified in the Overheat field is reached an overheat alarm is triggered. A corresponding message is displayed in the status bar of the window frame.

7.1.7.7 Cleaning Mode



The Cleaning function affects multiple device components. Pressing the Cleaning button opens a dialogue and starts the cleaning process.



The duration of the cleaning process can be set up to 96 hours in selectable in 1 hour steps or to infinite.

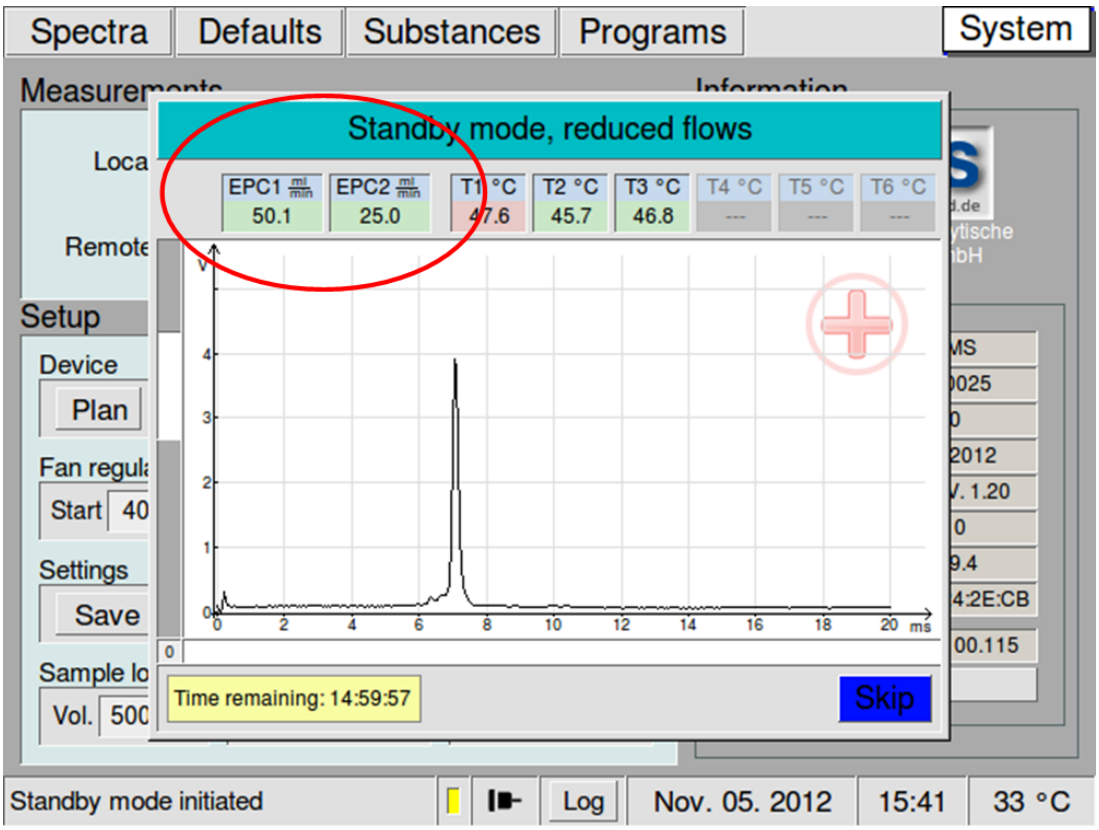
During the cleaning process the system flushes undesired residuals/contaminants out of it. Heating will raise internal temperatures to a maximum which optimizes the cleaning effect. The cleaning process is terminated after the number of hours set in the "**Cleaning**" process duration field or when the button "**Cancel**" in the opened cleaning dialogue is activated. The flow rates for EPC1 and/or EPC 2 are not modified during cleaning.

Information!

After completing the cleaning procedure wait until the system reach the measurement conditions (flow and temperatures) before starting a new measurement.

7.1.7.8 Standby mode

Pressing the "**Standby"** button starts the Standby process. The rate of the drift gas flow (EPC1) and/or the carrier gas (EPC2) will be reduced to save gas.



The duration of the Standby process can be set up to 96 hours in selectable in 1 hour steps or to infinite.

7.1.7.9 Managing System Settings

By using the Settings Buttons the system settings including all measurement programs and substance entries can be saved to a connected USB volume, loaded from a connected USB volume or restored to default settings. After the settings are successfully loaded or restored to system settings the system restarts automatically.

Information!

When loading settings all measurement programs and substance entries currently existing in the will be overwritten.
When restoring default settings by activating the Default button all measurement programs and substance entries will be erased by this action.

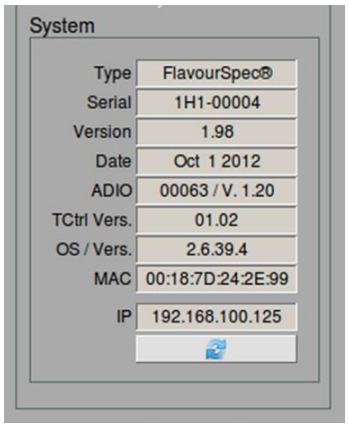
The firmware of the can easily be upgraded with a new or modified firmware version. Firmware upgrades will be provided by G.A.S.. For questions please contact the G.A.S. hotline.

To perform an upgrade the new firmware must be stored on a USB volume connected to the USB socket at the front of the device. Activating the "**Firmware Upgrade**" button starts the update process. After a successful update the system automatically restarts and activates the new firmware. Depending on the extent of changes in the new firmware version the upgrade process may take several minutes. After firmware upgrade the system restarts automatically.

Information!

Depending on the extent of changes in the new firmware version some or all user created entries like measurement programs and substance entries may be deleted in the upgrade process. It is recommended to save all system settings, measurement programs and substance entries before any firmware upgrade. **Restarting the system will deactivate the Export-Button.**

7.1.7.10 System Information Panel



The “**System**” information panel is located on the right side of the window. It displays application specific information such as application device “**Type**”, “**Serial**” number and firmware “**Version**”.

It also displays system specific information most importantly the network “**IP**” address of the .

In case the device is not integrated into a network environment with DHCP server, the standard network IP address is 192.168.100.200.

In case the device is integrated into a network environment with DHCP server, this field displays the assigned network IP address.

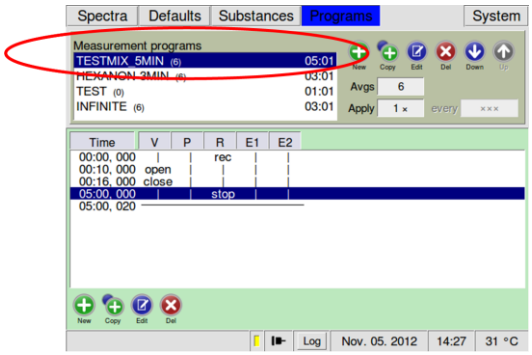
With the **“IP refresh”** button  a static network IP address can be set. A successful network integration indicated by this IP address entry is necessary for storing measurement files in a shared network folder.

8 System Operation

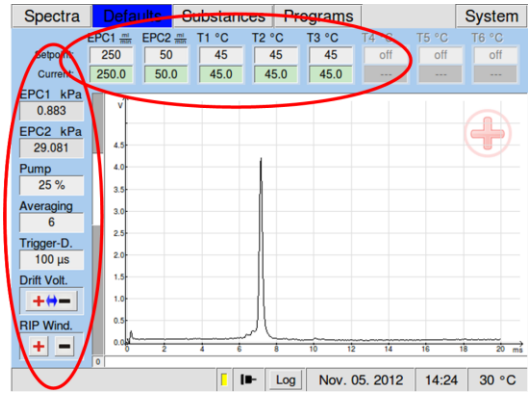
Information!

It is recommended **not to switch off the device** during longer pauses in measuring. Using the **Standby mode** ensures the cleanness of the system and a quick readiness to measure.

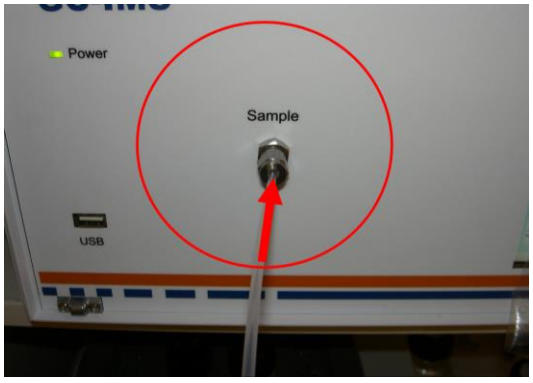
8.1 Running a measurement *(A-IMS with membrane or 6-port valve)*



Select a measurement program or create a new program in the Programs window.

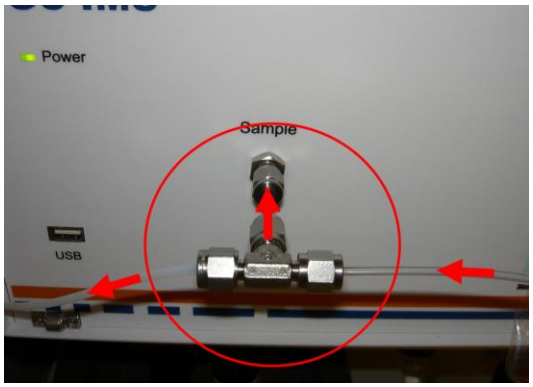


Check and setup the measurement parameter.



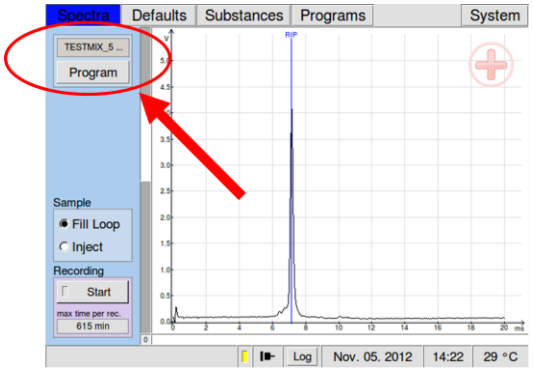
Direct sample introduction

Connect a **pressure-free** sample-gas-supply directly to the 3mm Swagelock **Sample** connection on the front panel of the device. Set the pump power for sample in the defaults window. The sample is sucked into the device.

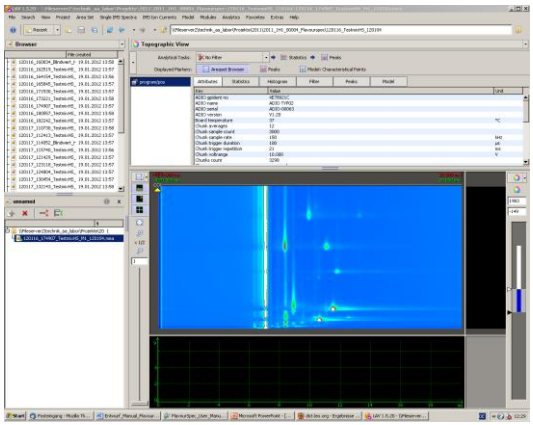


Sample introduction in the by-pass mode:

Connect a **pressure** sample-gas-supply (e.g. from a gas-generator) in by-pass to the 3mm Swagelock **Sample** connection on the front panel of the device. Set the pump power for sample in the defaults window. The sample is sucked into the device.



Select the measurement "**Program**" in the Spectra-Window and start by pressing the rotary knob or by the touch-screen.

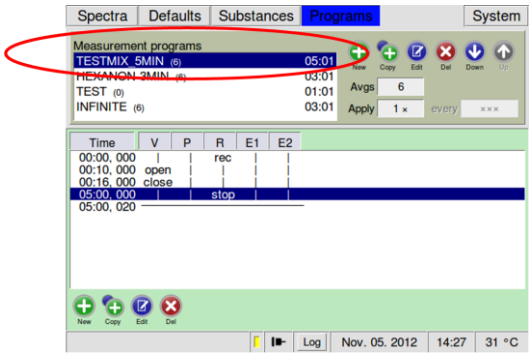


View and analyze the measurement file with the Laboratory Analytical Viewer LAV.

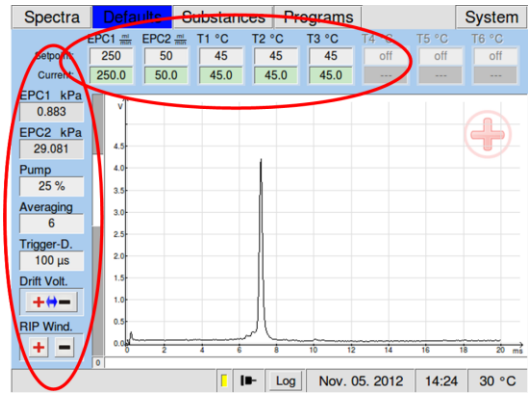
Information!

For detailed Information about the Laboratory Analytical Viewer (LAV) refer to the IMS Software Suite Manual.

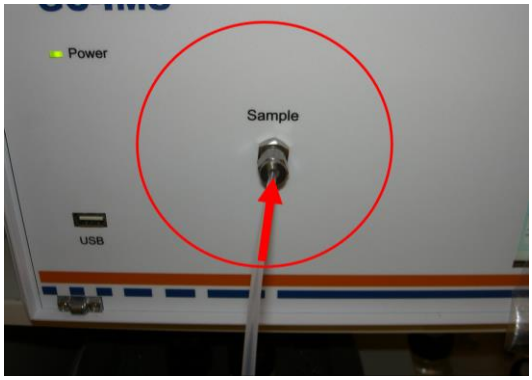
8.2 Running a measurement *(A-IMS with heated transfer line)*



Select a measurement program or create a new program in the "**Programs**" window.

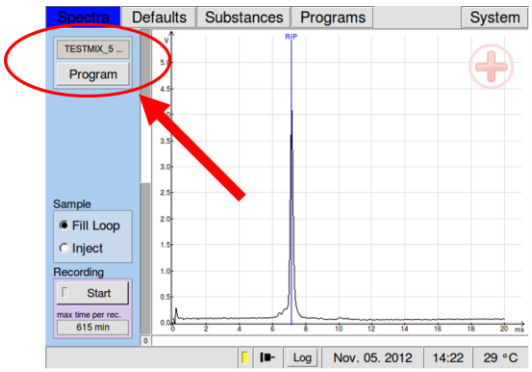


Check and setup the measurement parameter.

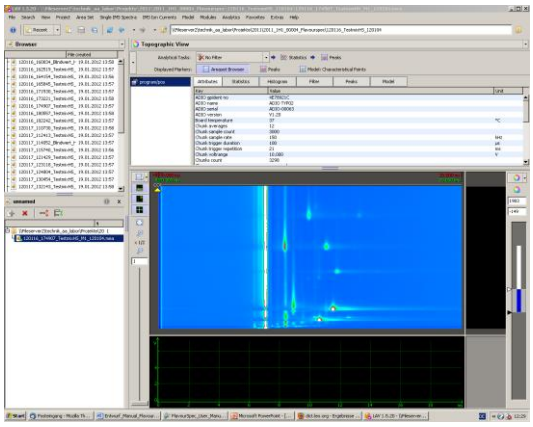


Direct sample introduction

Connect a **pressure** sample-gas-supply (e.g. from a gas-generator or a gas cylinder) directly to the 3mm Swagelock **Sample** connection on the front panel of the device. Set up the gas flow with an extern flow regulator (e.g. 200 ml/min). The sample is fed into the device.



Select the measurement "Program" in the Spectra-Window and start by pressing the rotary knob or by the touch-screen.

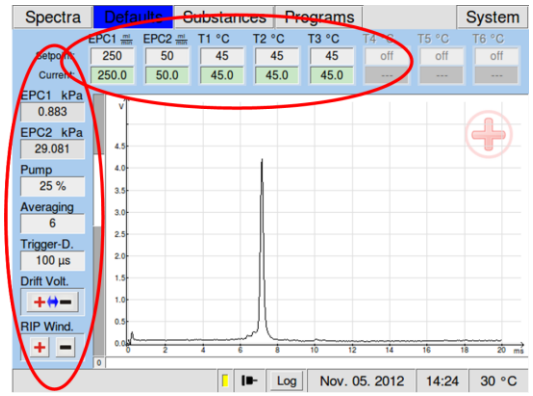


View and analyze the measurement file with the Laboratory Analytical Viewer LAV.

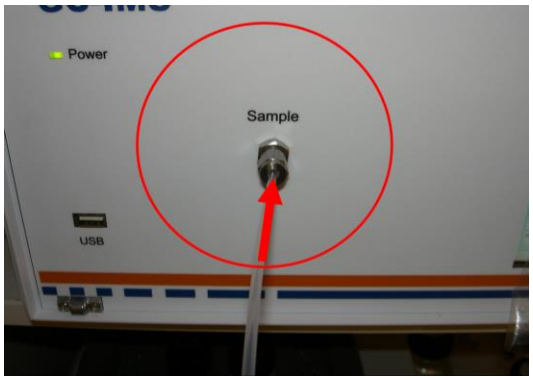
Information!

For detailed Information about the Laboratory Analytical Viewer (LAV) refer to the IMS Software Suite Manual.

8.3 Manually recording

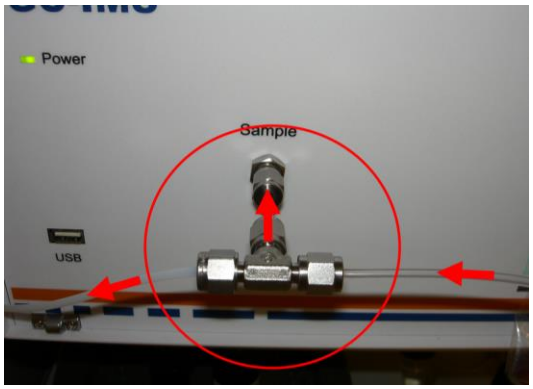


Check and setup the measurement parameter.



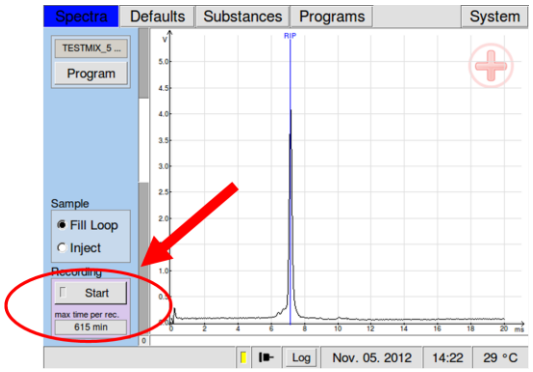
Direct sample introduction:

Connect a **pressure-free** sample-gas-supply directly to the 3mm Swagelock **Sample** connection on the front panel of the device. Set the pump power for sample in the defaults window. The sample is sucked into the device.

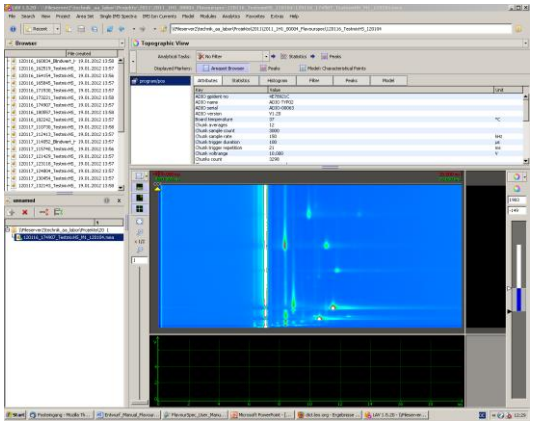


Sample introduction in the by-pass mode:

Connect a **pressure** sample-gas-supply (e.g. from a gas-generator) in by-pass to the 3mm Swagelock **Sample** connection at the front panel of the device. Set the pump power for sample in the defaults window. The sample is sucked into the device.



Select the Recording Start button in the Spectra-Window and start by pressing the rotary knob or using the touch-screen.



View and analyze the measurement file with the Laboratory Analytical Viewer LAV.

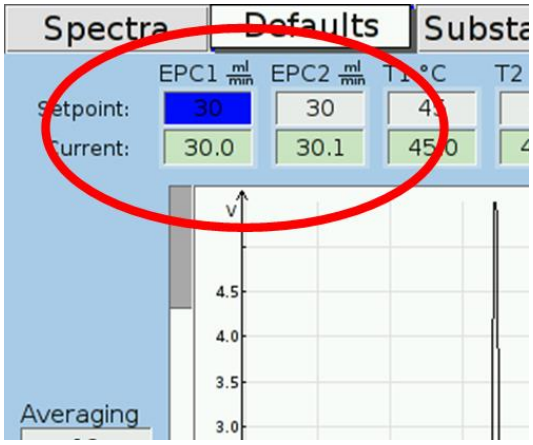
Information!

For detailed Information about the Laboratory Analytical Viewer (LAV) refer to the IMS Software Suite Manual.

8.4 Tightness Quicktest

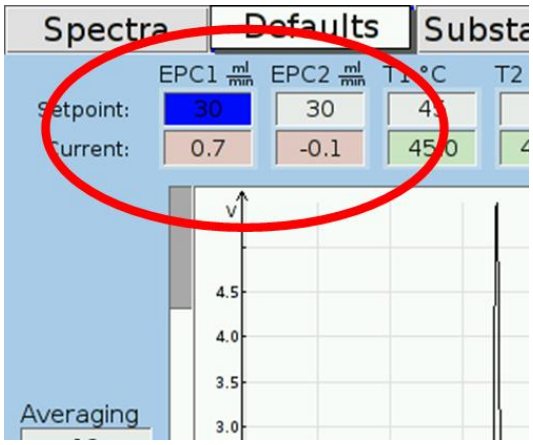
IMPORTANT
Reduce the backpressure down to 0.5 bar !

A higher pressure will destroy the sensor!



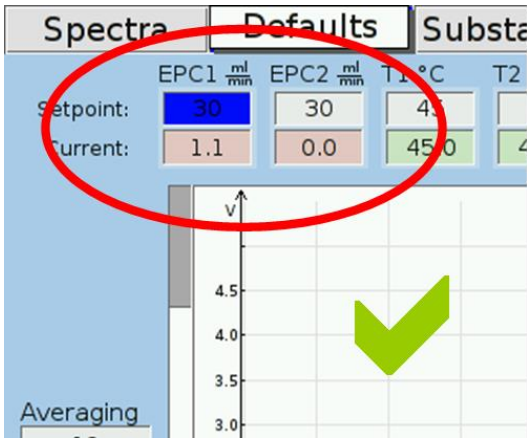
1. Set the drift gas- (EPC1) and/or the carrier gas flow (EPC2) to 30 ml/min.

2. Disconnect the gas flow (drift gas and/or carrier gas) at the rear of the device.



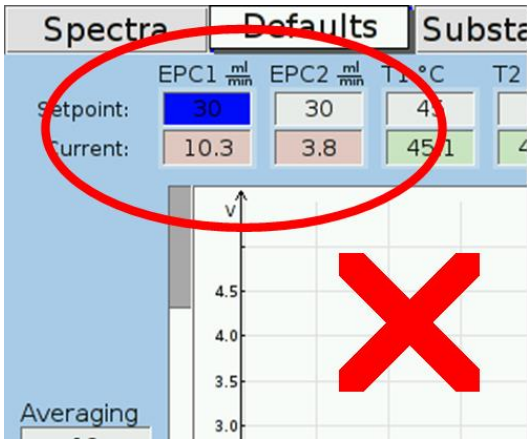
3. Wait about one minute and note the actual current values. Note that these values represent the starting point for a leak test of the device.

4. Connect the gas flow (drift gas and/or carrier gas) at the rear of the device.
Close Gas Out on the rear of the device with a 3 mm Swagelock blind plug.



5. Wait about two minutes and watch the drift gas and carrier gas flow.

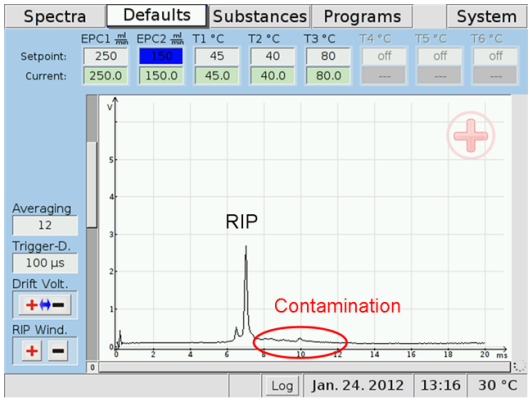
On a tight system the actual current gas flow increases to the starting point values of the device. A difference of ± 0.4 ml/min is tolerable.



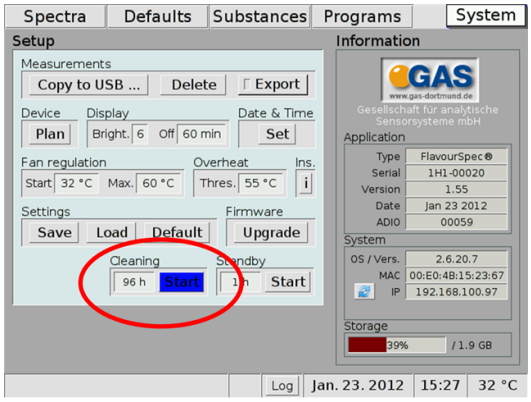
On a leaking system the difference of the noted current values are more than 0,4 ml/min.

All connections have to be controlled.

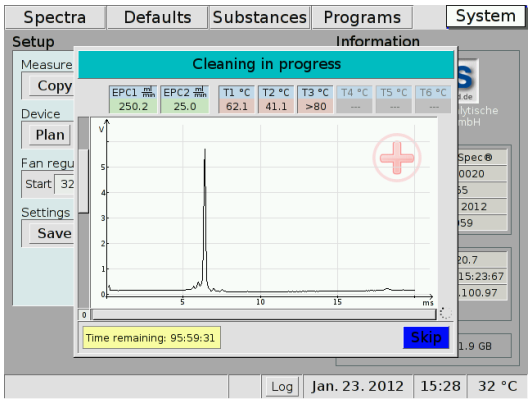
8.5 Cleaning mode



In case of contamination it is necessary to activate the cleaning mode to clean the system.
The frequency of cleaning interval is depending on the character and quantity of the samples measured.



In the "**System**" window select the cleaning time. By using the start button the cleaning process starts. All temperatures are automatically set up to their maxima.



During the cleaning process a Cleaning window appears. During this process no other activities can be executed.
This process can be skipped at any time.

Information!

After completing the cleaning procedure wait until the system reach the measurement conditions (flow and temperatures) before starting a new measurement.

9 Appendix

9.1 Technical Data

Dimensions Housing

- Height: 184,5 mm
- Width: 449 mm
- Depth: 435 mm
- Weight: 12-15 kg (depending on sampling system)

Operational conditions

- Temperature range: 5 - 40°C
- Humidity: 0-90 % RH

Electrical connectors

- 2 x RS232 DE9 plug
- 1 x I/O DA15 socket
- 1 x Ethernet RJ45 IEEE 802.3 100BASE-T
- 1 x USB 1.1 Host (USB A Connector)
- 1 x XLR 3 pole male for Power Supply

RS232 is not intended for customer use.

Power Supply

- Input line voltage: Grounded AC, 100 to 240 V
- Input line frequency: 47-63 Hz
- Input current: < 2.8 A
- Output Voltage: 24 VDC
- Output Current: 8.33A
- Power consumption: < 180 Watt

Warning! Do not use any other power supply than supplied by G.A.S.

Cooling

- Axial ventilator, temperature controlled, max. 5.5 m^3/h

Gas connectors

- 3 mm stainless steel Swagelok connectors for drift gas inlet, sample gas in- and outlet, carrier gas inlet and IMS gas outlet)

Internal hoses

- PFA

IMS parameters

- Drift length: 50 mm
- Electrical field strength: 400 V/cm
- Resolution: >35 (typical 50)
- Operation temperature: 35–80°C (default: 45 °C)

Ionisation source

- Radioactive - Tritium H3 (ß radiation) <300 MBq, below the exemption limit of 1 GBq (acc. to EURATOM guidelines) – solid state bonded
- radioactive half-life: 12.5 years

Data acquisition

- Sample Rate: 150 kHz
- Resolution: 14 bits
- Trigger duration: 100 µs (default) changeable
- Trigger repetition rate: 21 ms
- Transimpedance: -9.125 V/nA typ.

Drift voltage

2 kV - polarity switchable

Sampling systems

with 6-port valve

- 6-port valve
- Sample loop: 5 ml (other volumes available on request)
- Operation temperature: 35 – 80 °C (default 45 °C)
- Temperature display accuracy: ± 1°C
- Temperature control accuracy: ± 0,1 K

with membrane

- Poly dimethyl siloxane membrane
- Operation temperature: 35 – 80 °C (default 45 °C)
- Temperature display accuracy: ± 1°C
- Temperature control accuracy: ± 0,1 K

with heated transfer line

- Heated transfer line
- Operation temperature: 35 – 80 °C (default 45 °C)
- Temperature display accuracy: ± 1°C
- Temperature control accuracy: ± 0,1 K

Data storage

- Storage on internal storage volume
- Data transfer via LAN connection in a shared network folder

Operation

- 6.4” TFT, VGA-Display
- Rotary knob
- Escape push button

Flow Control

Control of drift gas flow rate: EPC1 – electronic pressure controllers

- Control type: Flow control by differential pressure control
- Operation flow rates: 0-500 mL/min (typical: 250 mL/min)
- Output pressure stability 0.01% typical
- Output pressure linearity 0.05% typical

Control of carrier gas flow rate EPC2 – electronic pressure controllers

- Control type: Flow control by differential pressure control
- Operation flow rates: 0-250 mL/min (typical: 50 mL/min)
- Output pressure stability 0.01% typical
- Output pressure linearity 0.05% typical

Cleaning mode

- IMS, column and sampling system are heated up to >80°C (~100°C) up to 96 h.

Stand-by mode

- Drift gas and/or carrier gas flow rates are reduced to save gas and still keep the system clean and operable: drift gas to 50 mL/min and carrier gas to 25 mL/min.

Consumables

Gas: nitrogen or synthetic air (purity 5.0, 99.999%)

Technical Data "I/O interface" for G.A.S.' instruments

Analog output	Output type	Isolated active current output 0-20 mA
	Non-loaded voltage	< 20 V
	Maximum output signal	< 22 mA
	Maximum output load (burden resistance)	500 Ohm
	Accuracy	better than 1 %
	Linearity error	(t.b.d)
	Temperature coefficent	(t.b.d 0,02 %/K)
	Output Ripple (RMS)	(t.b.d. < 0.1 %)

Information!

Output can be set to 0-10V voltage output by connecting internal 500 Ohm shunt resistor

Digital output	Output type	Isolated passive transistor output
	Maximum open circuit voltage	30 V
	Maximum on-state saturation voltage	2 V
	Maximum on-state current	20 mA
Digital input	Input type	Isolated opto-coupler input (Connect to Pin 9 to select 0-10 V voltage output))
	Off-state voltage	< 1 V
	On-state voltage	5 .. 30 V
	Input current	< 20 mA depending on input voltage

Isolation

Isolation type	basic insulation according to EN 61010
Surge voltage category	II
Pollution degree	2
Rated insulation voltage	100 V DC or 100 Vrms AC

Connector Pinout

Connector type	D-Sub DA-15 female	
Analog output	Return	Pin 1
	Internal shunt	Pin 2 (Connect to Pin 9 to select 0-10 V voltage output)
	Current output	Pin 9
Digital input	Negative	Pin 13
	Positive	Pin 5
Digital output	Negative	Pin 6
	Positive	Pin 4

Warning!
DO not connect any other pins.

9.2 Specification of Tritium source applied within IMS detector

The permitted limits are determined by the Radiation Protection Ordinance and are according to the International Atomic Energy authority (IAEA) and European limits according to EU directive 96/29/EURATOM.

Description of source:	H-3
Activity:	300 MBq Below Exemption limit of 1 GBq for tritium acc. To Annex I, Table A of Article 3, 2 (a) of the Directive 96/26 EURATOM of May 13, 1996
Type of radiation:	β-Emmission
Radiation energy:	average energy 5,68 keV maximum energy 18,7 keV
Full duration half maximum (FDHM):	12,3 years
Braking radiation:	2×10^{-7} (mSv / h x GBq) $H_{Brake} = A \times h_{Br} \times (1m / r)^2$ $hBr = 0,257 \times 10^{-4} \times (E\beta max / MeV) \times 2$
Attenuation of radiation:	Air → 4mm Water → < 100 µm Tissue → < 100 µm Below a dose rate of 1µSv h-1 at a distance of 0,1m from accessible surface of the apperatus acc. to Article 3, 2 (a) (iii) of the Derictive 96/26 EURATOM of May 13, 1996
Mounting location and type:	**Fixed inside the device.** **The Source is impossible to contact directly.** **It is mounted in a safe way and not accessible from the outside.**

9.3 Error message list

Error message	**Drift voltage supply.**
Description	*Drift voltage error*
Action	Fatal Error! Contact the G.A.S. service hotline.

Error message	**Can't save measurement**.
Description	*The measurement file could not be saved to the internal memory.*
Action	Export and save all Measurement of the internal storage and clear the storage. Repeat the procedure. If that still does not help contact the G.A.S. service hotline.

Error message	**smb connection failed:**
Description	*Samba (Service Message Block SMB) connection failed.*
Action	Check network cable, network shares and IP-adress. Repeat the procedure. If that still does not help contact the G.A.S. service hotline.

Error message	**sftp connection failed:**
Description	*Secure File Transfer Protocol (SFTP) connection failed.*
Action	Check network cable, network shares and IP-adress. Repeat the procedure. If that still does not help contact the G.A.S. service hotline.

Error message	**No USB-Storage found.**
Description	*Mounting of the USB-Stick failed.*
Action	Ensure that a USB-Stick is insert. Ensure that the USB-Stick is FAT32 formatted. Reformat the USB-Stick. Replace the USB-Stick with a new one. If that still does not help contact the G.A.S. service hotline.

Error message	**Unable to unmount USB-Storage.**
Description	*Unmounting of the USB-Stick failed.*
Action	Remove the USB-Stick and restart the device. Check the USB-Stick, optionally reformat it. Insert the USB-Stick and repeat the procedure. If that still does not help contact the G.A.S. service hotline.

Error message	**No program selected.**
Description	*At programstart no program was detected*
Action	Create and select a program. Repeat the procedure. If that still does not help contact the G.A.S. service hotline.

Error message	**Drift gas flow too low. Aborting…**
Description	*At program start the driftgas flow is to low. Programstart will be refused.*
Action	Increase the back pressure. Repeat the procedure. If that still does not help contact the G.A.S. service hotline.

Error message	**Stop recording first.**
Description	*If recording is activ a programstart is refused.*
Action	Deactivate recording and repeat the procedure. If that still does not help contact the G.A.S. service hotline.

Error message	**Can't initalize drift supply. Program can not be started.**
Description	*Drift voltage error*
Action	Fatal Error! Contact the G.A.S. service hotline.

Error message	**Invalid program.**
Description	*The selected program has no instructions.*
Action	Complete the program and repeat the procedure. If that still does not help contact the G.A.S. service hotline.

Error message	**Not enough storage space left. Please delete or copy measurement or choose a shorter program.**
Description	*The internal storage has not enough storage space left.*
Action	Export and save all Measurement of the internal storage and clear the storage. Repeat the procedure. If that still does not help contact the G.A.S. service hotline.

Error message	**Hardware access failure**
Description	*Error when switching the drift voltage polarity.*
Action	Fatal Error! Contact the G.A.S. service hotline.

Error message	**Valve set to Inject. Loop not filled! Proceed? OK or Chancel**
Description	*Valve start position is set to Inject instead of Fill loop.*
Action	Set valve start position manuelly to Fill loop. Repeat the procedure. If that still does not help contact the G.A.S. service hotline.

Error message	**Can't import calibration.gsd**
Description	*The file „calibration.gsd" was not found.*
Action	Create the file „calibration.gsd" and import it with an USB-Stick. Repeat the procedure. If that still does not help contact the G.A.S. service hotline.

Error message	**No measurements stored.**
Description	*No measurements stored on the internal storage.*
Action	Do a measurement. Repeat the procedure. If that still does not help contact the G.A.S. service hotline.

Error message	**Folder cannot be created :**
Description	*When exporting the device subfolder could not be created.*
Action	Check the external storage. Check network cable, network shares and IP-adress. Check write protection of the USB-Stick. Ensure that the USB-Stick is FAT32 formatted. Reformat the USB-Stick. Replace the USB-Stick with a new one. Repeat the procedure. If that still does not help contact the G.A.S. service hotline.

Error message	**No measurement files transferred**
Description	*No measurement were transferred to an external storage.*
Action	Check the external storage. Check network cable, network shares and IP-adress. Check write protection of the USB-Stick. Ensure that the USB-Stick is FAT32 formatted. Reformat the USB-Stick. Replace the USB-Stick with a new one. Repeat the procedure. If that still does not help contact the G.A.S. service hotline.

Error message	**No measurements stored.**
Description	*No measurements were deleted, because no measurements are available.*
Action	Do a measurement. Repeat the procedure. If that still does not help contact the G.A.S. service hotline.

Error message	**RTC read error.**
Description	*Date and time setting failed.*
Action	Restart the system and repeat the procedure. If that still does not help contact the G.A.S. service hotline.

Error message	**Save settings failed.**
Description	*Setting data could not be save on a USB-stick.*
Action	Check write protection of the USB-Stick. Ensure that the USB-Stick is FAT32 formatted. Reformat the USB-Stick. Replace the USB-Stick with a new one. Repeat the procedure. If that still does not help contact the G.A.S. service hotline.

Error message	**Load settings failed.**
Description	*Setting data could not be load from a USB-stick*
Action	Repeat the procedure. Restart the system and repeat the procedure. Check write protection of the USB-Stick. Ensure that the USB-Stick is FAT32 formatted. Reformat the USB-Stick. Replace the USB-Stick with a new one. Repeat the procedure. If that still does not help contact the G.A.S. service hotline.
Error message	**Do you really want to relabel loop volume? It will be stored in all following measurements.**
Description	*Sample loop setting is change manually.*
Action	Confirm or abort the dialog.
Error message	**Can't set static ip!**
Description	*Setup of the static IP-adress failed.*
Action	Check the network settings. Contact your adminstrator. Repeat the procedure. If that still does not help contact the G.A.S. service hotline.
Error message	**Can't request DHCP:**
Description	*Setup of the dynmaic IP-adress failed.*
Action	Check the network settings. Check DHCP-server. Contact your adminstrator. Repeat the procedure. If that still does not help contact the G.A.S. service hotline.
Error message	**Valve set to Inject. Loop not filled**
Description	*Valve setting is set to position “Inject” and not to “Fill loop”. Sample loop could not be filled.*
Action	Abort program and set valve to position „Fill loop“ manually.
Error message	**Trigger recieved while running program.**
Description	*During the program run a new trigger signal will be received. The program run ist aborted.*
Action	The device get a wrong trigger signal. Check the external trigger programming. Repeat the procedure. If that still does not help contact the G.A.S. service hotline.
Error message	**Stop recording first.**
Description	*When starting the trigger mode recording is activated.*
Action	Deactivate recording and repeat the procedure. If that still does not help contact the G.A.S. service hotline.
Error message	**Select program first.**
Description	*When starting the trigger mode no program is activated.*

Action	Select a program and repeat the procedure. If that still does not help contact the G.A.S. service hotline.

Error message	**Can’t read calibration.gsd**
Description	*The import of the calibration.gsd. file failed. The file was not found.*
Action	Ensure that the file calibration.gsd exist and is placed in the measurement subfolder of the device. Check network cable, network shares and IP-adress. Repeat the procedure. If that still does not help contact the G.A.S. service hotline.

9.4 Troubleshooting

Information!

This chapter is a collection of possible practical problems and serves as a guide for making an initial assessment. It makes no claim to be complete.

Symtom	**Device does not start**
Possible Cause	*Problem with the electrical power supply*
Action	Check the current power supply and restart the system. If that still does not help contact the G.A.S. service hotline.

Symtom	**Device freezes during start procedure.**
Possible Cause	*Problem with the Firmware*
Action	Restart the system. If that still does not help contact the G.A.S. service hotline.

Symtom	**Start procedure paused**
Possible Cause	*Hardwarecheck during the start procedure*
Action	Wait up to 5 min. Normally the start procedure continues. Restart the system. If that still does not help contact the G.A.S. service hotline.

Symtom	**Temperature and/or gas flow values will not be displayed**
Possible Cause	*Problem with hardware/firmware communication*
Action	Restart the system. If that still does not help contact the G.A.S. service hotline.

Symtom	**Screen is black while device is on.**
Possible Cause	*Screensaver is active*
Action	Using the pushable rotary knob to active the screen. If the screen can’t be reactivated then restart the system. If that still does not help contact the G.A.S. service hotline.

Symtom	**Gasflow set-values cannot be achieved.**
Possible Cause	*Backpressure to low*
Action	Set up the back pressure at least to 2,5 bar. If that still does not help contact the G.A.S. service hotline.
Possible Cause	*Hardware failure*
Action	Contact the G.A.S. service hotline.

Symtom	**Temeperature set-values cannot be achieved.**
Possible Cause	*Hardware failure*
Action	Contact the G.A.S.service hotline.

Symtom	**No display of measurement values during monitoring**
Possible Cause	*Hardware failure*
Action	Contact the G.A.S.service hotline.

Symtom	**No Reaktion Ion Peak (RIP) will be displayed.**
Possible Cause	*Device is in negative mode*
Action	Switch the drift volage into positive mode. If that still does not help contact the G.A.S. service hotline.

Description	*Hardware failure*
Action	Contact the G.A.S. service hotline.

Symtom	**No or small Reaktion Ion Peak (RIP) will be displayed.**
Possible Cause	*Systemcontamination*
Action	Start cleaning mode.

Symtom	**Find signals from the prior measurement run in the chromatogram**
Possible Cause	*The measurement runtime is to short.*
Action	Increase the measurement run time

Symtom	**The actual size of the measurement file is to large**
Possible Cause	
Action	Increase the Average setting or shorten the runtime.

Symtom	**The measurement signals cannot mapped well.**
Possible Cause	*Average setting is to high*
Action	Decrease the Average setting.

9.5 How to...