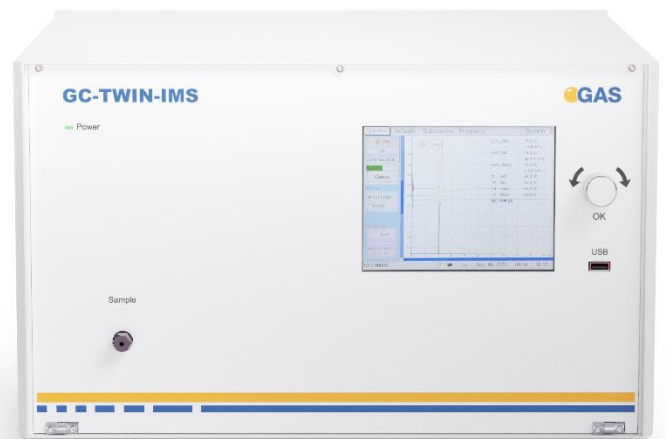


GC-TWIN-IMS



Addendum Manual



**G.A.S. Gesellschaft für
analytische Sensorsysteme mbH**

GC-TWIN-IMS – Addendum Manual

Version 1.00, August 2025

Valid from GC-IMS Firmware Version 4.76

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Table of Content

1	General Information	4
2	Internal gasflow	5
3	GC-TWIN-IMS Housing.....	7
3.1	Front.....	7
3.2	Rear.....	9
4	GC-TWIN-IMS Operating Interface	11
4.1	Spectra Window	12
4.2	Defaults Window.....	13
4.3	Programs Window	15
4.4	System Window.....	16
4.4.1	System Plan Window	16
4.4.2	System Settings Window	17
4.4.3	System Transfer Window	19
5	Measurement files.....	21

1 General Information



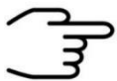
INFORMATION!

This **Addendum GC-TWIN-IMS Manual** is a supplement to the GC-IMS manual. It describes the differences of the GC-TWIN-IMS to the GC-IMS. The basic functions and operation can be found in the GC-IMS User Manual.

The GC-IMS TWIN is an advanced version of the GC-IMS. It features two Ion Mobility Spectrometers (IMS) that enable simultaneous and continuous detection/operation generating positive and negative ions applying both drift voltage polarities.

Two measurements, known as RAW files, are stored simultaneously, one for the measurement in the positive drift voltage and one for the measurement in the negative drift voltage.

Noise-reduced files can also be generated from the RAW files. These are called 'denoised files'.

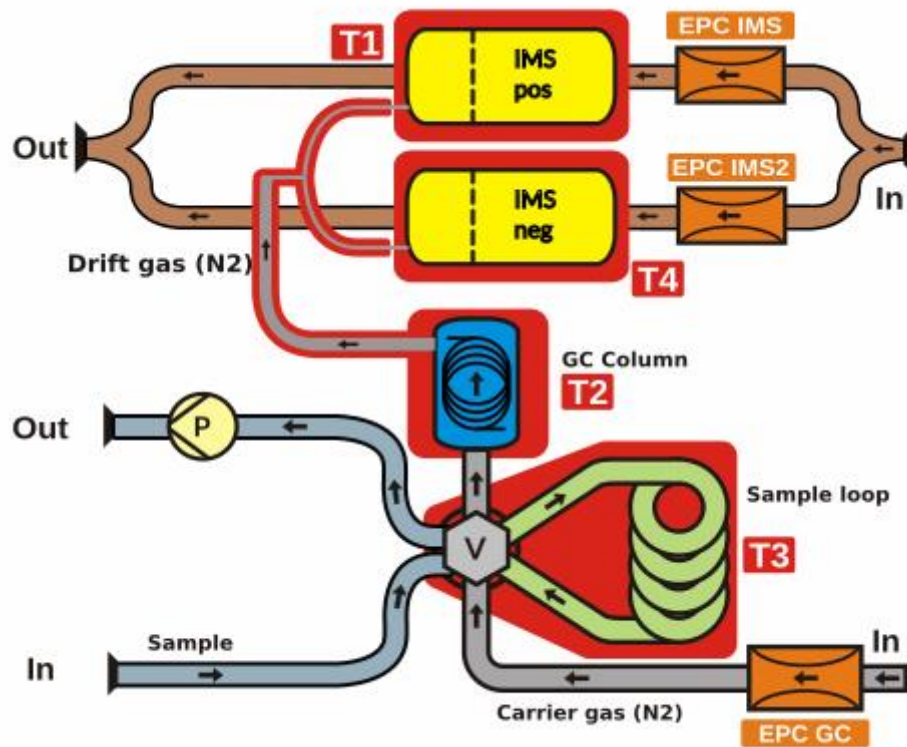


INFORMATION!

The graphics in this user manual are schematic and may differ from the actual version. The firmware and PC software screenshots in this user manual may differ from the latest version.

2 Internal gas flow

The schematic drawing shows the principal structure of the gas flow system of the GC-TWIN-IMS. The system consists of a gas chromatographic column coupled with two IMS sensors.



The drift gas for the two IMS sensors is supplied via electronic pressure control units (EPCs). The EPC-IMS pressure control unit supplies the IMS sensor with the positive drift voltage (IMS pos).

The EPC-IMS2 pressure control unit supplies the IMS sensor with the negative drift voltage (IMS neg).

The carrier gas for the gas chromatographic (GC) column is supplied via another electronic pressure control unit (EPC GC).

At the end of the gas chromatographic column, the carrier gas flow is split between the two IMS sensors.

Both gases (carrier gas and drift gas) leave the device at the gas outlet, which should be connected to an exhaust system/fume hood.



INFORMATION!

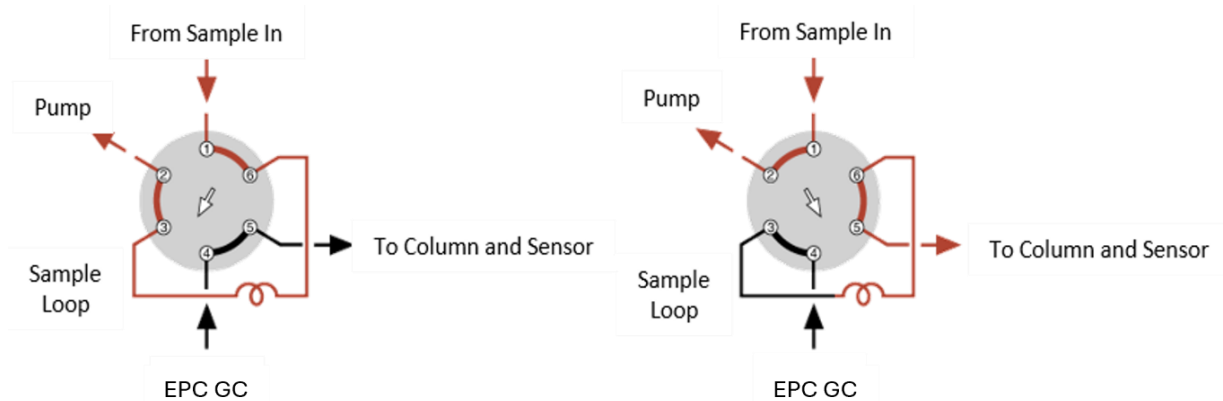
The exhaust tubes (Gas out and Sample gas out) **must be led separately into the exhaust system and must not be connected/united.**

The exhaust system must **not generate any negative pressure.**

GC-TWIN-IMS – Addendum Manual

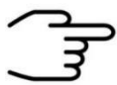
IMS pos (T1), IMS neg (T4), GC-Column (T2), and the 6-Port Valve with sample loop (T3) are heated.

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 transferred via the heated 6-port-valve (T3) to the GC-Column. In the default position of the 6-port-valve the carrier gas permanently flushes the GC-column. 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 GC-Column and to the two IMS sensors, the 6-port-valve is switched to the second position called “Inject”. The carrier gas now transports the sample gas into the loop and further to the GC-column, where the substances within the sample gas are separated by time. The eluting substances are introduced into the ionization chamber of both IMS sensors (IMS pos and IMS neg) and leave the system via the ‘Gas out’ socket.

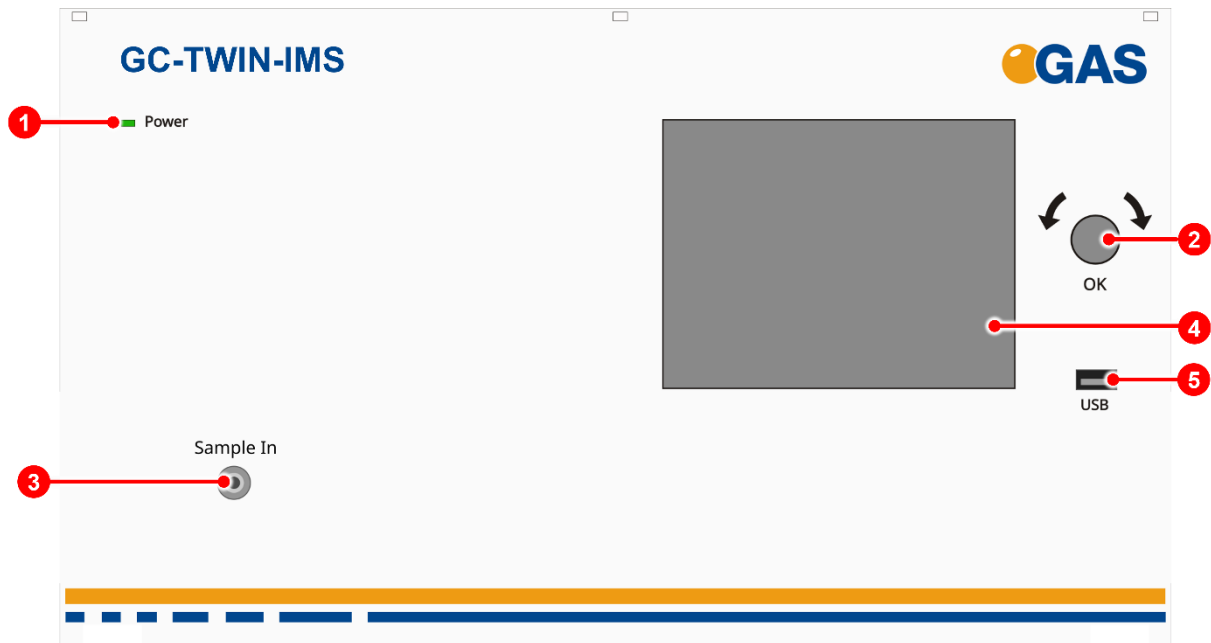


INFORMATION!

In the event of a power failure, check the standard position of the valve position. The basic setting must be set to **Fill Loop**.

3 GC-TWIN-IMS Housing

3.1 Front



1	Power LED	<ul style="list-style-type: none"> ■ Indicates whether or not the device is connected to a power supply and is switched on ■ Indicates an internal system error.
2	Pushable Rotary Knob	Input control for cycling through and activating the control elements of the graphical user interface.
3	Sample In socket	<p>3 mm stainless steel inlet plug with integrated Luer-port for connecting the device to a gas source via</p> <ul style="list-style-type: none"> Bypass Adapter Transfer Line Disposable syringes

4	Touch screen Display	Displays the graphical user interface and allows the manual control of the device via touch screen.
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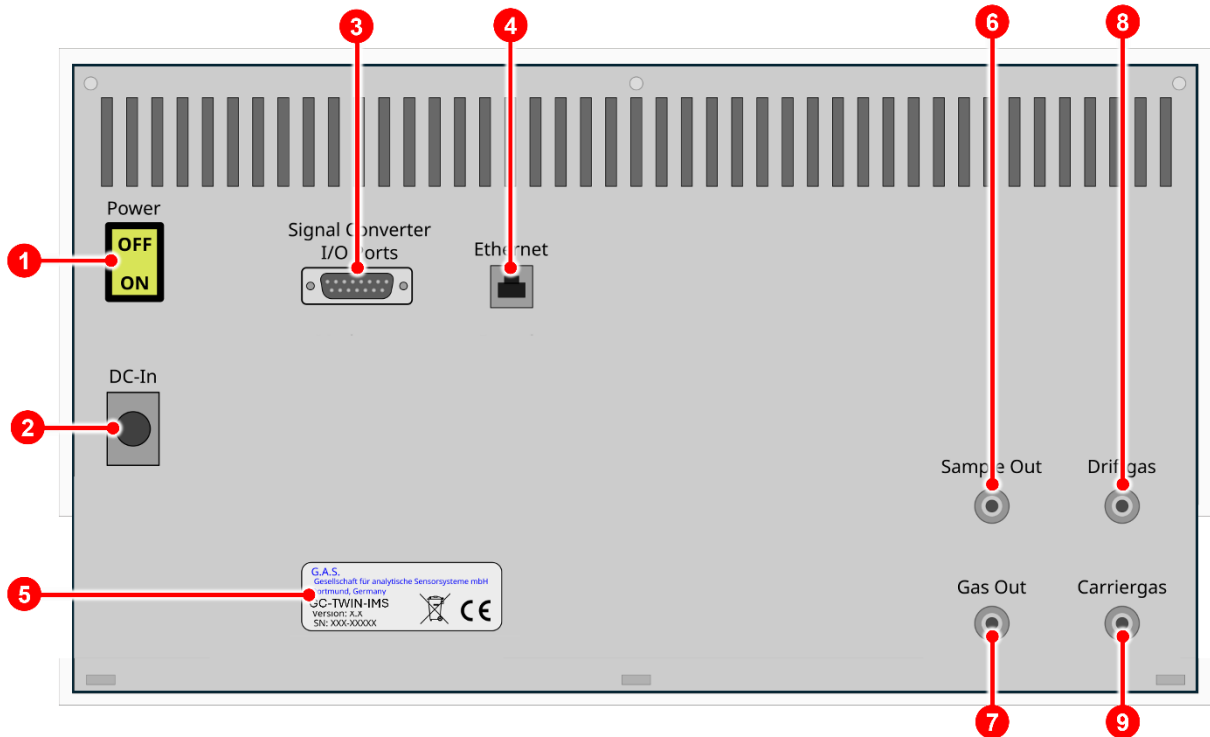


DANGER

The **Sample In socket** can reach higher temperatures (up to 50°C) approximately during the cleaning procedure. Do not touch these parts during the cleaning procedure.

5	USB Socket	USB socket for connecting external USB storage volumes. These volumes can be used for: <ul style="list-style-type: none">• exporting measurement files• importing sample name lists• Import/Export programs• upgrading the device's firmware• saving/loading system settings
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3.2 Rear



1	Power Switch	Switches the device on or off.
2	DC-In Socket	24 V XLR-Connector for connecting the power supply.
3	Signal Converter –I/O Socket	Socket for connecting a PLC (Programmable Logic Controller) or other devices.
4	Ethernet Socket	Socket for connecting the device to a local area network (LAN) or directly to a computer.
5	Device Type/Serial Number Plate	Displays manufacturer identification, device type, serial number and version.
6	Sample Out Socket	3 mm stainless steel plug for connecting the device to an adequate laboratory waste gas ventilation system/fume hood.

GC-TWIN-IMS – Addendum Manual

7	Gas Out Socket	3 mm stainless steel plug for connecting the device to an adequate laboratory waste gas ventilation system/fume hood.
8	Drift Gas In Socket	3 mm stainless steel inlet plug for connecting the device to a drift gas source.
9	Carrier Gas In Socket	3 mm stainless steel inlet plug for connecting the device to a drift gas source.

4 GC-TWIN-IMS Operating Interface

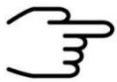


INFORMATION!

This supplement only describes the main differences of GC-TWIN-IMS operation interface and the GC-IMS operation interface. The basic functions and operation can be found in the GC-IMS User Manual.

The graphical user interface of the device can be controlled by using the touchscreen in combination with the pushable rotary knob on the front of the device.

The selected control (button, input field etc.) element is marked blue. To activate it the knob can be pressed.



INFORMATION!

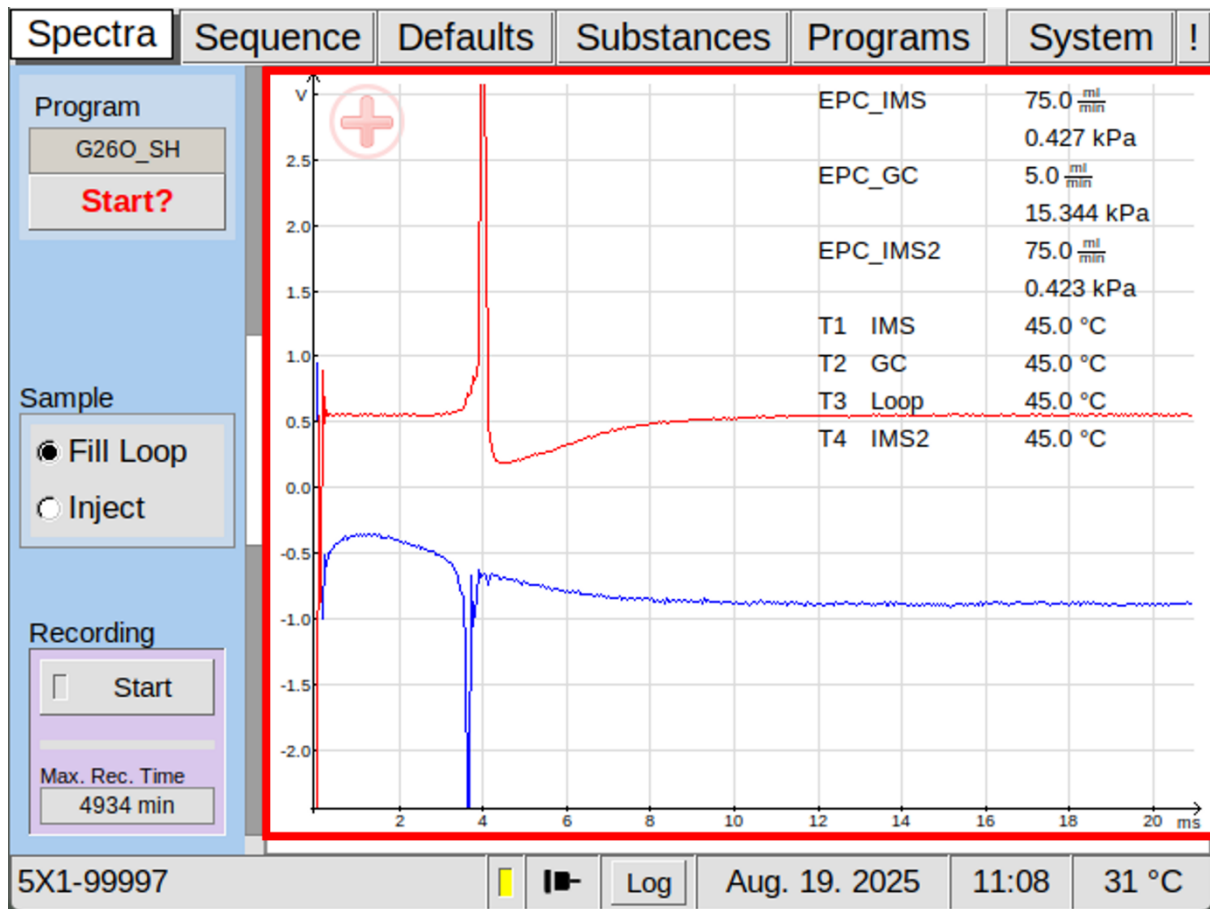
For detailed Information refer to the [GC-IMS User Manual](#).



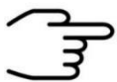
INFORMATION!

As the product is under continuous development, the screen shots in this user manual may differ from the latest version .

4.1 Spectra Window



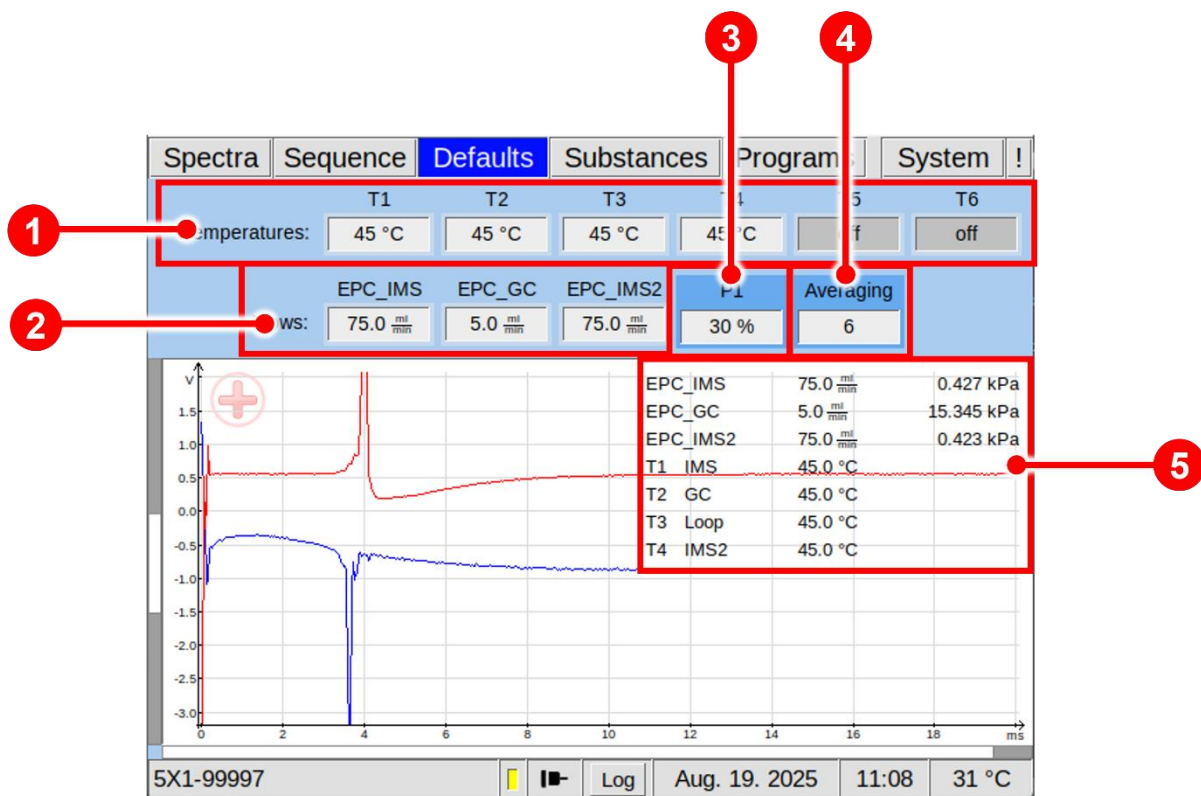
Data acquisition can be controlled in the GC-TWIN-IMS spectrum window. The current spectra at positive and negative drift voltages are displayed simultaneously. This is the main difference to GC-IMS. Operation and further display correspond to the GC-IMS manual.



INFORMATION!
 For detailed Information refer to the [GC-IMS User Manual](#).

4.2 Defaults Window

The **Defaults** window allows the monitoring and modification of various device parameters. The electronic pressure controllers (EPC_IMS, EPC-IMS2 and EPC_GC) and the heated device components of the device can be controlled (T1 – T6). Further, the sample pump intensity and averaging of spectra acquisition can be changed manually.



1

Temperature display

The temperature values of the heated device components **IMS pos (T1)**, **GC Column (T2)**, **Loop (T3)**, **IMS neg (T4)** can be set.

The set temperatures (T1–T4) are displayed. Temperature modules T5 and T6 are currently not equipped/needed. The maximum user value is 80°C.

2

Flow display

The flowrates of Drift gas (**EPC_IMS**), **EPC_IMS2** and the Carrier gas (**EPC_GC**) can be set.

		<p>The set flowrates for Drift gas (EPC_IMS), (EPC_IMS2) and Carrier gas (EPC_GC) are displayed.</p> <p>The maximum value for EPC_IMS is 500 ml/min. The working value for EPC_IMS depends on the application. The recommended working value for EPC_IMS is 75 ml/min. The working value of EPC_GC depends on the application and is influenced by the built-in GC-Column (length, inner diameter).</p>
3	Sample Pump (P1)	<p>The Sample In flow in percent of the sample pump duty can be set in P1. The value depends on the application.</p>
4	Averaging display	<p>Displays the current Averaging value. The averaging value determines how many raw spectra are averaged to generate one single spectrum as result in the stored measurement file. Modifying the averaging parameter affects the number of recorded spectra per time interval. A typical averaging value is 6. The maximum value is 99. A value of 0 (Off) disables averaging.</p>
5	Device Parameter	<p>Displays the current temperature, flow and pressure values.</p>



INFORMATION!
 For detailed Information refer to the **GC-IMS User Manual**.

4.3 Programs Window

In the Programs Window user-defined measurement programs can be selected, managed and edited.

Time	R	V1	E_GC	E_IMS	E_IMS2	P1 %
00:00.000	●	Fill	20.0 $\frac{ml}{min}$	75.0 $\frac{ml}{min}$	75.0 $\frac{ml}{min}$	30
00:13.000		Inj				
00:22.000						
00:30.000			20.0 $\frac{ml}{min}$			
01:30.000	■		30.0 $\frac{ml}{min}$			
01:30.020	—	—	—	—	—	—

1 **Time:** Time point of action start

2 **R:** Start / Stop recording spectra **Start** = ● **Stop** = ■

3 **V1:** Switch of the Valve Position (**Fill / Inj**)

4 **E_GC:** Flow rate control for carrier gas EPC_GC (**0- 150* ml/min**)

5 **E_IMS:** Flow rate control for drift gas (EPC_IMS) for IMS pos (**0- 500 ml/min**)

6 **E_IMS2:** Flow rate control for drift gas (EPC_IMS2) for IMS neg (**0- 500 ml/min**)

7

P1: The sample flow can be set in percent of the total (~275 ml/min.) pump power (0- 100 %)

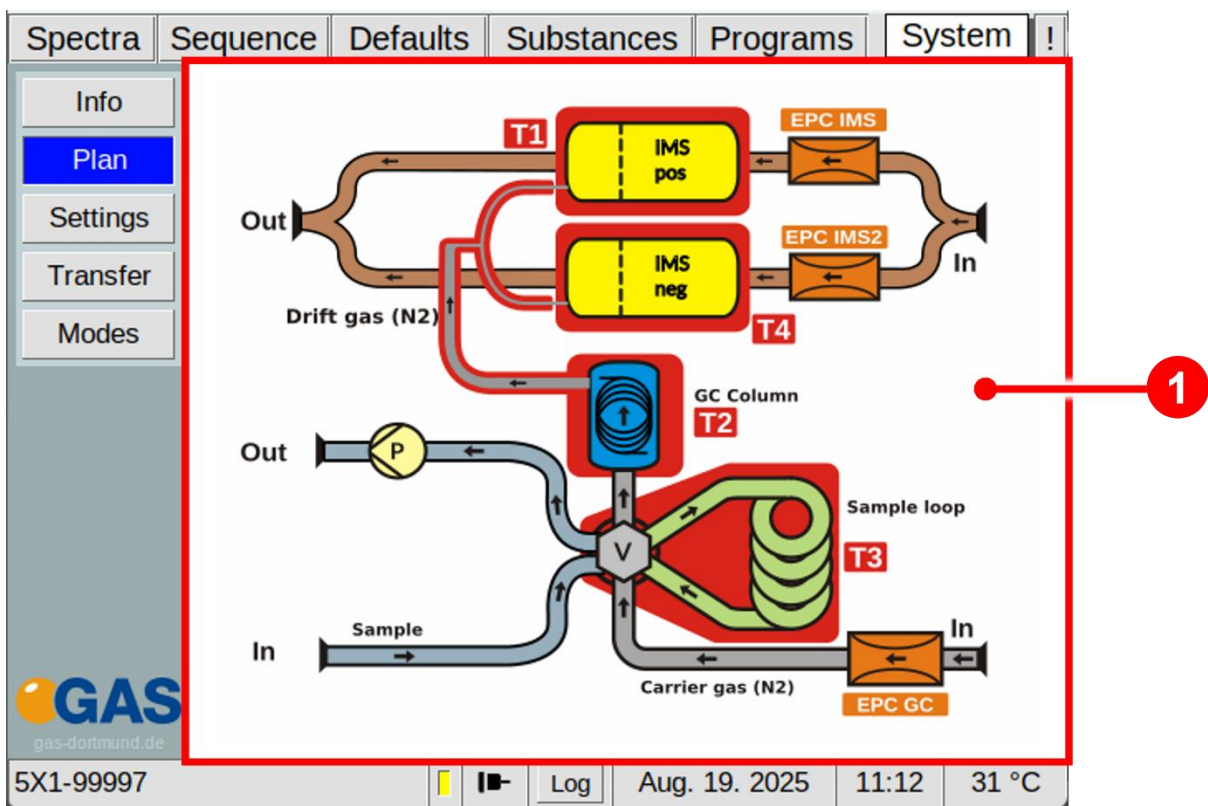


INFORMATION!

For detailed Information refer to the [GC-IMS User Manual](#).

4.4 System Window

4.4.1 System Plan Window



1

Plan

Displays a schematic drawing of the device.

4.4.2 System Settings Window

The screenshot shows the 'System' settings window with the following configuration:

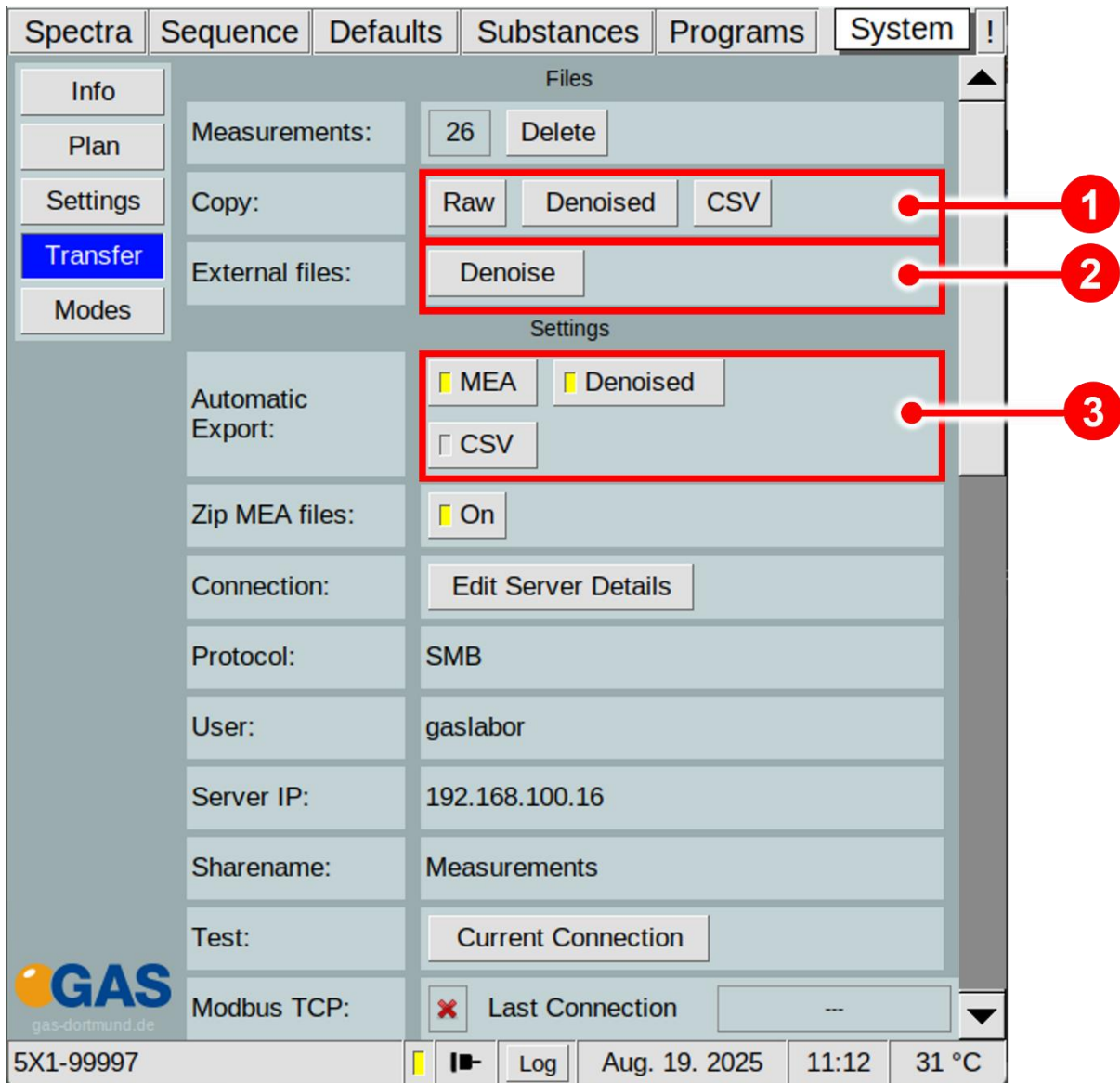
- General Settings:**
 - Language: ENG
 - IP Address: 192.168.100.121 (Set)
 - View: Simplified, Normal
 - Append ID to file in Simplified view:
 - Date/Time: Set
 - Settings: Save, Load, Default
 - Firmware: Upgrade
 - Overheat: Threshold 55 °C
 - After Seq.: CUSTOM
 - Snapshot: Manage
- Contaminant Settings (highlighted in red box):**

	Pos	Neg
Current	18 mV	111 mV
Threshold	149 mV	321 mV
Search from	1.086	1.086
- Current Loop Settings:**
 - Currentloop: Settings...
- Device Attributes:**
 - Sampleloop: Volume 1000 µl
 - GC Column: MXT-WAX, L: 15.00m, ID: 0.53mm, FT: 1.0...
 - Tubelen pos: 53.000 mm (Callout 2)
 - Tubelen neg: 53.000 mm (Callout 3)
 - Drift V. pos: 2700 V (Callout 4)
 - Drift V. neg: 2700 V (Callout 5)
 - Drift Gas: Nitrogen, Air, Other
- Miscellaneous:**
 - Diagnostics: Create and export file
 - Alarm: Frequency 440 Hz
 - EPC settings: Edit

At the bottom, the status bar shows: 5X1-99997, Log, Aug. 19. 2025, 11:11, 31 °C.

<p>1</p>	<p>Contamin.:</p>	<p>Defines the automatic search area for a potential contamination for both IMS detectors. The search window can be defined by setting the Threshold (signal level in mV which is recognized as a contamination) and the Search from Drift time in the drift-time spectrum given as RIP and RIN relative factor.</p> <ul style="list-style-type: none"> • Current: Shows the currently detected contamination. • Threshold: The set value from which an error is triggered. • Search from: The RIP-relative and RIN-relative starting position of the search.
<p>2</p>	<p>Tubelen pos:</p>	<p>Setting the length of the drift tube for IMS pos.</p>
<p>3</p>	<p>Tubelen neg:</p>	<p>Setting the length of the drift tube for IMS neg.</p>
<p>4</p>	<p>Drift V. pos:</p>	<p>Setting of the applied drift voltage for IMS pos.</p>
<p>5</p>	<p>Drift V. neg:</p>	<p>Setting of the applied drift voltage for IMS neg.</p>

4.4.3 System Transfer Window



1

Copy:

The current number of internal stored measurement files and the following measurement file managing options are displayed and available:

Raw: Copy the internal stored measurements to a connected USB device or to the connected shared folder.

Denoised: Copies a denoised version generated from the measured raw file to a connected USB device or to the connected shared folder.

		CSV : Copies a result file in CSV format generated from the measured raw file to a connected USB device or to the connected shared folder.
2	External files:	A raw file can be loaded into the system and subsequently denoised. This file can then be saved using the copy functions.
3	Automatic Export:	Automatic Export ensures that the generated measurement files are exported automatically. By activating this function, various formats can be specified: Mea : the raw files Denoised : the denoised files generated from the raw files CSV : the CSV files generated from the raw files

5 Measurement files

Three types of measurement files can be generated.

Raw files: Raw files are the actual, untreated data that have been acquired. These are stored on the system's memory.

Raw files measured with positive drift voltage are saved in the format

YYYYMMdd_hhmmss.mea.

Raw files measured with negative drift voltage are saved with the extension NEG in the format **YYYYMMdd_hhmmss_NEG.mea.**

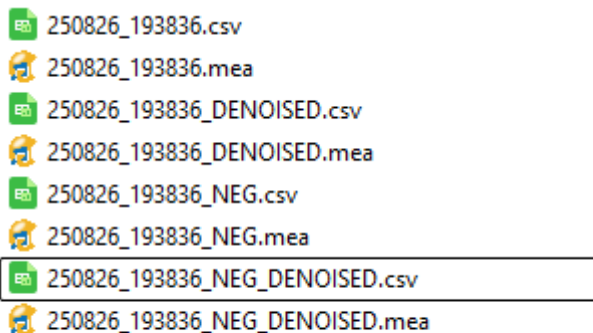
Denoised: These files are generated from the existing raw files and are only available temporarily. The signal-to-noise ratio is significantly improved by the applied mathematical algorithms. However, these are processed files.

Denoised files are saved with the extension DENOISED or NEG_DENOISED.

YYYYMMdd_hhmmss_DENOISED.mea. or

YYYYMMdd_hhmmss_NEG_DENOISED.mea.

CSV: Files in CSV format can be generated from the existing raw files for further external processing. CSV files are given the extension csv instead of mea.



250826_193836.csv
 250826_193836.mea
 250826_193836_DENOISED.csv
 250826_193836_DENOISED.mea
 250826_193836_NEG.csv
 250826_193836_NEG.mea
 250826_193836_NEG_DENOISED.csv
 250826_193836_NEG_DENOISED.mea

6 Quantitative measurements

The GC-TWIN-IMS uses a 3-way split in order to divide the sample after the GC column. Afterwards the sample portions are introduced into IMS and IMS2 in a defined ratio (s. figure 1).

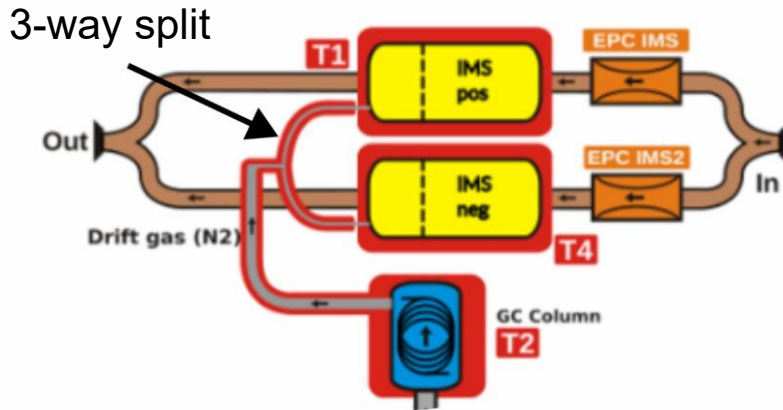


Figure 1: 3-way split between GC column and IMSs

Both IMS flows can be adjusted between 0 and 500 mL/min which corresponds to a certain pressure within each IMS. Furthermore, the flow or rather the pressure of one IMS can affect the other one, due to variations in the counter pressure, and vice versa (see figure 2). These variations can affect the signal response as depicted in figure 2. When working quantitatively or semi-quantitatively the drift gas flows of both IMSs and therefore the pressures of both IMSs should be kept constant or rather not differ from the calibration/method parameters applied.

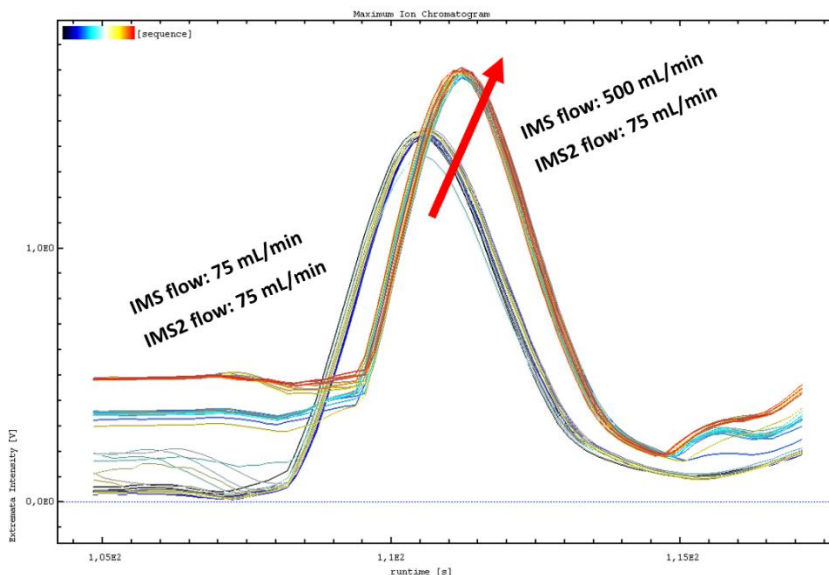


Figure 2: Impact of drift gas variation of IMS with regards to signal response of IMS2. IMS2 flow is kept constant.

6.1 Technical data: GC-TWIN-IMS

Dimensions	<ul style="list-style-type: none"> • Housing: 19"-compatible • Height: 273 mm • Width: 463 mm • Depth 440 mm • Weight: approx. 17 kg • IP 20 enclosure
Operational conditions	<ul style="list-style-type: none"> • Temperature range: +5°C ... +40°C • Humidity: 0-90% RH, non-condensing
Electrical Connectors	<ul style="list-style-type: none"> • 1 x I/O DA15 socket • 1 x Ethernet RJ45 IEEE 802.3 1000BASE-T • 1 x USB 2.0 Host (USB A Connector) • 1 x XLR 3-pole male, for power supply
Power Supply	<ul style="list-style-type: none"> • Input line voltage: Grounded AC, 85 to 264V • Input line frequency: 47-63 Hz • Input current: < 2.8 A • Output voltage: 24 VDC • Output current: 9.2 A internal • Power consumption: < 221 Watt
Cooling	<ul style="list-style-type: none"> • Radial fan, temperature-controlled, max. 5.5 m³/h
Gas connectors	<ul style="list-style-type: none"> • 3 mm stainless steel connector.
Internal hoses	<ul style="list-style-type: none"> • All sample relevant tubing is SilcoNert stainless steel • Other PFA
IMS-parameters	<ul style="list-style-type: none"> • Two IMS (positive, negative) • Drift tube length: 53 mm • Electrical field strength: 500 V/cm • Resolution: ~45 • Operating temperature: 35–100°C

GC-TWIN-IMS – Addendum Manual

Ionisation source	<ul style="list-style-type: none">• Two β-Radiation tritium (H^3) sources of 100MBq each)
Data acquisition	<ul style="list-style-type: none">• Sample-Rate: 150 kHz• Resolution: 14 bits• Trigger-duration: 100 μs• Trigger-repetition rate: 21 ms• Spectra-Rate: 23.8 Hz for each IMS
Drift voltage	<ul style="list-style-type: none">• 2,7 kV simultaneous positive and negative drift voltage
Sampling system	<ul style="list-style-type: none">• 6-port-valve• Sample loop: 1 ml• Splitter after sample loop 1:1 for each IMS• Operation temperature: 35 – 100°C (default 45°C)• Temperature display accuracy: $\pm 1^\circ\text{C}$• Temperature control accuracy: $\pm 0,1\text{ K}$
Data storage	<ul style="list-style-type: none">• Internal storage volume• Data transfer via LAN-connection via SMB, SFTP or TFTP (G.A.S. version of TFTP)
Operation	<ul style="list-style-type: none">• 6.4" TFT Touchscreen• Rotatable push button
Standard gas chromatographic capillary column (other column types only on request)	<ul style="list-style-type: none">• Standard Stationary Phase:<ul style="list-style-type: none">• (5% diphenyl, 95% dimethylpolysiloxane)• Capillary column<ul style="list-style-type: none">• Identification: MXT-WAX• Film thickness: 1 μm• Column length: 15 m• ID: 0.53 mm• OD: 0.68 mm
Column oven	<ul style="list-style-type: none">• Operation temperature: 35 – 100°C• Temperature-display accuracy: $\pm 1^\circ\text{C}$• Temperature-control accuracy: $\pm 0.1^\circ\text{C}$

Flow Control EPC_IMS Drift gas	<ul style="list-style-type: none">• Type: Differential pressure control• Input pressure: 4.0 bar (400 kPa) – 6.0 bar (600 kPa)• Output Pressure Stability: 0.01%• Output Pressure Linearity: 0.05%• Operation flow rates: 0 – 500 ml/min
Flowcontrol EPC_GC Carriergas	<ul style="list-style-type: none">• Type: Differential pressure control• Input Pressure: 4.0 bar (400 kPa) – 6.0 bar (600 kPa)• Output Pressure Stability: 0.01%• Output Pressure Linearity: 0.05%• Operation flow rates: 0 – 150 ml/min (depending on the GC-Column dimensions)
Consumables	<ul style="list-style-type: none">• Gas nitrogen 5.0 quality or Synthetic air 5.0 quality
Cleaning mode	<ul style="list-style-type: none">• Both IMS, column and sampling system are heated up to > 100°C (~ 120°C).