INFICON



Operating Manual

Micro GC Fusion®

Gas Analyzer

074-594-P1-L

INFICON
Two Technology Place
East Syracuse, NY 13057-9714

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1 Warranty

WARRANTY AND LIABILITY - LIMITATION: Seller warrants the products manufactured by it, or by an affiliated company and sold by it, to be, for the period of warranty coverage specified below, free from defects of materials or workmanship under normal proper use and service. The period of warranty coverage is specified for the respective products in the respective Seller instruction manuals for those products but shall not be less than two (2) years from the date of shipment thereof by Seller. Seller's liability under this warranty is limited to such of the above products or parts thereof as are returned, transportation prepaid, to Seller's plant, not later than thirty (30) days after the expiration of the period of warranty coverage in respect thereof and are found by Seller's examination to have failed to function properly because of defective workmanship or materials and not because of improper installation or misuse and is limited to, at Seller's election, either (a) repairing and returning the product or part thereof, or (b) furnishing a replacement product or part thereof, transportation prepaid by Seller in either case. In the event Buyer discovers or learns that a product does not conform to warranty, Buyer shall immediately notify Seller in writing of such non-conformity, specifying in reasonable detail the nature of such non-conformity. If Seller is not provided with such written notification, Seller shall not be liable for any further damages which could have been avoided if Seller had been provided with immediate written notification.

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These instructions do not provide for every contingency that may arise in connection with the installation, operation, or maintenance of this equipment. Should you require further assistance, please contact INFICON.

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3 Safety Information

All work described in this document may only be carried out by persons who have suitable technical training and the necessary experience or who have been instructed by the end user of the product.

3.1 Definition of Safety and Informational Messages

When using this document, please pay attention to the safety and informational messages found throughout. For the purposes of this manual, they are defined as follows:



⚠ DANGER

This type of message indicates an imminently hazardous situation that will result in death or serious injury if proper precautions are not taken.



⚠ WARNING

This type of message indicates a potentially hazardous situation that could result in death or serious injury if proper precautions are not taken.



⚠ WARNING

This type of message indicates that dangerous electrical voltages are present that could result in personal injury if proper precautions are not taken.



⚠ WARNING

This type of message indicates that high temperatures are present that could result in personal injury if proper precautions are not taken.



⚠ CAUTION

This type of message indicates a potentially hazardous situation that could result in minor or moderate injury if proper precautions are not taken.

NOTICE

This type of message warns against actions that could cause equipment damage or malfunction, environmental damage, and/or the loss of data.



This type of message indicates information that is considered important but is not related to any type of hazard.

3.2 Safety Precautions When Using Micro GC Fusion

Misuse of Micro GC Fusion can damage the instrument and may cause bodily harm. The safety messages in this document are provided to protect the user, as well as to optimize product performance.

Before operating Micro GC Fusion, the user must read and understand all safety messages and take adequate precautions to mitigate hazards or equipment damage.



⚠ DANGER

Micro GC Fusion is not intrinsically safe and is not recommended for use in explosive environments.



⚠ WARNING

Micro GC Fusion has a heated inlet which is hot to the touch.



⚠ WARNING

Never interrupt the protective earth circuit on a 4-module Micro GC Fusion.

Any interruption of the protective earth circuit inside or outside of the 4-module Micro GC Fusion, or disconnection of the protective earth terminal is likely to make the instrument dangerous.

This symbol ⏚ indicates where the protective earth ground is connected inside the 4-module Micro GC Fusion. Never unscrew or loosen this connection.



⚠ WARNING

Dangerous voltages may be present in a 4-module Micro GC Fusion whenever the power cord or external input/relay is connected.



⚠ WARNING

The 4-module Micro GC Fusion system has a line voltage present on the primary circuits whenever it is plugged into a main power source.

Removal of the cover must be done only by a technically qualified person.



⚠ WARNING

Safely vent carrier and sample streams—potentially toxic, noxious, asphyxiant (oxygen-displacing), or flammable gases—outside Micro GC Fusion and away from the operating area. Vent toxic gases to a fume hood, chemical trap, or reaction medium.



⚠ WARNING

Many gases are explosive when their concentration builds up over time due to leaks, poor connections, or inadequate ventilation. Verify proper venting prior to using hydrogen or other gases in enclosed environments.



⚠ CAUTION

Use Micro GC Fusion in an upright position.



⚠ CAUTION

Only technically qualified personnel should perform the procedures and maintenance described in this manual.



⚠ CAUTION

For rack mount installation, use only the INFICON supplied mounting kit.

Using unspecified mounting hardware may result in personal injury caused by unstable instrument mounting.



⚠ CAUTION

The 2-module Micro GC Fusion remains powered on, even if it is placed into standby mode. Disconnect the power supply to completely power off the instrument.



⚠ CAUTION

In older instruments with the Integrated Sample Conditioner installed, a pressurized sample of up to 6895 kPa (1000 psi) can be connected to the Micro GC Fusion inlet. Exercise caution when handling high-pressure samples.

NOTICE

Ensure the Micro GC Fusion fan exhaust at the back of the instrument is not blocked and the air flow through the bottom of Micro GC Fusion is unobstructed.

NOTICE

Micro GC Fusion air pathways must remain unobstructed to allow cooling of the analytical column(s) following a temperature programmed method run.

Allow a minimum of 6.5 cm (2.5 in.) clearance to the top, the front, the back, and both sides of the instrument to provide unrestricted air flow to the instrument.

NOTICE

Carrier gas inlet (rear of instrument) pressure must be within 400-427 kPa (58-62 psi). Use a dual-stage regulator on the carrier gas cylinder to ensure the pressure range is maintained.

Exceeding 565 kPa (82 psi) may damage Micro GC Fusion and require factory repair.

NOTICE

Sample inlet gas pressure must be less than 172 kPa (25 psi).

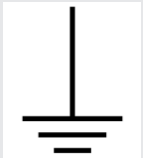
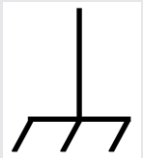
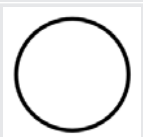
Exceeding 172 kPa (25 psi) will damage Micro GC Fusion and require factory repair.

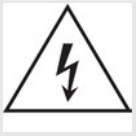
NOTICE

Micro GC Fusion is ventilated using an internal fan. The air inlet on the front of Micro GC Fusion must be kept clean and unobstructed. Allow a minimum of 6.5 cm (2.5 in.) clearance in front of the instrument to allow for proper ventilation.

3.3 Explanation of Symbols Used

The following symbols may be found in the operating manual and on the equipment.

Symbol	Reference	Description
	ISO 7000/IEC 60417-5031 (2002-10)	Direct current
	ISO 7000/IEC 60417-5017 (2006-08)	Earth (ground) terminal
	ISO 7000/IEC 60417-5019 (2006-08)	Protective earth (ground) terminal
	ISO 7000/IEC 60417-5020 (2002-10)	Frame or chassis terminal
	ISO 7000/IEC 60417-5007 (2002-10)	On (Power)
	ISO 7000/IEC 60417-5008 (2002-10)	Off (Power)

Symbol	Reference	Description
	ISO 7000/IEC 60417-6042 (2010-11)	Caution, risk of electric shock
	ISO 7000/IEC 60417-5041 (2002-10)	Caution, hot surface
	ISO 7000/IEC 60417-0434B (2004-01)	Caution*
	ISO 7000/IEC 60417-2760 (2006-05)	Product information

* Documentation must be consulted in all cases where this symbol is marked.

3.4 Liability and Warranty

INFICON assumes no liability and the warranty becomes null and void if the custodian or third parties:

- disregard the information in this document
- use the product in a non-conforming manner
- make any kind of changes (modifications, alterations, etc.) to the product
- use the product with accessories not listed in the corresponding product documentation

The custodian assumes the responsibility in conjunction with the process media used.

3.5 Training

For the optimal use of this product, INFICON offers application, operation, and maintenance courses. Your INFICON partner would be glad to provide the information.

4 Service and Technical Support

4.1 How to Contact Customer Support

Worldwide customer support information is available under **Contact** at www.inficon.com:

- Sales and Customer Service
- Technical Support
- Repair Service

When reporting an issue with your instrument, please have the following information readily available:

- the instrument part number(s) and serial number(s)
- a description of the problem
- an explanation of any corrective action already attempted
- the exact wording of any error messages

For technical support, visit www.inficon.com and select **Contact >> Service & Support**. Select your region and product to obtain support contact information.

4.2 Shipping to an INFICON Service Center

Do not return any component of the instrument to an INFICON Service Center without first obtaining a Return Material Authorization (RMA) number. To obtain an RMA, fill out and submit a Service Request form https://www.inficon.com/en/rma/.

The RMA number must be included with the shipment. If you deliver a package to a Service Center without an RMA number, your package will be held and you will be contacted. This will result in delays in servicing the instrument.

INFICON restricts certain chemicals from entering our facility. If your equipment has been exposed to a chemical on our disapproved list, the Service Center may direct you to send your product to a decontamination facility.

4.3 Warranty Extension

INFICON offers a multiple-year warranty extension option upon Micro GC Fusion purchase. Contact INFICON for details.

4.4 Service Contract

INFICON offers service contracts for an out-of-warranty Micro GC Fusion. INFICON will conduct an evaluation to verify the condition of an out-of-warranty Micro GC Fusion before agreeing to offer a service contract. Contact INFICON for details.

5 Introduction

Micro GC Fusion is an analytical instrument that can accommodate multiple gas chromatograph (GC) modules, each performing GC analysis with individually optimized chromatographic conditions. The sample is introduced through the front sample inlet to optimize detection and separation on the GC modules using appropriate carrier gases.

A GC module is a self-contained miniature gas chromatograph that consists of:

- a sample injector using Microelectromechanical Systems (MEMS) technology
- a resistively-heated, temperature programmable capillary column
- an electronic pressure control system
- a MEMS-based micro thermal conductivity detector (µTCD)

Chromatography software included with Micro GC Fusion may be operated from the instrument front panel display or by a networked computer. Both the analytical method and the resulting data files are stored on the Micro GC Fusion hard drive.

5.1 Measurements and Applications Overview

Micro GC Fusion provides concentration measurement for fixed gases, including:

- nitrogen
- oxygen
- carbon monoxide
- carbon dioxide
- hydrogen
- helium
- neon
- krypton

and light hydrocarbons, including:

- methane
- ethane, ethylene, acetylene
- propane, propylene
- butane, pentane, hexane
- C_3-C_5 olefins
- C_7-C_{12} saturated hydrocarbons
- volatile organic compounds (VOC)

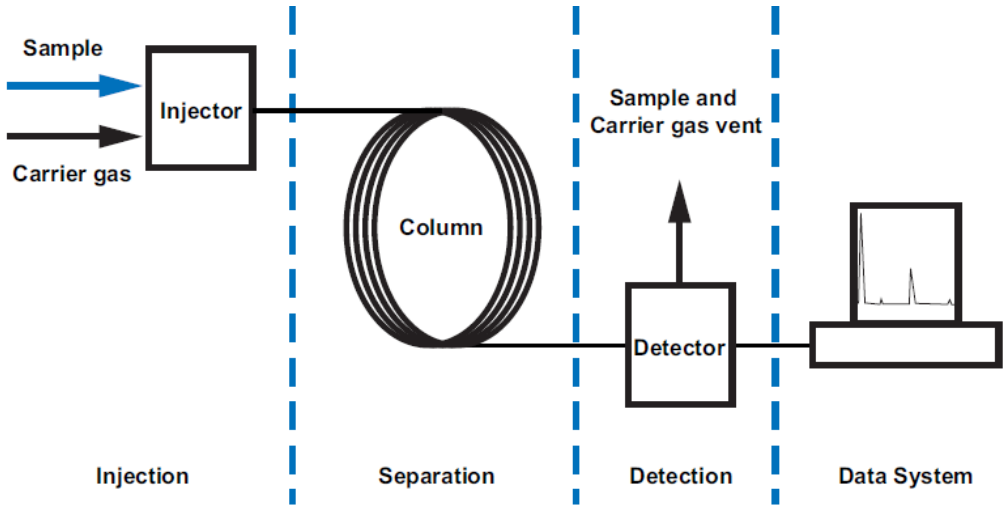
Common Micro GC Fusion applications include compositional analysis for:

- natural gas
- natural gas odorants
- refinery gas
- fixed gas
- syngas
- fuel cell

- biogas/biomethane
- landfill gas
- flue gas
- mine gas

5.2 Theory of Operation

Gas chromatography is used to separate and analyze compounds in mixed gas samples. A typical GC module consists of four main subsystems: injection, separation, detection, and data system.



5.2.1 Injection

A sample is introduced into a GC system through its injector. Micro GC Fusion accepts gas phase samples only at pressures ranging 0-172 kPa (0-25 psi). Micro GC Fusion is equipped with a sample inlet system that distributes injected sample to each injector on multiple GC modules within the instrument for simultaneous analysis.

NOTICE

Micro GC Fusion is intended for gas sampling only. Liquid injections will damage the instrument.

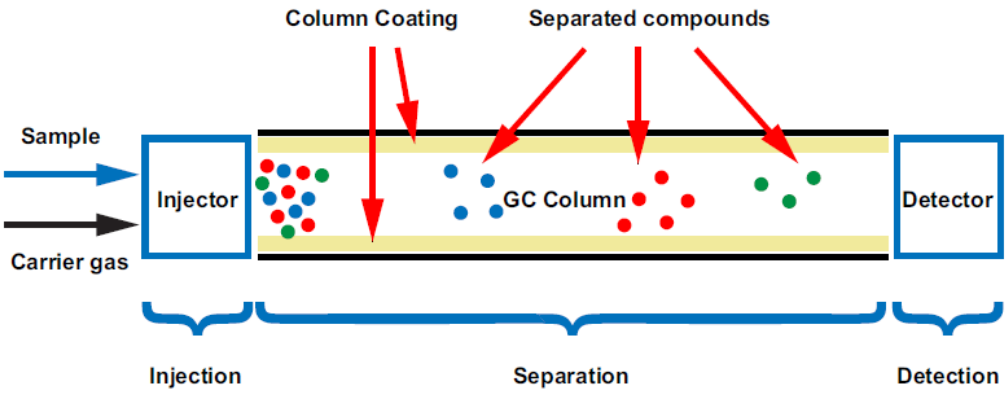
The optional External Sample Conditioner is recommended when the sample gas is at high pressure—up to 5516 kPa (800 psi). The External Sample Conditioner reduces the sample gas pressure to approximately 0–172 kPa (0-25 psi) and heats the sample to a constant temperature to optimize analysis repeatability.

Carrier gas, also known as the mobile phase, carries the injected sample into the column for analysis. A high-purity inert gas, free from hydrocarbons, oxygen, and moisture is required. Helium is preferred, while hydrogen, nitrogen, and argon are viable options depending on application requirements.

Carrier gas with a purity of 99.999% is preferred. A purity of 99.995% is acceptable when a carrier gas trap is installed.

5.2.2 Separation

Component separation of a sample injected onto a column is achieved through the interaction between the sample and the column coating, also known as the stationary phase. The less retentive the column coating is to a specific compound, the faster that compound travels, or elutes, through the column. Order of elution is primarily determined by the compound boiling point and polarity.



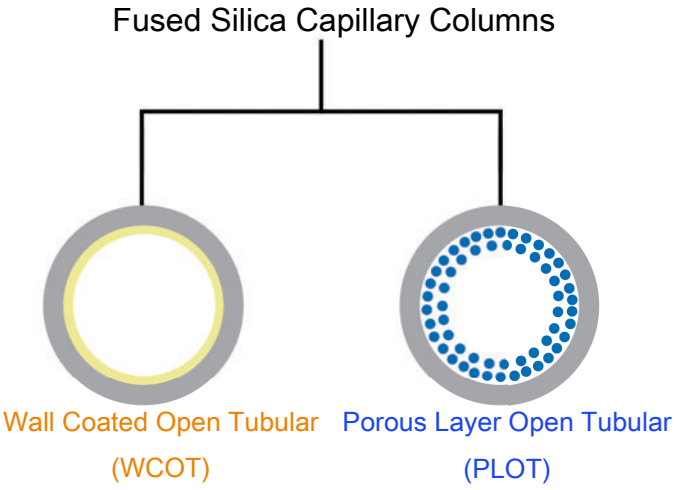
Micro GC Fusion uses high performance fused silica capillary columns to perform GC separation. Two types of capillary columns are used:

- Porous Layer Open Tubular (PLOT)

  PLOT columns have small particles coated on the inner surface of the column and separation is based on gas-solid partitioning. Common PLOT columns are Molsieve, Q-Bond, U-Bond, and Alumina. PLOT columns separate based on compound polarity.

- Wall Coated Open Tubular (WCOT)

  WCOT columns have a liquid stationary phase based on gas-liquid partitioning. The dimethylpolysiloxane (PDMS) column is a commonly used WCOT column, which primarily separates compounds based on boiling point.



The capillary column installed in Micro GC Fusion is resistively heated to achieve temperature ramping, which quickly increases the column temperature to reduce analysis time and improve compound separation.

Separation may be optimized by:

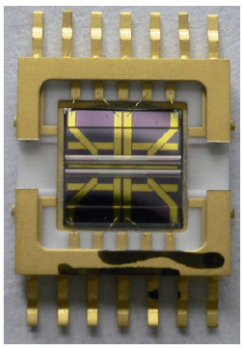
- selecting the appropriate column coating type and thickness
- selecting the appropriate column length and diameter
- selecting the appropriate carrier gas type
- adjusting the column head pressure
- adjusting the column temperature programming profile

5.2.3 Detection

The separated sample elutes from the GC column and enters the detection subsystem, where and electrical signal is generated based on compound type and concentration.

Micro GC Fusion MEMS-based µTCD provides excellent sensitivity. A detection limit of 1 ppm can be achieved for some compounds when the analysis method is optimized. The µTCD detects the difference in thermal conductivity of the gas traveling through the reference side (pure carrier gas) versus the gas traveling through the analytical side (carrier gas plus the sample gas).

µTCD sensitivity is matrix, carrier gas, and component dependent.



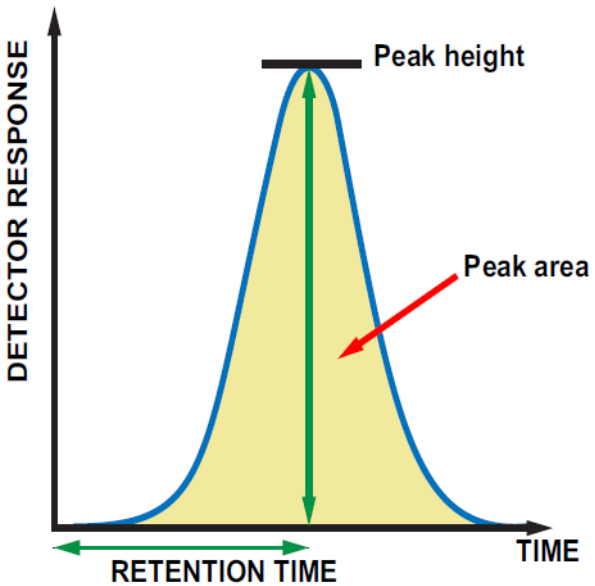
5.2.4 Data System

A data system controls the GC and processes the detector signal output for the sample being analyzed. GC operation parameters such as the sample injection time, column pressure, and column temperature programming profile are defined in a method. Once a method is loaded on Micro GC Fusion, a sample run can be initiated. As compounds elute from the GC column and are detected, a chromatogram is displayed with the detector response on the y axis and retention time of the separated compound on the x axis. The chromatogram provides qualitative and quantitative information about the injected sample.

Component identity is determined by its retention time in a GC analysis. Retention time measures the time interval between injection and the detection of a component. The less retentive the column coating is to a specific compound, the faster that

compound will travel, resulting in shorter retention times. Components that are more retentive to the column will travel slower, resulting in longer retention times. A calibration standard with compounds at known concentrations is necessary to determine the retention times of the target compounds. Using the same analytical conditions, an unknown sample is then injected into the GC to determine its composition based on the pre-determined peak retention time.

Quantitation of the target compounds in a GC analysis can be obtained by measuring the corresponding peak area presented in a chromatogram. The peak area is proportional to the analyte concentration detected and can be obtained by integrating the peak. The target compound concentration may be obtained by creating a calibration curve using calibration gases. Micro GC Fusion uses peak area to quantify target compound concentration.



Micro GC Fusion embedded chromatography software controls the GC and performs data analysis. Operation may be controlled directly from the front panel display. A web-based user interface can be accessed by computers connected through Ethernet or Wi-Fi on commercially available web browsers.

Micro GC Fusion can also be controlled using INFICON EZ IQ or Agilent CDS OpenLab EZChrom software. See EZ IQ or OpenLab EZChrom Instrument Control [▷ 223] for details.

6 Product Overview

Micro GC Fusion is available in two chassis configurations:

- 2-module chassis, which can house one or two GC modules
- 4-module chassis, which can house three or four GC modules

The two-chassis configurations share most of the hardware components. The following overview is applicable to both chassis configurations unless otherwise specified.

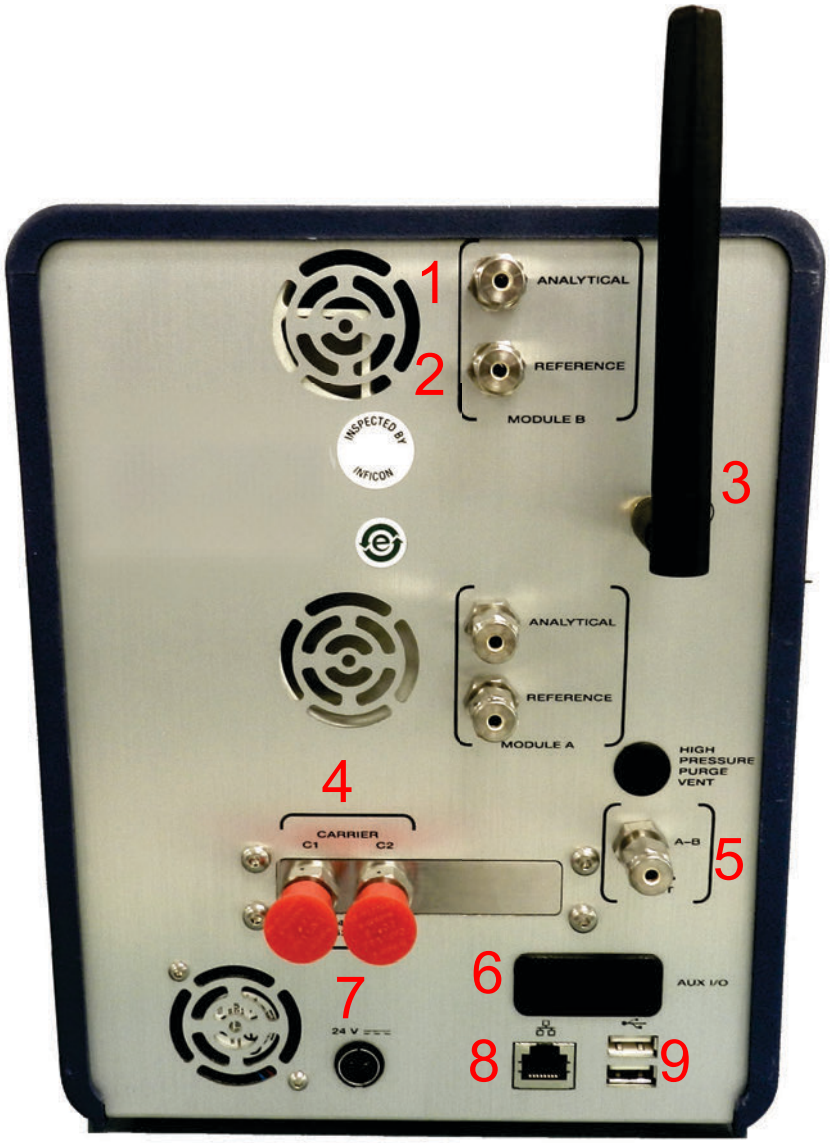
6.1 2-Module Chassis

The 2-module Micro GC Fusion chassis houses up to two analytical GC modules, electrical components, and internal plumbing. The front panel display provides access to basic operating interfaces and controls.

- Heated sample inlet
  - 1/16 in. Swagelok® male connector.
- Front panel display
  - See Front Panel Operation [▷ 140] for details about using the front panel display to access routine operating controls.
- On/Standby button
  - Illuminated On/Standby button to power on or place the instrument in standby mode.



Electrical and gas connections are located on the Micro GC Fusion back panel.



Number	Label	Description
1	ANALYTICAL	Vents for the analytical column(s) with 1/8 in. Swagelok connectors
2	REFERENCE	Vents for the reference columns(s) with 1/8 in. Swagelok connectors
3	Wi-Fi Antenna	Boosts wireless signal strength and improves connectivity
4	CARRIER C1 and C2	Carrier gas connections with 1/8 in. Swagelok connectors
5	PUMP VENT	Vent for the pump
6	AUX I/O	The AUX I/O can be configured to remotely start or cancel sample runs
7	24 V	24 V (dc) input from the external V (ac) to V (dc) power adaptor
8	RJ-45 LAN connector	Wired LAN connection
9	USB connectors	Two USB interfaces are provided

6.2 4-Module Chassis

The 4-module Micro GC Fusion chassis houses up to four analytical GC modules, electrical components, and internal plumbing. The front panel display provides access to basic operating interfaces and controls.

- Heated sample inlet
  - The inlet is a 1/16 in. Swagelok male connector.
- Front panel display
  - See Front Panel Operation [▶ 140] for details about using the front panel display to access routine operating controls.
- On/Standby button
  - Use the illuminated On/Standby button to power on or place the instrument in standby mode.



Electrical and gas connections are located on the Micro GC Fusion back panel.



Number	Label	Description
1	SAMPLE INLET	Optional 1/8 in. unheated rear sample inlet
2	CARRIER C1, C2, C3, and C4	Carrier gas connections with 1/8 in. Swagelok connectors
3	ANALYTICAL	Vents for the analytical column(s) with 1/8 in. Swagelok connectors
4	REFERENCE	Vents for the reference column(s) with 1/8 in. Swagelok connectors
5	PUMP VENT	Vent for the pump (black)
6	Wi-Fi Antenna	Boost wireless signal strength and improves connectivity
7	RJ-45 LAN connector	Wired LAN connection
8	AUX I/O	The auxillary I/O interface can be configured to remotely start or cancel sample runs
9	USB connectors	Two USB interfaces are provided
10	Grounding	Connect to the grounding when installed in a rack
11	100-240V~7A 50/60 HZ	120-240 V (ac) power cord connection, with a 7 A 240 V replaceable fuse and a power on/off switch

An optional rack mounting kit (PN 952-4100-G1) is available which allows the 4-module chassis to be mounted on a 19 in. rack mount. See Installing the Rack Mount Kit [▷ 61].

6.3 Sample Inlets

Sample gas is introduced to Micro GC Fusion through a front sample inlet.

Sample input pressure may range from 0 to 172 kPa (0 to 25 psi), or up to 5516 kPa (800 psi) when an optional External Sample Conditioner is used.

6.3.1 Front Sample Inlet

The standard inlet is a 1/16 in. Swagelok male connector. It connects the sample to one or more GC modules inside Micro GC Fusion, allowing for parallel analysis on multiple GC modules.

The front sample inlet is heated and deactivated to avoid sample condensation and adsorption. Inlet temperature can be set in the method, which may range from 30 to 140°C (86 to 284°F).



⚠ WARNING

Micro GC Fusion has a heated inlet which is hot to the touch.

NOTICE

Sample inlet gas pressure must be less than 172 kPa (25 psi).

Exceeding 172 kPa (25 psi) will damage Micro GC Fusion and require factory repair.



6.4 Carrier Gas Connections

Micro GC Fusion supports up to two external carrier gas connections from pressurized tanks for the 2-module chassis, and up to four external carrier gas connections for the 4-module chassis. Common carrier gases include: helium, hydrogen, argon, and nitrogen. The selection of carrier gases is dependent on the analytical compounds, sample matrix, and concentration.

Two 1/8 in. Swagelok carrier gas connectors are located on the back panel of the 2-module chassis. Four 1/8 in. Swagelok carrier gas connectors are located on the back panel of the 4-module chassis.

- When one carrier gas connector is configured, it supports the operation of all GC modules
- When two carrier gas connectors are configured on the 2-module chassis, one will support GC module A and the other will support GC module B
- For the 4-module chassis, the carrier gas connector can be configured with:
  - One carrier gas connector for Modules A and B, one carrier gas connector for Modules C and D. In this configuration, one carrier gas is shared by Modules A and B. The other is shared by modules C and D.
  - Two carrier gas connectors for Modules A and B, two carrier gas connectors for Modules C and D. In this configuration, each module is configured with its own carrier gas connector, allowing up to four carrier gas connections.

NOTICE

Use high-purity carrier gas (99.999%) with an input pressure range of 400-427 kPa (58-62 psi).



4-module Micro GC Fusion back panel



2-module Micro GC Fusion back panel

NOTICE

Carrier gas inlet (rear of instrument) pressure must be within 400-427 kPa (58-62 psi). Use a dual-stage regulator on the carrier gas cylinder to ensure the pressure range is maintained.

Exceeding 565 kPa (82 psi) may damage Micro GC Fusion and require factory repair.

6.5 Venting Connections

Three types of venting connections are located on the back panel:

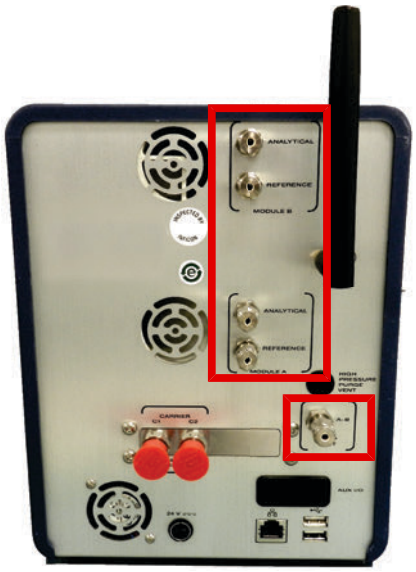
- ANALYTICAL
- REFERENCE
- PUMP

ANALYTICAL, REFERENCE, and PUMP vents require 1/8 in. Swagelok connectors.

Micro GC Fusion instruments shipped before October 2019 may have Luer Lock connectors for the ANALYTICAL, REFERENCE, and PUMP vents.



4-module Micro GC Fusion back panel



2-module Micro GC Fusion back panel

6.5.1 ANALYTICAL Vent

The ANALYTICAL vents are used to vent the exhaust from the GC module analytical columns.

6.5.2 REFERENCE Vent

The REFERENCE vents are used to vent the exhaust from the GC module reference columns.

6.5.3 PUMP Vent

The PUMP vent is used to vent the exhaust from the purge of the inlet and injection assembly. In Backflush mode, the PUMP vent is also used to vent the backflushed sample exhaust from the pre-column.

6.6 Front Panel Display

The front panel display is used to load a stored method/sequence, run the loaded method/sequence, view run data, and view system status.

For more details, see Front Panel Operation [▶ 140].

Complex operations such as method or sequence development require a separate computer with a larger display screen.



6.7 GC Module

A GC module is a self-contained gas chromatograph that can perform sample injection, separation, and detection. Up to two GC modules can be installed in a 2-module chassis or up to four GC modules can be installed in a 4-module chassis, each optimized to analyze different compounds from the same sample source.



6.7.1 Injection

A gas sample is injected into Micro GC Fusion through the front and is directed to one or more GC modules simultaneously. The MEMS injector on the GC module contains a sample loop and micro-diaphragm valves which are used to direct the sample and carrier gas flows. The sample volume is determined by the **Inject (ms)** time setting in the method. The injector temperature is also set in the method and can range from 30-100°C (86-212°F).

Micro GC Fusion supports four types of injectors:

- Variable Volume
- Variable Large Volume
- Fixed Volume
- Backflush, Fixed and Timed

6.7.1.1 Variable Volume Injector

Valid **Inject (ms)** time set points for the Variable Volume injector range from 10 to 100 ms. A typical set point is 25 ms. An **Inject (ms)** time of 0 ms results in no injection.

- Values less than 10 ms may result in poor repeatability
- Longer injection times allow larger volumes of sample to be injected, which results in higher sensitivity on a µTCD.



The Variable Volume Injector may be influenced by matrix effect as the sample density varies with compositional changes.

6.7.1.2 Variable Large Volume Injector

The Variable Large Volume Injector (LVI) should only be used when lower detection limits (1-10 ppm) are required.

Valid **Inject (ms)** time set points for the Variable Large Volume Injector range from 10 to 450 ms. A typical set point is 100 ms. An **Inject (ms)** time of 0 ms results in no injection.

- Values less than 10 ms may result in poor repeatability
- Longer injection times allow larger volumes of sample to be injected, which results in higher sensitivity on the µTCD



The Variable Large Volume Injector may be influenced by matrix effect as sample density varies with compositional changes.

6.7.1.3 Fixed Volume Injector

The Fixed Volume Injector provides the best accuracy and precision for concentrations above 200 ppm. It minimizes matrix effects as sample density varies with compositional changes.

Valid **Inject (ms)** time set points for the Fixed Volume Injector range from 0 to 50 ms. A typical set point is 30 ms. An **Inject (ms)** time of 0 ms results in no injection.

- Values less than 15 ms may result in poor repeatability

6.7.1.4 Backflush Injector

The backflush assembly consists of:

- a backflush injector
- a pre-column
- an analytical column

The pre-column is a short section of column connected in series to the analytical column. The pre-column prevents contaminants from entering the analytical column.

After the sample enters the analytical column, the flow is reversed (backflushed) through the pre-column, flushing undesired components from the pre-column to vent. Backflushing the pre-column prevents strongly retained compounds from entering the analytical column and causing ghost peaks on subsequent runs.

The Backflush Injector has two method parameters: **Backflush Time** (in seconds) and **Inject (ms)** time (in milliseconds).

Valid **Backflush Time** set points range from 0 to 250 s.

Valid **Inject (ms)** time set points range from 0 to 250 ms.

The **Backflush Injector** can function in a semi-fixed mode. An **Inject (ms)** time of 0 ms will result in a fixed injection volume. This is best used for component concentrations above 0.1%, and will result in higher precision.

For component concentrations below 0.1%, the backflush injector can be operated as a variable volume injector. An **Inject (ms)** time greater than 10 ms will allow larger sample volumes to be injected, which in turn results in higher sensitivity on a µTCD.

Backflush times vary with column types, lengths, head pressure, and temperature set points. Backflush times should be optimized for each GC module.

6.7.2 Separation

Depending on the GC column used, separation is primarily based on the component boiling point or polarity. The table below contains a list of common components that can be separated on various GC column types.

GC Column	Compounds Separated
Molsieve 5a	hydrogen, oxygen, nitrogen, methane, carbon monoxide
PLOT U	air, methane, carbon dioxide, ethylene, ethane, acetylene, propane, hydrogen sulfide, carbonyl sulfide
PLOT Q	air, methane, carbon dioxide, ethane, ethylene/acetylene, propane, propylene, C4-C8 hydrocarbons, hydrogen sulfide
Alumina	C4 and C5 hydrocarbons and olefins, 1,3-butadiene
PDMS	C4-C12 hydrocarbons, hydrogen sulfide, volatile organic compounds

Separation is influenced by:

- coating type
- thickness
- length
- diameter
- carrier gas

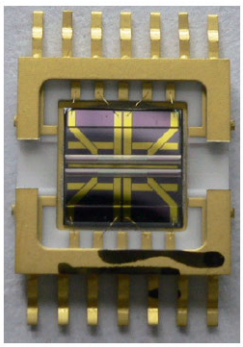
Separation may be further optimized by adjusting:

- column temperature
- column head pressure

Temperature ramping provides additional control of component separation, compared to isothermal operation. With temperature programming, light components can be separated at low column temperatures. The column temperature can then be ramped to increase the elution speed of heavier components.

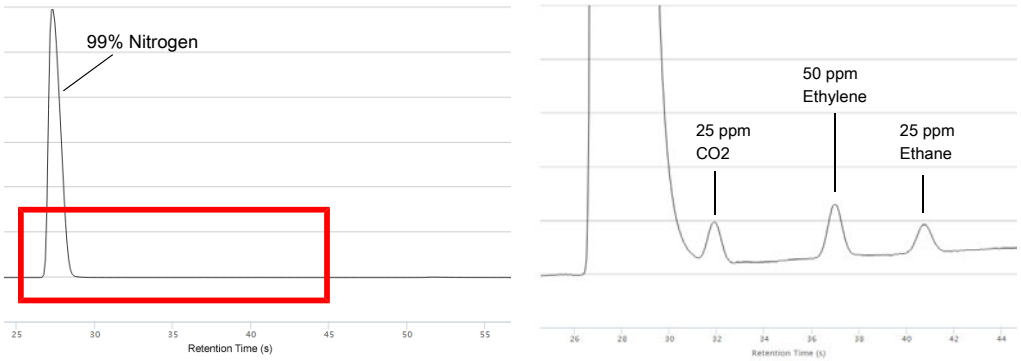
6.7.3 Detection

Micro GC Fusion uses a MEMS-based µTCD and has a detection range from low ppm to high percent.



The Fusion Auto-Sensing Technology (FAST) Enabled detector system automatically adjusts detector gain during a single sample run, effectively eliminating the need of two sensitivity settings when analyzing low ppm and high percentage in the sample.

The FAST Enabled Micro GC Fusion is proven to provide excellent linearity over ppm to high percent component concentrations, allowing fast and accurate analyses of gases over a large concentration spread.



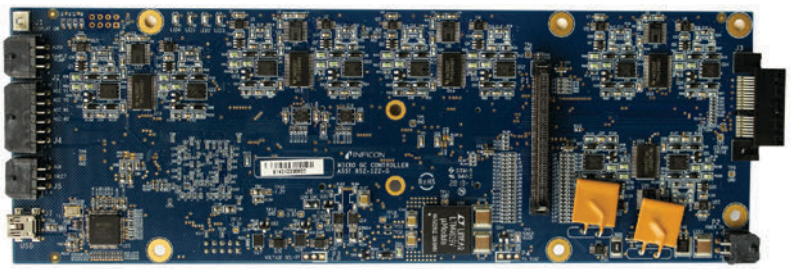
A detection limit of 1 ppm can be achieved for some compounds when the analyses method is optimized. The µTCD detects the difference in thermal conductivity of the gas traveling through the reference column (pure carrier gas) versus the gas traveling through the analytical column (carrier gas plus the sample gas). The difference generates an electrical signal, which when plotted over time creates a chromatogram for the sample gas.

6.7.4 Module Circuit Boards

Micro GC Fusion modules are controlled by two circuit boards: the GC module controller board and the GC module interface board.

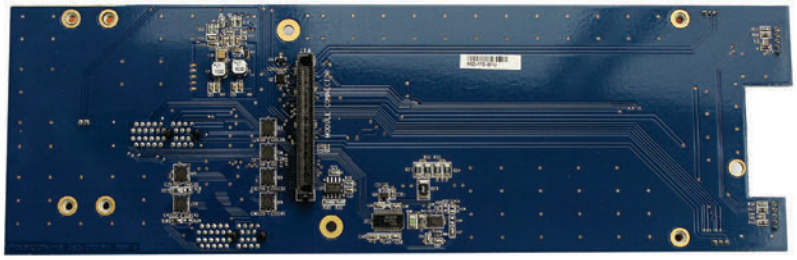
6.7.4.1 GC Module Controller Board

The GC module controller board receives commands from the Micro GC Fusion software, performs hardware control of the GC module, and sends the data signal back to the software. The GC module controller board is installed on the Micro GC Fusion chassis frame and is connected to the GC module interface board.



6.7.4.2 GC Module Interface Board

The GC module interface board is the interface between the GC module controller board and the analytical hardware components, including electronics on the injector, the resistively heated GC column, and the detector assembly. The GC module interface board is part of a GC module and attached to the GC module controller board when it is installed into a Micro GC Fusion instrument.



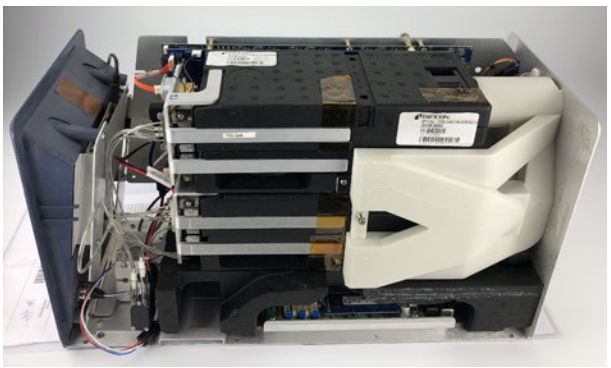
6.8 JP-100

The Micro GC Fusion JP-100 is a 3D-printed device that is installed at the back of the Micro GC Fusion modules. For a 1- or 2-module chassis, a single JP-100 controls both modules. For a 3- or 4-module chassis, two JP-100 devices are installed.

Wide changes in ambient temperature can impact µTCD response. This device provides temperature control and stability over the ambient air surrounding the µTCD. Having a consistent µTCD external temperature allows for accurate and repeatable area counts, even when the Micro GC Fusion is subjected to wide ambient temperature ranges. This is important in applications such as natural gas or chemical process control/monitoring where measurements are made at instrument locations that are subjected to wide temperature ranges.

The JP-100 has two method parameters located in the **Method Editor** – **TCD** and **TCD Delta**. The **TCD** parameter allows the user to control the TCD external temperature. The **TCD Delta** parameter allows the user to control the temperature range before the GC becomes ready. This can be set up to 50°C. See Edit Method [▷ 152] for more details on these method parameters.





6.9 External Sample Conditioner

The External Sample Conditioner (PN 952-004-G1) is an apparatus that mounts to the front of Micro GC Fusion. It maintains the incoming sample temperature at >50°C (122°F) and reduces sample pressure from up to 5516 kPa (800 psi) down to approximately 0-172 kPa (0-25 psi) prior to the sample being introduced to Micro GC Fusion. This minimizes the introduction of contaminants and aerosols onto Micro GC Fusion.

The external sample conditioner can be installed on the front of a 2-module Micro GC Fusion and transported into the field for direct analysis.



NOTICE

Micro GC Fusion is intended for gas sampling only. Liquid injections will damage the instrument.



⚠ WARNING

Gas pressure on the external sample conditioner vent may be up to 5516 kPa (800 psi). Extreme caution must be taken when venting the high pressure sample to avoid personal injury.

NOTICE

The external sample conditioner is rated for 5516 kPa (800 psi) input sample pressure.



⚠ WARNING

Do not open the instrument case. There are no user-serviceable components within the instrument case. Dangerous voltages may be present whenever power is present. Refer all maintenance to qualified personnel.



⚠ CAUTION

Do not use the product in a manner not specified by the manufacturer. If the product is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.



⚠ CAUTION

Use caution when mounting the external sample conditioner to a fixed position. Ensure there is enough room to disconnect the power cord when needed.



⚠ WARNING

When working with chemicals, follow PPE guidelines listed in chemical safety data sheets (SDS).

6.10 Specifications

6.10.1 Physical Operating Requirements

2-module chassis	Specification
Maximum weight	6.2 kg (13.6 lb.)
Dimensions (L x W x H)	46.2 x 19.6 x 25.4 cm (18.2 x 7.7 x 10 in.)
Installation (Overvoltage)	Category II per IEC 60664
Power supply input	100 to 240 V (ac), 50 to 60 Hz, 5 A
Power supply output	24 V (dc), 10.83 A, 260 W maximum
Operating temperature	0°C to 50°C (32°F to 122°F) ambient
Storage temperature	-20°C to 60°C (-4°F to 140°F) ambient
Relative humidity	5 to 95% (non-condensing)
Altitude	2000 m (6562 ft.)
Pollution degree	2 per EN 61010
Vibration	MIL-STD-810F-514.5C, Highway Truck Vibration

4-module chassis	Specification
Maximum weight	15.4 kg (33.8 lb.)
Dimensions (L x W x H)	47.5 x 43.2 x 27.1cm (18.7 x 17 x 10.7 in.)
Installation (Overvoltage)	Category II per IEC 60664
Power supply input	100 to 240 V (ac), 50 to 60 Hz, 7A
Power supply output	24 V (dc), 42 A, 1008 Watts maximum
Fuse	250 V (ac), 10 A
Operating temperature	0°C to 50°C (32°F to 122°F) ambient
Storage temperature	-20°C to 60°C (-4°F to 140°F) ambient
Relative humidity	5 to 95% (non-condensing)
Altitude	2000 m (6562 ft.)
Pollution degree	2 per EN 61010



⚠ WARNING

Replace only with fuse of the same type and rating to avoid fire and personal injury.

6.10.2 Sample Inlet

Sample Inlet	Specification
Front inlet	Heated, 30-140°C (86-284°F), 1/16 in. Swagelok
Maximum sample pressure	172 kPa (25 psi)
Recommended sample pressure	Ambient to 69 kPa (10 psi)

6.10.3 Gas Liquid Separator

Gas Liquid Separator	Specification
Sample inlet	1/16 in. Swagelok
Maximum sample pressure	172 kPa (25 psi)

6.10.4 Pressure Reducer and Gas Liquid Separator

Pressure Reducer and Gas Liquid Separator	Specification
Sample inlet	1/8 in. Swagelok
Maximum sample pressure	3450 kPa (500 psi)

6.10.5 Sample Injector

Sample Injector	Specification
Variable volume	Heated, 1 to 10 uL
Variable large volume	Heated, 1 to 30 uL
Fixed volume	Heated, 1.6 uL
Backflush to vent	Heated, 0.4 or 1 uL fixed, 7.1 uL maximum variable

6.10.6 Column Heater

Column Heater	Specification
Max (temp. programmed)	250°C or column phase maximum, whichever is lower with temperature programming
Max (isothermal)	225°C or column phase maximum, whichever is lower with isothermal operation
Resolution	0.1°C
Maximum heating rate	5°C per second (column dependent)
Minimum column temperature	15°C above ambient temperature

6.10.7 GC Column

GC Column	Specification
Fused silica	• Wall coated open tubular (WCOT) • Porous layer open tubular (PLOT)

6.10.8 Thermal Conductivity Detector

Thermal Conductivity Detector	Specification
Internal volume	240 nL (MEMS)
Detection limit	1 ppm, n-Hexane (WCOT columns)
Linear dynamic range	10^6 ± 10%

6.10.9 Carrier Gas Specifications

Carrier Gas	Specification
Connector type	1/8 in. Swagelok
Source	External pressurized cylinder
Types	Helium, hydrogen, nitrogen, argon
Carrier gas purity	99.999%
Input pressure	400–427 kPa (58–62 psi)

6.10.10 Repeatability

Repeatability	Specification
Retention time	≤0.1% RSD (WCOT columns)
Peak area	≤1% RSD (≥0.1% concentration, WCOT columns)

6.10.11 Communication

Communication	Specification
Wired Ethernet	RJ-45 connection
Wireless	Ethernet IEEE 802.11 a/b/g/n
Signal range	30 m (100 ft.), line of sight

6.10.12 Control Software

Embedded, web-based software compatible with common web browsers. See Computer Web Browser Requirement [▷ 42].

6.11 User Interface

Control software embedded in Micro GC Fusion provides instrument control data, data analysis, and data storage capabilities. A local web server runs on Micro GC Fusion, allowing instrument control and data access through a user interface displayed on a web browser.

This web-based user interface can automatically adjust to the display screen size, providing the user with the option of using computing devices with different screen sizes and resolutions.



The software user interface described in this operating manual references features delivered in Fusion software v1.8 release. Updates to the software user interface will be described in the future revision of the operating manual.

Micro GC Fusion Offline Analysis is an offline software (able to be installed on a computer) that allows the user to view and reprocess data. It offers a similar work flow and capability as the Micro GC Fusion Data Browser, but without the need to connect to an instrument. It adopts the same computer and web browser specifications as the embedded software user interface. See Micro GC Fusion Offline Analysis [▷ 209].

6.11.1 Minimum Hardware Requirement

The following is the minimum tablet and computer hardware configuration necessary to run the Micro GC Fusion web-based user interface.

6.11.1.1 Tablet

RAM	1 GB minimum
Memory	16 GB minimum
CPU	1 GHz minimum
Screen Size	9.7 in. minimum
Resolution	1024 x 768 pixels minimum
Network Connectivity	Wi-Fi

6.11.1.2 Computer

RAM	2 GB minimum
Hard Drive	100 GB minimum
CPU	1.5 GHz minimum
Screen Size	12 in. minimum
Resolution	1024 x 768 pixels minimum
Network Connectivity	Wi-Fi or RJ-45 wired

6.11.2 Tablet Web Browser Requirement

Micro GC Fusion supports the following tablet web browsers:

- Android 4+ stock browser
- Chrome or Firefox for Android
- Safari on iOS 6 for iPad

Symbian is not supported.

6.11.3 Computer Web Browser Requirement

Micro GC Fusion supports the following computer web browsers:

- Chrome for Mac OS and Windows XP or above
- Firefox for Mac OS and Windows XP or above
- Internet Explorer version 10 and above for Windows 7 or above

6.12 Wireless Regulatory Compliance Information

This section of the Operating Manual lists FCC compliance information for Micro GC Fusion wireless communication.



This equipment contains an OEM Embedded Wireless Bridge (Ethernet to Wireless LAN)

This device complies with Part 15 of the FCC rules and is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.



⚠ CAUTION

To maintain compliance with FCC standards and regulations and to ensure the proper operation of the wireless communication system used within Micro GC Fusion, ONLY use the antenna that was originally supplied with the instrument.

If the original antenna is damaged, please contact the INFICON service department for a replacement antenna.

6.12.1 Regulatory Compliance Information for UNITED STATES Users

6.12.1.1 FCC Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for assistance

6.12.1.2 FCC RF Exposure Statement



⚠ WARNING

To satisfy RF exposure requirements, this device and its antenna must operate with a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

6.12.2 Regulatory Compliance for CANADIAN Users

This section of the Operating Manual lists Industry Canada (IC) compliance information for Micro GC Fusion.



This equipment contains an OEM Embedded Wireless Bridge (Ethernet to Wireless LAN) Module

This device complies with RSS-210 of Industry Canada (IC) and is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

6.12.2.1 Industry (IC) Notices

This equipment complies with Canadian RSS-210.



⚠ CAUTION

This device has been designed to operate with an antenna having a maximum gain of 5.0 dB. An antenna having a higher gain is strictly prohibited per regulations of Industry Canada (IC). The required antenna impedance is 50 ohms.

To reduce potential radio interference to other users, the antenna type and gain should be so chosen that the equivalent isotropically radiated power (IEIRP) is not more than required for successful communications.

6.12.3 Regulatory Compliance for EUROPEAN Users

This section of the Operating Manual lists CE and R&TTE compliance information for Micro GC Fusion.

Micro GC Fusion is marked with the following symbol:

CE

This symbol indicates compliance with the essential requirements of Directive 2014/53/EU (RED Directive). Such marking is indicative that this equipment meets or exceeds the following technical standards:

- EN 300 328-2 - Electromagnetic compatibility and Radio spectrum Matters (ERM); Wideband Transmission systems; data transmission equipment operating in the 2.4 GHz ISM band and using spread spectrum modulations techniques.
- EN 301 489-17 - Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for 2.4 GHz wideband transmission systems and 5 GHz high performance RLAN equipment.
- EN 61010-1 - Safety requirements for electrical equipment for measurement, control and laboratory use.

6.12.3.1 European User Restrictions



⚠ CAUTION

European usage restrictions apply to this instrument! The end user must comply with the usage restrictions noted in the table below when operating this equipment in the countries that have restrictions.

Micro GC Fusion is marked with the following symbol:

CE

This symbol indicates that usage restrictions apply to this equipment. Such marking indicates that the end user must comply with the following statements about usage restrictions:

- To ensure compliance with local regulations, be sure to select the country in which the access point is installed
- This instrument can be used as shown in the table below

Countries	Restrictions
France	Outdoor use limited to 10mW e.i.r.p. within the band 2454 to 2483.5 MHz.
Italy	If used outdoor of own premises, general authorization is required.
Luxembourg	General authorization required for public service.
Romania	On a secondary basis. Individual license required.
Austria, Denmark, Finland, Germany, Greece, Iceland, Ireland, Liechtenstein, Luxembourg, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, The United Kingdom	None

6.12.3.2 European EMC Compliance Statement

English	Hereby, INFICON Inc. declares that this Micro GC Fusion is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.
Finnish	INFICON Inc. vakuuttaa täten että Micro GC Fusion tyyppinen laite on direktiivin 1999/5/EY oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen.
Dutch	Hierbij verklaart INFICON Inc. dat het toestel Micro GC Fusion in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 1999/5/EG. Bij deze verklaart INFICON Inc. dat deze Micro GC Fusion voldoet aan de essentiële eisen en aan de overige relevante bepalingen van Richtlijn 1999/5/EC.

French	Par la présente INFICON Inc. déclare que l'appareil Micro GC Fusion est conforme aux exigences essentielles et aux autres dispositions pertinentes de la directive 1999/5/CE.
Danish	Undertegnede INFICON Inc. erklærer herved, at følgende udstyr CMS5000 overholder de væsentlige krav og øvrige relevante krav i direktiv 1999/5/EF.
German	Hiermit erklärt INFICON Inc. dass sich dieser Micro GC Fusion in Übereinstimmung mit den grundlegenden Anforderungen und den anderen relevanten Vorschriften der Richtlinie 1999/5/EG befindet". (BMWi) Hiermit erklärt INFICON Inc. die Übereinstimmung des Gerätes Micro GC Fusion mit den grundlegenden Anforderungen und den anderen relevanten Festlegungen der Richtlinie 1999/5/EG. (Wien)
Swedish	Härmed intygar INFICON Inc. att denna Micro GC Fusion står I överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 1999/5/EG.
Greek	ΜΕ ΤΗΝ ΠΑΡΟΥΣΑ INFICON Inc. ΔΗΛ□ΝΕΙ ΟΤΙ Micro GC Fusion ΣΥΜΜΟΡΦ□ΝΕΤΑΙ ΠΡΟΣ ΤΙΣ ΟΥΣΙ□ΔΕΙΣ ΑΠΑΙΤΗΣΕΙΣ ΚΑΙ ΤΙΣ ΛΟΙΠΕΣ ΣΧΕΤΙΚΕΣ ΔΙΑΤΑΞΕΙΣ ΤΗΣ Ο□ΗΓΙΑΣ 1999/5/ΕΚ
Italian	Con la presente INFICON Inc. dichiara che questo Micro GC Fusion è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 1999/5/CE.
Spanish	Por medio de la presente INFICON Inc. declara que el Micro GC Fusion cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 1999/5/CE.
Portugese	INFICON Inc. declara que este Micro GC Fusion está conforme com os requisitos essenciais e outras disposições da Directiva 1999/5/CE.

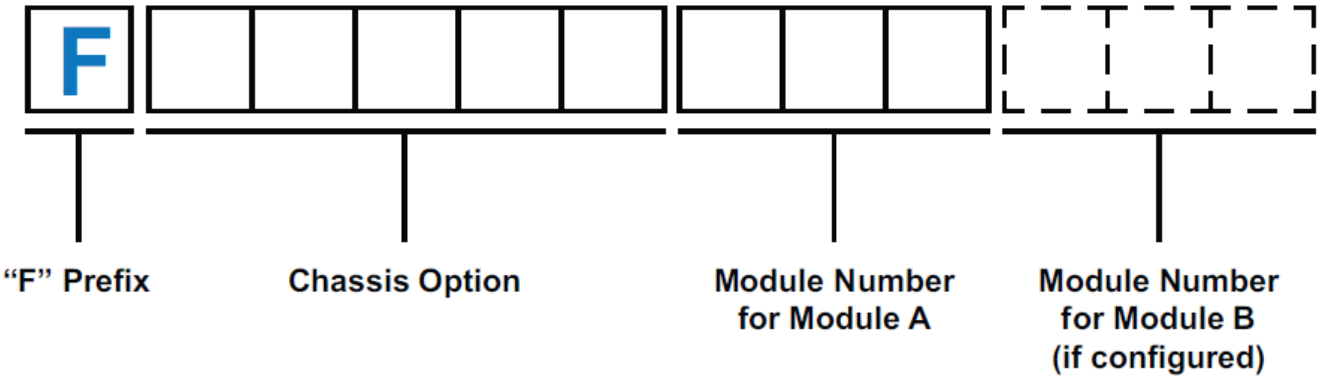
6.12.3.3 European Safety Compliance Statement

This device has been tested and certified according to the safety standard EN 61010-1: 2001 and is intended to be used in accordance with the information provided in this manual. For additional information concerning the directives and standards that this instrument complies with, please refer to the Declaration of Conformity that is located in the front of this manual.

6.13 Micro GC Fusion and GC Module Part Numbers

6.13.1 2-Module Micro GC Fusion Part Number

A 2-module Micro GC Fusion can be configured with one or two GC modules. The figure below shows how a Micro GC part number is constructed.

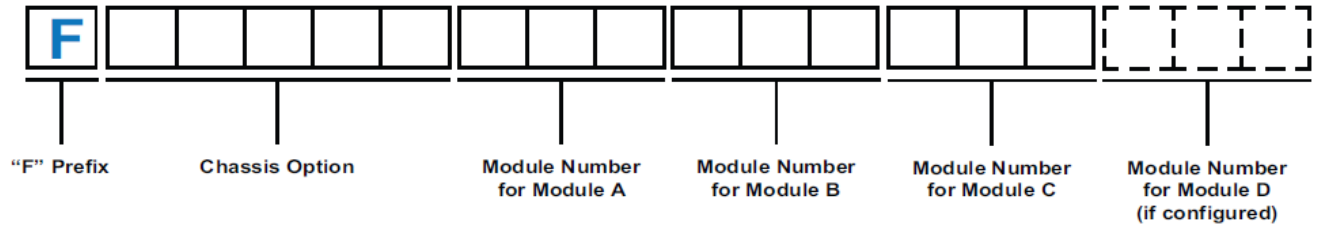


- **"F" prefix**: a fixed prefix - this is the same for every instrument
- **Chassis Option**: a five digit number that identifies sample inlet, carrier gas connection, number of GC modules, AUX I/O, power cord and factory checkout gas type
- **Number for Module A**: a three digit number that specifies injector type, column type and length, detector type, and venting connector type
- **Number for Module B**: a three digit number that specifies injector type, column type and length, detector type, and venting connector type

At least one module must be specified for a system. The module (part) number for Module B is only specified when Module B is configured.

6.13.2 4-Module Micro GC Fusion Part Number

A 4-module Micro GC Fusion can be configured with three or four GC modules. The figure below shows how a Micro GC part number is constructed.

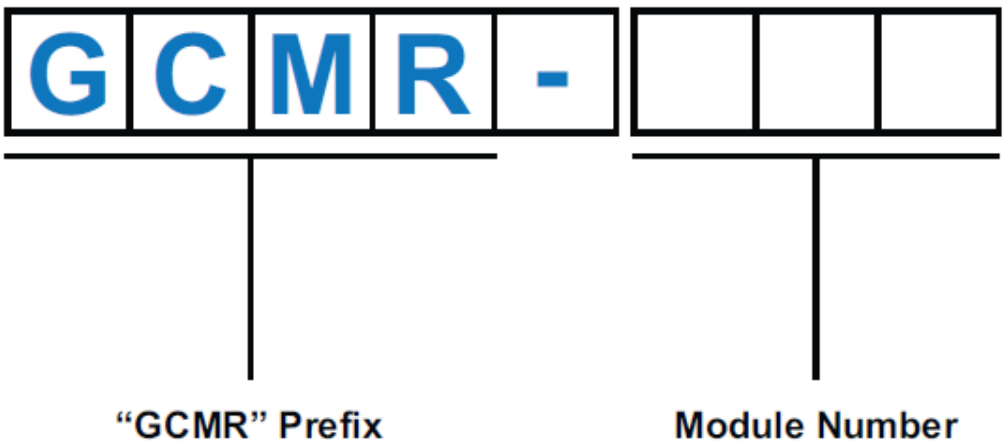


- **"F" prefix**: a fixed prefix - this is the same for every instrument
- **Chassis Option**: a five digit number that identifies sample inlet, carrier gas connection, number of GC modules, AUX I/O, power cord and factory checkout gas type
- **Number for Module A**: a three digit number that specifies injector type, column type and length, detector type, and venting connector type
- **Number for Module B**: a three digit number that specifies injector type, column type and length, detector type, and venting connector type
- **Number for Module C**: a three digit number that specifies injector type, column type and length, detector type, and venting connector type
- **Number for Module D**: a three digit number that specifies injector type, column type and length, detector type, and venting connector type

At least three modules must be specified for a system. The module (part) number for Module D is only specified when Module D is configured.

6.13.3 GC Module Part Number

The figure below shows how a GC module replacement part number is constructed.



- **"GCMR" Prefix:** a fixed prefix that identifies a GC module replacement
- **Module Number**: a three digit number that specifies injector type, column type and length, detector type, and venting connector type

7 Installation

7.1 Site Preparation

Proper site preparation prior to installing Micro GC Fusion is critical. Contact INFICON (refer to Service and Technical Support [▷ 18]) with any questions regarding site preparation.



Bullet points identify hardware that must be available and actions that must be addressed when installing Micro GC Fusion.

7.1.1 List of Required Tools

The following tools are user supplied:

- 1 1/8 in. wrench recommended, or adjustable large wrench (for attaching regulator to gas tank)
- Teflon® tape for regulator connections
- 1/16 in. tubing and fittings for connection to the sample inlet
- Philips #2 screwdriver (for rack mounting)

The following tools and parts are included in the optional Install Kit (PN 952-021-G1) to facilitate installation. If the optional install kit was not purchased, the tools and parts below must be provided by the user upon installation.

PN	Description	Quantity
059-0442	Ball valve, 2-way, 0.125-tube brass RoHS	2 pc
059-0449	Union tee, 0.125-Tube, 0.437 nut brass RoHS	1 pc
059-0554	Nut, 0.125-Tube, 0.437 Hex, 0.47 Lg Brass RoHS	4 pc
059-0714	Ferrule set, 0.125-Tube 10 pack brass RoHS	4 pc
069-0115	Copper tubing, 0.128 OD, 0.065 ID	1 pc
070-1999	Hex driver, 2.5 mm ball point L-handle SS RoHS	1 pc
070-2000	Tubing cutter, 0.125 to 0.625 OD tubes, RoHS	1 pc
070-2002	Wrench combination, 0.312 steel RoHS	2 pc
070-2003	Wrench combination, 0.437 steel RoHS	2 pc
070-2004	Wrench combination, 0.562 steel RoHS	1 pc

7.1.2 Carrier Gas Requirement

- Carrier gas (e.g., helium, argon) with purity of 99.999% (or minimum 99.995% when the appropriate carrier gas trap is installed)



A pressurized >16,547 kPa (>2400 psi) 50 liter tank of carrier gas will last approximately one year or more.

- Dual-stage regulator for pressurized carrier gas tank with outlet pressure regulated to 400–427 kPa (58–62 psi). A Swagelok 1/8 in. fitting is preferred on the regulator outlet to connect the carrier gas feed tube to Micro GC Fusion.



In North America, use the CGA 580 inlet connection (PN 952-416-P1) for helium, nitrogen, and argon carrier gas. Use the CGA 350 inlet connection (PN 952-415-P1) for hydrogen carrier gas. For installations outside of North America, use the appropriate standard inlet connections for the region.

NOTICE

Carrier gas inlet (rear of instrument) pressure must be within 400-427 kPa (58-62 psi). Use a dual-stage regulator on the carrier gas cylinder to ensure the pressure range is maintained.

Exceeding 565 kPa (82 psi) may damage Micro GC Fusion and require factory repair.

- Moisture/hydrocarbon trap (PN G2870A-01) is required for the carrier gas when using Molsieve or Alumina columns

NOTICE

To protect Micro GC Fusion and enhance performance, carrier gas traps should be used to purify the carrier gas before introduction into Micro GC Fusion.

A moisture/hydrocarbon trap (PN G2870A-01) is recommended.

- Copper or stainless steel tubing (pre-cleaned) 1/8 in. OD for carrier gas connections between the tank regulator output and Micro GC Fusion carrier gas inlet. Micro GC Fusion has up to four 1/8 in. Swagelok male carrier gas inlet connections.



3 m (10 ft.) of pre-cleaned GC grade copper tubing is included with Micro GC Fusion. Additional copper tubing is available in the installation kit (PN 952-021-G1), or can be ordered in 15 m (50 ft.) lengths (PN 069-0115).

NOTICE

Do not clean copper or stainless steel tubing with solvent.

The solvent can enter Micro GC Fusion and cause damage to the instrument.

NOTICE

Do not use Teflon® or Tygon® tubing for carrier gas.

- Assortment of male and female Swagelok fittings for regulator, tubing, etc., including nuts and front and back ferrules. Typical size is 1/8 in. but adaptors for 1/4 in. to 1/8 in. may be needed if 1/4 in. tubing is used
- 1/8 in. tee fitting and 1/8 in. ball valve, depending on connection requirements

7.1.3 Calibration Gas Requirement

- Commercially supplied calibration gas specific to the analysis



Calibration gas must be available at the time of installation.



Calibration gas must closely resemble the composition of the actual process gas.

- A regulator, if necessary, to reduce calibration gas pressure below 69 kPa (10 psi) at the Micro GC Fusion inlets. The regulator must be clean, grease-free and non-venting
- Copper or stainless steel tubing (pre-cleaned) 1/16 in. OD for calibration and sample gas connections between the tank regulator output and Micro GC Fusion sample inlet



Checkout gas mixtures are only used for instrument installation and startup.

Checkout gas mixtures supplied by INFICON are not calibration gases.



When the instrument is configured with a 1/16 in. Swagelok front sample inlet, the ship kit includes a 61 cm (24 in.) 1/16 in. OD piece of stainless steel sample tubing and nuts and ferrules for both ends.

7.1.4 Sample Gas Pressure Range

NOTICE

Sample inlet gas pressure must be less than 172 kPa (25 psi).

Exceeding 172 kPa (25 psi) will damage Micro GC Fusion and require factory repair.

- The maximum pressure for direct sample injection into either the front or rear sample inlet is 172 kPa (25 psi). The recommended input sample pressure is 69 kPa (10 psi) or lower.

- When a Gas Liquid Separator (PN 952-022-G1) is installed, sample pressures up to 172 kPa (25 psi) can be introduced, even though the Genie filter itself is rated up to 3447 kPa (500 psi). Sample pressures higher than 172 kPa (25 psi) must be reduced.
- When a Pressure Reducer and Gas Liquid Separator (PN 952-033-G1) is installed, a sample pressure of up to 3450 kPa (500 psi) can be introduced.

7.1.5 Installation Space and Venting

- Installation space required for Micro GC Fusion is an additional 6.5 cm (2.5 in.) to the front, back and sides of the instrument

Dimensions of a 2-module Micro GC Fusion:
46.2 x 19.6 x 25.4 cm (18.2 x 7.7 x 10 in.)

Dimensions of a 4-module Micro GC Fusion:
46.2 x 19.6 x 25.4 cm (18.2 x 7.7 x 10 in.)

NOTICE

Micro GC Fusion air pathways must remain unobstructed to allow cooling of the analytical column(s) following a temperature programmed method run.

Allow a minimum of 6.5 cm (2.5 in.) clearance to the top, the front, the back, and both sides of the instrument to provide unrestricted air flow to the instrument.

- Install Micro GC Fusion in a location with easy access to the instrument and associated computer
- For optimum Micro GC Fusion performance and to dissipate heat, do not restrict airflow around Micro GC Fusion

NOTICE

Ensure the Micro GC Fusion fan exhaust at the back of the instrument is not blocked and the air flow through the bottom of Micro GC Fusion is unobstructed.

NOTICE

Regularly inspect and clean the filter at the bottom of the instrument.



⚠ WARNING

Safely vent carrier and sample streams—potentially toxic, noxious, asphyxiant (oxygen-displacing), or flammable gases—outside Micro GC Fusion and away from the operating area. Vent toxic gases to a fume hood, chemical trap, or reaction medium.

- Avoid venting Micro GC Fusion into drafty areas, such as in front of a heating/cooling vent

7.1.6 Power Requirement

- Standard 100-240 V (ac), 50 to 60 Hz, 5A (minimum) electric outlet for 2-module systems
- Standard 100-240 V (ac), 50 to 60 Hz, 7A (minimum) electric outlet for 4-module systems
- Maximum power for a 2-module Micro GC Fusion system: 300W
- Uninterruptible AC power source with surge protection is recommended

Every Micro GC Fusion 2-module system is shipped with a 24 VDC power supply (PN: 952-435-P1S). Always use this power supply to power the instrument.

Every 4-module system contains an internal 24 VDC power supply and does not need the external supply.

NOTICE

Using an alternative power supply voids the warranty.

7.1.7 Computer Hardware Requirement

Minimum hardware configuration required to run Micro GC Fusion web-based software user interface:

Tablet

RAM	1 GB
Memory	16 GB
CPU	1 GHz
Screen size	9.7 in.
Resolution	1024 x 768 pixels
Network connectivity	Wi-Fi

Computer

RAM	2 GB
Memory	100 GB
CPU	1.5 GHz
Screen size	12 in.
Resolution	1024 x 768 pixels
Network Connectivity	Wi-Fi or RJ-45 wired

7.1.8 EZ IQ Computer Requirement

A driver software can be installed on the EZ IQ chromatography software to control Micro GC Fusion.

Minimum hardware configuration required to run the optional EZ IQ software:

RAM	2 GB
Memory	10 GB
CPU	2 GHz
Resolution	1024 x 768 pixels
Network connectivity	RJ-45 wired
Operating system	Windows XP or Pro SP3, or Windows 7 Pro 32-bit

NOTICE

EZ IQ is not compatible with Windows 8 or above operating systems.

7.1.9 Network Preparation

- If Micro GC Fusion will be connected to a local area network (LAN) using a static IP address, the Micro GC Fusion hostname and static IP address must be assigned by the LAN administrator
- It is not necessary for a LAN administrator to set up the Micro GC Fusion hostname and static IP address when Dynamic Host Configuration Protocol (DHCP) is used to assign the Micro GC Fusion IP address.

7.1.10 Web Browser Requirement

Micro GC Fusion supports the following tablet web browsers:

- Android 4+ stock browser
- Google Chrome or Firefox for Android
- Safari on iOS 6 for iPad



Symbian is not supported.

Micro GC Fusion supports the following computer web browsers:

- Google Chrome for Mac OS and Windows XP or above
- Firefox for Mac OS and Windows XP or above
- Internet Explorer version 10 and above for Windows 7 or above

7.2 Instrument Hardware Setup

7.2.1 Unpacking the Instrument

Verify the contents of the order, including accessories, consumables and checkout gases using the included packing list. The contents of the ship kit should also be verified.

7.2.2 Ship Kit Contents

A Micro GC Fusion ship kit is included with each instrument. Some items are common to all configurations and some items are instrument configuration dependent.

7.2.2.1 Common to Every Instrument

PN	Description	Quantity
952-437-P1	1/8 in. outer diameter,0.065 in. inner diameter copper,10 ft., cleaned	1 pc
952-417-G1	Nut and ferrule set 0.062 and 0.125	1 pc
600-1190-P4	Ethernet communication cable 4.3 m	1 pc
074-666-P1	Micro GC Fusion Quick Start Guide	1 pc

7.2.2.2 Configuration-Dependent Parts

Sample inlet parts

PN	Description	Inlet	Quantity
952-423-P1	Filter and holder assembly 0.062	Front	1 pc
FRL-1269	Dual end ferrule for 1/16 in. inlet	Front	2 pc
952-418-G1	Gas sample tube 0.062 with nuts	Front	1 pc
059-0718	Frit disk, 10 µm, 0.062 OD, 5 pack, RoHS	Front	1 pc

Quick connect

PN	Description	Inlet	Quantity
059-0329	Quick connect SS-QM2-D-200	Quick connect	1 pc

Carrier gas inlet parts

PN	Description	Number of Carriers	Quantity
059-0701	Filter, inline, 1/8-tube, 2 µm pore	1-4	1-4 pc

Power supply

PN	Description	Chassis	Quantity
952-435-P1S	Power supply 24 V (dc)	2-module only	1 pc
600-1546-P1S	Cable assembly 24 V (dc)	2-module only	1 pc

Country-dependent power cords

PN	Description	Quantity
068-0433	Power cord, USA, 10 A/125 V, 6 ft.	0 or 1 pc
068-0434	Power cord, Euro 10 A/250 V, 2.5 m	0 or 1 pc
068-0590	Power cord, UK, 10 A, BLK PVC, 220 V, RoHS	0 or 1 pc
068-0419	Power cord SL-16+SL-3, Australia, 1.8 m	0 or 1 pc

7.2.3 Making Swagelok Connections

A 1/16 in. sample inlet Swagelok connector is located on the Micro GC Fusion faceplate. A 1/8 in. carrier gas Swagelok connector is located on the back of Micro GC Fusion. The vent ports on the back of Micro GC Fusion also use 1/8 in. Swagelok connectors.

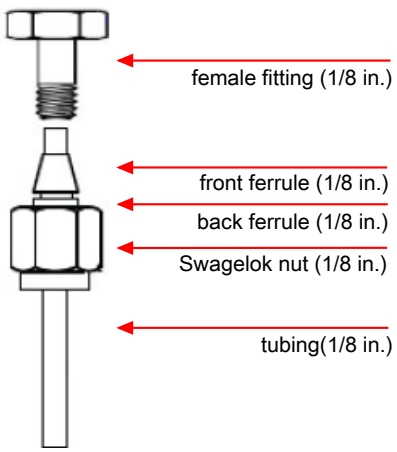
This section reviews how to construct Swagelok connections and connect tubing to a fitting, such as the sample inlet(s), carrier gas inlet(s), vents, or the gas supply tank.

Materials Needed:

- 1/8 in. OD pre-cleaned copper or stainless steel tubing
- 1/8 in. Swagelok nuts, and front and back ferrules
- Two 7/16 in. wrenches for 1/8 in. tubing
- Two 5/16 in. wrenches for 1/16 in. tubing

Procedure

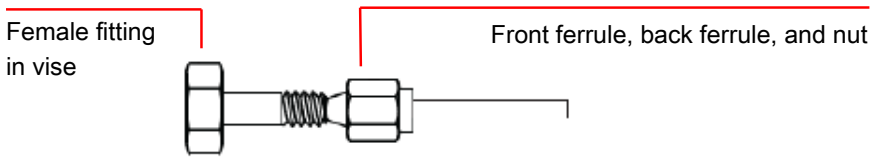
1 Attach a 1/8 in. Swagelok nut, back ferrule and front ferrule to the tubing.



2 Clamp a female fitting in a bench vise.

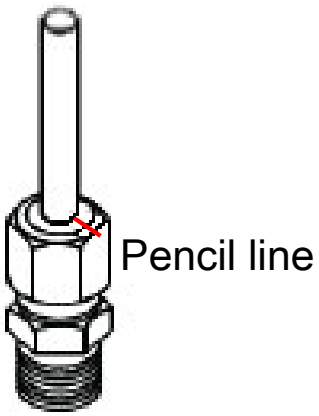
3 Push the tubing into the female fitting.

4 Ensure that the front ferrule makes contact with the female fitting, slide the Swagelok nut over the ferrule, then finger-tighten.

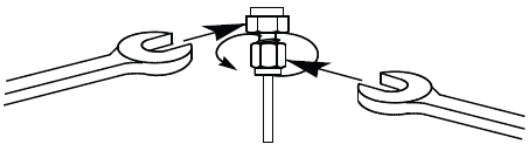


5 Push the tube fully into the female fitting.

6 Mark the Swagelok fitting with a pencil line as shown.



7 Tighten the 1/8 in. fitting 3/4 of a turn, referenced to the pencil line, using one 7/16 in. wrench to hold the female fitting steady, and another 7/16 in. wrench to turn the Swagelok fitting.



8 Unscrew the Swagelok fitting. Connect the tubing with the Swagelok fitting and ferrules to the pencil marked location. Tighten the nut 1/4 turn past finger-tight.

NOTICE

Do not over-tighten.

Over-tightening can damage the fitting and restrict gas flow.

Micro GC Fusion is equipped with a 1/16 in. sample inlet Swagelok connector on the faceplate. Use the same procedure to connect the sample inlet tubing as described for carrier gas inlet tubing in steps 1–8.

7.3 Connecting the Carrier Gas

7.3.1 Carrier Gas Safety



⚠ WARNING

Gas cylinders present a hazard when not secured properly. Securely fasten all compressed gas cylinders to an immovable structure or permanent wall. Store and handle compressed gases in accordance with safety procedures.



⚠ WARNING

Gas cylinders may present a hazard under extreme temperature conditions. Do not store gas cylinders in the path of heated oven exhausts or other sources of heat. Do not expose cylinders to extreme cold or heat. It is recommended to store or place cylinders in a temperature-controlled environment.



⚠ CAUTION

Wear eye protection when using compressed gas.



⚠ WARNING

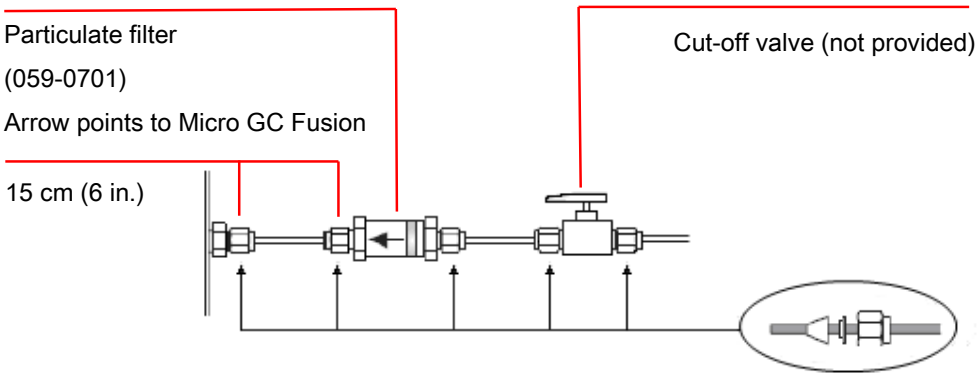
Many gases are explosive when their concentration builds up over time due to leaks, poor connections, or inadequate ventilation. Verify proper venting prior to using hydrogen or other gases in enclosed environments.

7.3.2 Connecting the Carrier Gas Particulate Filter

1. Remove the shipping caps from the Micro GC Fusion carrier gas inlet.
2. Install one carrier gas particulate filter (PN 059-0701) on the carrier gas supply tubing for each carrier gas used. Do not connect the tubing directly to Micro GC Fusion.

NOTICE

The carrier gas particulate filter prevents particles in the carrier gas from entering Micro GC Fusion. Connecting carrier gas tubing directly to the carrier gas inlet without installing the carrier gas particulate filter may damage Micro GC Fusion.



- Install the carrier gas particulate filter, using the supplied fittings, within 15 cm (6 in.) of the Micro GC Fusion fitting to maximize its effectiveness
- Use a cut off valve (not provided) for ease of maintenance. The valve should be "packless" (sealed to atmosphere) and grease free. Do not use common industrial or home-supply ball valves
- Chemical traps on the carrier gas line may be used to protect the column

7.3.3 Setting Carrier Gas Pressure

Use a dual-stage regulator to reduce carrier gas tank output pressure down to an appropriate input pressure for Micro GC Fusion. Set the carrier gas output pressure on a dual-stage regulator as shown below.

Carrier Gas	Required Delivery Pressure
helium	400–427 kPa (58–62 psi)
hydrogen	400–427 kPa (58–62 psi)
argon	400–427 kPa (58–62 psi)
nitrogen	400–427 kPa (58–62 psi)

NOTICE

Carrier gas inlet (rear of instrument) pressure must be within 400-427 kPa (58-62 psi). Use a dual-stage regulator on the carrier gas cylinder to ensure the pressure range is maintained.

Exceeding 565 kPa (82 psi) may damage Micro GC Fusion and require factory repair.

7.3.4 Purging and Connecting Carrier Gas Line

Prior to connecting carrier gas to Micro GC Fusion, the carrier gas supply line must be purged to remove air. Open the carrier gas supply tank and flush the carrier gas supply line with carrier gas for five to ten seconds.



⚠ WARNING

Many gases are explosive when their concentration builds up over time due to leaks, poor connections, or inadequate ventilation. Verify proper venting prior to using hydrogen or other gases in enclosed environments.



⚠ WARNING

Safely vent carrier and sample streams—potentially toxic, noxious, asphyxiant (oxygen-displacing), or flammable gases—outside Micro GC Fusion and away from the operating area. Vent toxic gases to a fume hood, chemical trap, or reaction medium.

NOTICE

Do not use leak detection fluids.

Immediately after purging the carrier gas line, connect it to the 1/8 in. Swagelok carrier gas connector(s) located on the back of Micro GC Fusion.

7.4 Installing the Sample Inlet Filter

Micro GC Fusion is shipped with an external 10 micron sample inlet filter assembly, one dual-ended ferrule per sample inlet, and extra replacement filter disks.

7.4.1 Sample Inlet Filter Parts List

Description	PN
Sample inlet filter assembly	952-423-P1
Dual-ended ferrule	FRL-1269
Replacement filter disks (5/pk)	059-0718

7.4.2 Tools Required

- Two 7/16 in. wrenches
- One 5/16 in. wrench

7.4.3 Sample Inlet Filter Assembly Installation

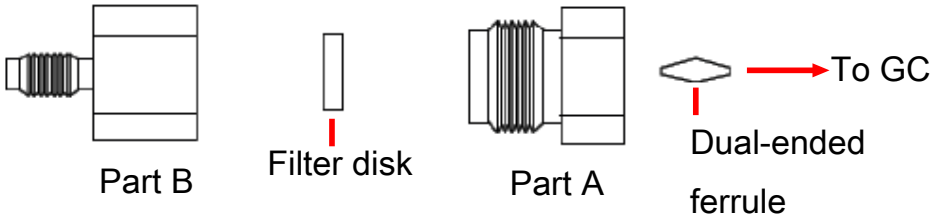
1. Shut off sample flow to Micro GC Fusion.
2. Reduce the temperature of the sample inlet by loading a method that has a low sample inlet temperature (below 60°C).



⚠ WARNING

Micro GC Fusion has a heated inlet which is hot to the touch.

3. Wait for Micro GC Fusion sample inlet to cool.
4. Disconnect any sample line to Micro GC Fusion input fitting using a 5/16 in. wrench.
5. Inspect the sample inlet filter assembly and verify that the filter disk is in place. If not, place a filter disk between parts A and B of the filter body, thread the parts together until finger-tight and then use two 7/16 in. wrenches to tighten an additional 1/4 turn.



6 Place the dual-ended ferrule inside Part A.

7 Connect the sample inlet filter to the sample inlet.

8 Turn Part A clockwise until finger-tight, then use a 7/16 in. wrench to tighten an additional 1/4 turn.

NOTICE

Do not over-tighten the sample inlet filter assembly to Micro GC Fusion.

This will damage the dual-ended ferrule.

9 Finger-tighten the sample line to the male portion of filter Part B, and then use a 5/16 in. wrench to tighten an additional 1/4 turn while stabilizing the sample inlet filter assembly Part B using a 7/16 in. wrench.

7.5 Installing the Rack Mount Kit

7.5.1 Rack Mount Kit (PN 952-4100-G1) Parts

PN	Description	Quantity
952-4005-P2	Bracket-rack mount right (with handle)	1
952-4006-P2	Bracket-rack mount left (with handle)	1
070-2026*	Handle 6.375 LG 2-leg 10-32 THD SS RoHS	2
070-2028	Washer countersink #10 hole 0.593 OD SS	8
070-2027	Nut retainer G-type 10-32 THD Steel/ZN RoHS	8
090-062	Screw, 10-32 x 0.375 lg phil flat head SS	6
090-077	Screw, 10-32 x 0.750 lg phil oval head SS	8
074-683-P1	Micro GC Fusion rack mount IS	1

*PN 070-2026 is preassembled on PN 952-4005-P2 and 952-4006-P2 at the factory.

7.5.2 Required Tools

- Phillips head screwdriver
- 3 mm hex driver

7.5.3 Rack Mount Kit Installation

The following procedure indicates the necessary materials and proper procedure when installed the 4-module Micro GC Fusion into a rack.

1. Ensure the instrument is turned off and all connections are removed (including the power supply, Ethernet cable and carrier gas lines).
2. Remove the rubber feet from the bottom of Micro GC Fusion by removing the hex screw located at the center of the foot. Properly store the rubber feet and screws for future bench top installation.



3. Install brackets (PN 952-4005-P2 and 952-4006-P2) onto the 19 in. rack prior to attaching Micro GC Fusion when access is available from below. Install the rack mount brackets onto the unit prior to rack installation if access to the underside is not available.

   ⇨ Attach the four retainer nuts to the left bracket (PN 952-4006-P2) in the four hole locations.



   ⇨ Place the left bracket (PN 952-4006-P2) on the rack, as shown below, and line up the holes with the retainer nuts.





⇨ Thread the oval head screw (PN 090-077) through the washer (PN 070-2028) as shown, then screw the bracket into the retainer nut.



⇨ Repeat the previous step to finish securing the remaining nuts on the left bracket.

⇨ To attach the right bracket (PN 952-4005-P2), repeat step 3.

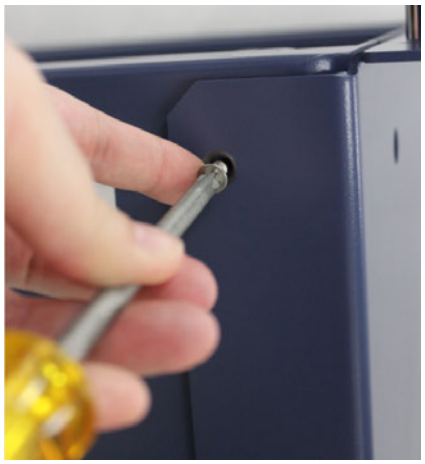
4 Once both brackets are secure, gently place Micro GC Fusion onto rack mount brackets.



5 Line up the holes on the bottom of the unit to the holes in the brackets.



6 Secure the instrument on the brackets with the provided flat Phillips head screw (PN 090-062).



7 Micro GC Fusion is now attached to the rack.

7.6 Wired Ethernet Connection

Connect an Ethernet (LAN) cable to the RJ45 connector on the rear of Micro GC Fusion. The other end of this connection can be connected to a computer or Ethernet switching device.

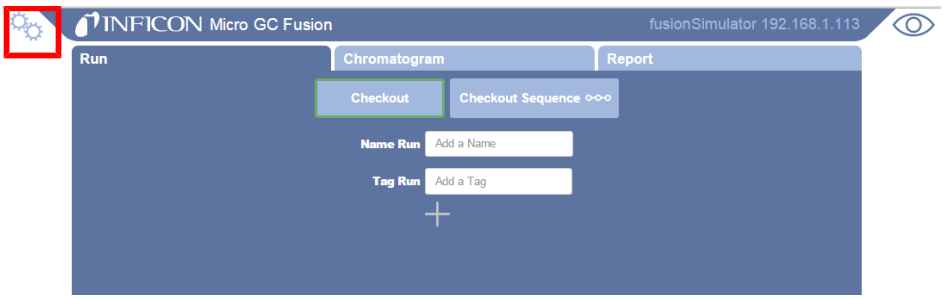
7.6.1 Set Up the Dynamic IP Address

Micro GC Fusion adopts a dynamic IP address and runs Dynamic Host Configuration Protocol (DHCP) by default. This means no static IP address is preassigned from the factory.

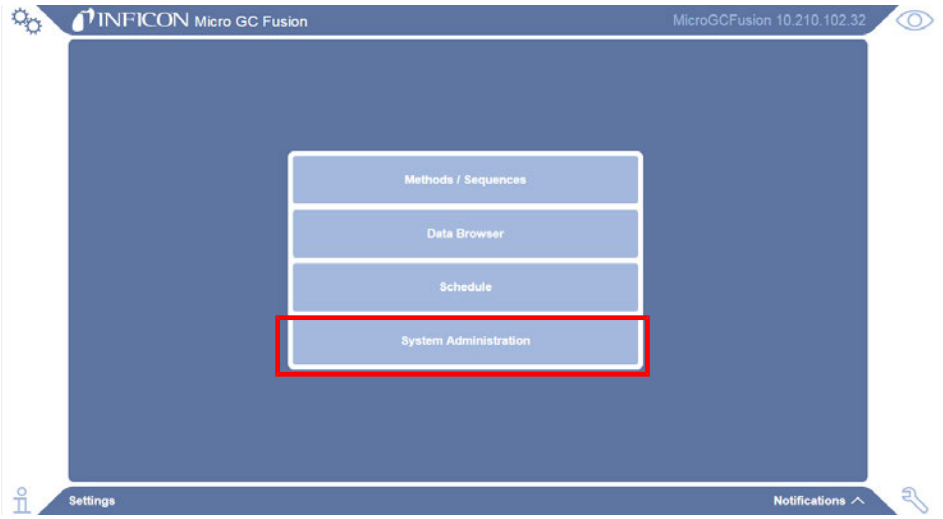
When Micro GC Fusion is connected to a computer through a direct Ethernet cable and the computer is configured to accept an IP address automatically, Micro GC Fusion will dynamically assign an IP address to the computer such that both devices are connected automatically.

Under dynamic IP address mode, Micro GC Fusion is also capable of accepting an IP address when connected to an Ethernet switching device.

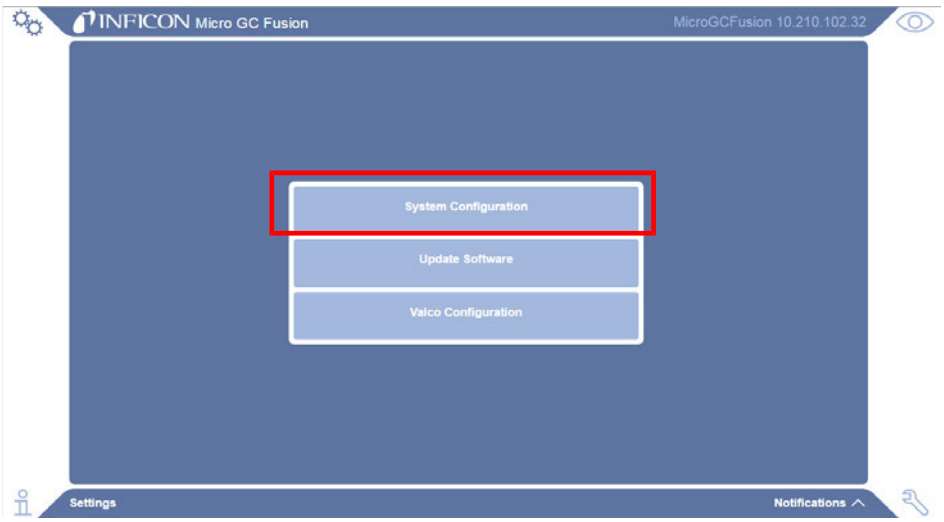
1 Click the icon.



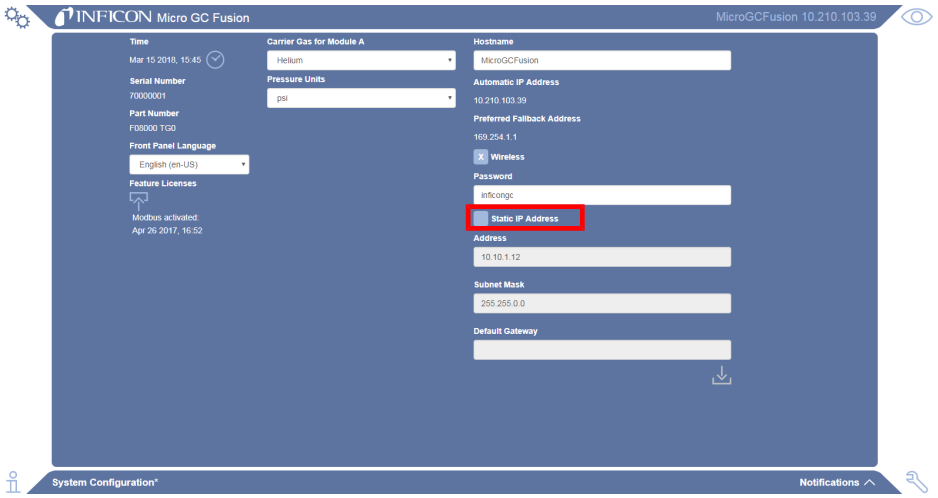
2 Click **System Administration**.



3 Click **System Configuration**.



4 Uncheck the **Static IP Address checkbox** to achieve dynamic IP addressing.



5 Micro GC Fusion is now setup to use DHCP.

7.6.2 Set Up the Static IP Address

NOTICE

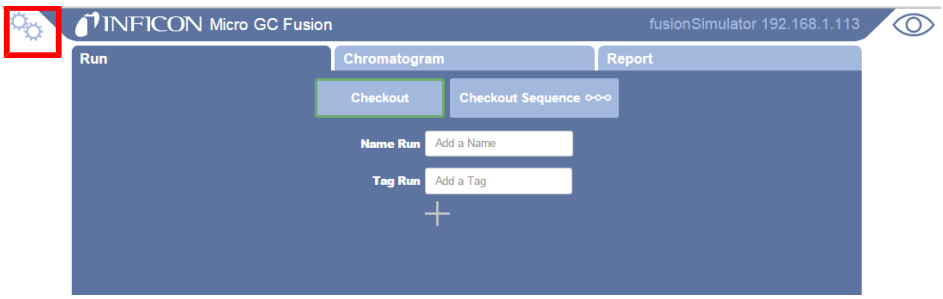
If Micro GC Fusion will be connected to a local area network, check with the network administrator prior to changing to static IP address to avoid conflicts.

The wireless Ethernet port on Micro GC Fusion uses IP address 10.10.0.1. Do not use this static IP address.

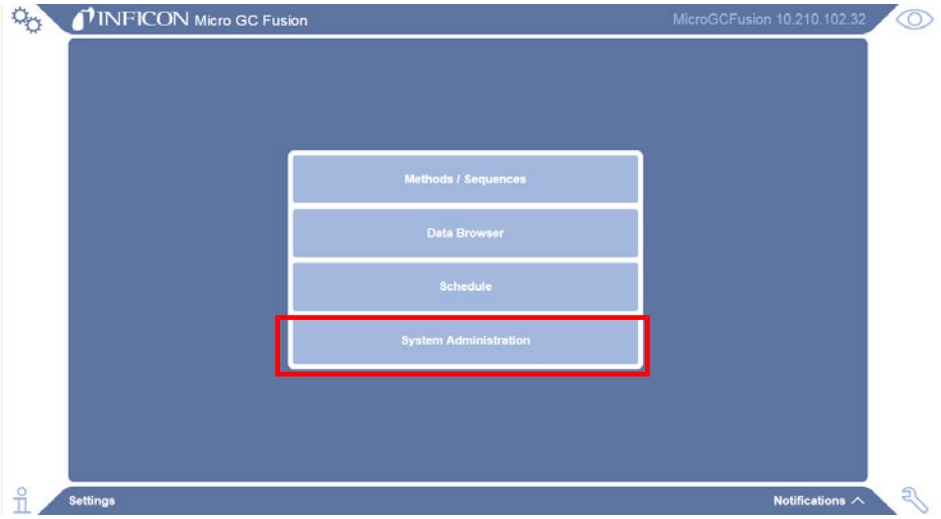
Three blocks of IP address spaces are reserved by the Internet Assigned Numbers Authority (IANA) for private internets. INFICON recommends using these IP addresses for setting up a static IP address on Micro GC Fusion.

Start IP Address	End IP Address	Remarks
10.0.0.0	10.255.255.255	24-bit block, 10/8 prefix, one class A
172.16.0.0	172.31.255.255	20-bit block, 172.16/12 prefix, 16 contiguous class B
192.168.0.0	192.168.255.255	16-bit block, 192.168/16 prefix, 256 contiguous class C network numbers

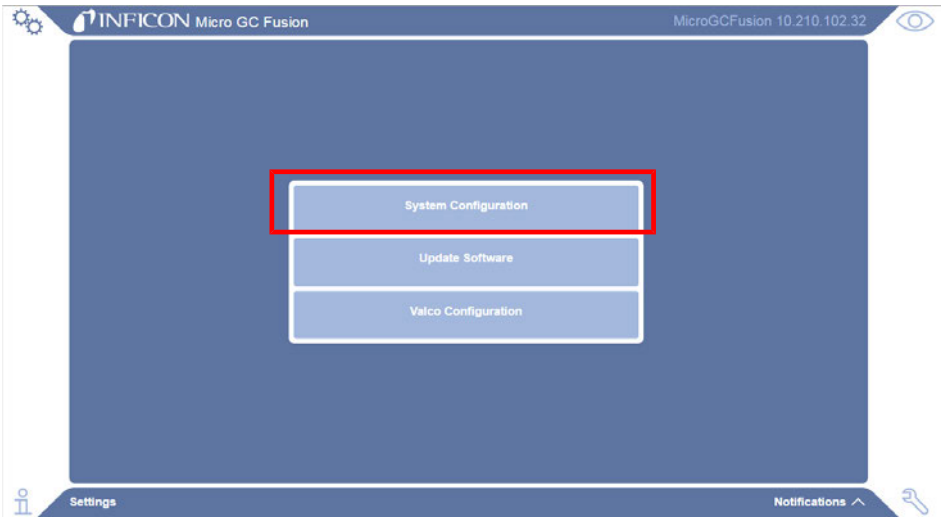
1 Click the icon.



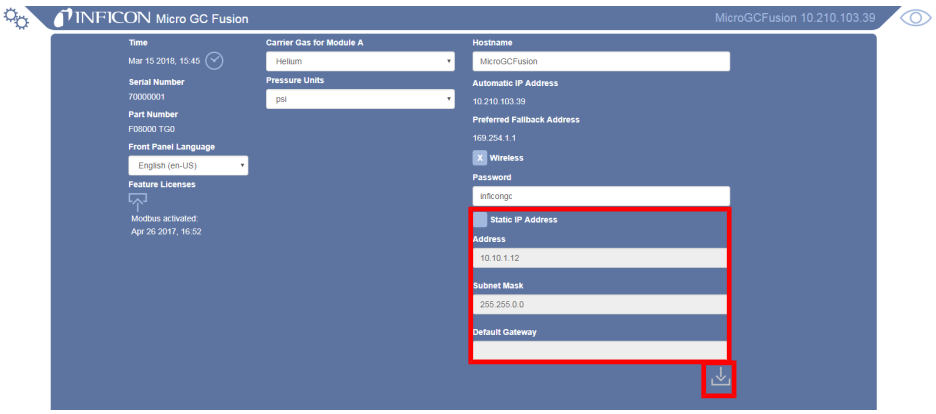
2 Click **System Administration**.



3 Click **System Configuration**.



4 In the **System Configuration** window:



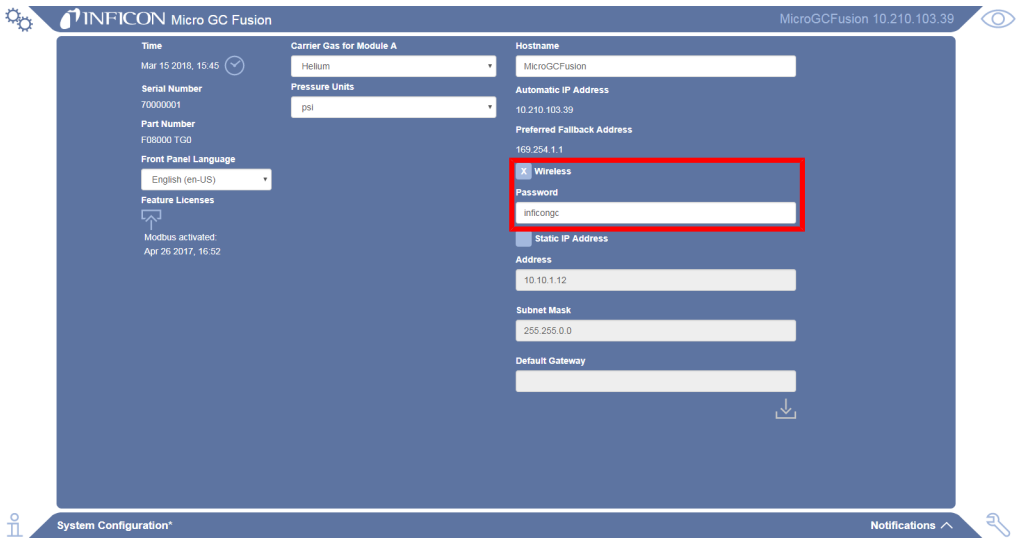
⇨ Check the **Static IP Address**

⇨ Enter the static **IP address**, **Subnet Mask**, and **Default Gateway** (if applicable)

⇨ Click the icon.

7.7 Wireless Connection

Micro GC Fusion enables wireless networking by default. The default wireless signal name **<serial number>.local** and the wireless **password** is **inficongc**. Wireless password protection is provided to prevent accidental or unauthorized access.



To connect a computer or a device to Micro GC Fusion through the wireless connection:

1. Locate the wireless connection (**<serialnumber>.local**) on the web-enabled wireless device (tablet, computer, smartphone) under available networks.
2. Connect using the wireless password (ex. **inficongc**).
3. Open a supported web browser.
4. Type **10.10.0.1** in the address bar to access the Micro GC Fusion main screen.

Micro GC Fusion runs Dynamic Host Configuration Protocol (DHCP) on the wireless connection and assigns an IP address to the connected computing device.

7.7.1 Disable Wireless Connection

1. Click the icon.
2. Click **System Administration**.
3. Click **System Configuration**.
4. In the **System Configuration** window, clear the Wireless check box.



7.7.2 Changing the Wireless Password

1. Click the icon.
2. Click **System Administration**.
3. Click **System Configuration.**
4. In the **System Configuration** window, select the **Wireless** check box and type a new **Password**.



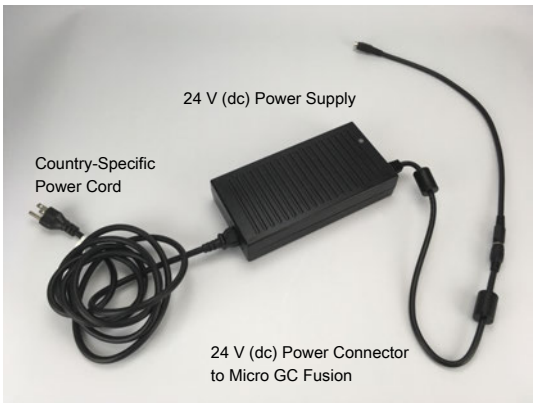
7.8 Connecting the Power Supply

7.8.1 2-Module Micro GC Fusion

The 2-module Micro GC Fusion system uses a power supply that accepts 100-240 V (ac) input and provides 24 V (dc) to the instrument.

NOTICE

Connect the cables in the following order to avoid damage to the instrument.



1. Connect the 24V (dc) power connector from the power supply to one end of the 24 V (dc) cable assembly (PN 600-1546-P1). Connect the other end of the 24 V (dc) cable assembly to the 24V power input on the Micro GC Fusion back panel. A "click" will be audible when the power connector is properly connected.
2. Micro GC Fusion ships with a country specific power cord. Connect the end of this power cord to the 24 V (dc) power supply (PN 952-435-P1).
3. Connect the other end of the power cord to the 100-240 V (ac) power source.

With the power supply properly connected, Micro GC Fusion can be powered on by pressing the **On/Standby** button on the front panel.

NOTICE

Using an alternative power supply voids the warranty.

7.8.2 4-Module Micro GC Fusion

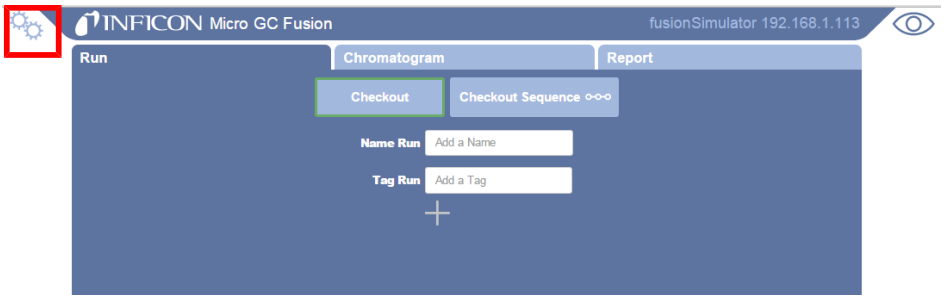
The 4-module Micro GC Fusion system uses a power supply that accepts 100-240 V (ac) input. A 24 V power supply is built into the chassis, and is not required externally.

To power on a 4-module Micro GC Fusion system, press the power button above to the AC power inlet on the back panel to "I," and then press the **On/Standby** button on the front panel.

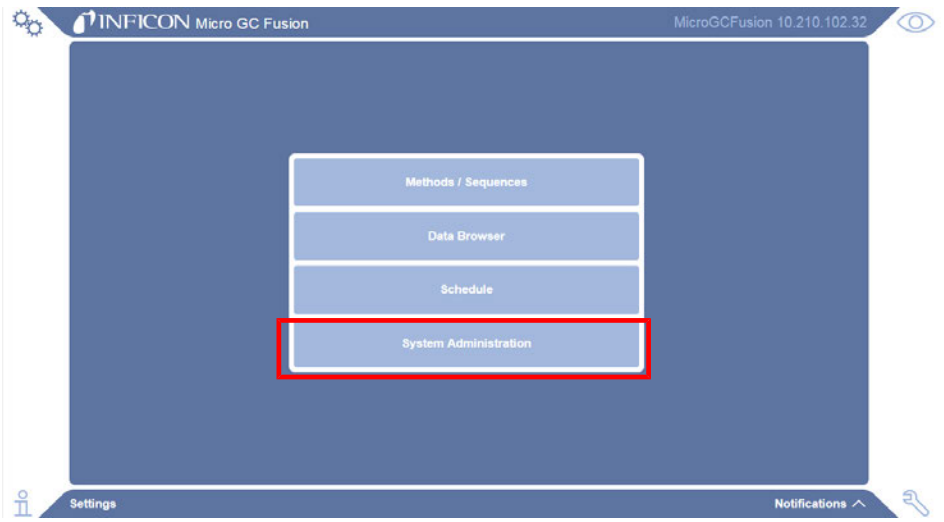
7.9 Carrier Gas Configuration

By default, Micro GC Fusion is set to use helium carrier gas for all GC modules.

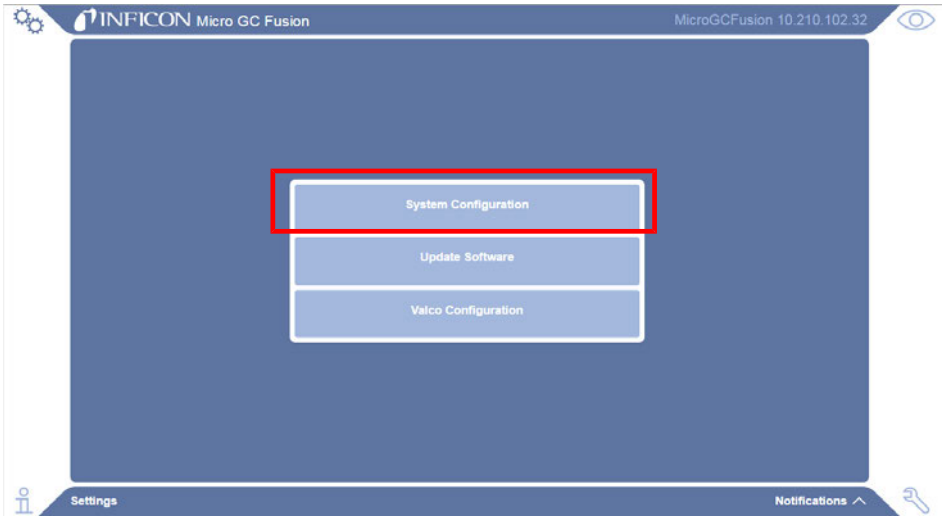
1 Click the icon to change the carrier gas type.



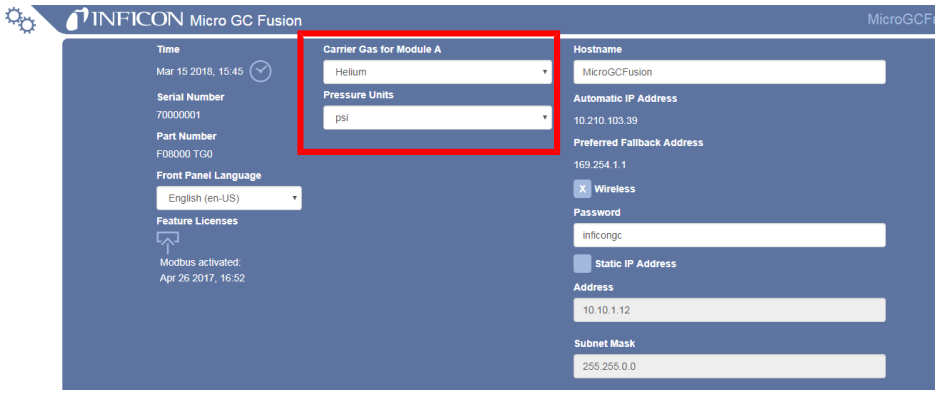
2 Click **System Administration**.



3 Click **System Configuration**.



4 In the **System Configuration** window, select the desired carrier gas from the shortcut menu for each GC module.

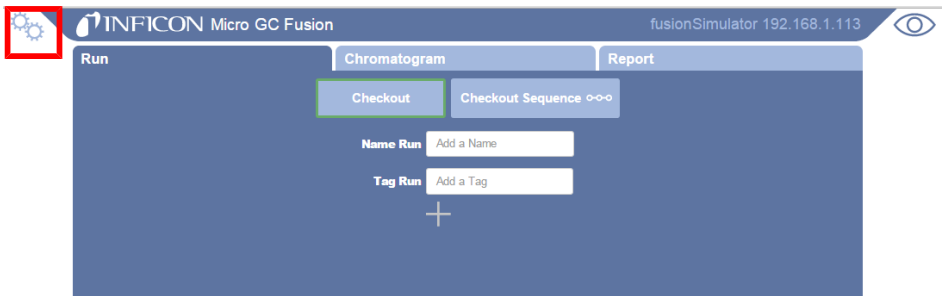


5 Click **Pressure Units** to switch from **psi** to **kPa**.

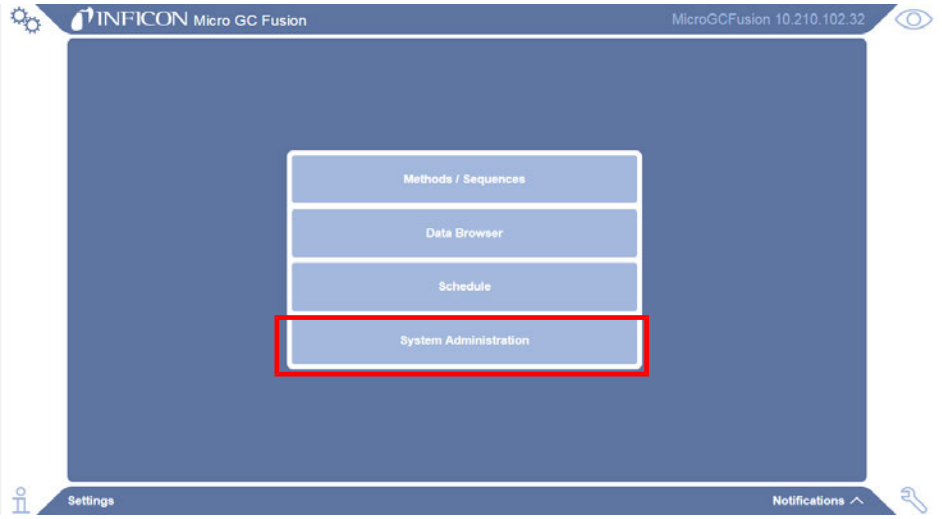
7.10 Set Instrument Time

To set Micro GC Fusion to the same time as the connected device:

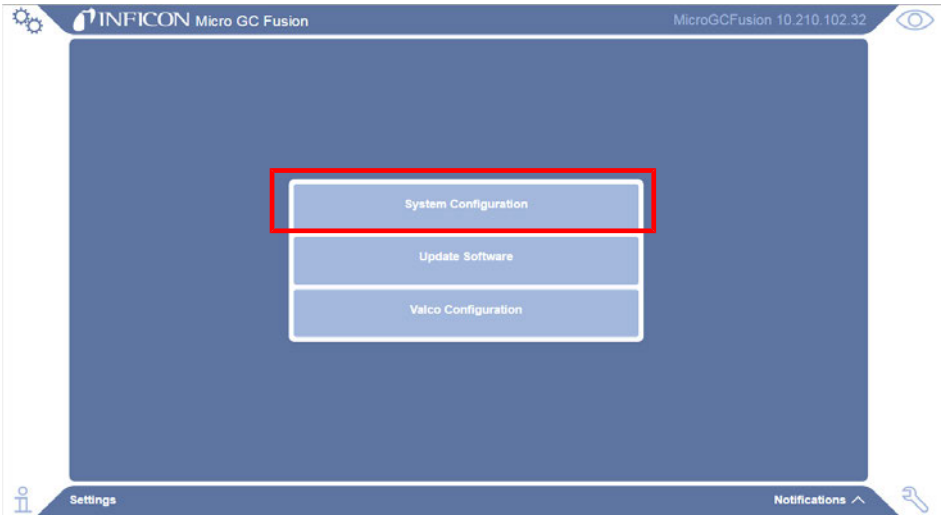
1 Click the icon to change the instrument time.



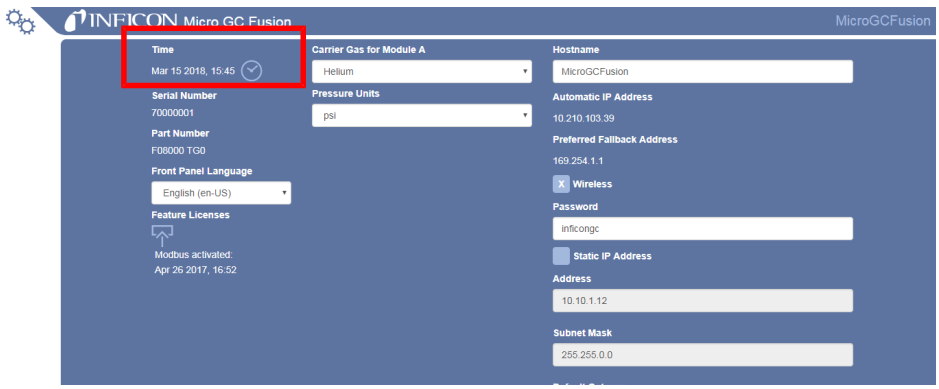
2 Click **System Administration**.



3 Click **System Configuration**.

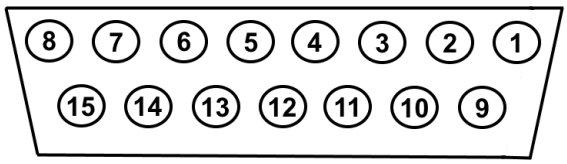


4 In the **System Configuration** window, click the icon to set the instrument time.

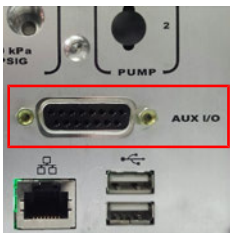


7.11 The AUX I/O Connector

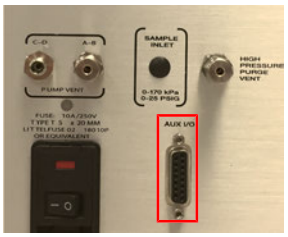
For some applications, an external triggering device may be required for sampling. This can be accomplished by connecting an external triggering device to the Micro GC Fusion AUX I/O port via a Remote Start Cable (PN G2801-60618). This cable has a 15 pin connector at one end. The other end can be fitted with a desired connector type.



2-Module chassis:



4-Module chassis:



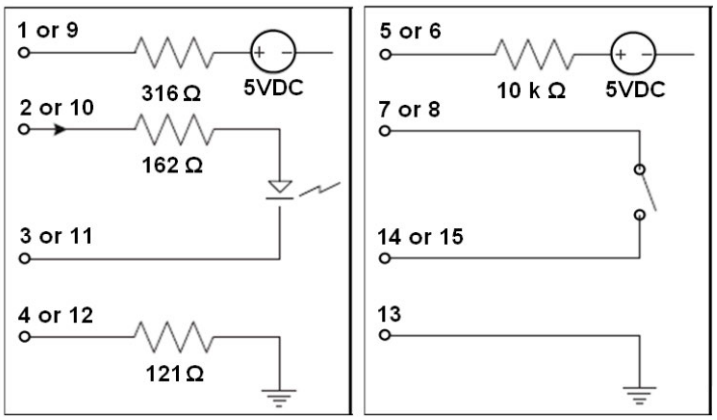
The AUX I/O connector pin outputs are listed in the table below.

Pin	Function	Color
1	Provides 5 mA remote input	Black
2	REMOTE_START input	White
3	REMOTE_START input	Red
4	Variable GND	Green
5	Provides "5V pull up" for logic command	Orange
6	Provides "5V pull up" for logic command	Blue
7	Contact closure output FAULT_OUT*	White/black
8	Contact closure output READY_OUT	Red/black
9	Provides 5 mA for remote input	Green/black
10	REMOTE_CANCEL input	Orange/black
11	REMOTE_CANCEL input	Blue/black
12	Variable GND	Black/white
13	GND	Red/white
14	Contact closure output FAULT_OUT*	Green/white
15	Contact closure output READY_OUT	Blue/white
	*Not implemented	

Remote start cable:



Remote start/cancel circuitry:

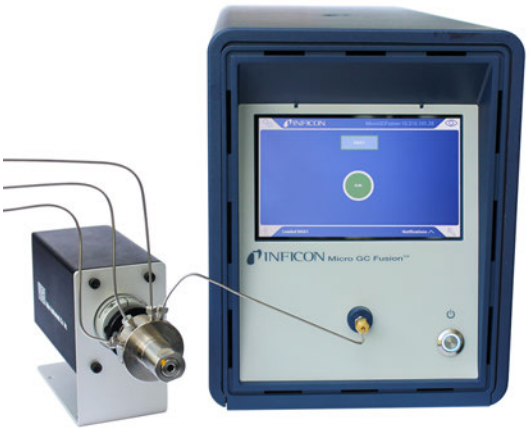


Purpose	Pin Connection	Action
Remote Start	Pin 1 and pin 2	Connect together to activate circuit
	Pin 3 and pin 4	No action when open Trigger REMOTE_START when closed
Remote Cancel	Pin 9 and pin 10	Connect together to activate circuit
	Pin 11 and pin 12	No action when open Trigger REMOTE_CANCEL when closed

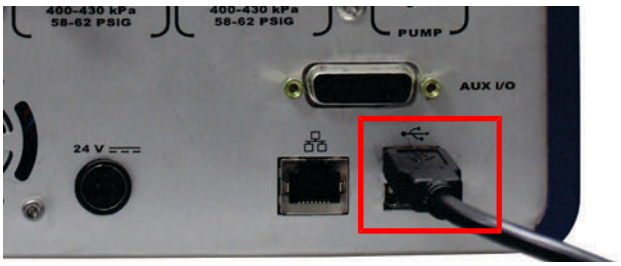
If the REMOTE_CANCEL contacts are closed, Micro GC Fusion opens the READY_OUT relay (pins 8 and 15) to signal the connected device that the run is terminated.

7.12 Valco Stream Selector

Micro GC Fusion can be paired with a Valco stream selector from VICI® (Valco® Instruments Co. Inc.) to perform analysis on multiple gas streams. Valco stream selector models EUH, EUD and EUT with USB option are supported.



A Valco stream selector is connected to and controlled by Micro GC Fusion via a USB connection on the back of the instrument. The proper USB cable is provided with the Valco stream selector.



Sample streams can be connected to the Valco stream selector with any one of the following valve types:

- SD: Dead-ended - sample streams are dead-ended at the stream selection valve
- SC: Common outlet - all sample streams vent to a common outlet port
- SF: Flow-through - each sample stream continuously flows through the stream selection valve
- ST: Trapping - samples are trapped in sample loops for injection
- STF: Trapping flow-through - a variation of the ST: Trapping, except the non-selected streams are returned to their own vents or sources rather than being trapped

7.12.1 Installing the Valco Stream Selector Accessories

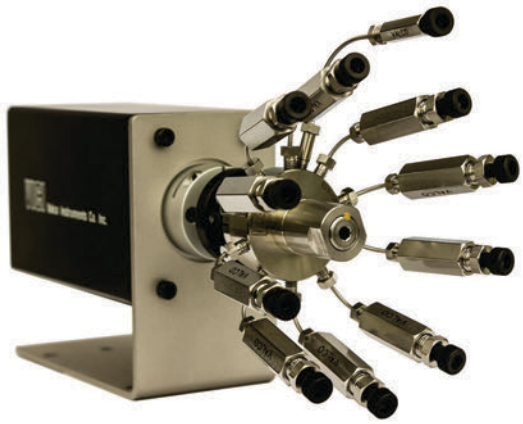
7.12.1.1 Equipment Required

The following tools are required to install and connect sample lines to the Valco stream selector accessories:

- two 1/4 in. wrench
- one 5/16 in. wrench
- one 7/16 in. wrench
- 1/16 in. OD stainless steel sample line(s)

7.12.1.2 Valco Stream Selector Accessories

INFICON offers a 10-port SD and a 10-port SF Valco stream selector as an accessory.





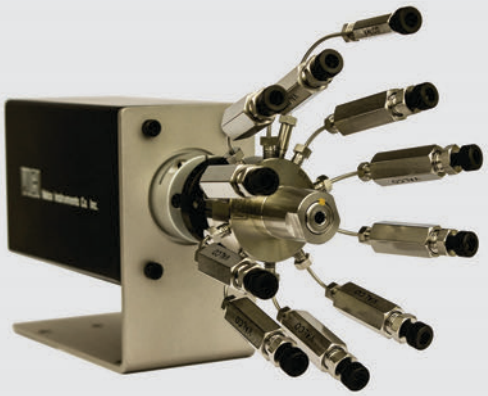
When sample or calibration gas is in short supply and sample composition does not change drastically over time, the dead-ended (SD) Valco stream selector is the desired choice.

When sample or calibration gas is abundant and sample composition changes quickly over time, the flow-through (SF) Valco stream selector is the desired choice.

The pre-assembled accessories have 1/16 in. sample line filters installed at each inlet port. These sample lines are leak checked at the factory and are labeled to provide clear identification. For instance, the sample port #1 is labeled as **1 IN** and sample port #2 is labeled as **2 IN**. The outlet sample line going into the GC is labeled as **OUT TO GC**.



7.12.1.3 10-Port SD Valco Stream Selector Accessory

Description	Quantity	Photo
10-port SD Valco stream selector	1	
Power supply	1	
Power cord	1	

Description	Quantity	Photo
Manual remote	1	
USB cable	1	
Nut and ferrules	11 each	

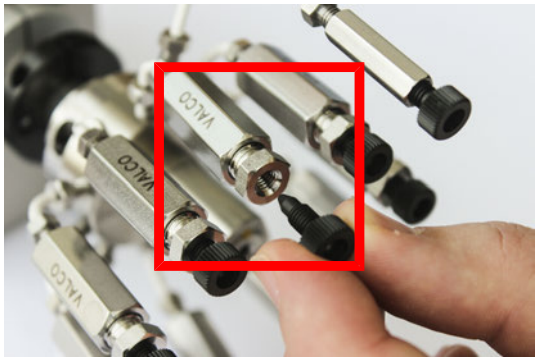
7.12.1.4 10-Port SF Valco Stream Selector Accessory

Description	Quantity	Photo
10-Port SF Valco stream selector	1	

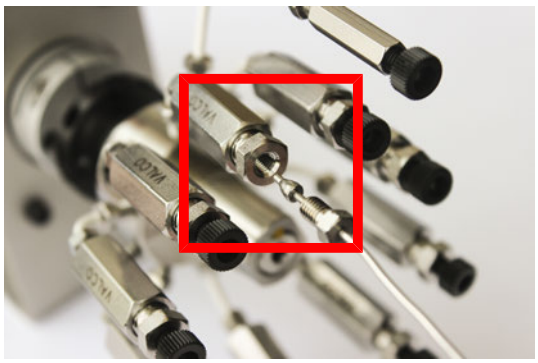
Description	Quantity	Photo
Power supply	1	
Power cord	1	
Manual remote	1	
USB cable	1	
Nuts and ferrules	21 of each	

7.12.1.5 Installing the 10-Port SD Valco Stream Selector Accessory

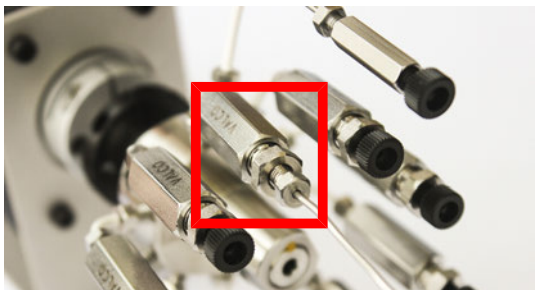
1. Identify sample line **1 IN** and remove the black filter caps from the desired sample line ports.



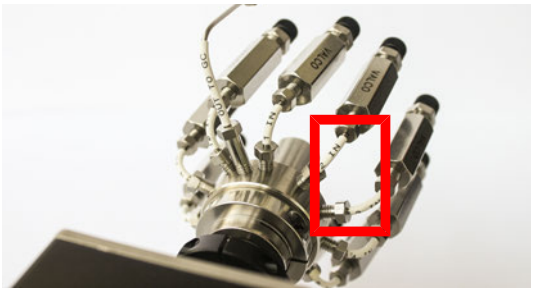
2. Place a union fitting and ferrule onto a 1/16 in. OD stainless steel sample line.



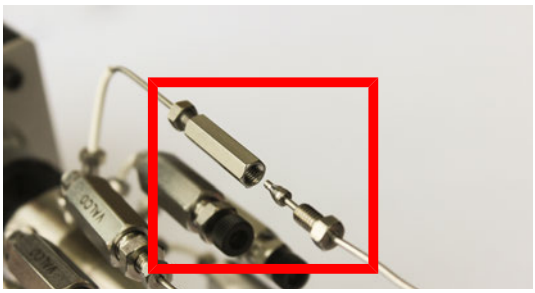
3. Connect the 1/16 in. sample line to the **1 IN** filter on the Valco stream selector.



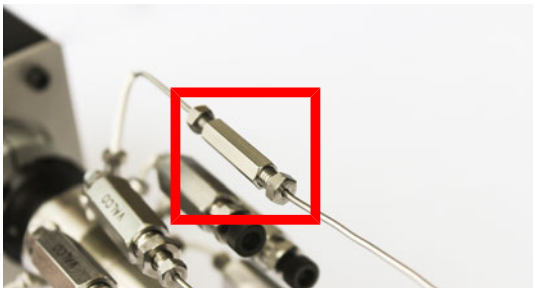
4. While holding the filter with a 7/16 in. wrench, use a 1/4 in. wrench to turn the union fitting. Over-tighten by 1/2 turn to swage the union fitting and ferrule onto the 1/16 in. sample line.
5. Loosen the union fitting and then tighten it again.
6. Repeat steps 1–5 for sample lines to **2 IN** filter, **3 IN** filter, etc. until the desired number of sample lines are connected.



7 Place a union fitting and ferrule onto a 1/16 in. OD stainless steel sample line.



8 Connect the 1/16 in. OD stainless steel tubing to the **OUT TO GC** union.



9 While holding the OUT TO GC fitting with a 1/4 in. wrench, use a 1/4 in. wrench to turn the union fitting. Over-tighten by 1/2 turn to swage the union fitting and ferrule onto the 1/16 in. sample line.

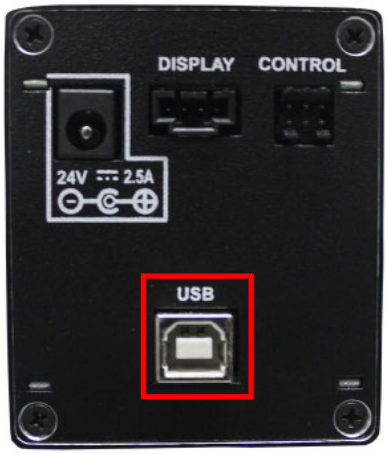
10 Loosen the union fitting and then tighten it again.

11 Swage the 1/16 in. OD stainless steel tubing to the Micro GC Fusion 1/16 in. front inlet using a 5/16 in. wrench.

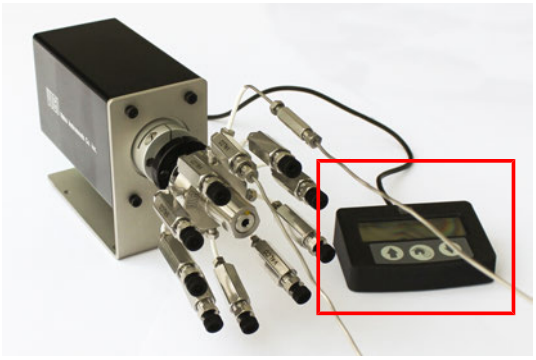
12 Plug the DC power connector on the power supply into the back of the Valco stream selector. Connect the AC power connector on the power supply into a 100–240 V (ac) power source.



13 Connect the USB Type B connector of the USB cable to the back of the Valco stream selector. Connect the USB Type A connector of the USB slot in the back of Micro GC Fusion.



14 Connect the Manual Controller to the back of the Valco stream selector to manually control the internal actuator.



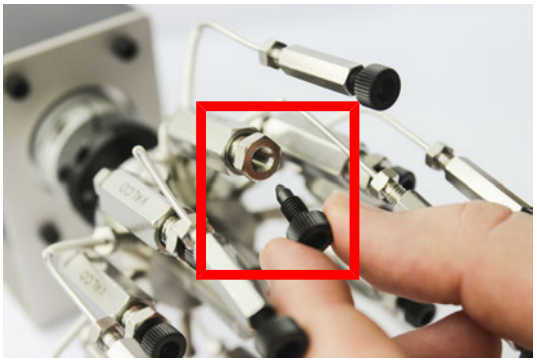
15 To validate that the Valco stream selector was installed successfully, open the Micro GC Fusion Main Page on any supported web browser or wireless device. The **Valve Position** quick select menu will appear, enabling the user to select a valve position.



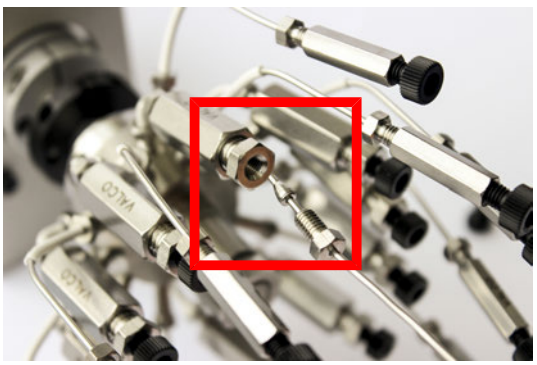
16 For instructions on Valco stream selector configuration, see Valco Stream Selector Operation [▷ 212].

7.12.1.6 Installing the 10-Port SF Valco Stream Selector Accessory

1. Identify sample line **1 IN** and remove the black filter caps from the desired sample line ports.



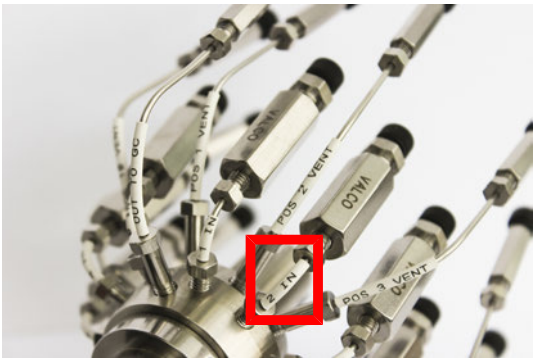
2. Place a union fitting and ferrule onto a 1/16 in. OD stainless steel sample line.



3. Connect the 1/16 in. sample line to the **1 IN** filter on the Valco stream selector.

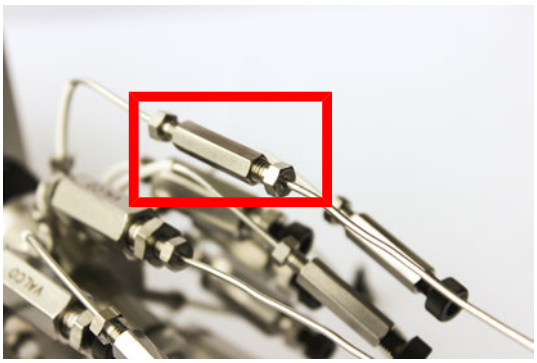


4. While holding the filter with a 7/16 in. wrench, use a 1/4 in. wrench to turn the union fitting. Over-tighten by 1/2 turn to swage the union fitting and ferrule onto the 1/16 in. sample line.
5. Loosen the union fitting and then tighten it again.
6. Repeat steps 1–5 for sample lines to **2 IN** filter, **3 IN** filter, etc. until the desired number of sample lines are connected.



7 Place a union fitting and ferrule onto a 1/16 in. OD stainless steel sample line.

8 Connect the 1/16 in. OD stainless steel tubing to the **POS 1 VENT** union on the Valco stream selector.



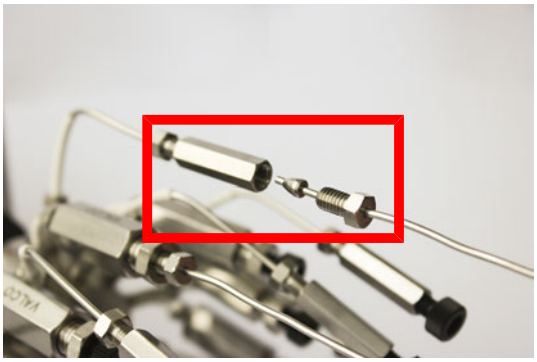
9 While holding the union with a 1/4 in. wrench, use a 1/4 in. wrench to turn the union fitting. Over-tighten by 1/2 turn to swage the union fitting and ferrule onto the 1/16 in. sample line.

10 Loosen the union fitting and then tighten it again.

11 Repeat steps 7–9 to connect vent lines to **POS 2 VENT**, **POS 3 VENT**, etc. to the corresponding venting lines.

If connecting a calibration gas, replace the vent line with a nut to prevent wasting gas.

12 Connect the 1/16 in. OD stainless steel tubing to the **OUT TO GC** union.



13 While holding the union with a 1/4 in. wrench, use a 1/4 in. wrench to turn the union fitting. Over-tighten by 1/2 turn to swage the union fitting and ferrule onto the 1/16 in. sample line.

14 Loosen the fitting and then tighten it again.

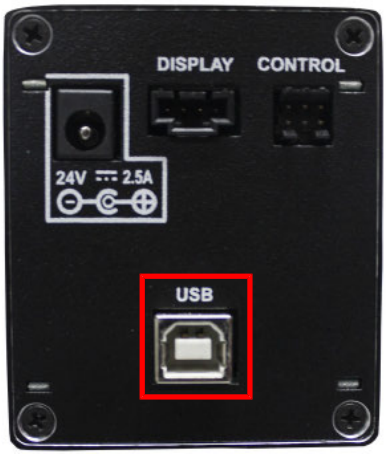
15 Swage the 1/16 in. OD stainless steel tubing to the Micro GC Fusion 1/16 in. front inlet using a 5/16 in. wrench.



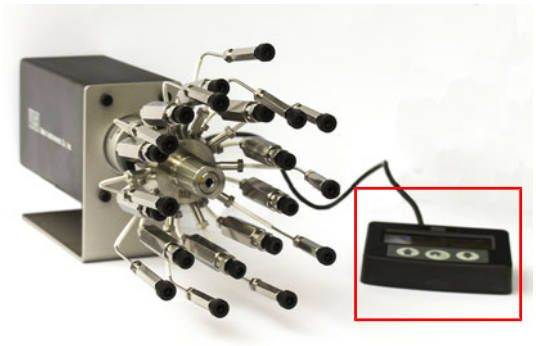
16 Plug the DC power connector on the power supply into the back of the Valco stream selector. Connect the AC power connector on the power supply into a 100–240 V (ac) power source.



17 Connect the USB Type B connector of the USB cable to the back of the Valco stream selector. Connect the USB Type A connector of the USB slot in the back of Micro GC Fusion.



18 Connect the Manual Controller to the back of the Valco stream selector to manually control the internal actuator.



19 To validate that the Valco stream selector was installed successfully, open the Micro GC Fusion Main Page on any supported web browser or wireless device. The **Valve Position** quick select menu will appear, enabling the user to select a valve position.



20 For instructions on Valco stream selector configuration, see Valco Stream Selector Operation [▷ 212].



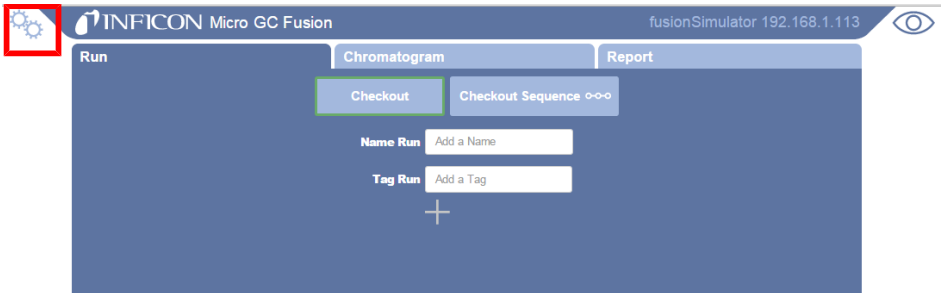
⚠ WARNING

Safely vent carrier and sample streams—potentially toxic, noxious, asphyxiant (oxygen-displacing), or flammable gases—outside Micro GC Fusion and away from the operating area. Vent toxic gases to a fume hood, chemical trap, or reaction medium.

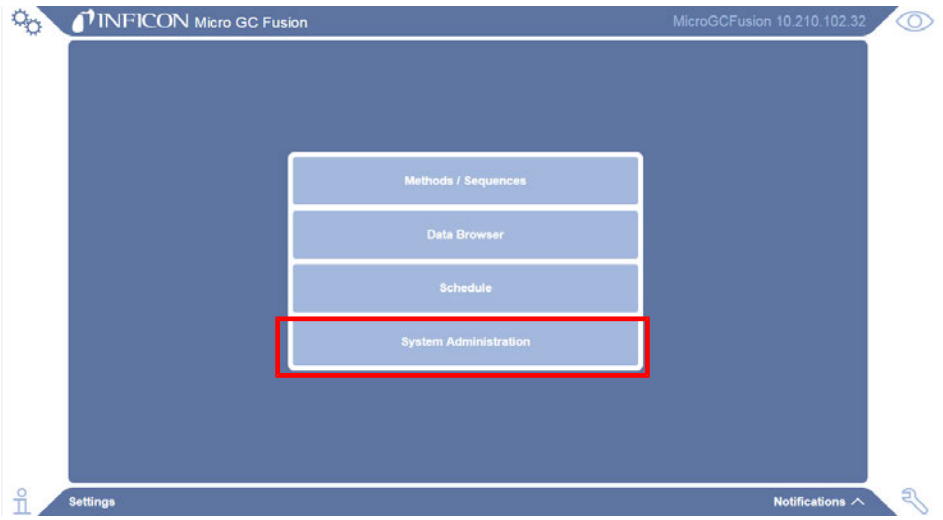
7.13 Front Panel Language Selection

Micro GC Fusion provides the option of using the English or Chinese language on the front panel display. To change the front panel display language:

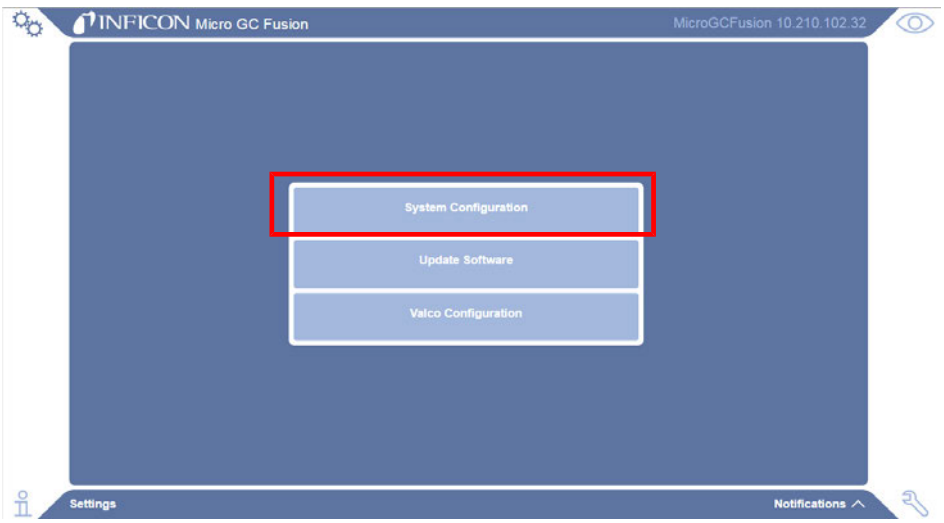
1 Click the icon to change the instrument language.



2 Click **System Administration**.



3 Click **System Configuration**.



4 In the **System Configuration** window, click the drop-down box under **Front Panel Language** and select the desired language.



5 Refresh the front panel display to allow the new setting to take effect.

7.14 Installing the Gas Liquid Separator

7.14.1 Introduction

The gas-liquid separator (PN 952-029-G1) provides gas-liquid separation through a Genie® membrane separator.





⚠ WARNING

Gas pressure on the gas-liquid separator sample vent may be up to 172 kPa (25 psi). Extreme caution must be taken when venting the high pressure sample to avoid personal injury.

NOTICE

The gas-liquid separator filters out liquid droplets in a gas sample. It is not intended for liquid injections.

NOTICE

Sample inlet gas pressure must be less than 172 kPa (25 psi).

Exceeding 172 kPa (25 psi) will damage Micro GC Fusion and require factory repair.

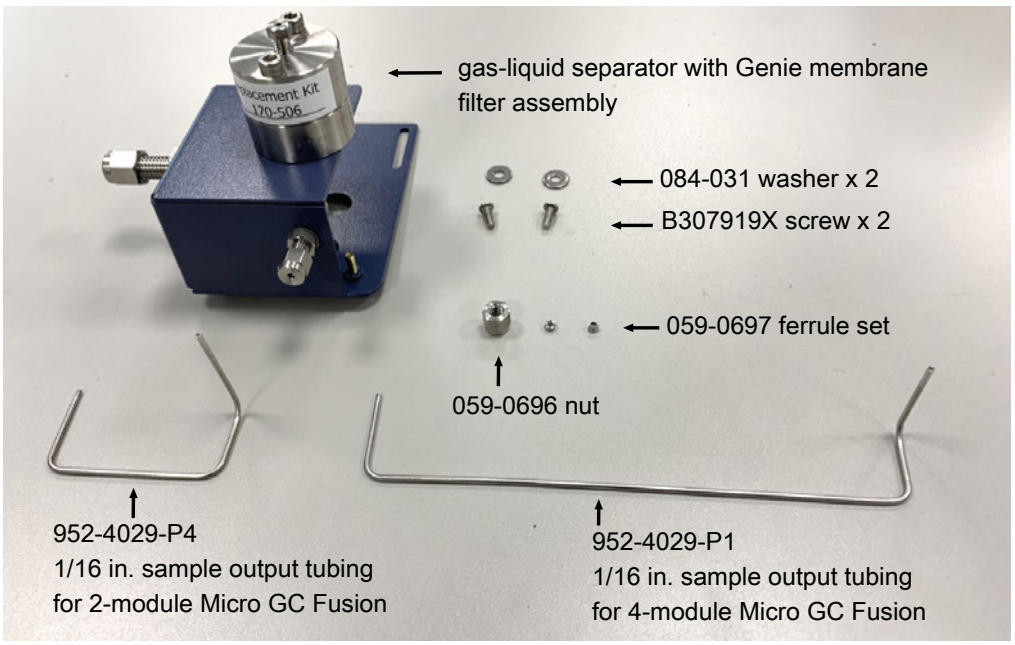
7.14.2 Gas-Liquid Separator Accessory Kit (PN 952-029-G1)

Specifications

Sample inlet	1/16 in. Swagelok
Maximum sample pressure	172 kPa (25 psi)

Gas-liquid separator accessory kit contents

PN	Description	Quantity
	Gas-liquid separator with genie membrane filter assembly	1
952-4029-P4	1/16 in. SS sample output tubing for the 2-module Micro GC Fusion	1
952-4029-P1	1/16 in. SS sample output tubing for the 4-module Micro GC Fusion	1
059-0696	Nut, 0.062-tube, 0.312 hex, 0.031 LG SS RoHS	1
059-0697	Ferrule set, 0.062-tube SS RoHS	1
084-031	Washer, #4 flat SS	2
B3079191X	Screw, M3 x 8	2
HDW-2170	Filter, membrane replacement	1



7.14.3 List of Required Tools

The following tools are user supplied:

- 2 mm hex driver
- 5/16 in. wrenches
- 1/4 in. wrench

7.14.4 Installing the Gas-Liquid Separator

The gas-liquid separator can be installed on the 2-module or the 4-module Micro GC Fusion. The gas-liquid separator is factory pre-assembled, and can be easily mounted onto Micro GC Fusion during instrument installation.



⚠ WARNING

Gas pressure on the gas-liquid separator sample vent may be up to 172 kPa (25 psi). Extreme caution must be taken when venting the high pressure sample to avoid personal injury.

NOTICE

The gas-liquid separator filters out liquid droplets in a gas sample. It is not intended for liquid injections.

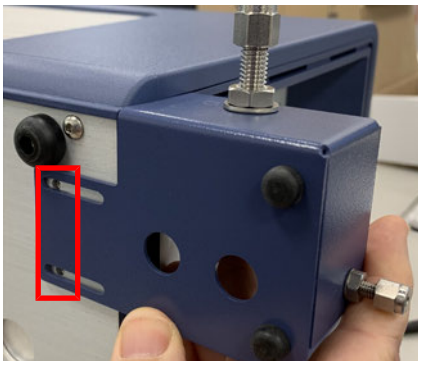
7.14.4.1 2-Module Chassis

To install the gas-liquid separator onto a 2-module Micro GC Fusion:

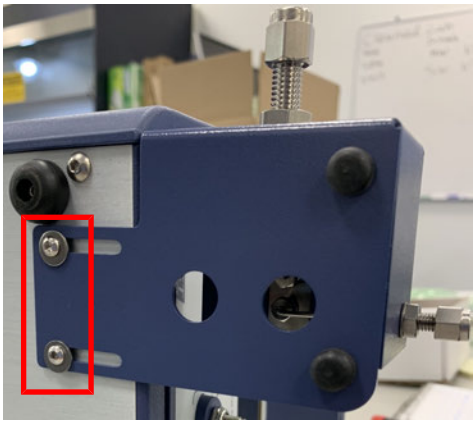
1. Press the **On/Standby** button once to shutdown Micro GC Fusion. This shutdown procedure cools down the analytical columns before powering down and may take 1 to 2 minutes.
2. Remove all electrical cables, including the power cable and the Ethernet cable.
3. Disconnect the sample gas connection(s), carrier gas connections and venting connections.
4. Turn Micro GC Fusion onto its side.
5. Remove the two M3 x 8 screws on the chassis bottom using a 2 mm hex driver. Retain screws for future use.



6 Mount the gas-liquid separator for the 2-module chassis as shown. Hold the gas-liquid separator so that the slots on the gas-liquid separator align with the holes on Micro GC Fusion.

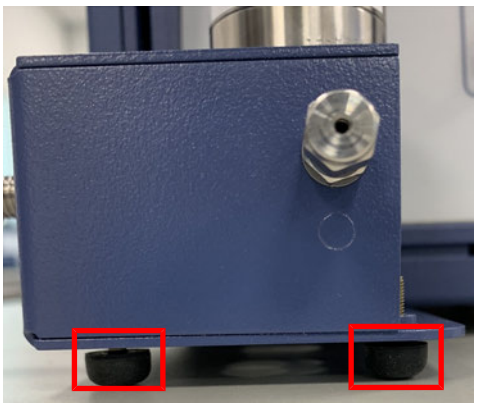


7 Use a 2 mm hex driver to secure the gas-liquid separator to the Micro GC Fusion chassis bottom with the two washers (084-031) and the two 8 mm M3 screws (B3079191X).



8 Turn Micro GC Fusion back to the upright position.

9 Adjust the front bumpers so that the gas-liquid separator lays flat on the surface.



10 Insert the sample output tubing for the 2-module chassis (952-4029-P4) into the Valco fitting on the gas-liquid separator. Do not tighten. The tubing should be loose.



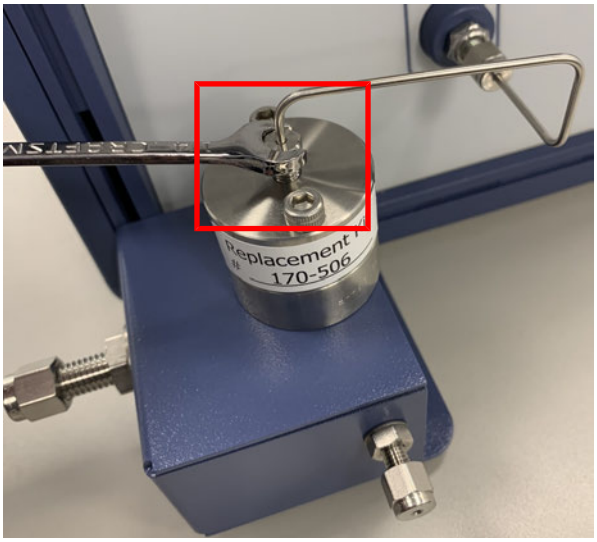
11 Place the 1/16 in. nut (059-0696) and the ferrule set (059-0697) onto the end of the sample output tubing going to Micro GC Fusion.



12 Connect the sample output tubing from the gas-liquid separator to the Micro GC Fusion sample inlet and tighten using a 5/16 in. wrench.



13 Tighten the Valco fitting on the gas-liquid separator using a 1/4 in. wrench.



14 Use additional tubing to connect the gas-liquid separator sample vent to a fume hood or other safe location.

15 Reconnect all electrical cables, including the power cable and Ethernet cable.

16 Reconnect the carrier gas and venting connections.

17 Turn on Micro GC Fusion. Connect a sample to the sample inlet on gas-liquid separator to perform an analysis.



⚠ WARNING

Safely vent carrier and sample streams—potentially toxic, noxious, asphyxiant (oxygen-displacing), or flammable gases—outside Micro GC Fusion and away from the operating area. Vent toxic gases to a fume hood, chemical trap, or reaction medium.

NOTICE

Ensure the vent tubing is not inclined upward to prevent potential liquid accumulation in the tubing.

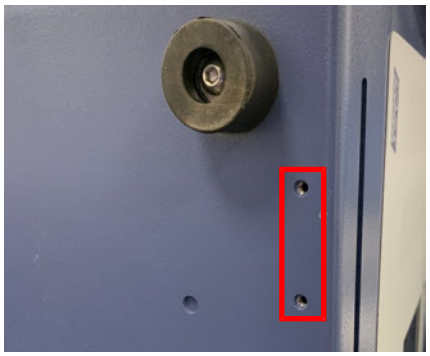
NOTICE

Blocking the vent port during operation significantly increases the output pressure from the device. When this happens, the instrument may be damaged if the incoming sample pressure is greater than 172 kPa (25 psi).

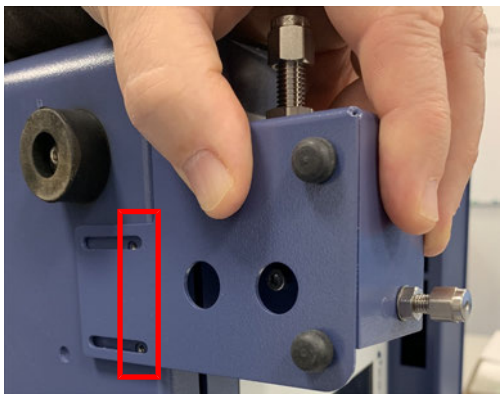
7.14.4.2 4-Module Chassis

To install the gas-liquid separator onto a 4-module Micro GC Fusion:

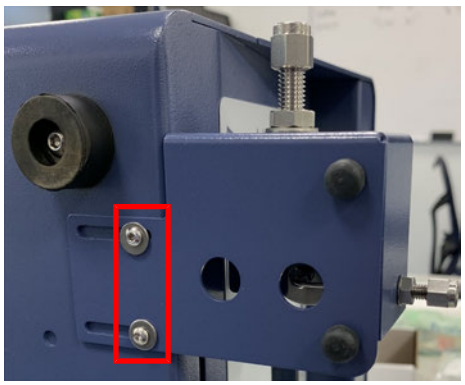
1. Press the **On/Standby** button once to shutdown Micro GC Fusion. This shutdown procedure cools down the analytical columns before powering down and may take 1 to 2 minutes.
2. Remove all electrical cables, including the power cable and the Ethernet cable.
3. Disconnect the sample gas connection(s), carrier gas connections and venting connections.
4. Turn Micro GC Fusion upside down. There are two holes for the M3 x 8 screws.



5. Mount the gas-liquid separator for the 4-module chassis as shown. Hold the gas-liquid separator so that the slots on the gas-liquid separator align with the holes on Micro GC Fusion.

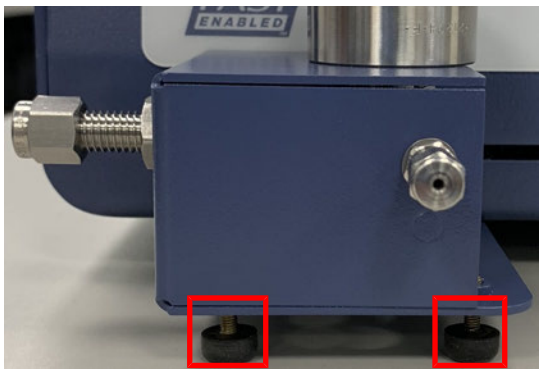


6. Use a 2 mm hex driver to secure the gas-liquid separator to the Micro GC Fusion chassis bottom with the two washers (084-031) and the two M3 x 8 screws (B3079191X).

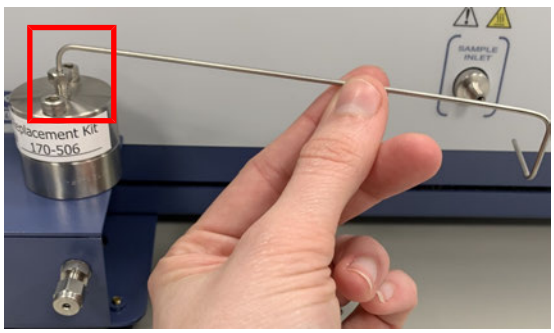


7 Turn Micro GC Fusion back to the upright position.

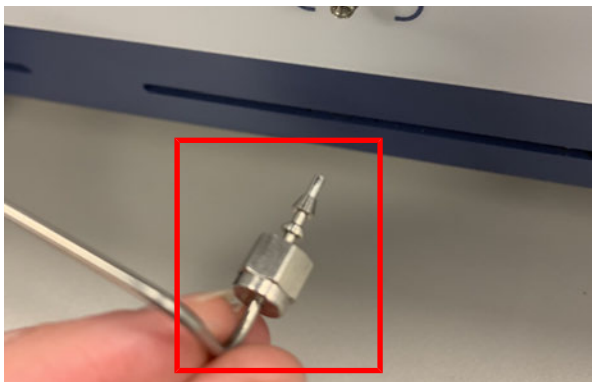
8 Adjust the front bumpers so that the gas-liquid separator lays flat on the surface.



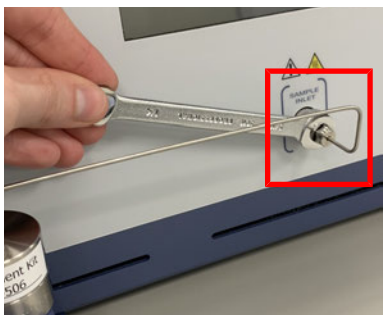
9 Insert the sample output tubing for the 4-module chassis (952-4029-P1) into the Valco fitting on the gas-liquid separator. Do not tighten. The tubing should be loose.



10 Place the 1/16 in. nut (059-0696) and the ferrule set (059-0697) onto the end of the sample output tubing going to Micro GC Fusion.



11 Connect the sample output tubing from the gas-liquid separator to the Micro GC Fusion sample inlet and tighten using a 5/16 in. wrench.



12 Tighten the Valco fitting on the gas-liquid separator using a 1/4 in. wrench.



13 Use additional tubing to connect the gas-liquid separator sample vent to a fume hood or other safe location.

14 Reconnect all electrical cables, including the power cable and Ethernet cable.

15 Reconnect the carrier gas and venting connections.

16 Turn on Micro GC Fusion. Connect a sample to the sample inlet on the gas-liquid separator to perform an analysis.



⚠ WARNING

Safely vent carrier and sample streams—potentially toxic, noxious, asphyxiant (oxygen-displacing), or flammable gases—outside Micro GC Fusion and away from the operating area. Vent toxic gases to a fume hood, chemical trap, or reaction medium.

NOTICE

Ensure the vent tubing is not inclined upward to prevent potential liquid accumulation in the tubing.

NOTICE

Blocking the vent port during operation significantly increases the output pressure from the device. When this happens, the instrument may be damaged if the incoming sample pressure is greater than 172 kPa (25 psi).

7.15 Pressure Reducer Genie Filter and Gas-Liquid Separator

The pressure reducer and gas-liquid separator (PN 952-033-G1) reduces sample pressure and filters out liquid particulates in the sample. The maximum sample input pressure is 3,450 kPa (500 psi). With a flow rate at or less than 100 mL/min, as indicated on the flow gauge on the device, the output pressure from the device is about ambient pressure.

NOTICE

If the flow rate through the device exceeds 100 mL/min, the output pressure from the device to Micro GC Fusion may exceed the acceptable pressure range, causing instrument damage.

NOTICE

Blocking off the venting port during operation significantly increases the output pressure from the device to Micro GC Fusion. When this happens, the Micro GC Fusion connected to the device may be damaged if the incoming sample pressure is greater than 172 kPa (25 psi).



⚠ WARNING

The pressure reducer and gas-liquid separator is rated for 3450 kPa (500 psi) input sample pressure.

Exceeding this pressure limit may result in component failure, with parts potentially blowing off at high pressure.



⚠ WARNING

Safely vent carrier and sample streams—potentially toxic, noxious, asphyxiant (oxygen-displacing), or flammable gases—outside Micro GC Fusion and away from the operating area. Vent toxic gases to a fume hood, chemical trap, or reaction medium.

NOTICE

Ensure the vent tubing is not inclined upward to prevent potential liquid accumulation in the tubing.

7.15.1 2-Module Micro GC Fusion Chassis Installation - Side Install

The pressure reducer and gas-liquid separator includes the following items. These items are needed to install the device on the side of a 2-module Micro GC Fusion chassis.

PN	Description	Quantity
059-0696	5/16 in. female nut	1
059-0697	1/16 in. ferrule set	1
059-0336	1/16 in. Valco male nut	1
059-0335	1/16 in. ferrule	1
952-229-G1	sample tube	1
	pressure reducer and gas-liquid separator assembly	1

There are three tubes in kit (PN 952-229-G1) and the medium length tube is used for this installation.

Tools required:

- 3/8 in. open-ended wrench
- 5/16 in. open-ended wrench
- 1/4 in. open-ended wrench



User supplied parts:

- vent tubing and fittings, if used
- 1/8 in. Swagelok type sample input tubing and female fittings

NOTICE

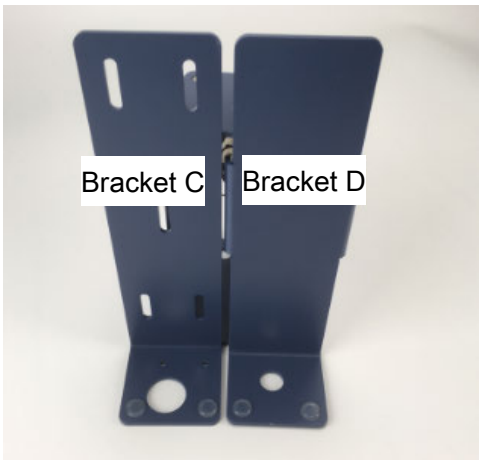
The cap plugs on the sample inlet and the sample vent of the pressure reducer and gas-liquid separator are not shown in the figure. They must be removed when performing this installation.

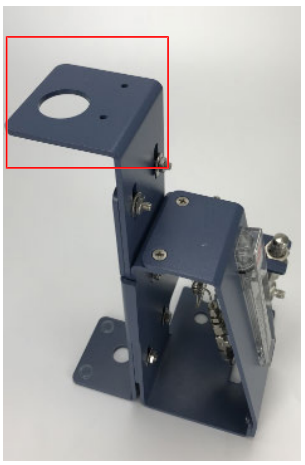
1 Turn off the instrument by following the system shutdown procedure in Shutdown Procedure [▶ 226].

2 Disconnect all the electrical cables, including the power cable and Ethernet cable, from the instrument.

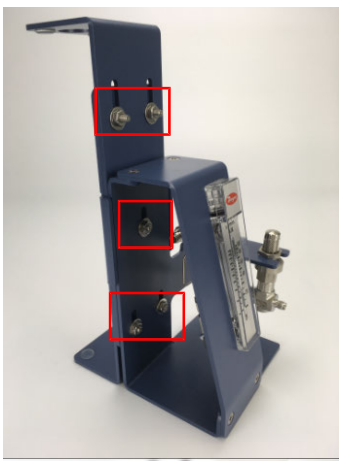
3 Disconnect the sample gas connection(s), the carrier gas connection(s) and the venting connections from the instrument.

4 Ensure that Bracket C is positioned with one large and two small holes at the top when in the upright position. If not, follow the procedure in Change Mounting Bracket Orientation [▷ 120] to adjust the mounting bracket orientation.





5 Set the five nuts on the mounting bracket to the positions shown. If the nut positions need adjustment, relax the nuts, adjusting the mounting bracket and re-tighten the nuts using a 3/8 in. wrench.



6 Clamp the mounting bracket onto the left side of the instrument.



7 Ensure the bottom mounting bracket hole is fitted into the lower-left chassis foot.



8 Adjust the nut position to remove the gap between the mounting bracket and the chassis top.



9 Tighten all nuts with a 3/8 in. wrench to fix the bracket on the instrument chassis.

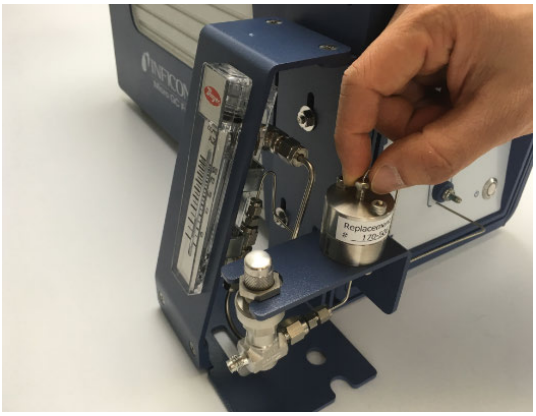


10 Put the Valco ferrule (PN 059-0335) and the nut (PN 059-0336) on the inlet tube.



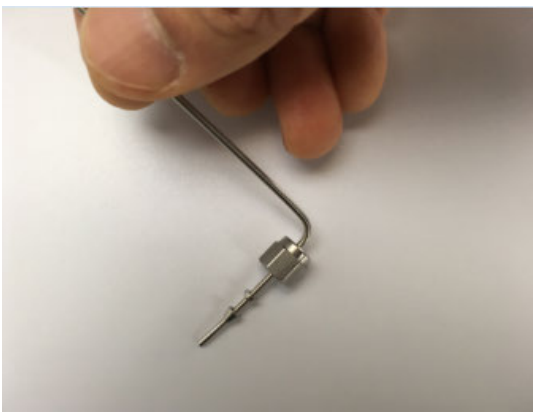


11 Insert the sample tubing with the Valco fittings into the fitting detail on the Genie filter. Push the tubing all the way forward into the detail, so that it seats firmly. Manually turn the nut into the detail until it is finger-tight. Using the 1/4 in. open-ended wrench, turn the nut 1/4 turn (90°) past the point where the ferrule first starts to grab the tubing. The amount of force required can vary considerably due to the friction between the nut and the treads and the composition and wall thickness of the tubing used.

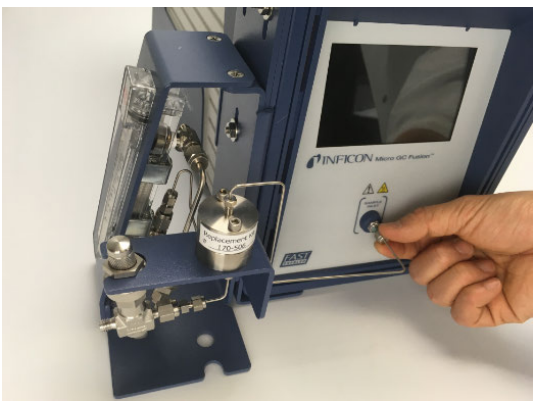




12 Put the 5/16 in. Swagelok nut (PN 059-0696) and the 1/16 in. ferrule set (PN 059-0697) on the other end of the sample tube.

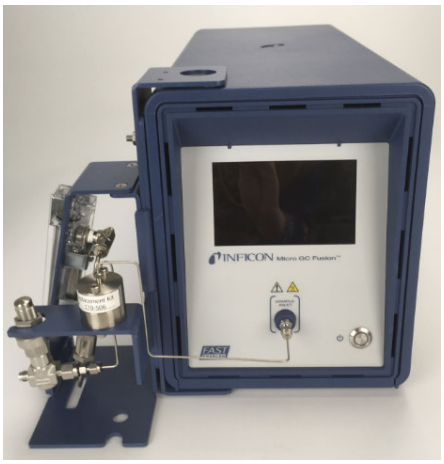


13 Insert the 1/16 in. sample tubing with the Swagelok fittings onto the instrument sample inlet. Tighten 1/2 turn past finger-tight using the 5/16 in. wrench.





14 The pressure reducer and gas-liquid separator installation is complete. Reconnect the power cable, the Ethernet cable, and the carrier gas lines.



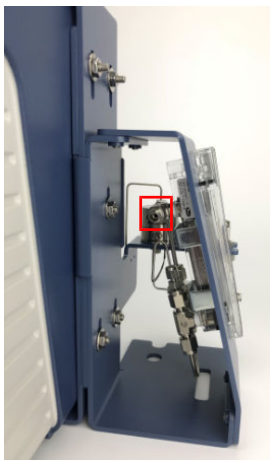
15 Before connecting a pressurized sample to the device, close the metering valve by turning the dial fully clockwise to ensure no sample flow through the device when the pressurized sample is connected.



16 Install a user-provided 1/8 in. sample line with the female Swagelok fittings preinstalled.



17 Connect a vent line to the vent fitting using 1/8 in. Swagelok fittings. Run the exhaust to a fume hood or other designated area for hazardous waste disposal.



18 Slowly open the dial to allow the sample to flow through the device. Check the flow indicated on the flow gauge and ensure it is less than 100 mL/min.

19 Turn on Micro GC Fusion. The instrument is ready to perform analysis.

NOTICE

If the flow rate through the device exceeds 100 mL/min, the output pressure from the device to Micro GC Fusion may exceed the acceptable pressure range, causing instrument damage.



⚠ WARNING

Safely vent carrier and sample streams—potentially toxic, noxious, asphyxiant (oxygen-displacing), or flammable gases—outside Micro GC Fusion and away from the operating area. Vent toxic gases to a fume hood, chemical trap, or reaction medium.

7.15.2 4-Module Micro GC Fusion Chassis Installation - Side Install

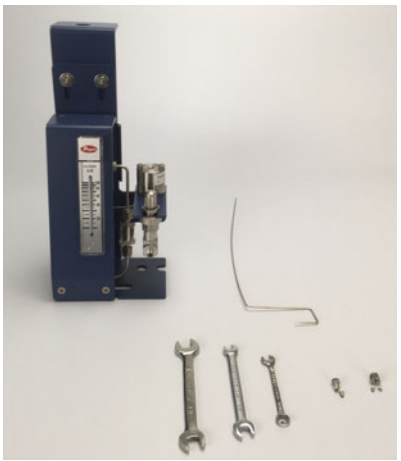
The pressure reducer and gas-liquid separator includes the following items. These items are needed to install the device on the side of a 4-module Micro GC Fusion chassis.

PN	Description	Quantity
059-0696	5/16 in. female nut	1
059-0697	1/16 in. ferrule set	1
059-0336	1/16 in. Valco male nut	1
059-0335	1/16 in. ferrule	1
952-229-G1	sample tube	1
	pressure reducer and gas-liquid separator assembly	1

There are three tubes in kit (PN 952-229-G1) and the longest length tube is used for this installation.

Tools required:

- 3/8 in. open-ended wrench
- 5/16 in. open-ended wrench
- 1/4 in. open-ended wrench



User supplied parts:

- vent tubing and fittings, if used
- 1/8 in. Swagelok type sample input tubing and female fittings

NOTICE

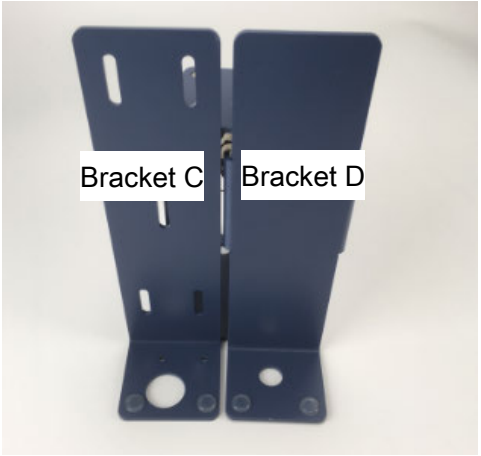
The cap plugs on the sample inlet and the sample vent of the pressure reducer and gas-liquid separator are not shown in the figure. They must be removed when performing this installation.

1 Turn off the instrument by following the system shutdown procedure in Shutdown Procedure [▷ 226].

2 Disconnect all the electrical cables, including the power cable and Ethernet cable, from the instrument.

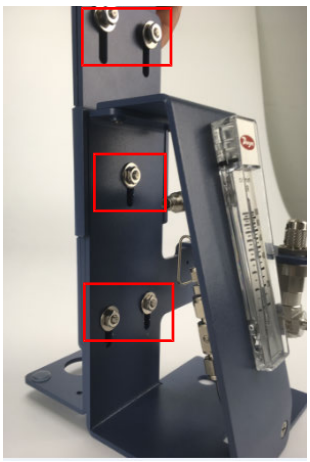
3 Disconnect the sample gas connection(s), the carrier gas connection(s) and the venting connections from the instrument.

4 Ensure that Bracket C is positioned with two small holes at the bottom when in the upright position. If not, follow the procedure in Change Mounting Bracket Orientation [▶ 120] to adjust the mounting bracket orientation.

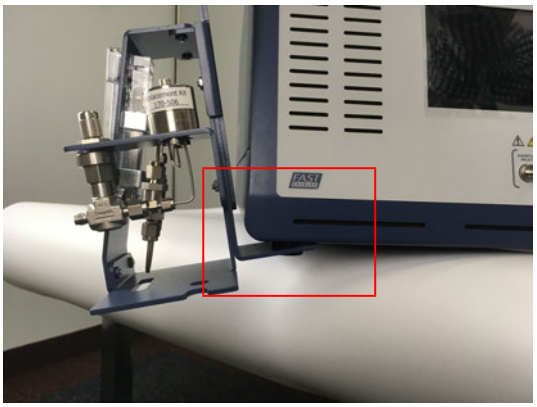




5 Set the five nuts on the mounting bracket to the positions shown. If the nut positions need adjustment, relax the nuts, adjusting the mounting bracket and re-tighten the nuts using a 3/8 in. wrench.



6 Clamp the mounting bracket onto the left side of the instrument, with the large hole on the bottom of the mounting bracket fitting into the left front foot of the instrument.



7 Push the top of the mounting bracket towards the instrument until it fits tightly.



8 Adjust and tighten all the nuts using a 3/8 in. wrench to fix the mounting bracket on the instrument chassis.

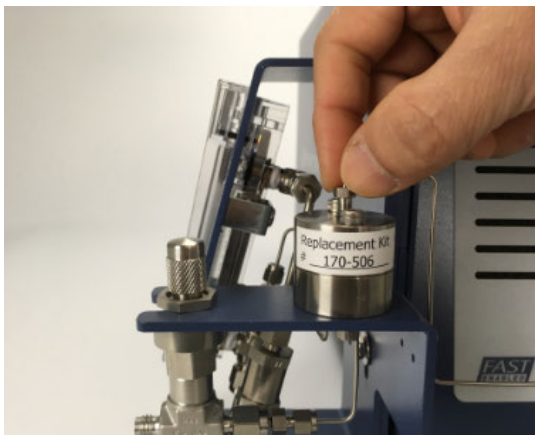


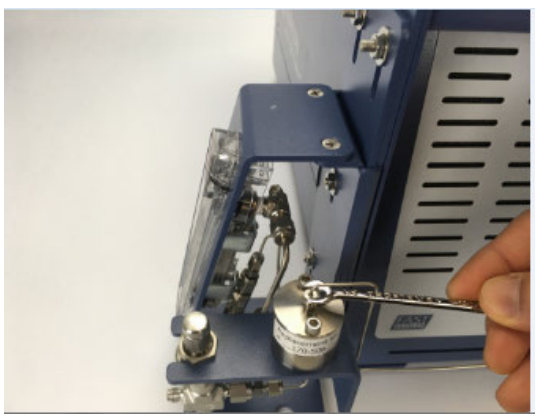
9 Put the Valco ferrule (PN 059-0335) and the nut (PN 059-0336) on the inlet tube.



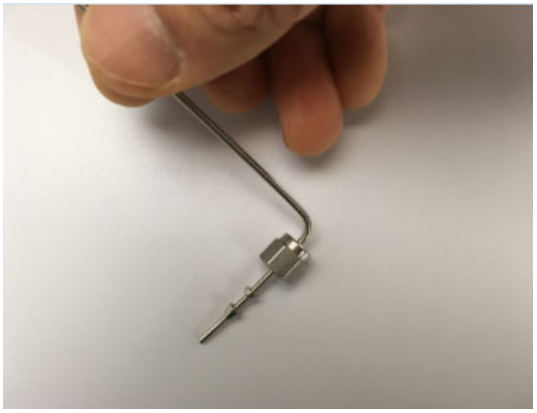


10 Insert the sample tubing with the Valco fittings into the fitting detail on the Genie filter. Push the tubing all the way into the detail, so that it seats firmly. Manually turn the nut into the detail until it is finger tight. Using the 1/4 in. open-ended wrench, turn the nut 1/4 turn (90°) past the point where the ferrule first starts to grab the tubing. The amount of force required can vary considerably due to the friction between the nut and the treads and the composition and wall thickness of the tubing used.

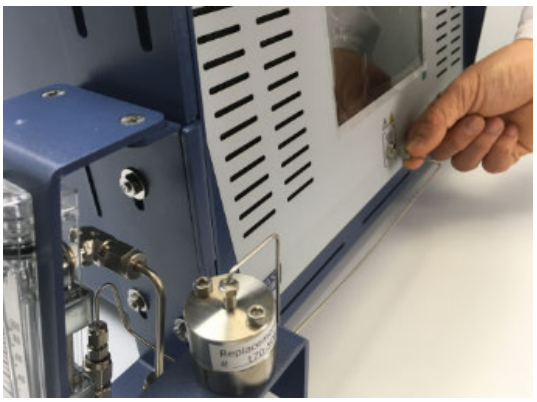




11 Put the 5/16 in. Swagelok nut (PN 059-0696) and the 1/16 in. ferrule set (PN 059-0697) on the other end of the sample tube.



12 Insert the 1/16 in. sample tubing with the Swagelok fittings onto the instrument sample inlet. Tighten 1/2 turn past finger-tight using the 5/16 in. wrench.



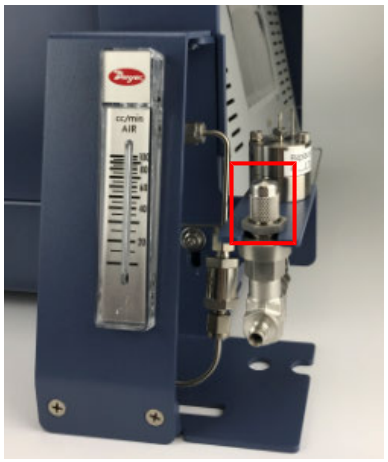


13 The pressure reducer and gas-liquid separator installation is complete.



14 Reconnect the power cable, the Ethernet cable and the carrier gas lines.

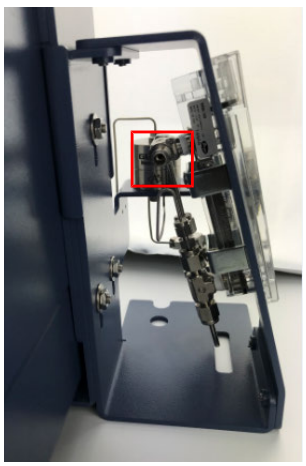
15 Before connecting the pressurized sample to the device, close the metering valve by turning the dial fully clockwise to ensure no sample flow through the device when the pressurized sample is connected.



16 Install a user-provided 1/8 in. sample line with the female Swagelok fittings preinstalled.



17 Connect a vent line to the vent fittings using 1/8 in. Swagelok fittings. Run the exhaust to a fume hood or other designated area for hazardous waste disposal.



18 Slowly open the dial to allow the sample to flow through the device. Check the flow indicated on the flow gauge and set the limit to less than 100 mL/min.

19 Turn on Micro GC Fusion. The instrument is ready to perform an analysis.

NOTICE

If the flow rate through the device exceeds 100 mL/min, the output pressure from the device to Micro GC Fusion may exceed the acceptable pressure range, causing instrument damage.



⚠ WARNING

Safely vent carrier and sample streams—potentially toxic, noxious, asphyxiant (oxygen-displacing), or flammable gases—outside Micro GC Fusion and away from the operating area. Vent toxic gases to a fume hood, chemical trap, or reaction medium.

7.15.3 4-Module Micro GC Fusion Chassis Installation - Front Install

The pressure reducer and gas-liquid separator includes the following items. These items are needed to install the device on the front of a 4-module Micro GC Fusion chassis.

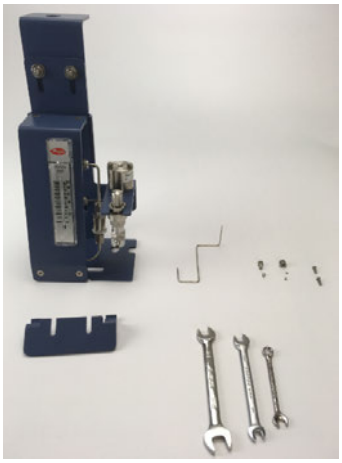
PN	Description	Quantity
059-0696	5/16 in. female nut	1
059-0697	1/16 in. ferrule set	1
059-0336	1/16 in. Valco male nut	1
059-0335	1/16 in. ferrule	1
952-229-G1	sample tube	1
B3079191X	M3 screw	2
952-361-P5	bracket E	1
	pressure reducer and gas-liquid separator assembly	1



There are three tubes in kit (PN 952-229-G1) and the shortest length tube is used for this installation.

Tools required:

- 3/8 in. open-ended wrench
- 5/16 in. open-ended wrench
- 1/4 in. open-ended wrench
- 2.0 hex driver

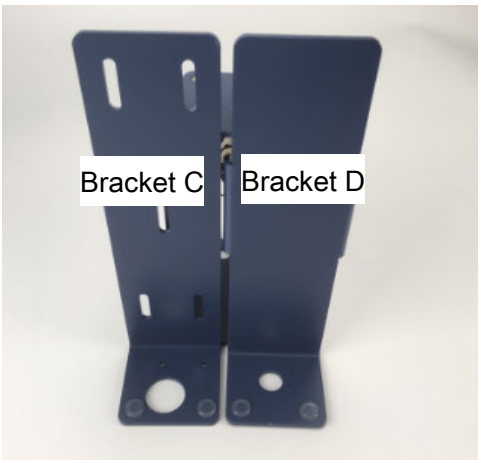


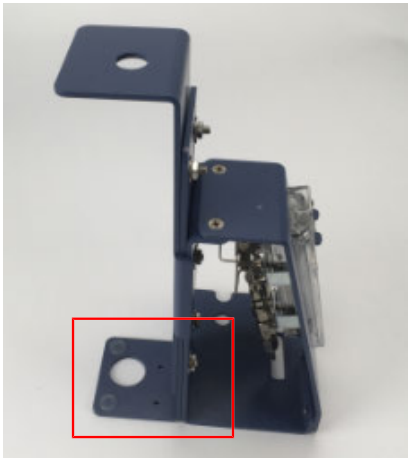
User supplied parts:

- vent tubing and fittings, if used
- 1/8 in. Swagelok type sample input tubing and female fittings

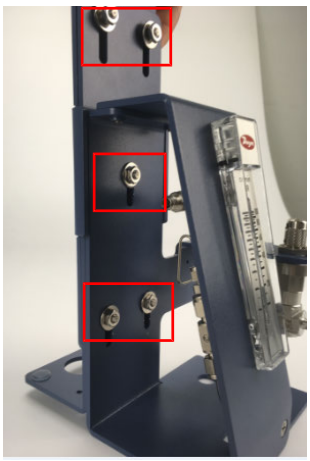
The cap plugs on the sample inlet and the sample vent of the pressure reducer and gas-liquid separator are not shown in the figure. They must be removed when performing this installation.

1. Turn off the instrument by following the system shutdown procedure in Shutdown Procedure [▷ 226].
2. Disconnect all the electrical cables, including the power cable and Ethernet cable, from the instrument.
3. Disconnect the sample gas connection(s), the carrier gas connection(s) and the venting connections from the instrument.
4. Ensure that Bracket C is positioned with two small holes at the bottom when in the upright position. If not, follow the procedure in Change Mounting Bracket Orientation [▷ 120] to adjust the mounting bracket orientation.





5 Set the five nuts on the mounting bracket to the positions shown. If the nut positions need adjustment, relax the nuts, adjust the mounting bracket and re-tighten the nuts using a 3/8 in. wrench.



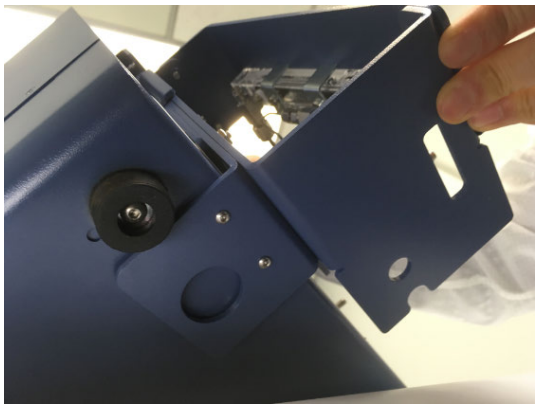
6 Clamp the mounting bracket on the instrument front, with the mounting bracket bottom to the right side of the instrument left front foot.



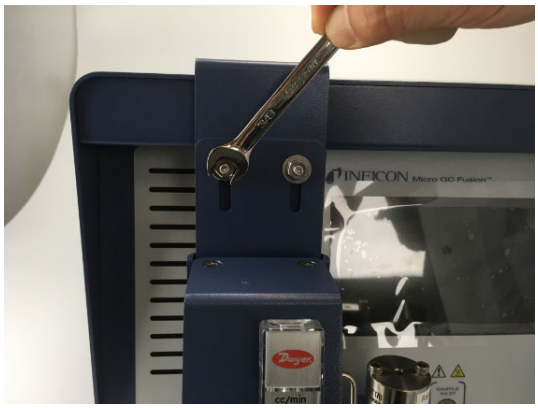


7 Put the two M3 screws (PN B3079191X) through the two small holes in the mounting bracket bottom and into the instrument chassis bottom with a 2.0 hex driver.

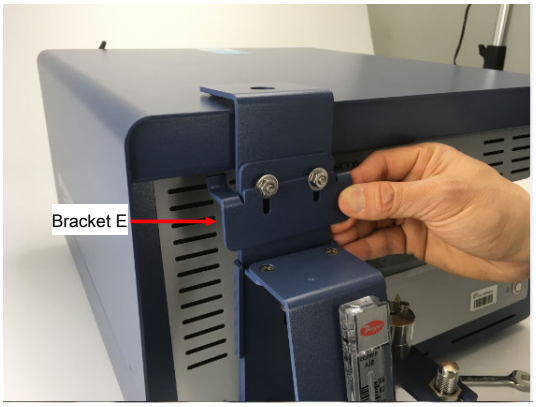




8 Loosen the top two nuts on the mounting bracket.

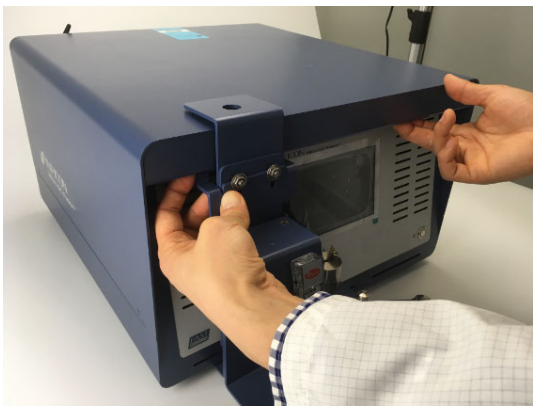


9 Slide in bracket E.



10 Fit the two inserts of bracket E into the air vent. Push or pull the front cover as required to align it into the air vent opening.





11 Tighten the two nuts using a 3/8 in. wrench to ensure that bracket E does not fall off.



12 Adjust and tighten all the nuts using a 3/8 in. wrench to fix the mounting bracket on the instrument chassis.

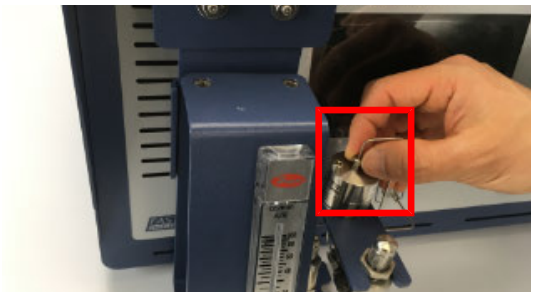


13 Put the Valco ferrule (PN 059-0335) and the nut (PN 059-0336) on the inlet tube.

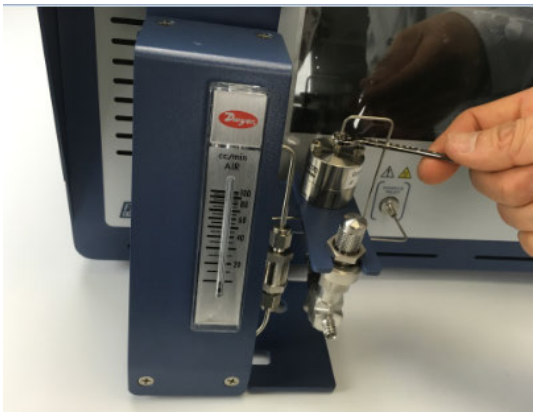




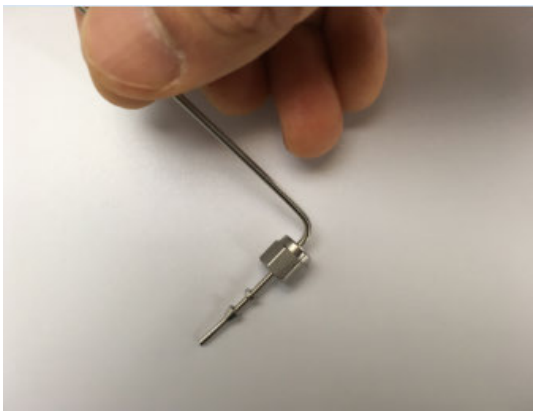
14 Insert the sample tubing with the Valco fittings into the fitting detail on the Genie filter. Push the tubing all the way into the detail, so that it seats firmly. Manually turn the nut into the detail until it is finger tight.



15 Using the 1/4 in. open-ended wrench, turn the nut 1/4 turn (90°) past the point where the ferrule first starts to grab the tubing. The amount of force required can vary considerably due to the friction between the nut and the treads and the composition and wall thickness of the tubing used.



16 Put the 5/16 in. Swagelok nut (PN 059-0696) and the 1/16 in. ferrule set (PN 059-0697) on the other end of the sample tube.



17 Insert the 1/16 in. sample tubing with the Swagelok fittings onto the instrument sample inlet.



18 Tighten 1/2 turn past finger-tight using the 5/16 in. wrench.



19 The pressure reducer and gas-liquid separator installation is complete. Reconnect the power cable, the Ethernet cable and the carrier gas lines.



20 Before connecting the pressurized sample to the device, close the metering valve by turning the dial fully clockwise to ensure no sample flow through the device when the pressurized sample is connected.



21 Install a user-provided 1/8 in. sample line with the female Swagelok fittings preinstalled.



22 Connect a vent line to the vent fittings using 1/8 in. Swagelok fittings. Run the exhaust to a fume hood or other designated area for hazardous waste disposal.



23 Slowly open the dial to allow the sample to flow through the device. Check the flow indicated on the flow gauge and set the limit to less than 100 mL/min.

24 Turn on Micro GC Fusion. The instrument is ready to perform an analysis.

NOTICE

If the flow rate through the device exceeds 100 mL/min, the output pressure from the device to Micro GC Fusion may exceed the acceptable pressure range, causing instrument damage.



⚠ WARNING

Safely vent carrier and sample streams—potentially toxic, noxious, asphyxiant (oxygen-displacing), or flammable gases—outside Micro GC Fusion and away from the operating area. Vent toxic gases to a fume hood, chemical trap, or reaction medium.

7.15.4 Change Mounting Bracket Orientation

1 Loosen the lower three nuts inside the mounting bracket using a 3/8 in. wrench.



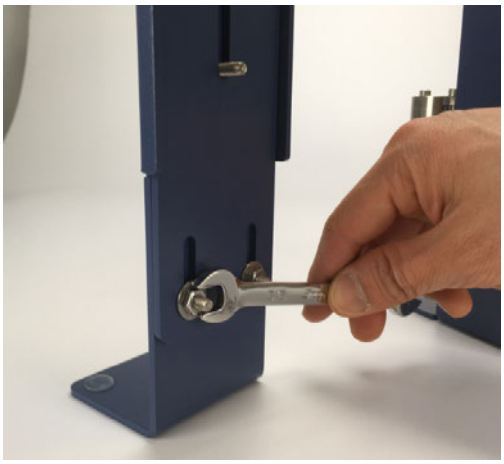
2 Turn the mounting bracket upside down.



3 Install the top two nuts in the back of the mounting bracket.



4 Remove the two bottom nuts.





5 Align the three holes and screws and then press the mounting bracket and the device together. Reattach the three nuts using a 3/8 in. wrench.



7.16 External Sample Conditioner

7.16.1 Introduction

Micro GC Fusion can be damaged by high pressure samples, especially those containing contaminants, such as condensing aerosols. The external sample conditioner (PN 952-004-G1) maintains the sample at > 50°C (122°F) and reduces the sample pressure from up to 5516 kPa (800 psi) down to approximately 0-172 kPa (0-25 psi) prior to the sample being introduced to Micro GC Fusion. This minimizes the introduction of contaminants and aerosols onto Micro GC Fusion.

The external sample conditioner can be installed on the front of a 2-module Micro GC Fusion and transported into the field for direct analysis.

NOTICE

The Micro GC Fusion external sample conditioner is designed for use indoors or in a covered area only.



NOTICE

Micro GC Fusion is intended for gas sampling only. Liquid injections will damage the instrument.



⚠ WARNING

Gas pressure on the external sample conditioner vent may be up to 5516 kPa (800 psi). Extreme caution must be taken when venting the high pressure sample to avoid personal injury.

NOTICE

The external sample conditioner is rated for 5516 kPa (800 psi) input sample pressure.



⚠ WARNING

Do not open the instrument case. There are no user-serviceable components within the instrument case. Dangerous voltages may be present whenever power is present. Refer all maintenance to qualified personnel.



⚠ CAUTION

Do not use the product in a manner not specified by the manufacturer. If the product is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.



⚠ CAUTION

Use caution when mounting the external sample conditioner to a fixed position. Ensure there is enough room to disconnect the power cord when needed.



⚠ WARNING

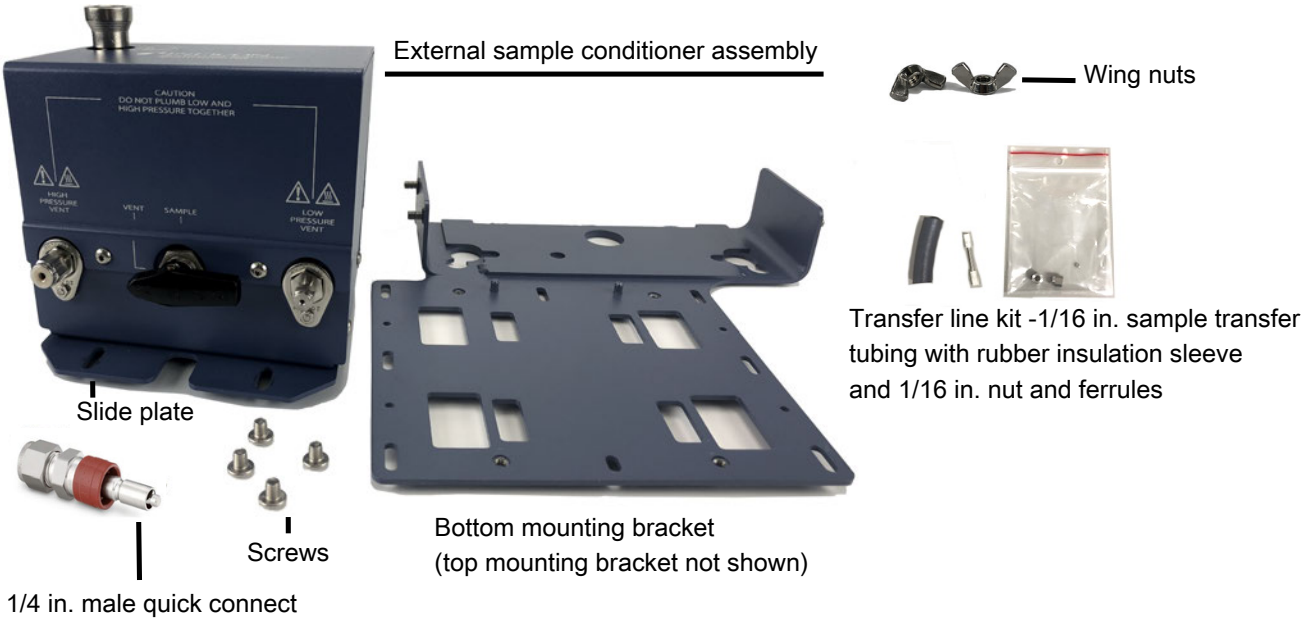
When working with chemicals, follow PPE guidelines listed in chemical safety data sheets (SDS).

7.16.2 Specifications

ESC sample inlet connection	1/4 in. Swagelok® female quick connect
Sample output temp to Micro GC Fusion	>50°C (122°F)
Maximum sample pressure	5516 kPa (800 psi)
Minimum sample pressure	14 kPa (2 psi)
Sample output pressure to Micro GC Fusion	0-172 kPa (0-25 psi)
High pressure venting connector	1/8 in. Swagelok
Low pressure venting connector	1/16 in. Swagelok
Filter	7 µm
Power input	85 to 264 V (ac), 47 to 63 Hz
Power output	24 V (dc), 6.67A, 160 Watts maximum
Operating temperature	0°C to 50°C (32°F to 122°F) ambient
Storage temperature	-20°C to 60°C (-4°F to 140°F) ambient
Relative humidity	5 to 95% (non-condensing)
Altitude	2,000 m (6,562 ft.)
Pollution degree	2 per EN 61010
Installation (overvoltage)	Category II per IEC 60664
Cleaning	Use a mild, non-abrasive cleaner or detergent. Ensure the cleaner does not enter the unit.

7.16.3 External Sample Conditioner Accessory Kit

Description	Quantity
External sample conditioner assembly	1
Slide plate	1
1/4 in. male quick connect (PN 059-0808S)	1
Screws	4
Bottom mounting bracket	1
Top mounting bracket (not shown)	1
Wing nuts (PN 144-374S)	4
Transfer line kit, includes 1/16 in. sample transfer tubing with rubber insulation sleeve and 1/16 in. nut and ferrules (PN 952-018-G1S)	1
Power supply (not shown, PN 033-0074S)	1



7.16.4 List of Required Tools

The following tools are user supplied:

- one 7/16 in. open-ended wrench for 1/8 in. connections
- one 5/16 in. open-ended wrench for 1/16 in. connections
- 2.5 mm hex driver
- 3.0 mm hex driver
- 1 in. open-ended wrench for filter replacement

7.16.5 Installation

⚠ CAUTION

Use caution when mounting the external sample conditioner to a fixed position. Ensure there is enough room to disconnect the power cord when needed.

The external sample conditioner can be installed on the 2-module Micro GC Fusion. The external sample conditioner is factory pre-assembled, and can be easily mounted onto Micro GC Fusion during instrument installation.

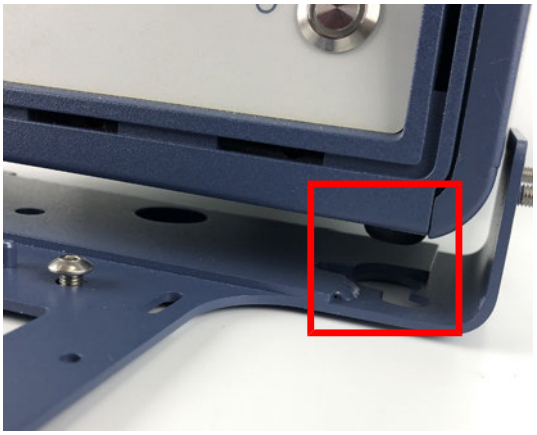
1. Verify that the contents of the accessory kit are correct.
2. Remove all of the parts from the packaging.
3. Attach the external sample conditioner slide plate to the bottom of the device using a 2.5 mm hex driver.



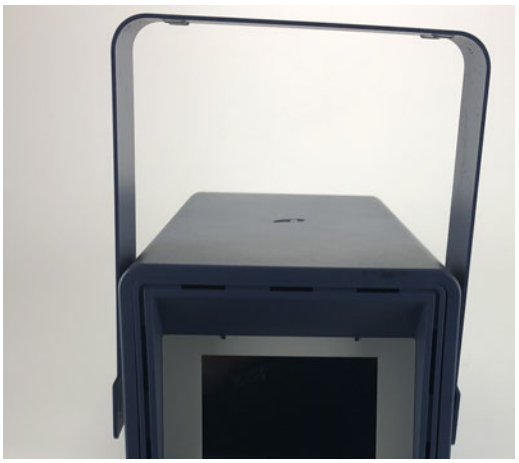
4. Attach the 1/16 in. sample transfer line with the rubber insulation sleeve onto the external sample conditioner using a 5/16 in. open-ended wrench.



5. Slide the bottom mounting bracket underneath Micro GC Fusion and align the feet with the dedicated holes.



6 Slide the top bracket over Micro GC Fusion and the threads from the bottom bracket.



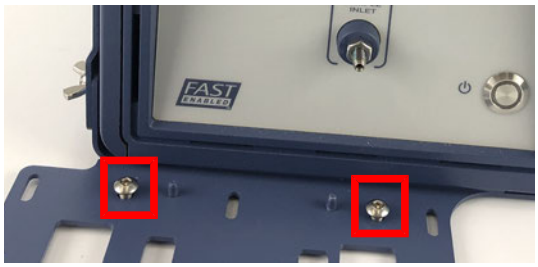
7 Align the screws on both sides of the chassis.



8 Place the wing nuts on the bottom bracket threads and hand-tighten. Ensure that the top bracket is pressed downward and is tightly secured to Micro GC Fusion.

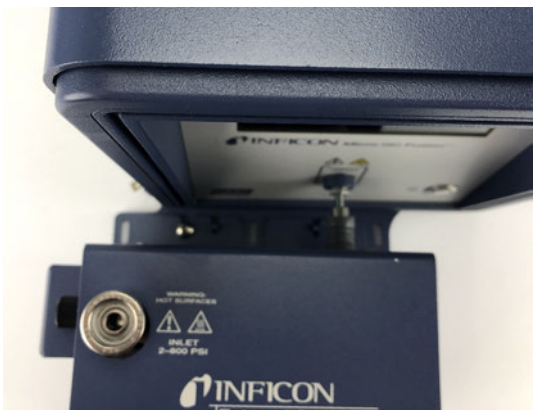


9 Using a 3 mm hex driver, slightly thread the M4 screws into the holes on the bottom bracket, near the chassis of Micro GC Fusion.

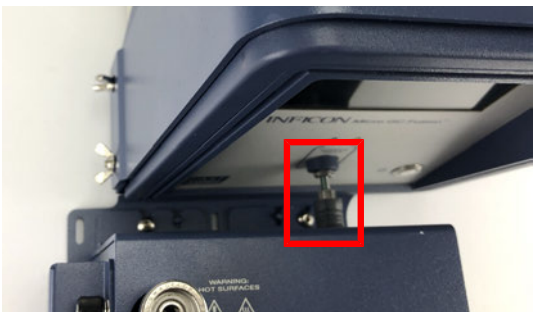


Allow enough space for the external sample conditioner slide plate to fit under the screw head.

10 Place the external sample conditioner, with the slide plate and the sample transfer line, onto the bottom bracket.



11 Gently push the device toward the instrument until the transfer line reaches the front inlet of Micro GC Fusion.



12 Loosely thread the front screws into the slide plate using a 3.0 mm hex driver.



13 Tighten the transfer line nut to the front inlet of Micro GC Fusion, ¼ turn past finger-tight using a 5/16 in. wrench.



14 Slide the rubber insulation sleeve in place to cover the entire inlet line and nut.

15 Tighten the front and rear slide plate screws using the 3.0 mm hex driver.





16 Attach a 1/8 in. vent line to the HIGH PRESSURE VENT. Tighten it with a 7/16 in. open-ended wrench.

⚠ WARNING

Gas pressure on the HIGH PRESSURE PURGE VENT may be up to 5515 kPa (800 psi). Extreme caution must be taken to avoid personal injury.



17 Attach a 1/16 in. vent line to the LOW PRESSURE VENT. Tighten it with a 5/16 in. open-ended wrench.

⚠ CAUTION

Do not plumb low and high pressure together.



18 (Optional) Use the holes in the bottom bracket to mount securely to a horizontal surface. Mounting hardware is not included.

19 Attach the power connector to the side of the external sample conditioner.



20 Plug in the power cord to the power supply and connect to an AC power source.



⚠ CAUTION

Only replace the power cord with proper approved cords or contact INFICON to purchase a replacement cord.



⚠ WARNING

Safely vent sample stream vent ports using the appropriate sized tubing for each connection. Potentially toxic, noxious, asphyxiant (oxygen displacing), or flammable gasses should be vented outside Micro GC Fusion and away from the operating area. Vent toxic gases to a fume hood, chemical trap, or reaction medium.

8 Connecting to a Sample

8.1 Introduction

Micro GC Fusion allows for a variety of sampling techniques including the use of syringes, sample bags, or pressurized cylinders.

8.2 Purging the Sample Path

To obtain an accurate analysis of the sample, always purge the sample line with the sample before connecting it to the sample inlet to remove residual gas in the sample line.

8.3 Front Sample Inlet

Micro GC Fusion provides flexible inlet options. Depending on the configuration and chassis type, sample gas may be introduced through a front sample inlet or through a sampling accessory, such as the Genie Filter Pressure Reducer, or the External Sample Conditioner.

8.3.1 Front Sample Inlet

The front sample inlet is a 1/16 in. Swagelok male connector. It connects the sample to one or more GC modules, allowing for parallel analyses on multiple GC modules. The front sample inlet is heated and deactivated to avoid sample condensation and adsorption.

NOTICE

Sample inlet gas pressure must be less than 172 kPa (25 psi).

Exceeding 172 kPa (25 psi) will damage Micro GC Fusion and require factory repair.



⚠ WARNING

Micro GC Fusion has a heated inlet which is hot to the touch.

8.4 Sampling Using Gas Cylinders and Canisters

Gas cylinders and canisters can be connected directly to the 1/16 in. Swagelok or 1/8 in. Quick Connect sample inlet on the External Sample Conditioner.

NOTICE

Sample inlet gas pressure must be less than 172 kPa (25 psi).

Exceeding 172 kPa (25 psi) will damage Micro GC Fusion and require factory repair.

NOTICE

The external sample conditioner is rated for 5516 kPa (800 psi) input sample pressure.

8.5 Sampling Using Syringes

Use syringes that are gas tight, accurate and have a low dead volume. The syringe must also be compatible with the Micro GC Fusion 1/16 in. Swagelok front inlet. The following are the general steps to sample using a syringe.

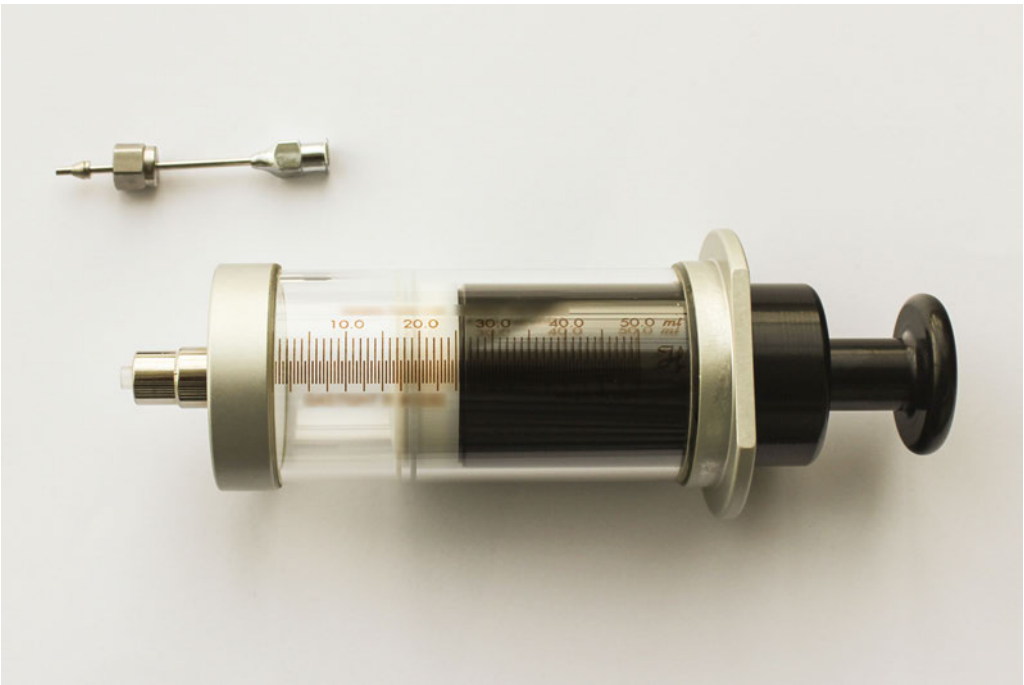
1. Connect the syringe to the gas source.
2. Fill the syringe with sample gas by drawing the syringe plunger to the desired volume.
3. Disconnect the syringe from the sample gas, and connect it to the GC inlet.
4. Depress the plunger using a slight pressure to inject when the GC is ready to sample.

8.5.1 Syringe Sampling Kits

The Ship Kit - Syringe Luer Adapator (PN 952-024-G1) includes a luer fitting which will adapt the PTFE luer lock termination on the gas tight syringe to the 1/16 in. sample inlet on Micro GC Fusion. The short needle on the adaptor allows for a quick transfer of the sample from a syringe into Micro GC Fusion.

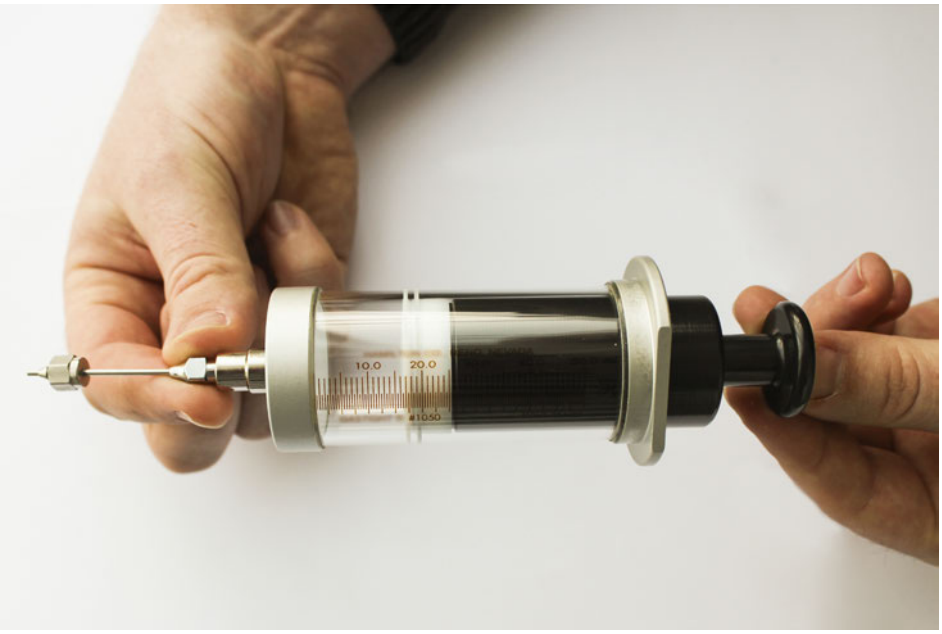


The Ship Kit 50 mL Syringe and Luer Adaptor (PN 952-025-G1) includes a 50 mL gas tight syringe with PTFE luer lock termination and a Syringe Luer Adaptor (PN 952-024-G1).



8.5.2 Installing a Syringe Luer Lock Adapter onto a Gas-Tight Syringe

1. Attach the Luer fitting of the Syringe Luer Adapter (PN 952-024-G1) to the PTFE Luer lock termination of the gas-tight syringe.
2. Turn the Luer fitting on the Syringe Luer Adapter clockwise until finger-tight.



8.6 Sampling Using Bags

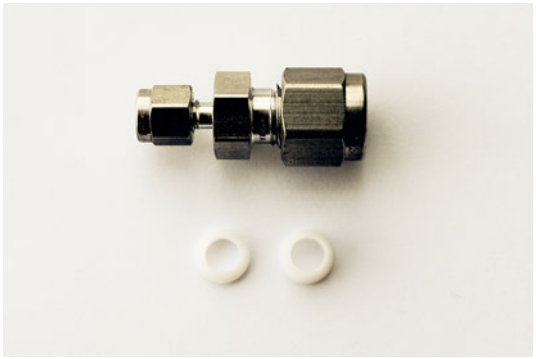
1. Open a new sample bag.
2. Connect the sample bag to the sample source.
3. Open the sample source.
4. Fill the sample bag, close it, and disconnect from the sample source.
5. Close the sample source.
6. Connect the sample bag to the Micro GC Fusion inlet using stainless steel or Teflon tubing.

An adapter may be required to connect the tubing to the Micro GC Fusion 1/16 in. Swagelok front inlet.

7. Open the sample bag when the GC is ready to sample.

8.6.1 Sample Bag Sampling Kits

The Ship Kit - SS Adapter for Sample Bag (PN 952-026-G1) includes a 3/16 in. to 1/16 in. stainless steel reducing union (PN 059-0298), a Teflon front ferrule (PN 059-0263) and a Teflon back ferrule (PN 059-0264) to adapt the polypropylene tube fitting on a sample bag to a 1/16 in. stainless steel sample line.

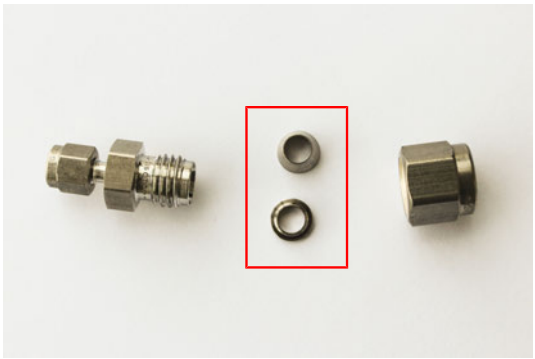


The Ship Kit - SS Adapter and 10/Pack 3L Sample Bag (PN 952-027-G1) includes one Ship Kit - SS Adapter for Sample Bag (PN 952-026-G1) and ten 3 L sample bags with polypropylene screw cap valve (PN 070-1726).

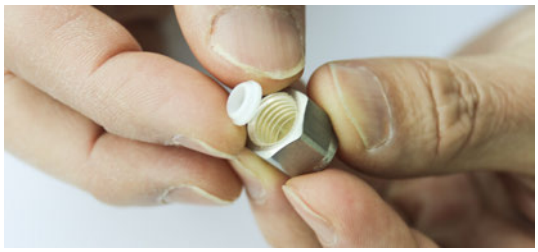


8.6.2 Installing a SS Adapter onto a Sample Bag

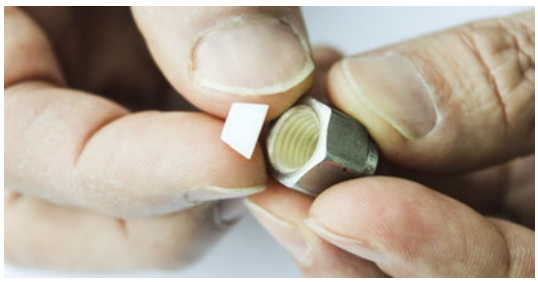
1. Remove the 3/16 in. nut from the reducing union (PN 059-0298).
2. Remove the stainless steel front and back ferrules from the 3/16 in. stainless steel nuts.



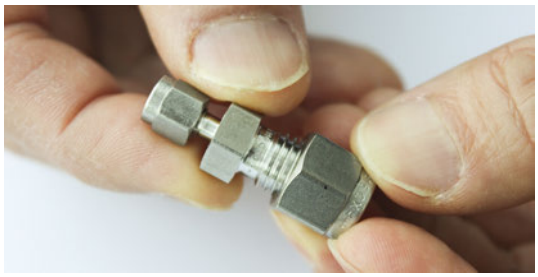
3. Place the Teflon front ferrule and the Teflon back ferrule into the 3/16 in. stainless steel nut.
   ⇨ Place the Teflon back ferrule into the nut with the narrow end facing outwards.



⇨ Place the Teflon front ferrule into the nut with the narrow end facing outwards. The two ferrules are designed to fit together.



4 Screw the 3/16 in. stainless steel nut with the Teflon ferrules back into the reducing union (PN 059-0298).



5 Insert the 1/4 in. tube fitting on the 3 L sample bag into the 3/16 in. end of the SS Adapter for the Sample Bag and screw clockwise until finger-tight.



8.7 Sampling Using the Gas-Liquid Separator

The gas-liquid separator provides gas-liquid separation through a Genie filter. Refer to Installing the Gas Liquid Separator [▶ 88] for the device installation procedure.



NOTICE

Sample inlet gas pressure must be less than 172 kPa (25 psi).

Exceeding 172 kPa (25 psi) will damage Micro GC Fusion and require factory repair.

8.8 Sampling Using the Pressure Reducer and Gas-Liquid Separator

The pressure reducer and gas-liquid separator (PN 952-033-G1) reduces sample pressure and filters out liquid particulates in the sample. The maximum sample input pressure is 3450 kPa (500 psi). Refer to Pressure Reducer Genie Filter and Gas-Liquid Separator [▶ 97] for the device installation procedure.



NOTICE

The gas-liquid separator filters out liquid droplets in a gas sample. It is not intended for liquid injections.

8.9 Sampling Using the External Sample Conditioner

1. Attach a 1/4 in. male Quick Connect (PN 059-0808S) to the sample line.
2. Set the sample line pressure regulator to < 5515 kPa (800 psi).



⚠ WARNING

A pressure regulator must be present on the sample line to ensure that the sample does not exceed 5515 kPa (800 psi).

3. Attach the 1/4 in. male Quick Connect to the external sample conditioner female quick connect port. It will click into place.



4. Before turning the sample on, ensure the manual valve is in the **Vent** position.





⚠ WARNING

Safely vent sample stream vent ports using the appropriate sized tubing for each connection. Potentially toxic, noxious, asphyxiant (oxygen displacing) or flammable gasses should be vented outside Micro GC Fusion and away from the operating area. Vent toxic gases to a fume hood, chemical trap, or reaction medium.

5 Turn the sample on and purge for the desired time to ensure an accurate sample. This time will vary depending upon amount of sample available and the length of the sample line.



⚠ WARNING

Gas pressure on the HIGH PRESSURE PURGE VENT may be up to 5515 kPa (800 psi). Extreme caution must be taken to avoid personal injury.

6 Turn the manual valve to the **Sample** position.

7 Conduct a run using Micro GC Fusion software.

8 When finished with the sample, shut off the gas source.

9 To depressurize the system, slowly turn the manual valve halfway towards the **Vent** position.

10 Monitor the pressure regulator on the sample line. When the regulator reads 0 psi, the external sample conditioner is depressurized and it is safe to remove the sample line.

11 Press on the female Quick Connect fitting to release the sample line.

9 Front Panel Operation

9.1 Introduction

The front panel display on Micro GC Fusion can be used to:

- load a method or a sequence
- run a method or a sequence
- view reports and chromatograms
- view the system status

More detailed operation such as editing a method, viewing previous runs, editing integration events, and entering calibration data can only be performed by connecting an external computer or tablet.

The front panel user interface described in this section references features delivered in Fusion software v1.8 release.

9.2 Launch Software

The Micro GC Fusion front panel display turns on when the **On/Standby** button is pressed. A splash screen is displayed.

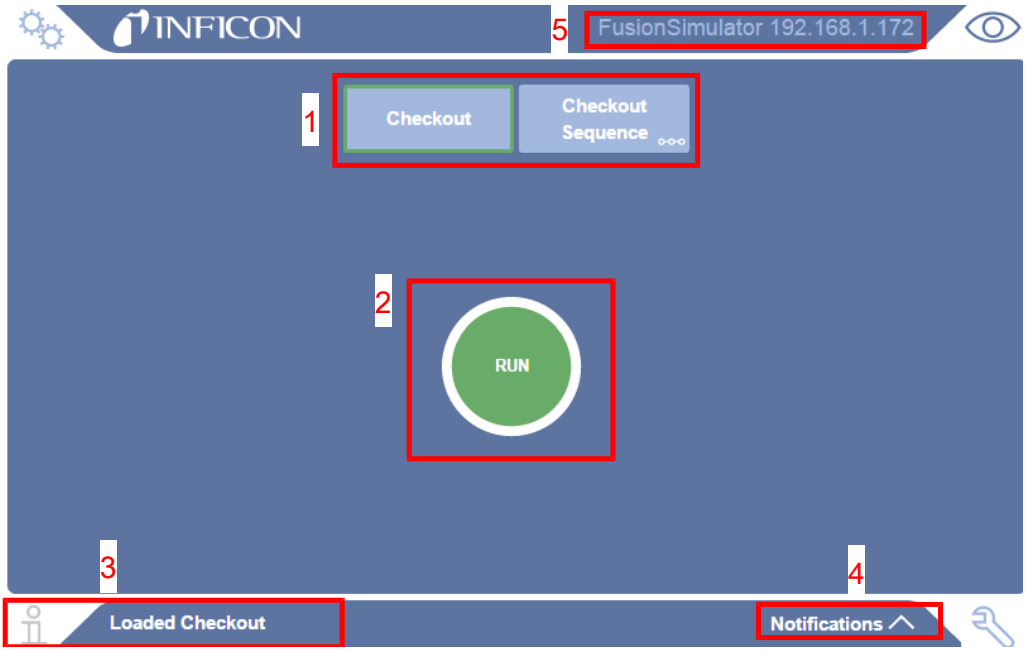


Once the system completes activation, the main page is displayed.

The following table illustrates the icons on each corner of the front panel display.

Icon	Name	Enabled on Front Panel Display (Y/N)	Function
	Home	Y	Return to the main operation screen
	Gear	Y	Access stored report and chromatogram
	Information	N	Access to Micro GC Fusion Operating Manual
	Wrench	Y	Access to system status

The figure and table below illustrate the labels and buttons on the front panel display.



Item	Name	Function
1	Method or Sequence Preset Buttons	Provides access to stored methods or sequences
2	RUN Button	Initiates a sample run based on the loaded method or sequence
3	Method or Sequence Loaded	Displays the loaded method or sequence
4	Notifications Label	Displays system status or error messages
5	Hostname and IP Address Label	Displays the instrument network hostname and IP Address

9.3 Select and Load a Method or Sequence

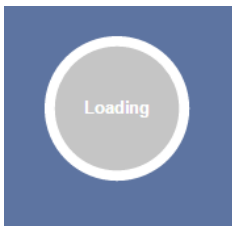
A method or sequence can be loaded on Micro GC Fusion by selecting the corresponding method or sequence preset button in the **Run** tab on the front panel display.

Methods and sequences can be loaded onto the Micro GC Fusion front panel display via the web-based software. See Software Operation [▷ 148].

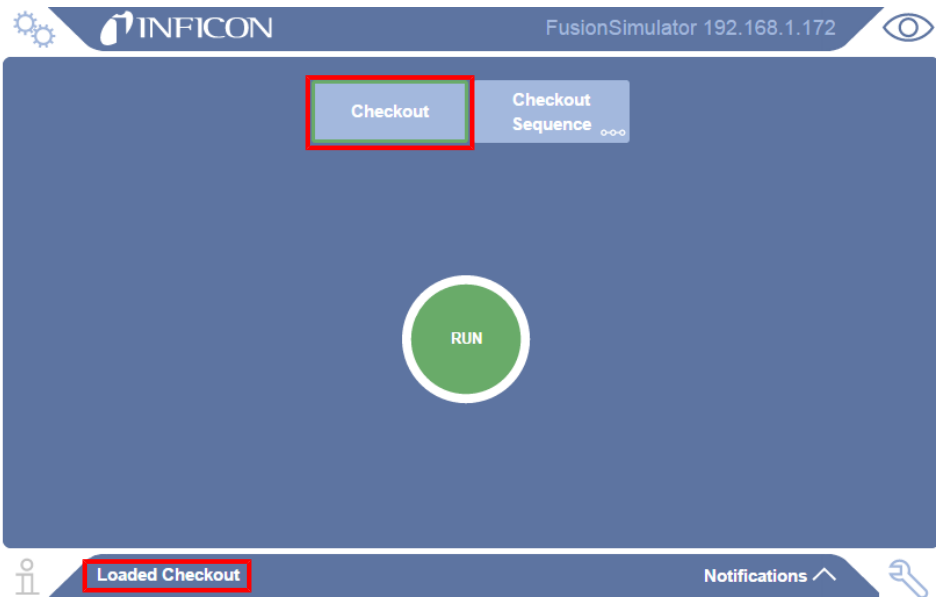
Methods cannot be created or edited on the Micro GC Fusion front panel display. See Method Development [▷ 150], to develop a method on a tablet or computer.

Perform the following steps to load a method or sequence onto the front panel display.

1. Select the desired method or sequence preset button on the front panel display.
2. The center button will display **Loading** until the instrument has reached the programmed method setpoints. Load times may vary depending on the method parameters.



3. The selected method or sequence is framed in green. The method and/or sequence name displays on the front panel.



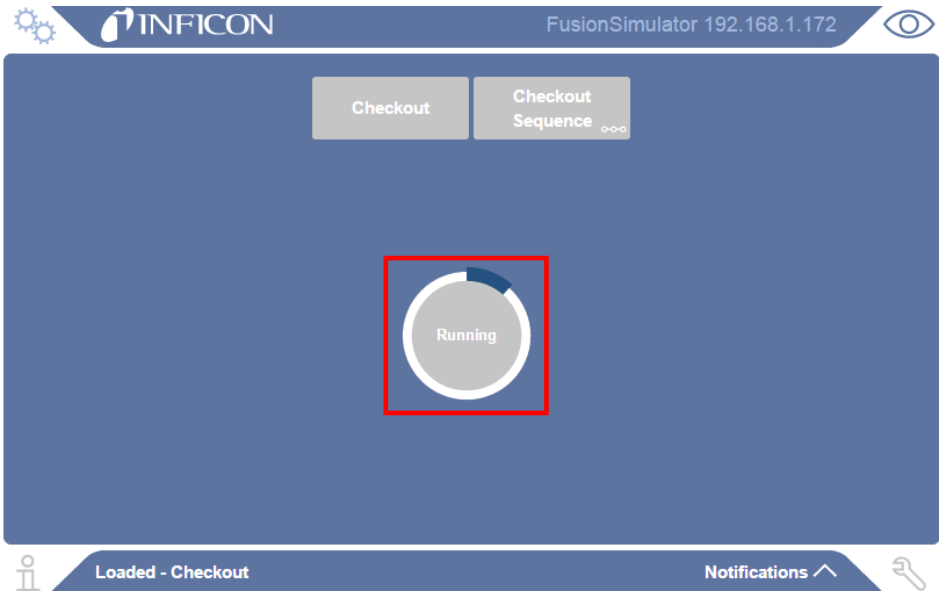
9.4 Run a Loaded Method or Sequence

Perform the following steps to run a loaded method or sequence from the Micro GC Fusion front panel display:

1. Ensure the desired method or sequence is loaded. If not, load the desired method or sequence by following the steps in Select and Load a Method or Sequence [▶ 142].
2. Tap the green **RUN** button to begin a sample run.



3. The **RUN** button displays **Running** and the process of the run is indicated by the movement of the blue band on the circumference of the button.



4. Once the run is completed and the starting method conditions are met, the green **RUN** button reappears.

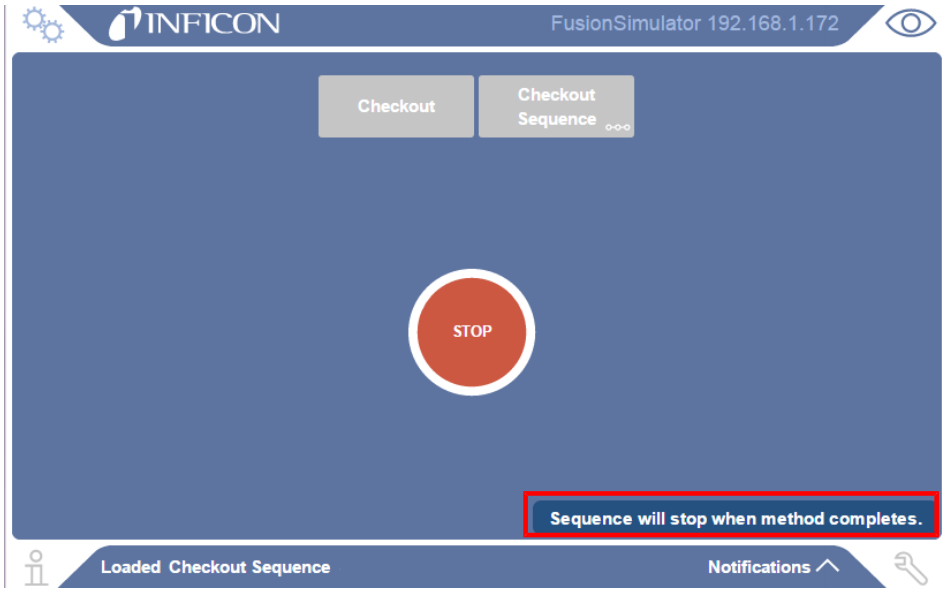
9.5 Stop a Sequence

Multiple runs may be programmed into a sequence. Once a sequence is started, the green **RUN** button on the Micro GC Fusion front panel display changes to a red **STOP** button, which can be used to stop a running sequence.

1 While a sequence is running, tap the **STOP** button to abort the sequence.

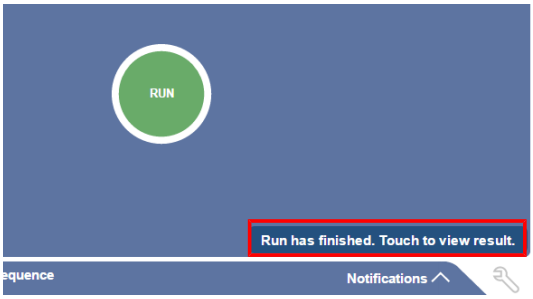


2 Micro GC Fusion finishes the current run and returns to the initial state of the currently loaded method. This may take a few minutes depending on the progress and duration of the interrupted method. A notification is displayed advising the sequence will stop when the current run completes.



9.6 View Results

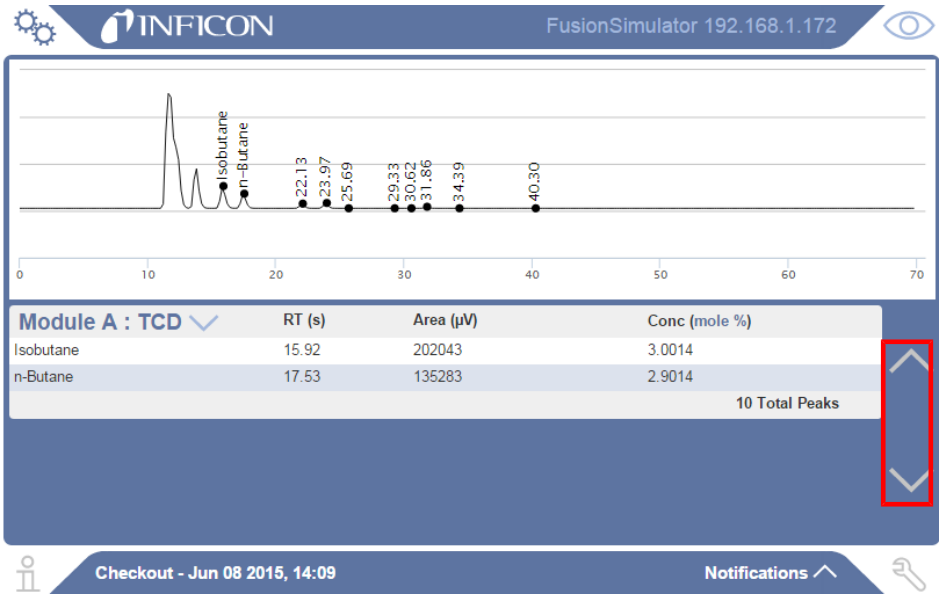
1 When a run is completed, a notification is displayed. Tap the notification message to enter the report window.



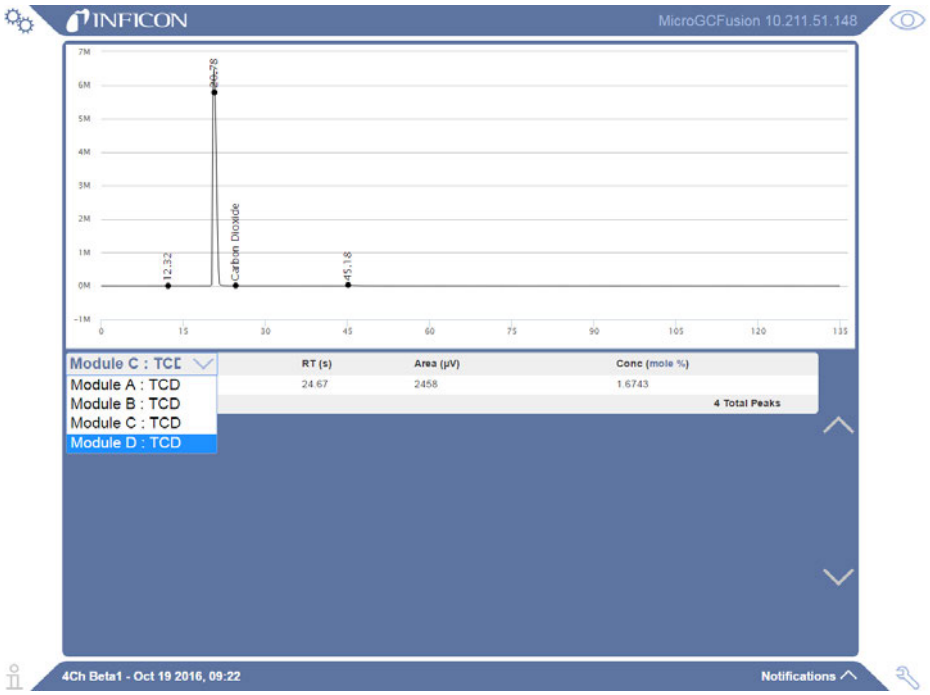
2 Alternately, tap the icon, followed by **View Result** to view the report.



3 The chromatogram displays on the top half of the screen. A table of the compound names, RT(s) (retention time in seconds), Area (µV) (peak area in µV), and Conc (mole %) or Conc (ppm) (concentration in mole% or ppm) is displayed. Tap the and icons on the right to scroll up or down.

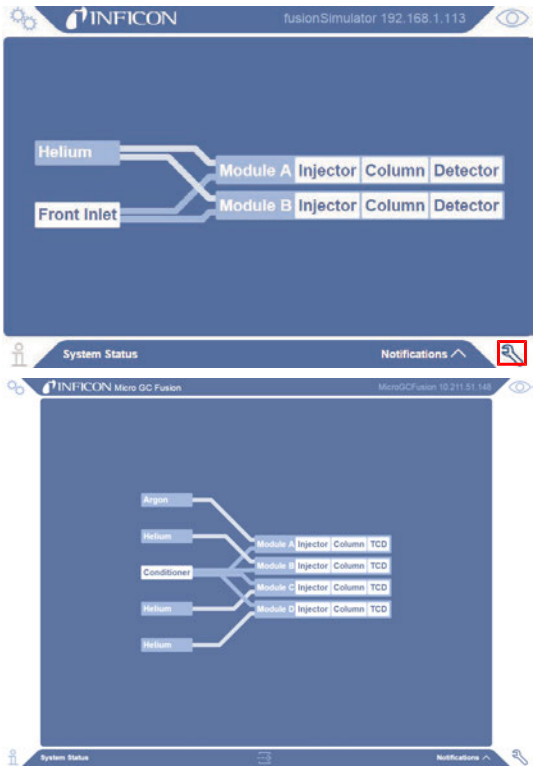


4 To optimize screen resolution, the table only displays analysis results for one module at a time. The user can select which module to display using a drop down control. Tap the module name to select the analysis result on a different module.



9.7 View System Status

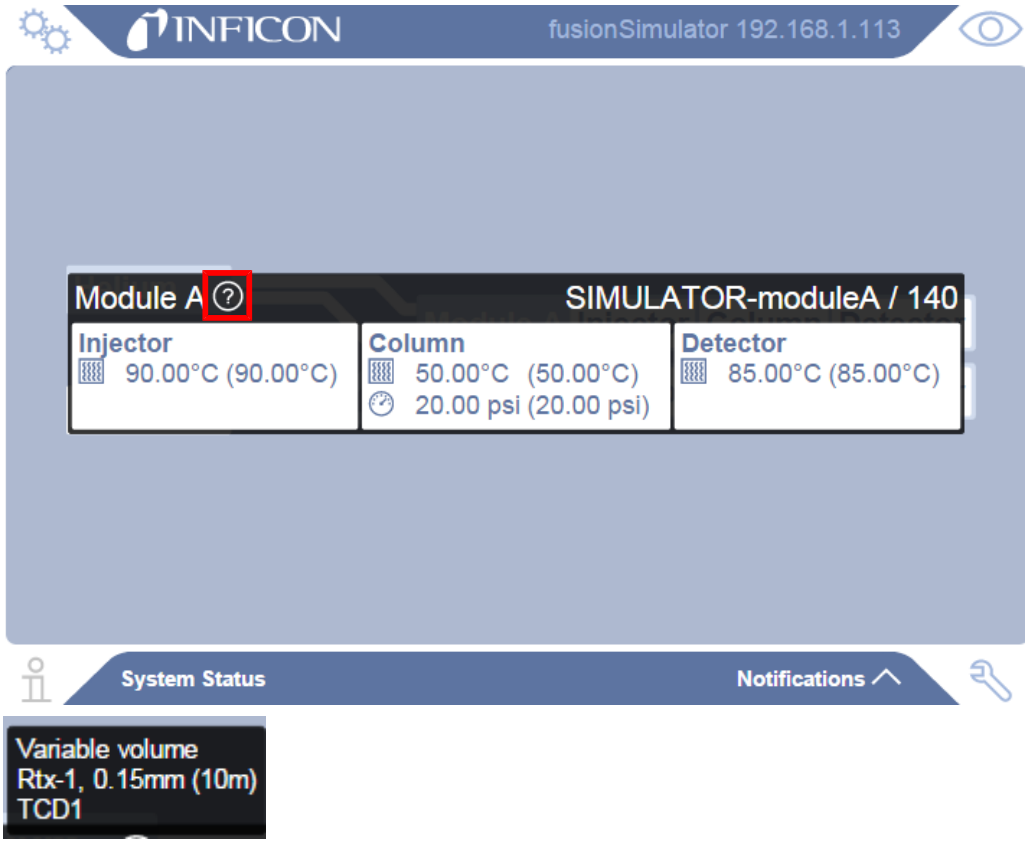
Tap the icon to display the **System Status** screen. Tap the desired module.



The following information is displayed:

- module serial number and part number
- installed module information
- temperature and pressure set points and real time readings

Once a method starts loading, the actual temperature and pressure readings equilibrate to the set points defined in the method. The System Status window displays both the set points and the actual readings of the temperatures and pressures for the Micro GC Fusion analytical components.



9.8 Front Panel Language

Micro GC Fusion provides the option of using the English or Chinese language on the front panel display. Refer to Front Panel Language Selection [▶ 87] for the procedure to change the language setting.

10 Software Operation

10.1 Connecting to a Computing Device

Micro GC Fusion connects to a computer via a standard Ethernet cable or via a wireless connection.

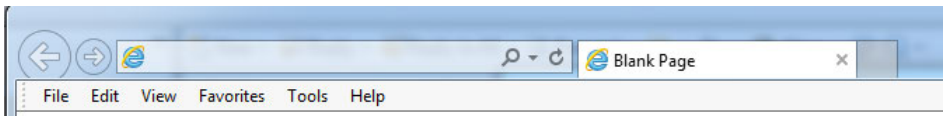
Refer to User Interface [▶ 41] for a list of the minimum hardware display and browser requirements.

The software user interface described in this section references features delivered in the Fusion software v1.8 release.

10.2 Launch Software User Interface

To access the Micro GC Fusion software user interface:

1. Open a supported web browser on a computer or tablet. (Refer to Computer Web Browser Requirement [▶ 42].)
2. Type **http://** followed by either the Micro GC Fusion hostname or IP address in the web browser address bar.



Bonjour Print Service for Windows is required for a Windows computer to recognize the hostname in a web browser. The software is available at https://support.apple.com/kb/DL999?locale=en_US.

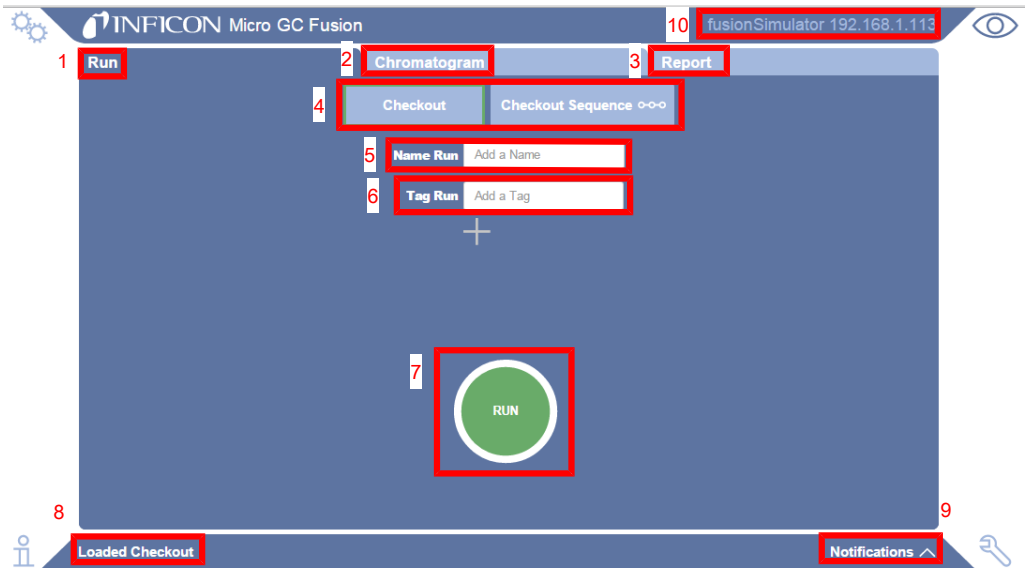
The default hostname from the factory is <Instrument Serial Number>.local.

3. Press the **Enter** key. The Micro GC Fusion main page is displayed.

The table below illustrates the icons on each corner of the page.

Icon	Name	Enabled (Y/N)	Function
	Home	Y	Returns to the main operation screen
	Gear	Y	Access stored report and chromatogram via the Data Browser Access to method editor and system configuration Access to the run scheduler
	Information	Y	Access to operating manual
	Wrench	Y	Access to system status

The figure and table below illustrate the tabs, labels and buttons on the main page.



Item	Name	Function
1	Run tab	Displays the method or sequence preset buttons and the **RUN** button
2	Chromatogram Tab	Displays the chromatogram of the current run in real time
3	Report Tab	Displays the analysis result of the last completed run
4	Method/Sequence Preset Button	Provides access to stored methods or sequences
5	Name Run	Allows the user to enter the desired analysis name
6	Tag Run	Allows the user to enter desired analysis tags
7	**RUN** button	Initiates a sample run based on the loaded method or sequence

Item	Name	Function
8	Method Loaded Label	Displays the currently loaded method or sequence
9	Notifications Label	Displays system status or error messages
10	Hostname and IP Address Label	Displays the instrument network hostname and IP address

10.3 Micro GC Fusion Workflow

The following outlines key steps in the Micro GC Fusion workflow:

1. Method Development.
2. View Instrument Status.
3. Run Method.
4. View Chromatogram.
5. View Report.
6. View Data Browser.
7. Calibration.
   - ⇨ Integration Parameters.
   - ⇨ Single Point Calibration.
   - ⇨ Multi Point Calibration.
   - ⇨ Automatic Recalibration.
8. Reprocess Runs.

10.4 Method Development

Methods can be created, copied, and edited from the Methods/Sequences window.

1. Click the icon.
2. Click **Methods/Sequences**. A list of methods is displayed.



Item	Name	Function
1	Name column	Displays the user defined methods and sequences
2	Preset	Allows selection of pre-defined method and sequence names to be displayed on the main page

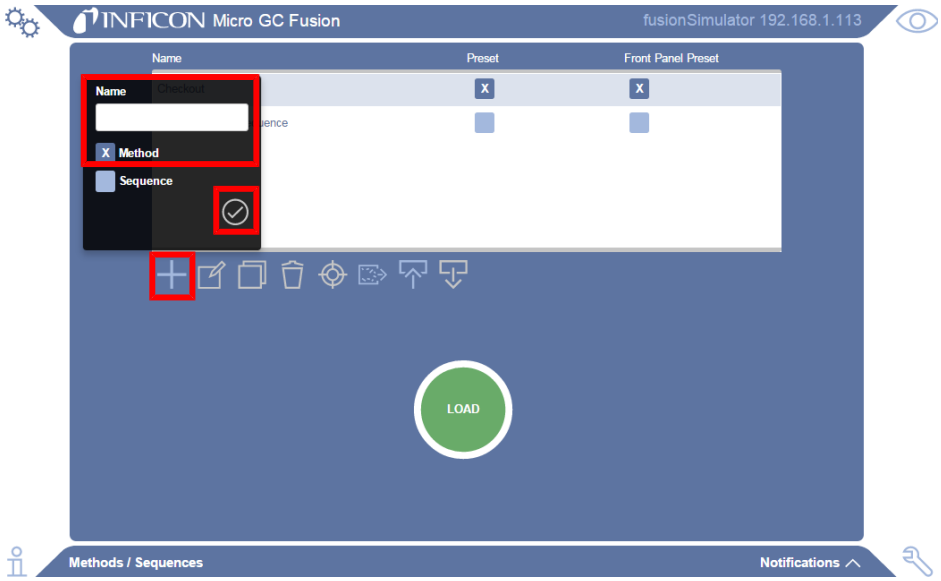
Item	Name	Function
3	Front Panel Preset	Allows selection of pre-defined method and sequences names to be displayed on the front panel display

The table below illustrates the icons for method and sequence options.

Item	Name	Function
	Add Method or Sequence	Allows for the creation of a method or sequence
	Edit	Edits selected method
	Copy	Copies selected method
	Delete	Deletes selected method
	Calibrate	Displays the calibration interface
	Bakeout	Sets a column bakeout for a desire duration in minutes
	Import Method	Imports a method from a computer onto Micro GC Fusion
	Export Method	Exports the selected method to the computer

10.4.1 Add Method

1. Click the  icon.
2. In the window, enter a method name in the **Name** field.
3. Select the **Method** option.
4. Click the  icon.

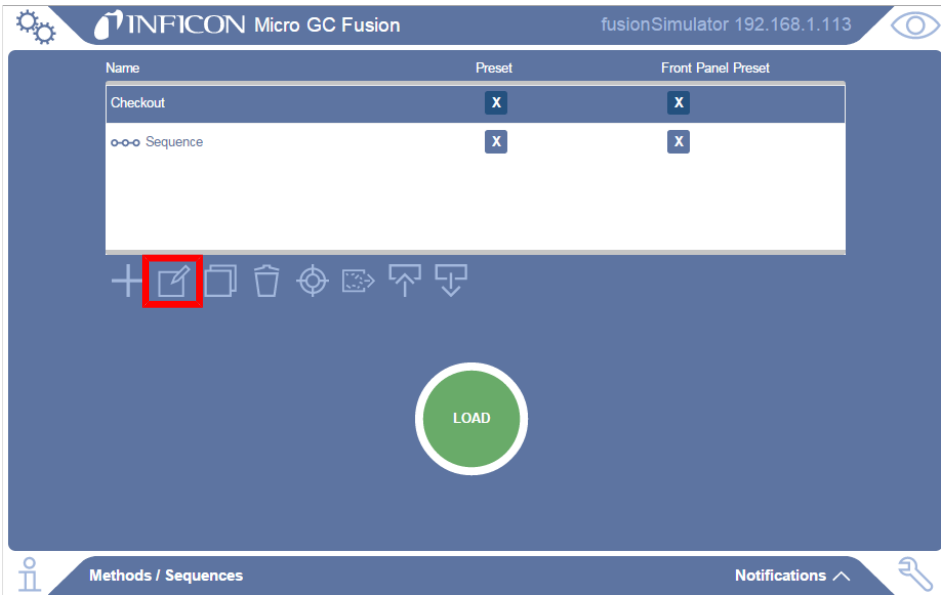


5 The **Method Editor** window is displayed.

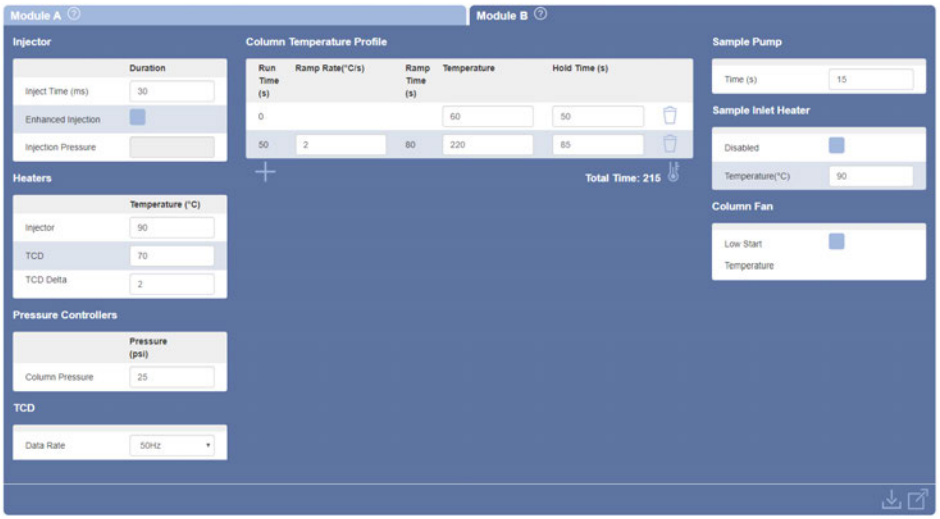
10.4.2 Edit Method

1 In the **Method/Sequences** window, select the desired method.

2 Click the icon to edit the highlighted method. The **Method Editor** window is displayed.



3 In the **Method Editor** window, edit method parameters of each GC module.



Continuous mode is not available with backflush module. Enhanced injection is not available with backflush and fixed volume injectors.

4 When finished editing the method parameters, click the icon to save the method or click the icon to leave the method editor without saving.

The number of module tabs is dependent on the instrument configuration. In a 2-module Micro GC Fusion system, either one or two module tabs (corresponding to Module A and Module B, if configured) will be present. In a 4-module Micro GC Fusion system, either three or four module tabs (corresponding to Module A, Module B, Module C and Module D, if configured) will be present.

To display the module injector, column, and detector information, hover the mouse over the icon next to the corresponding Module tab.

Method Parameter	Unit	Description
Inject (ms)	ms	Duration the injector valve is open to allow sample to enter the column
Injector	°C	Temperature of the injector
Enhanced inject	N/A	Changes the injection pressure to increase peak area and height for low level components. NOTE: Not available with backflush or fixed volume injectors.
Injection pressure	psi	The additional pressure for enhanced injections. This parameter can be set between10 to 50, or disabled. NOTE: Not available with backflush or fixed volume injectors.

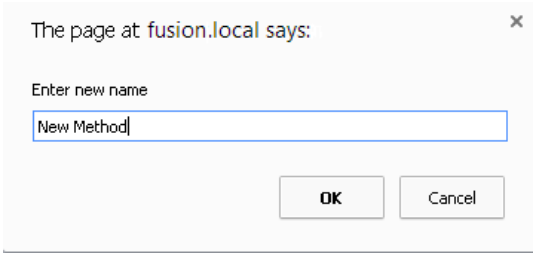
Method Parameter	Unit	Description
Backflush time (if configured)	s	Time between sample injection and injector backflush action to vent undesired compounds from the pre-column
TCD	°C	Temperature of the TCD
TCD delta	°C	The amount the TCD is allowed to vary before becoming "Ready." Can be set up to 50°C
Column pressure	psi (or kPa)	Carrier gas pressure applied at the column head to direct sample gas into the analytical column.
Data rate	Hz	Detector signal data points per second Note: For optimal separation on the Rt-Q-Bond and Rt-Alumina columns, use a data rate of 100 Hz or greater.
Ramp rate	°C/s	Temperature ramp rate of analytical column
Column temperature	°C	Temperature set point(s) of the analytical column
Hold time	s	Duration the column remains at the desired temperature
Temperature profile	N/A	Click on the  icon to display the column temperature profile.
Sample pump time	s	Duration that the sample pump pulls sample into the instrument
Continuous	N/A	Disables sample pump and allows sample to continuously flow through the injector, assuming positive sample pressure NOTE: Not available with backflush modules
Sample inlet heater disabled	N/A	Disables the sample inlet heater
Sample inlet heater temperature	°C	Temperature set point of the sample inlet
Low start temperature	N/A	Starts the column fan to allow Micro GC Fusion to start the run at a lower temperature
Sample conditioner enable heater	N/A	Enables the sample conditioner (if installed)
Sample conditioner purge time	s	Duration that the sample conditioner is purged (if installed)
Sample conditioner flow rate	N/A	Sets the sample conditioner purge flow rate to low or high (if installed)

Column Length	Maximum Ramp Rate
8 m	5°C/s
10 m	4°C/s
> 10 m	2.5°C/s

Micro GC Fusion is equipped with the Fusion Auto-Sensing Technology, known as *FAST Enabled*, automatically adjusts the gain of the detector during a sample run, providing fast and accurate analyses of gases within a large concentration range. Prior to being *FAST Enabled*, the instrument provided standard or high sensitivity settings to detect high ppm to percentage and low ppm to high ppm components, respectively.

10.4.3 Copy Method or Sequence

1. In the Methods/Sequences window, select the desired method or sequence.
2. Click the icon.
3. In the **Enter new name** field, type a new method or sequence name and click OK.



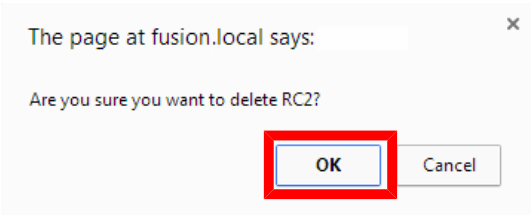
4. Refresh the screen using the browser's refresh function to display the copied method in the methods list. Alternately, press F5 on the keyboard.

10.4.4 Calibrate Method

In the **Methods/Sequences** window, click the icon to display the calibration interface. See Calibration [▶ 184].

10.4.5 Delete Method/Sequence

1. In the **Method/Sequences** window, select the desired method.
2. Click the icon.
3. Click **OK** to confirm the deletion.



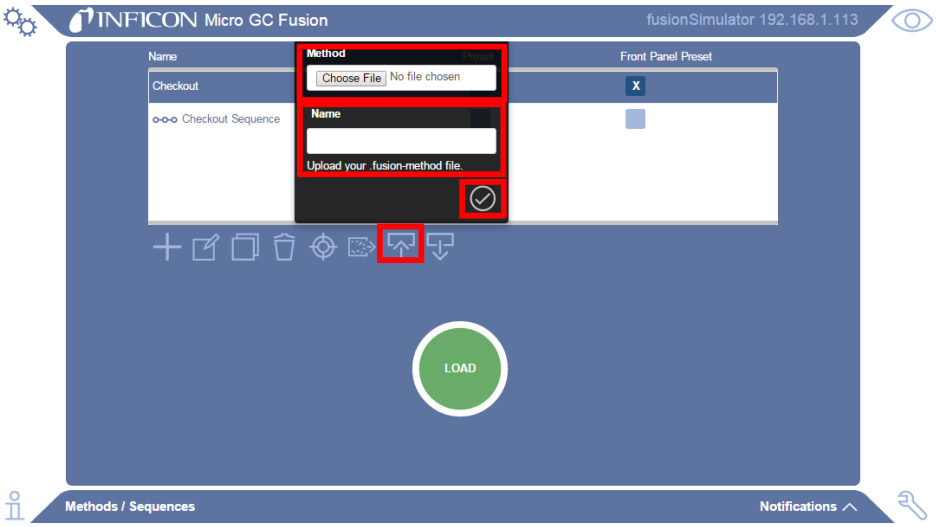
NOTICE

Deleting a method from the Method Editor permanently removes the method data. Export and archive the method(s) periodically to avoid data loss. See Export Method [▶ 156].

10.4.6 Import Method

1 In the **Methods/Sequences** window, click the icon.

2 In the **Method** window, click **Choose File**.



3 Navigate to locate the desired method file.

4 Type the method name in the **Name** field.

5 Click the icon to complete the method upload action.

10.4.7 Export Method

1 In the **Methods/Sequences** window, select the desired method.

2 Click the icon.



3 The method is exported to the browser's default download folder.

10.4.8 Load Method or Sequence

1 In the **Methods/Sequences** window, select the desired method.

2 Click **Load**.

3 Micro GC Fusion is ready to run the loaded method or sequence.



10.4.9 Preset Methods and Sequences

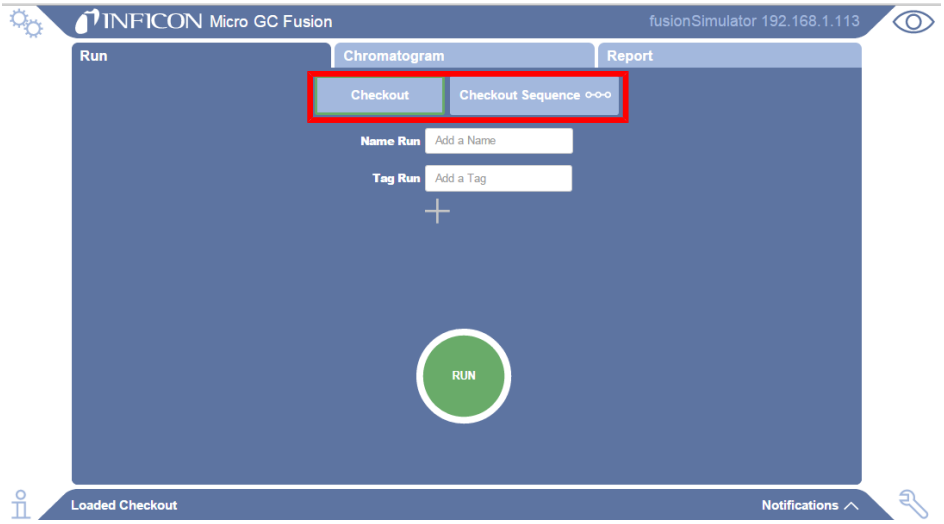
Methods and sequences can be set to display on the Micro GC Fusion main page and/or the front panel display. Present methods and sequences can be loaded by selecting the desired method from the Micro GC Fusion main page.

A maximum of ten methods or sequences can be added to the front panel display.

1 In the **Methods/Sequences** window, select the desired methods or sequences to **Preset** by selecting the check box next to the method or sequence.



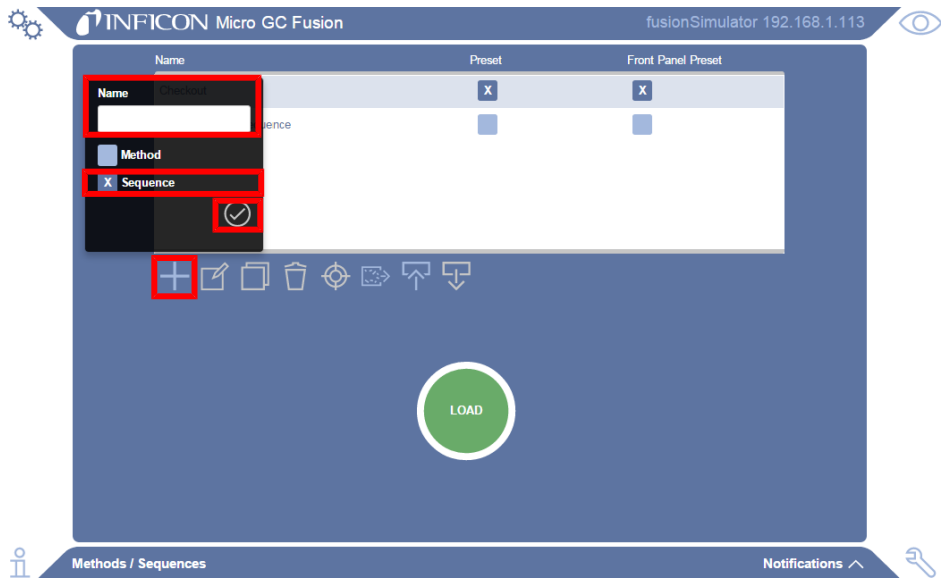
2 Click the icon to display the main page and verify that the selected method and/or sequence are displayed.



10.4.10 Add Sequence

When multiple runs of the same sample or different methods are desired, a sequence can be defined to automate the runs. Intervals between each run can be defined.

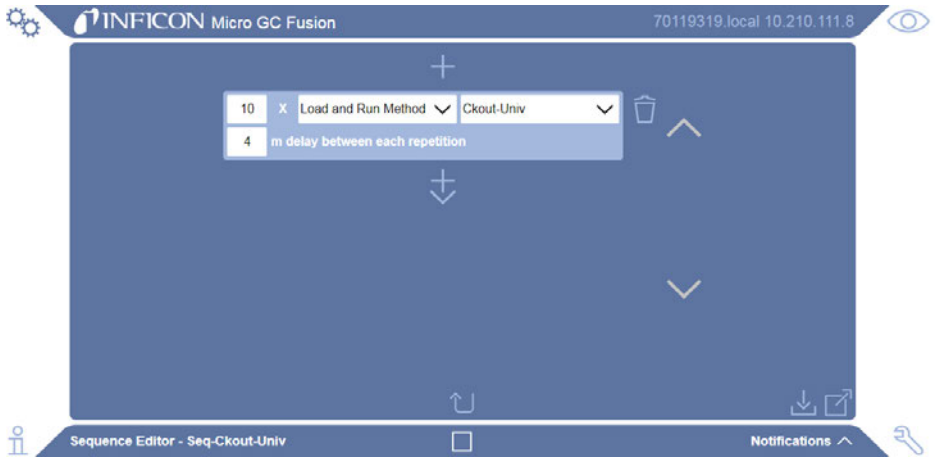
1. Click the + icon.
2. In the window, type a sequence name in the **Name:** field.
3. Select the **Sequence** option.
4. Click the ✓ icon. The **Sequence Editor** window opens.



10.4.11 Edit Sequence

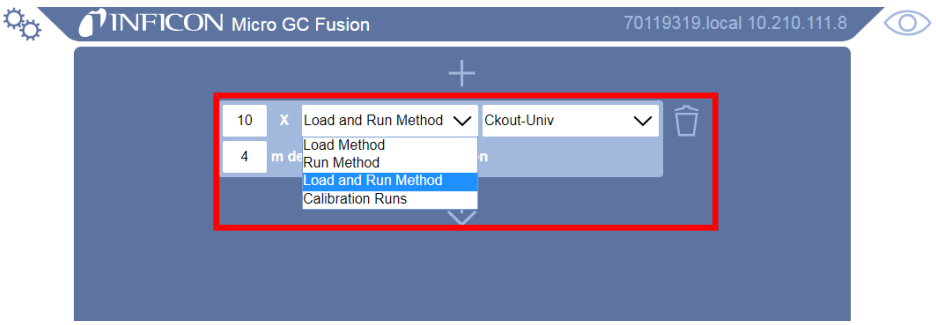
1 In the **Methods/Sequences** window, select the desired sequence.

2 Click the icon to edit the highlighted sequence. The **Sequence Editor** is displayed.



3 Click the step shortcut menu to select an action. Available actions include:

- ⇨ **Load Method** - Loads the desired method
- ⇨ **Run Method** - Runs the method selected in Load Method, once the method set points have been reached.
- ⇨ NOTE: Separate **Load Method** and **Run Method** commands allow the user to input a delay between the two.
- ⇨ **Load and Run Method** - Loads the selected method. Once the method set points are reached, a run is initiated
- ⇨ **Calibration Runs** - Loads and runs the selected method. Once all runs are complete, the area of each compound will be averaged and replaced in the desired calibration level. See Auto-Calibration [▶ 204].

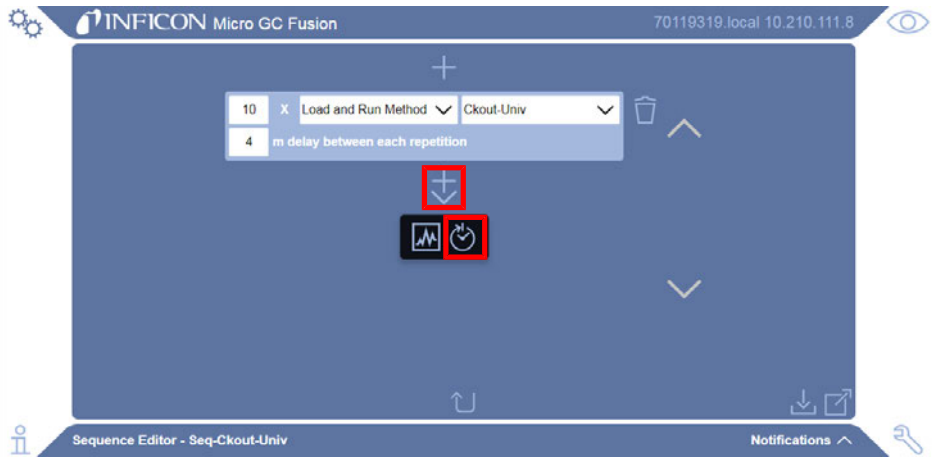


4 Click the method shortcut menu to select a method.

- ⇨ Type the number of step repetitions. If desired, add a delay to the repetitions. When the step repetition is changed, a **delay between each repetition** in minutes is displayed.



5 There is an option to add a delay to the step by clicking the icon followed by the icon.



⇨ Type the delay time in minutes.



6 To add a step to the sequence, click the icon followed by the icon.



⇨ Click the step shortcut menu to select an action.

⇨ To select a method, click the method shortcut menu. Type the number of step repetitions.

7 Click the icon to select the number of **Repetitions** for the defined sequence, or select **Non-stop** to run the sequence indefinitely.



8 To remove a method or delay in the sequence, click the icon to the right of the method or delay.

9 Click the icon to save the sequence and return to the **Methods/Sequences** window.

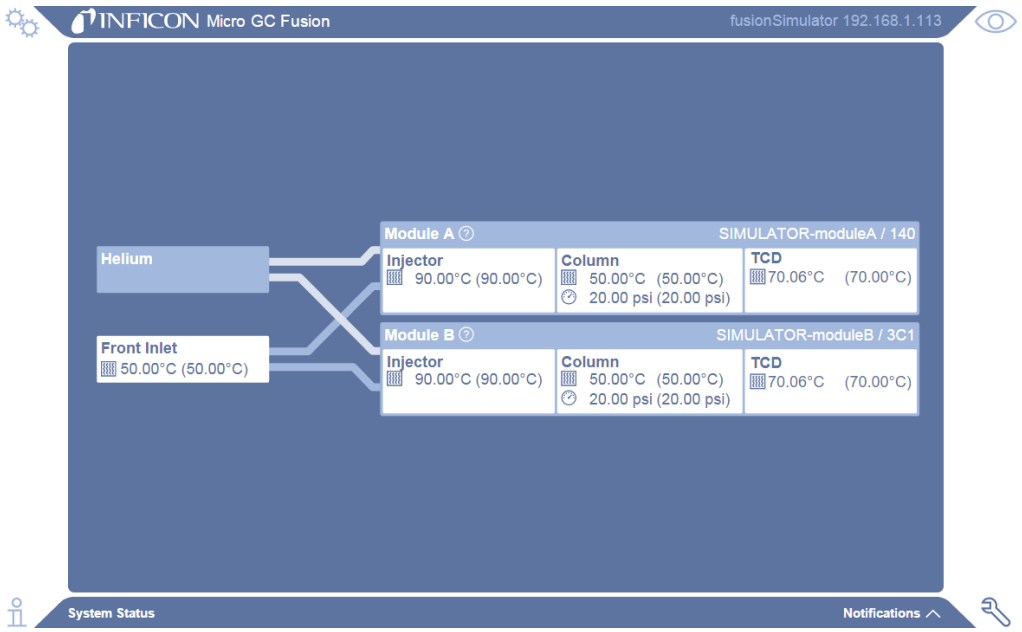
10.5 View System Status

Click the icon to display the **System Status** screen.

The **System Status** screen displays:

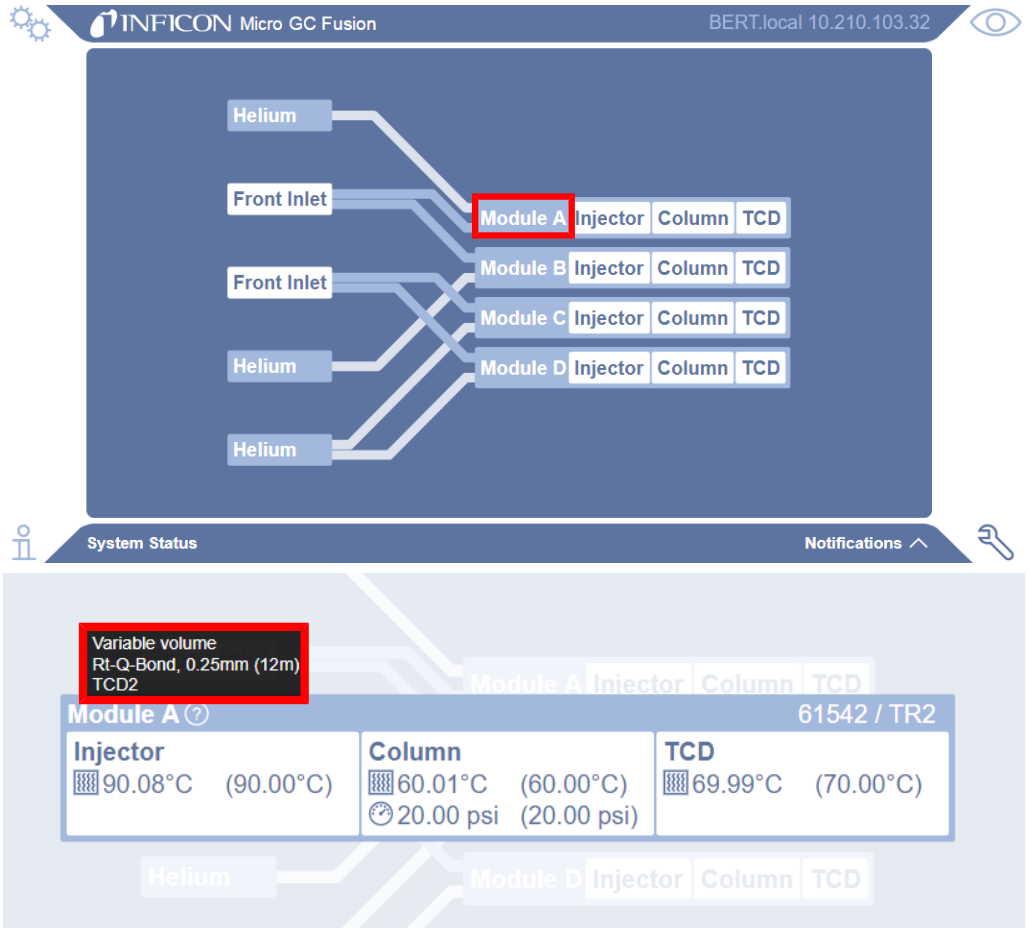
- module part number and serial number
- installed module information
- temperature and pressure set points and real time readings

Once a method starts loading, the actual temperature and pressure readings equilibrate to the set points defined in the method. The **System Status** window displays both the set points and the actual readings (in parentheses) of the temperatures and pressures for the Micro GC Fusion analytical components.



In the System Status window, Module A is displayed above Module B. Physically in the 2-module Micro GC Fusion instrument, Module A is the bottom module and Module B is the top module.

In the 4-module version of the software, click on the module name to display the readings.

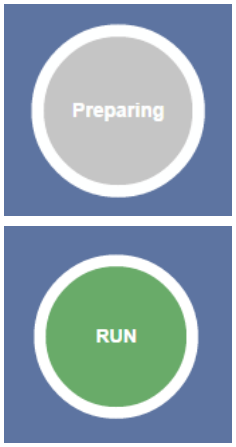


In the System Status window, Module A is displayed above Module B, Module B above Module C, and Module C above Module D. Physically in the 4-module Micro GC Fusion instrument, Module A is the bottom module and Module B is the top module of the left side of the instrument. On the right side of the instrument, Module C is the bottom module and Module D is the top module.

10.6 Run Method or Sequence

10.6.1 Run Method

1 Ensure the desired method is loaded.

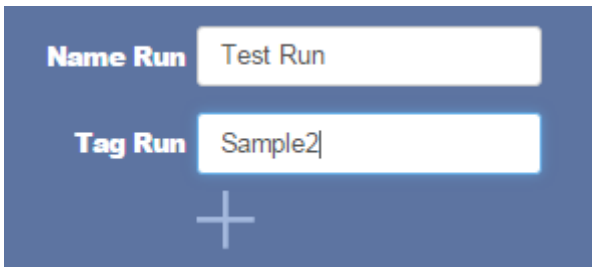


The Preparing button displays until the method has reached the programmed set points. Micro GC Fusion is ready to run when the green RUN button displays.

2 Type a sample name in the **Name Run** field on the main page, if desired. If no name is specified, the run is identified by the method name.

3 Type a descriptive or identifying word or phrase in the **Tag Run** field, if desired.

⇨ Click the icon after typing the tag or phrase. Tag(s) entered are associated with the run and are used to facilitate sample run searching in the **Data Browser**.



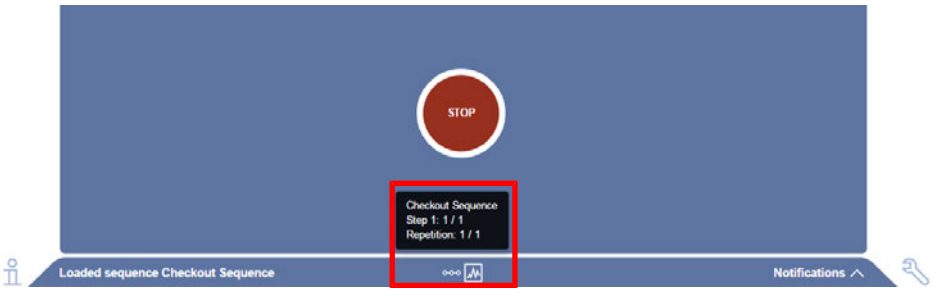
4 Click **RUN** to start the run.



10.6.2 Run Sequence

If a sequence is set as **preset**, it displays on the Micro GC Fusion main page. Click on the sequence to load it. Alternately:

1. In the **Method/Sequences** window, click on the sequence to highlight it.
2. Click **Load**.
3. Click the icon to display the main page.
4. Click the green **RUN** button to begin the sequence.
5. When a sequence is running, two icons are displayed at the bottom of the screen.
   - ⇨ Mouse over the icon to identify the sequence that is currently running and the current status of the sequence.
   - ⇨ Mouse over the icon to identify the method in the sequence that is currently running.



10.6.3 Stop a Sequence

To stop a sequence:

1. In the **Run** tab, click the red **STOP** button.
2. Micro GC Fusion finished the current run and returns to the initial state of the currently loaded method. This state may take a few minutes depending on the progress and duration of the interrupted method.

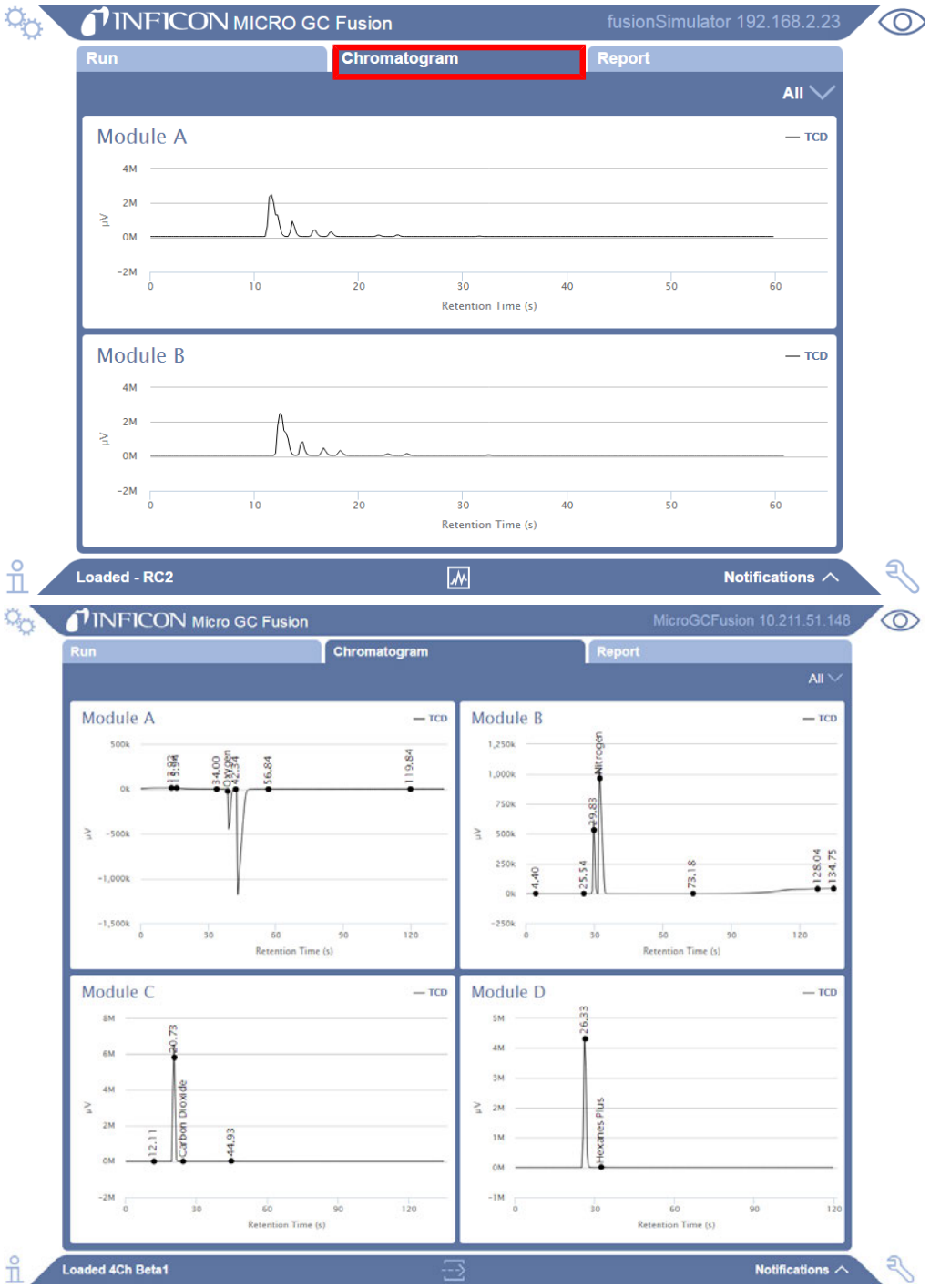


3. The notification **Sequence will stop when method completes** is displayed, advising that the sequence will stop when the current run completes.

10.7 View Chromatogram

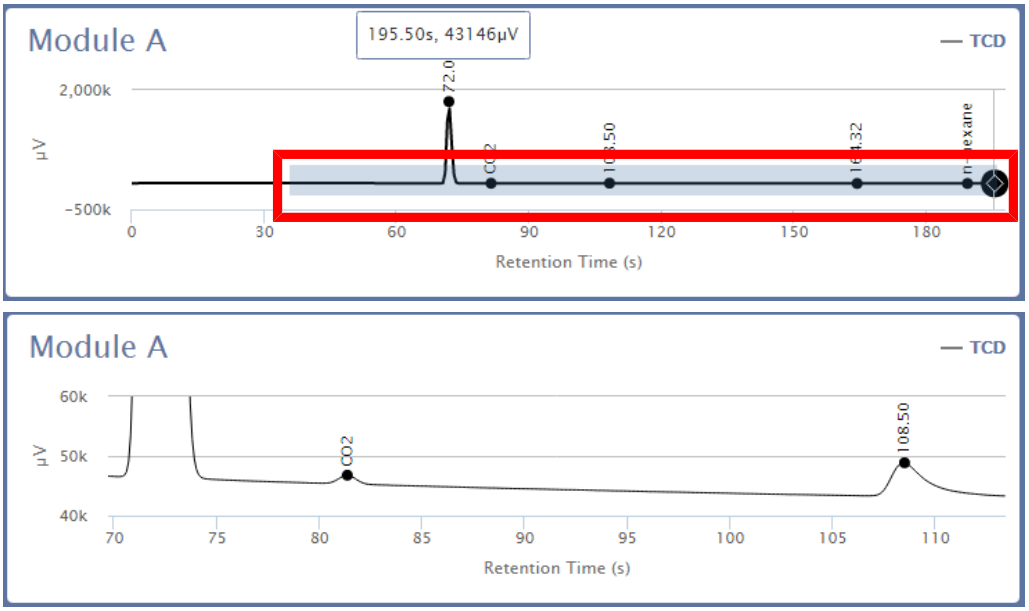
As soon as a run is started, the **Chromatogram** tab displays automatically. A real-time chromatogram is displayed for each configured GC module. Once the run is completed, the **Report** tab is displayed. Chromatograms of previous runs can be viewed in the **Data Browser**. See Data Browser [▶ 172].

A real-time chromatogram is not available on the front panel display.



10.7.1 Zoom

To zoom in on a particular region of the chromatogram, hold down the left mouse button and drag the cursor to create a rectangular area over the region. Release the left mouse button to zoom in.



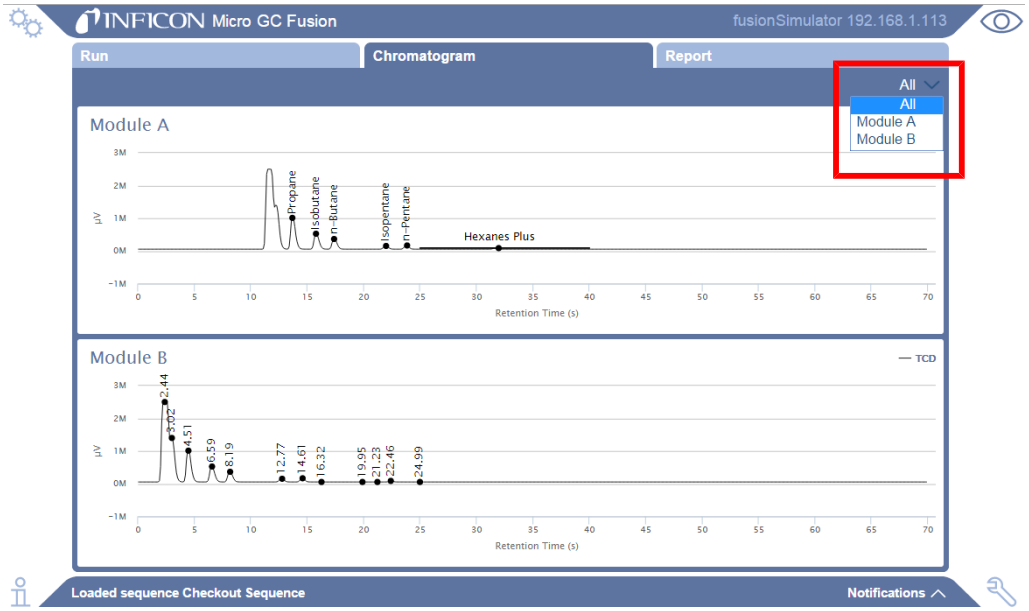
10.7.2 Reset Zoom

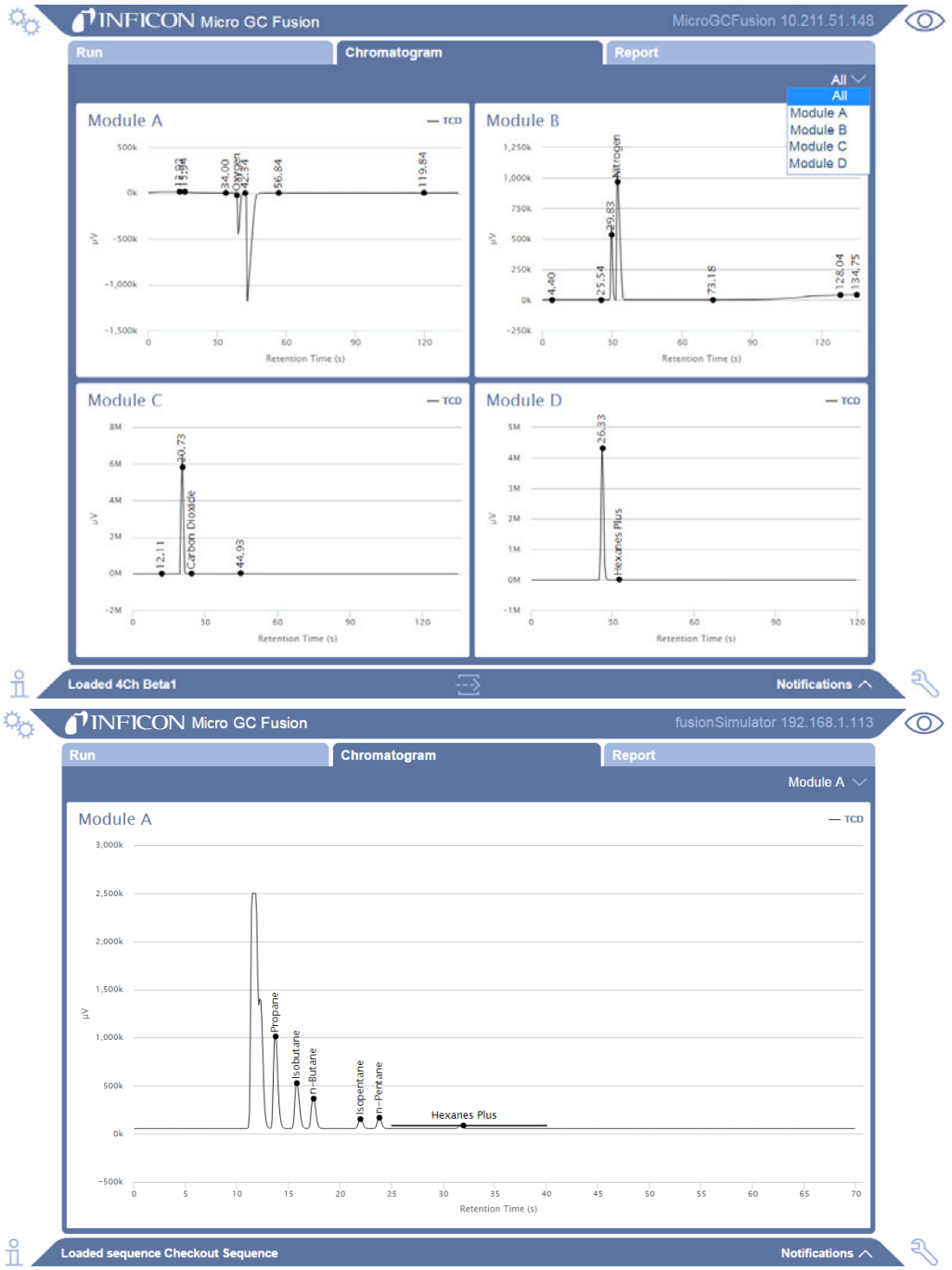
To return to the default chromatogram view, double-click on the chromatogram. Click the right mouse button to return to the previous zoom after multiple zoom actions are performed.

10.7.3 Expand Chromatogram

To expand individual chromatograms, click the icon. Use the shortcut menu on the right-hand side to select the desired chromatogram.

To return to the original view, select **All**.



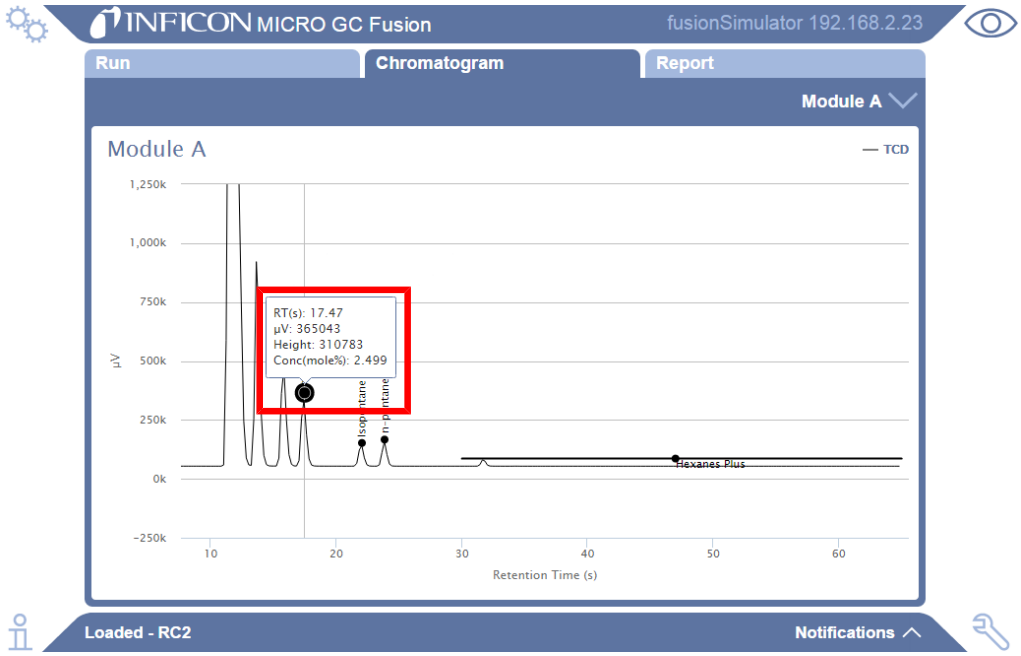


10.7.4 Viewing Coordinates

Hover the mouse over a region of the chromatogram to display a rolling black ball and a legend displaying *x* and *y* coordinates points on the chromatogram. The *x* axis is the retention time in seconds. The *y* axis is the peak height in µV.

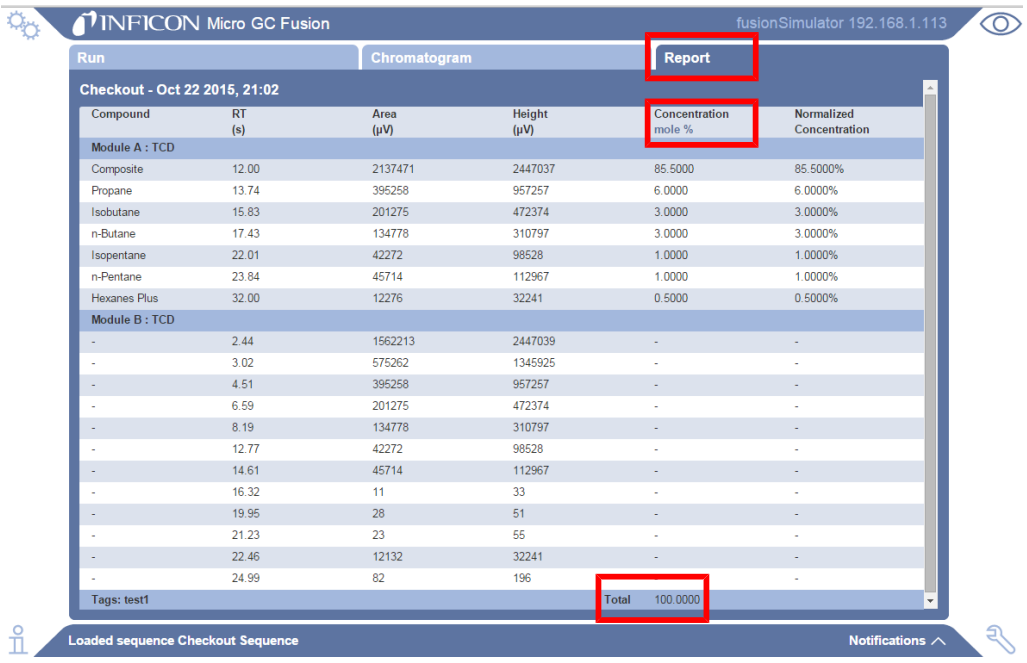
If hovering over a named peak, the **RT(s)** and the **Height** in µV are displayed.

If the peak has been calibrated, **Conc (mol%)** or **Conc (ppm)** are displayed.



10.8 View Report

When a run is completed, calibrated compound names, retention times, area counts, height counts, compound concentrations (if calibrated), and normalized amounts are displayed in the **Report** tab. Click **mol%** to change the view to **ppm**, and vice versa. The total un-normalized concentration is displayed at the bottom.

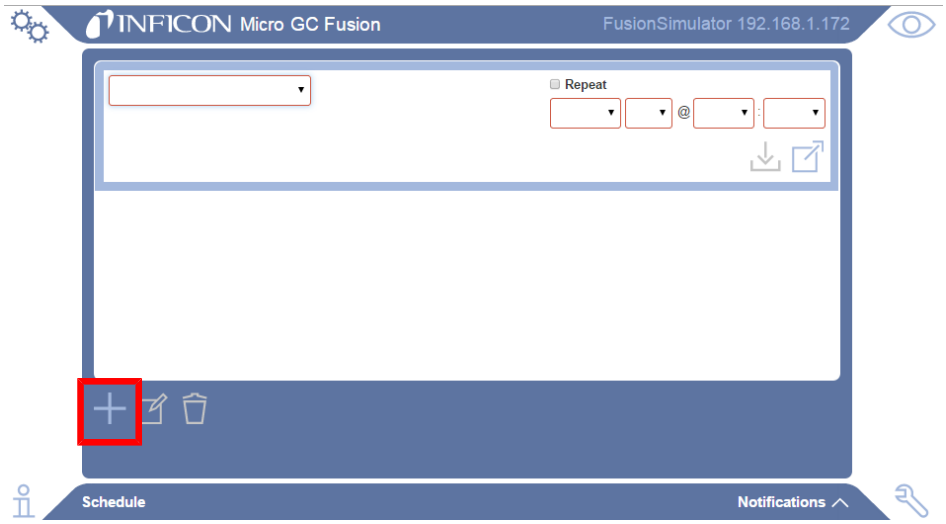


10.9 Scheduler

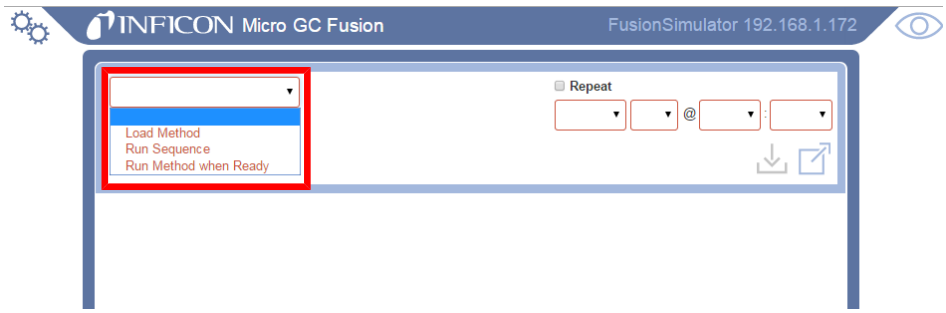
Methods and sequences can be scheduled to run on a specific day and time, repeatedly, or several times per week.

To schedule a method or sequence:

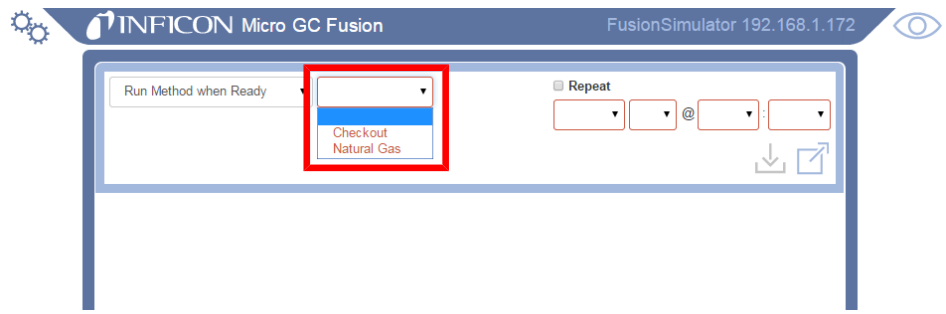
1. Click the icon.
2. Click **Schedule**.
3. Click the icon to add a scheduled event.



4. Click the event shortcut menu and select an event.



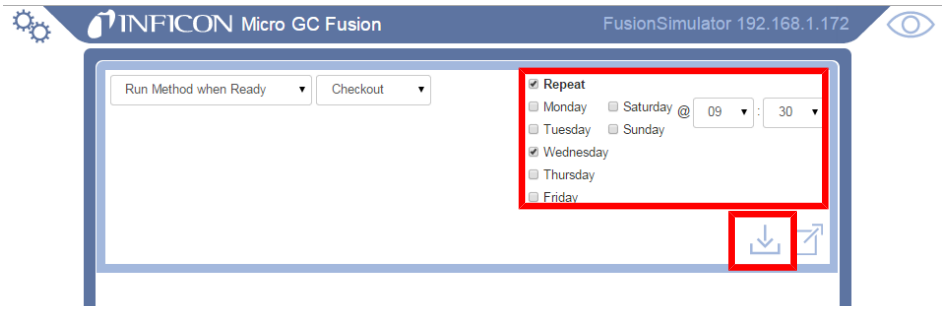
5. Click the method or sequence from the shortcut menu.



6. Select a data and time from the shortcut menus.

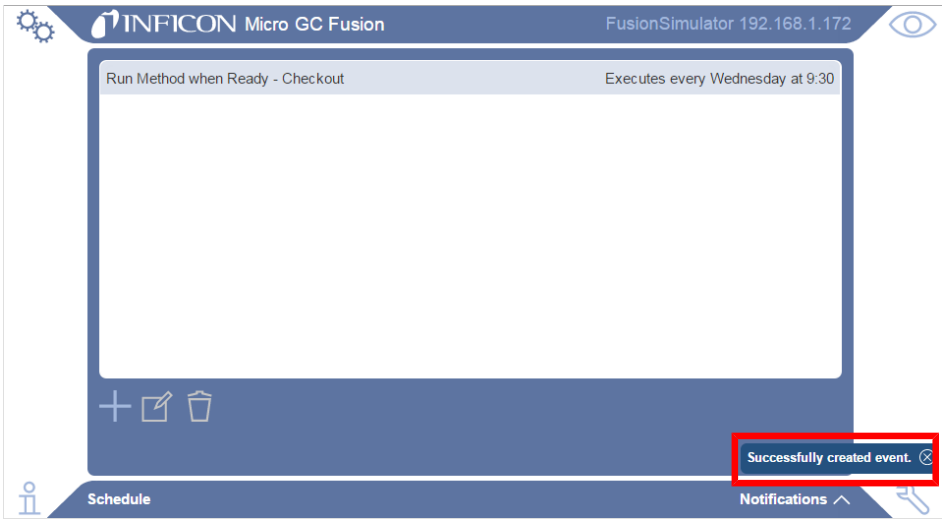


7 Alternately, click **Repeat** and select a day and time to repeat the event.

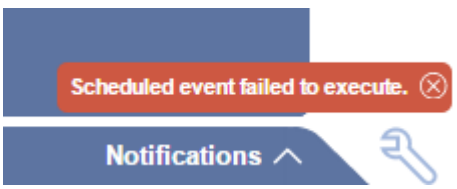


8 Click the icon to save the event.

9 A confirmation message is displayed.



If an event is scheduled to start while another method or sequence is running, the event will fail to start and be removed from the list. A message is displayed.



10.10 Data Browser

The **Data Browser** allows the user to access analysis data stored on Micro GC Fusion. The following actions can be accomplished through the interactive user interface.

- View Chromatogram and Report
- View Run Information an Acquisition Parameters
- Overlay Multiple Runs
- Filter and Search Runs
- Export Runs
- Import Runs
- Delete Runs
- Print Chromatogram or Reports
- Edit Integration Parameters
- Calibration
- Reprocess Runs

To access the Data Browser:

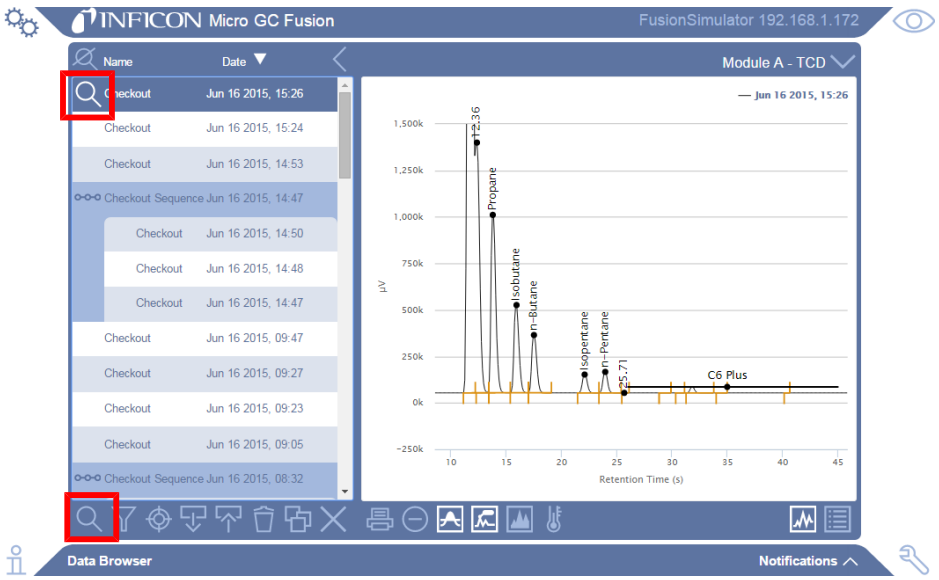
1. Click the icon.
2. Click **Data Browser**.
3. The **Data Browser** window is displayed.

Icon	Name	Function
	View Selected Run(s)	View chromatograms or reports
	Filter	Filter or search the run list
	Calibrate	Edit integration events or add compound information
	Import Run(s)	Imports a run or runs onto Micro GC Fusion
	Export Run(s)	Exports the selected run(s) to the computer
	Delete	Deletes the selected run(s)
	Select All	Highlights and selects all runs
	Clear All Selected	Clears selected runs
	Print	Prints the selected chromatogram(s) or report(s)

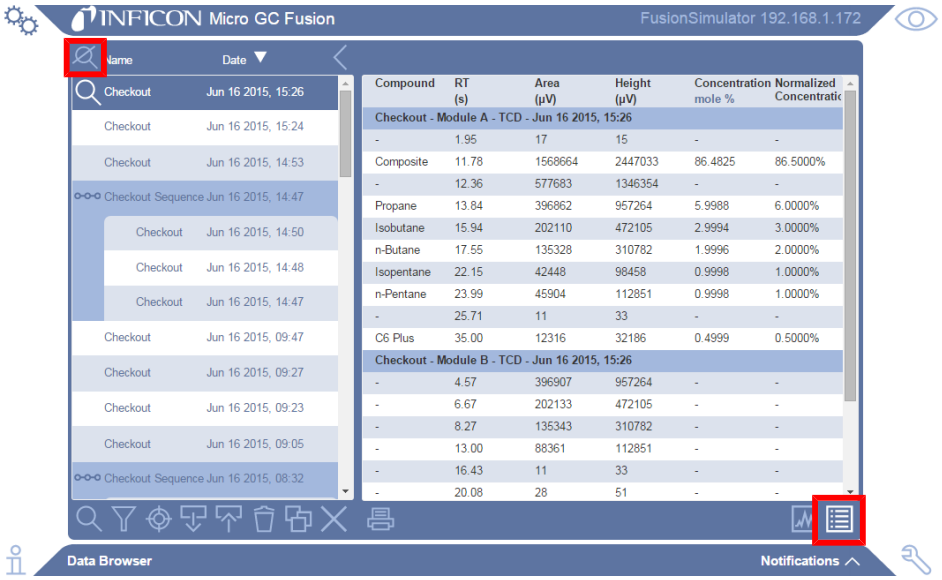
Icon	Name	Function
	Zoom Out	Returns the user to the previous zoom
	Toggle Integration Events	Displays the peak integration lines. This view is displayed by default
	Toggle Peaks	Displays the peak names entered during calibration. This view is displayed by default
	Toggle Areas	Displays the area underneath the peaks
	Toggle Temperature Profile	Displays the temperature profile overlaid on the chromatogram
	View Chromatogram	Displays the chromatogram
	View Report	Displays the report

10.10.1 View Chromatogram and Report

1 By default, the right chromatogram window in the data browser will be blank until a run is selected. Double-click a run to view the chromatogram or report. A  icon appears to the left of the selected run(s) and the corresponding chromatogram is displayed to the right. Alternately, click a run to highlight it and click the  icon in the bottom left hand corner to view it.



2 To view the corresponding report, click the  icon.

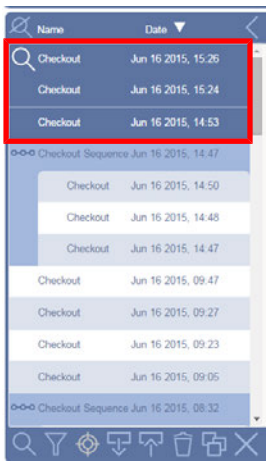


3 To deselect the viewed runs in the Data Browser window, click the icon.

10.10.1.1 View vs. Select

When viewing a chromatogram, a icon will appear on the left of the highlighted run. Highlighted runs that are not viewed and do not show a icon are considered selected runs. The following functions can only be accomplished by selecting the desired runs:

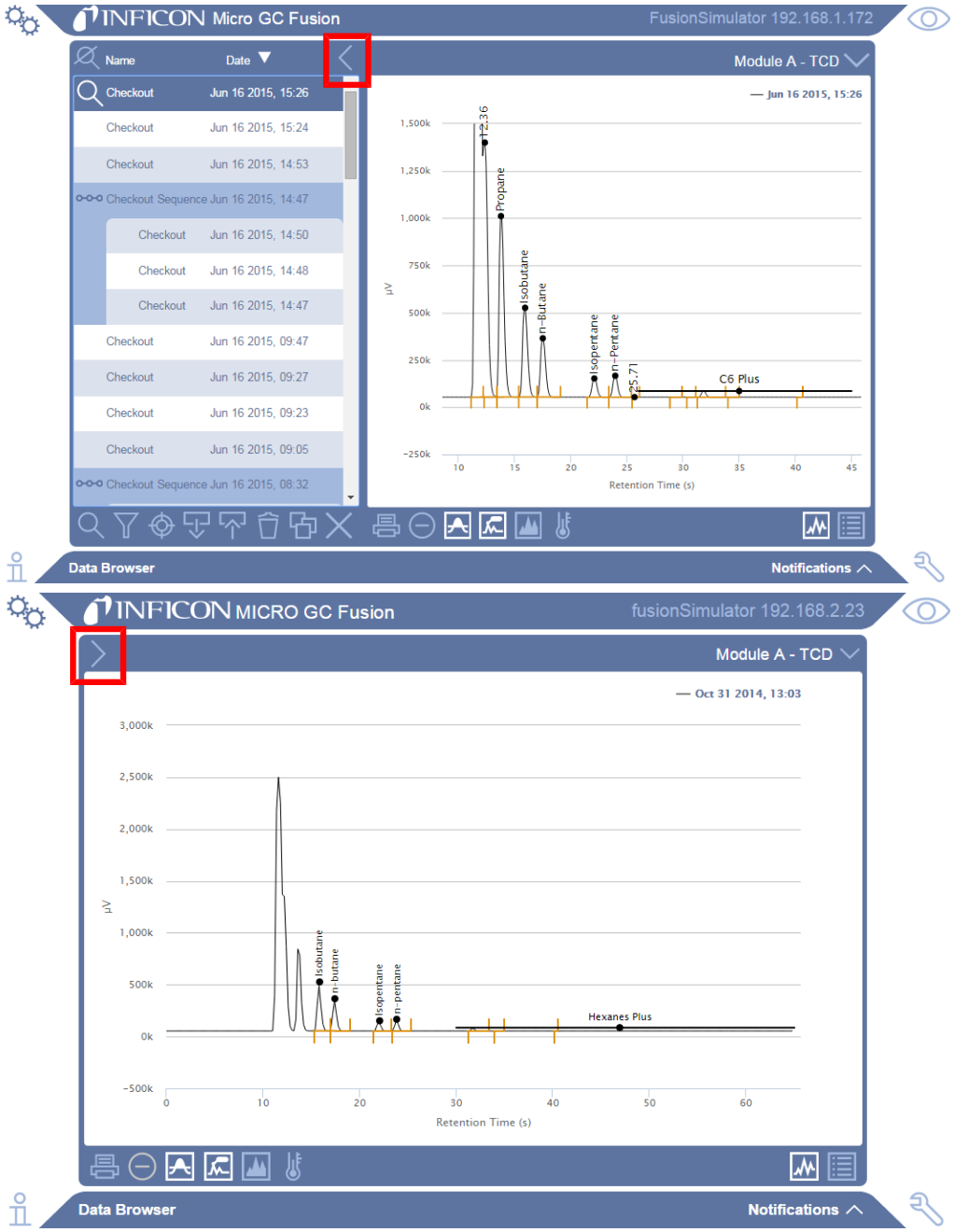
- export run(s)
- reprocess run(s)
- delete run(s)



In the above figure, one run is being viewed, and three runs are selected. To highlight and select all runs on the run list, click the icon. To clear the selected runs, click the icon.

10.10.1.2 Hide or Show Run List

The run list can be hidden to maximize the chromatogram or report display area. To hide the data run list, click the icon. To show the data run list, click the icon.



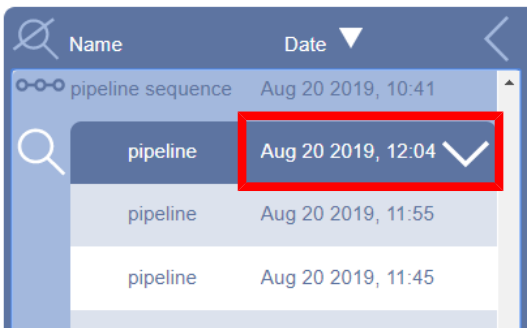
10.10.1.3 Toggle Chromatogram Information

Information such as integration lines, peak names, area shading and the temperature profile can be displayed on the chromatogram. Select the desired icon to display the chromatogram information.

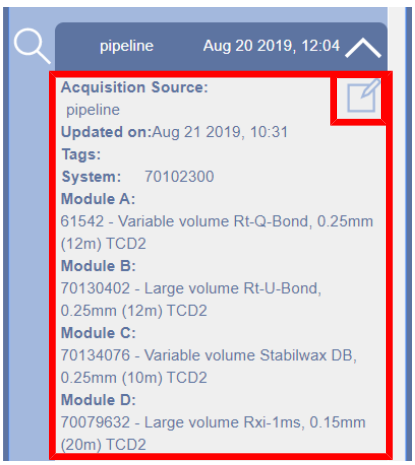
Icon	Description
	Toggle integration events
	Toggle peaks
	Toggle areas
	Toggle temperature profile

10.10.2 View Run Information and Acquisition Parameters

1 Click the icon to the right of the selected run to view information such as Acquisition Source, Updated On, Tags, System, and the module serial number(s).



2 Click the icon to view the run acquisition parameters such as column temperatures and pressures.



Changes can be made to the acquisition parameters, but the method must be saved with a different name.

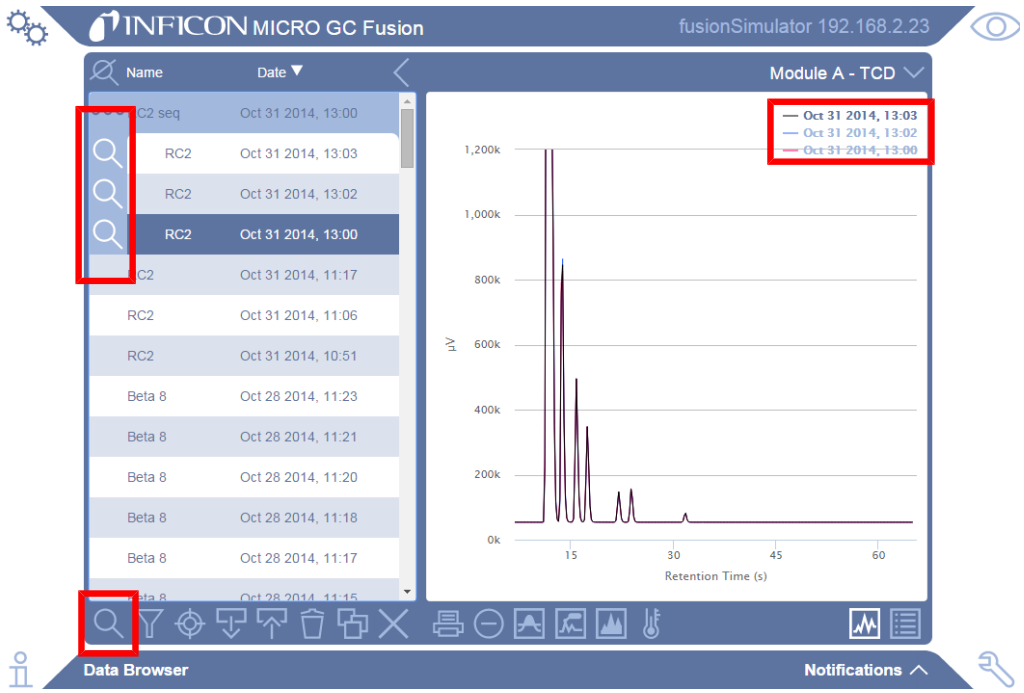
10.10.3 Overlay Multiple Runs

To overlay multiple chromatograms or view multiple reports, double-click the runs. The icon appears to the left. Alternately, highlight the run(s) and click the icon.

To remove a single chromatogram from view, double-click the run to remove the icon next to it.

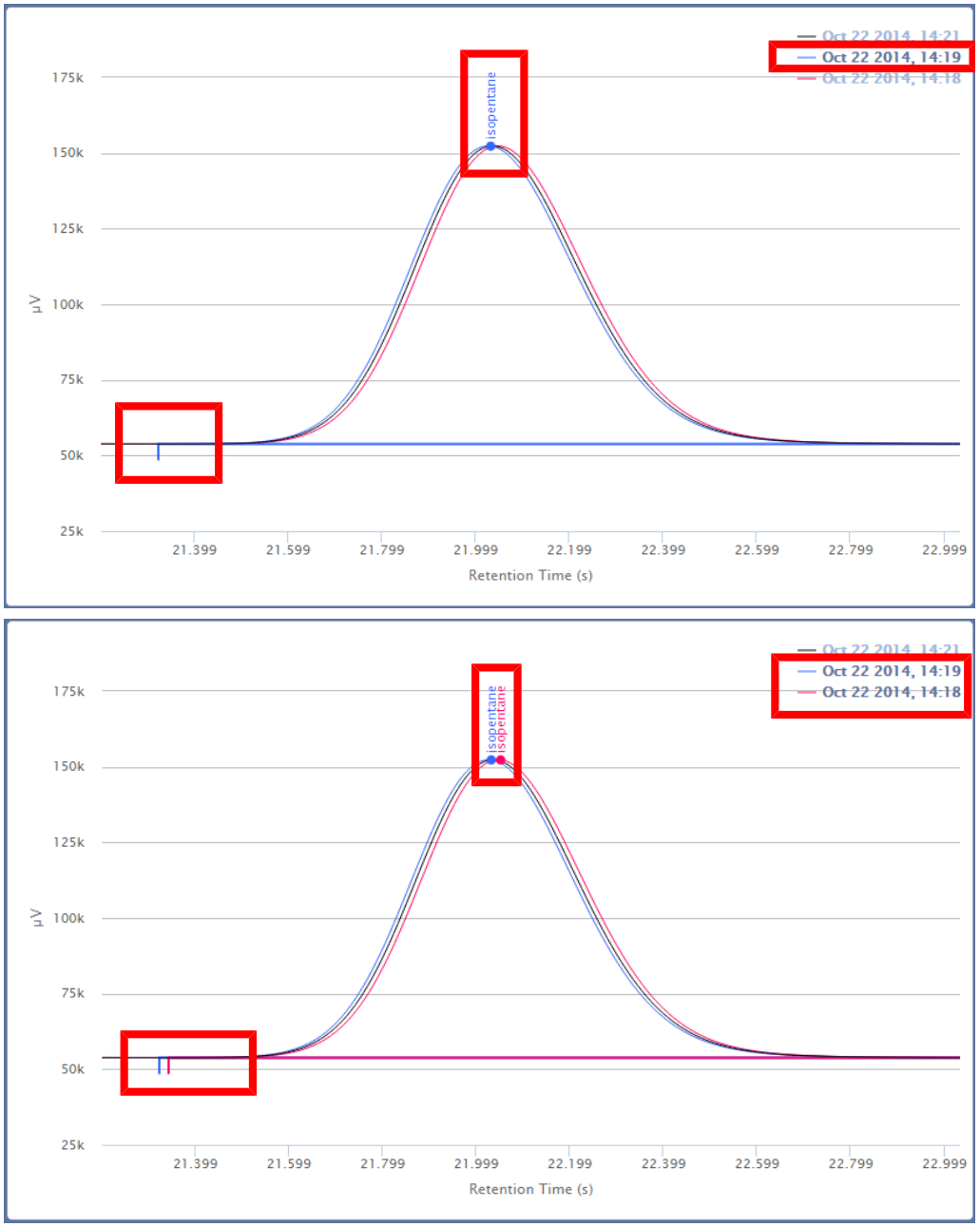
To remove all chromatograms from view, click the icon.

When multiple runs are overlaid, a legend appears in the upper right-hand corner to indicate which runs are being displayed.



10.10.3.1 Toggle Chromatogram Information

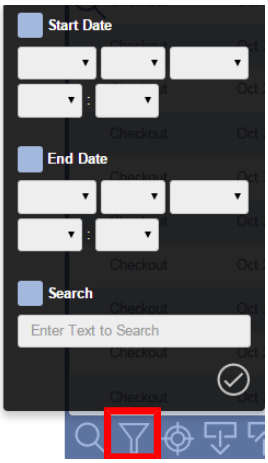
To display integration lines, peak names, areas, or the temperature profile for a specific run within the overlaid chromatogram, click on the run in the legend.



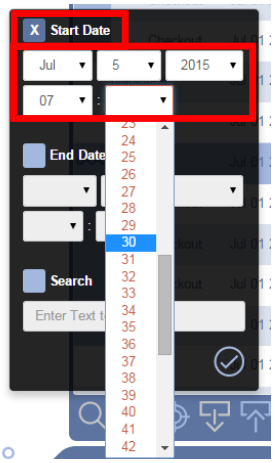
10.10.4 Filter

The run list can be filtered to display only runs within a user-specified time period.

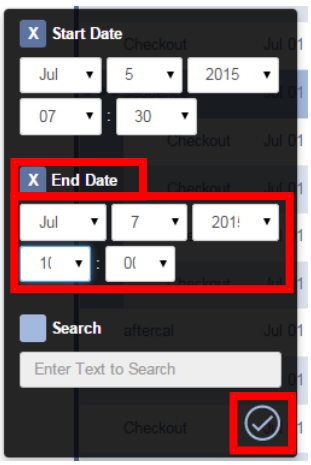
1 Click the icon.



2 Select the **Start Date** option and click on the date and time shortcut menus. Click on a date and time to add it to the field.



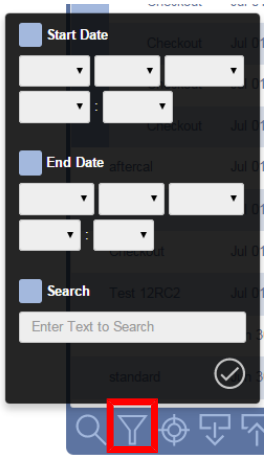
3 Select the **End Date** option and click on the date and time shortcut menus. Click on a date and time to add it the field. Click on the icon to apply the filter.



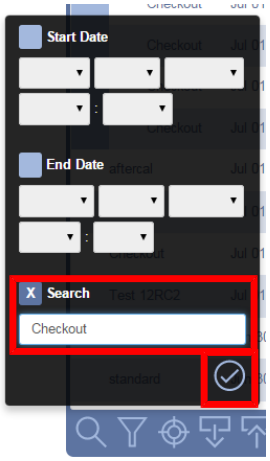
10.10.5 Search

Runs can be searched by analysis name (name run on the main page), method name, compound name (defined in calibration) or by tags.

1 Click the icon.



2 Select **Search**. Type the parameter to search.



3 Click the icon to apply the search.

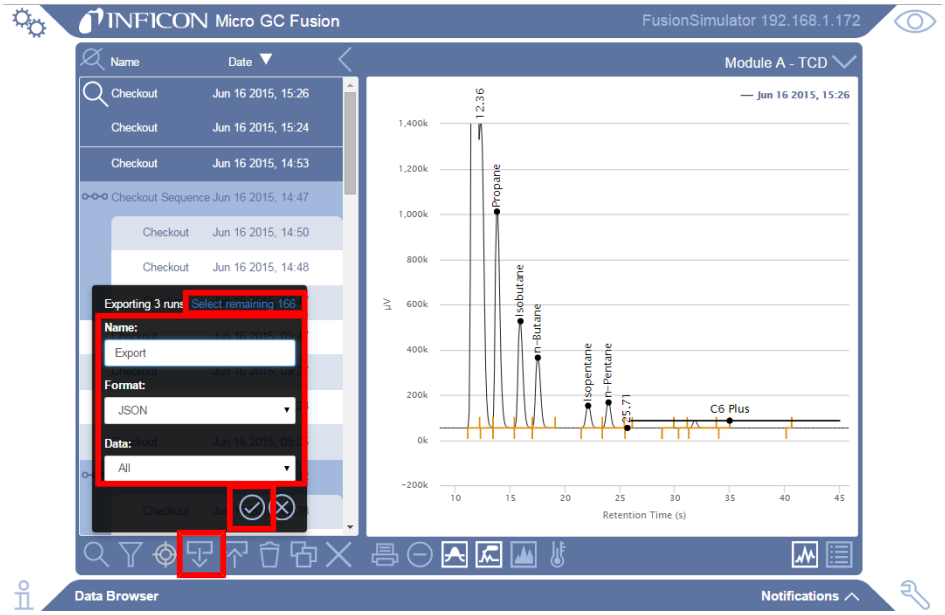
10.10.6 Export Runs

Raw data and peak information can be exported as a report. Reports can be exported into the following formats:

JSON	Micro GC Fusion native file format NOTE: Micro GC Fusion software is the most effective tool to view and reprocess exported run(s)
CSV	Comma separated text file format that can be easily viewed using Microsoft® Excel® or Notepad

10.10.6.1 Export as JSON

1. Select the run(s).
2. Click the icon. The export dialog box allows the user to export all of the runs stored on the instrument by clicking **Select remaining** link in the top right corner.

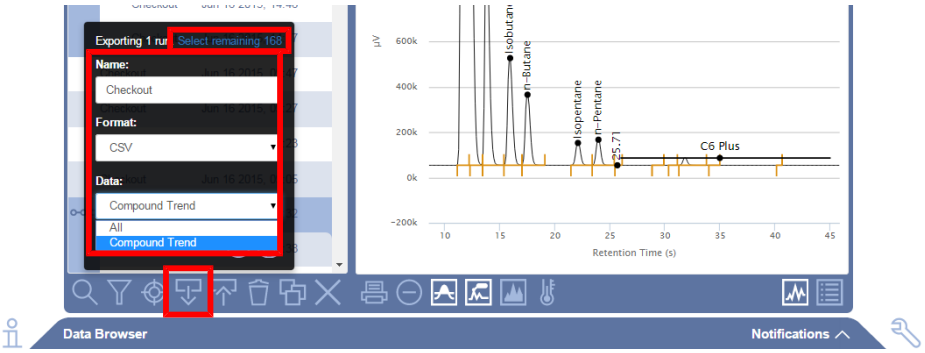


3. Type the file name in the **Name:** field. This name is saved onto the computer.
4. From the **Format:** shortcut menu, select **JSON**.
5. From the **Data:** shortcut menu, select **All** or **Compound Trend**.
6. Click the icon. The file(s) are downloaded to the browser's default downloads folder.

A single file has a .fusion-data extension. Multiple files download as a .zip file containing multiple files with a .fusion-data extension.

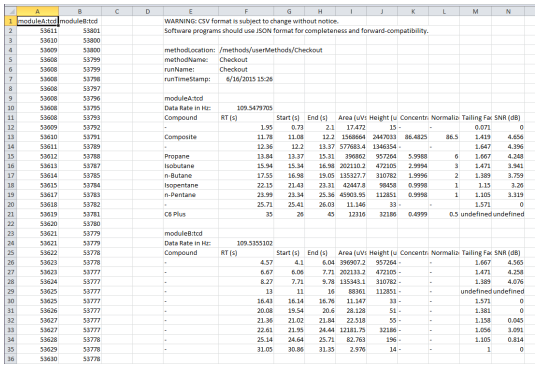
10.10.6.2 Export as CSV

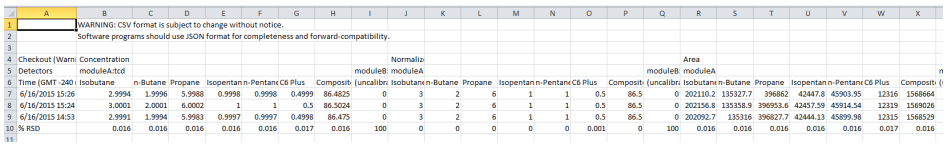
1. Select the run(s).
2. Click the icon.
3. Type the file name in the **Name:** field. This name is saved onto the computer.
4. From the **Format:** shortcut menu, select **CSV**.
5. From the **Data:** shortcut menu, select **All** or **Compound Trend**.



6 Click the icon. The file(s) will download to the browser's default downloads folder.

7 Open the file using Microsoft Excel or Notepad.





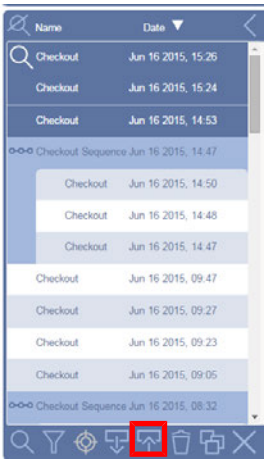
When exporting All data, the raw data is present in the file. This enables the user to construct a chromatogram in Microsoft Excel.

When multiple runs are selected, Compound Trend is the only available option. Compound Trend contains only concentration, area, and retention time information and does not include the raw data.

10.10.7 Import Runs

Exported run files with a .fusion-data extension can be imported onto any Micro GC Fusion via the Data Browser. Multiple runs can be compressed into a .zip file and imported onto any Micro GC Fusion.

1 Click the icon.



2 Navigate to the run(s). A singe file with a **.fusion-data** extension can be imported. Multiple files can be imported by selecting a compressed file with a **.zip** extension.

3 Click **Open**.

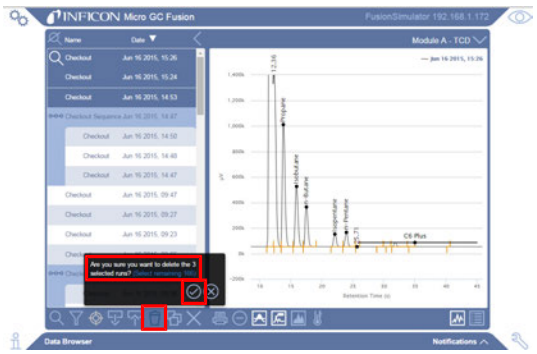
10.10.8 Delete Runs

1 Select the run(s) to delete.

2 Click the icon.

3 A window will display, **Are you sure you want to delete the X selected run(s)?**

4 Click the icon to delete the run(s).



NOTICE

Deleting a run from the Data Browser permanently removes the sample run data. Export data files periodically to avoid data loss. See Export Runs [▶ 180].

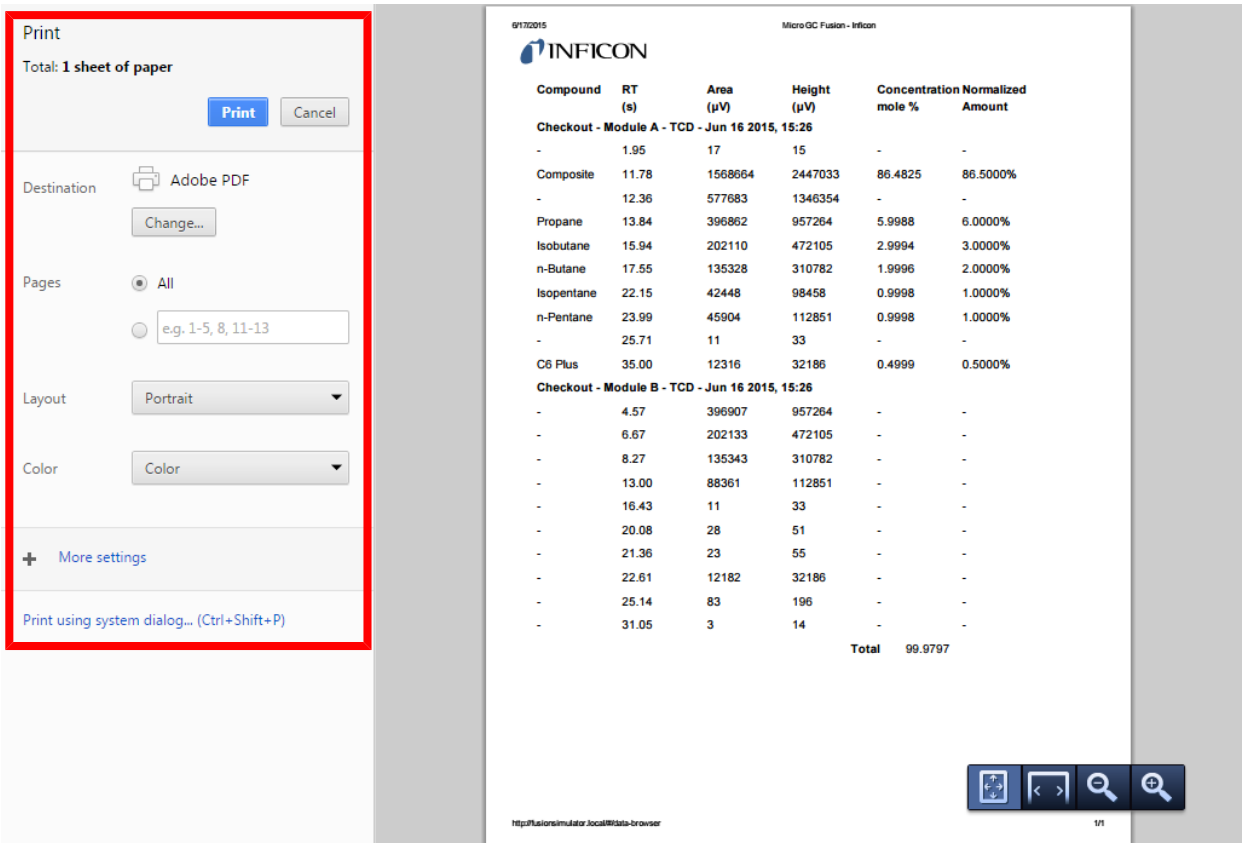
10.10.9 Print Chromatogram or Report

1 Double-click the desired run(s) to view the chromatogram(s) or report(s).

2 Click the icon to select the chromatogram(s) or the icon to select the report(s). The chromatogram and the report cannot be printed on the same page.

3 Click the icon.

4 In the window that appears, select the printer settings. To save the file as an Adobe® PDF, click **Save**. Otherwise, click **Print**.



10.10.10 Calibration

An external standard calibration must be performed to quantify a peak (i.e., determine the concentration). To calibrate Micro GC Fusion, a calibration gas with components and concentrations that closely resemble the sample composition must be available.

Calibration gases are available through specialty gas companies.

10.10.10.1 Access the Calibration Window through the Data Browser

The calibration window is in the data browser.

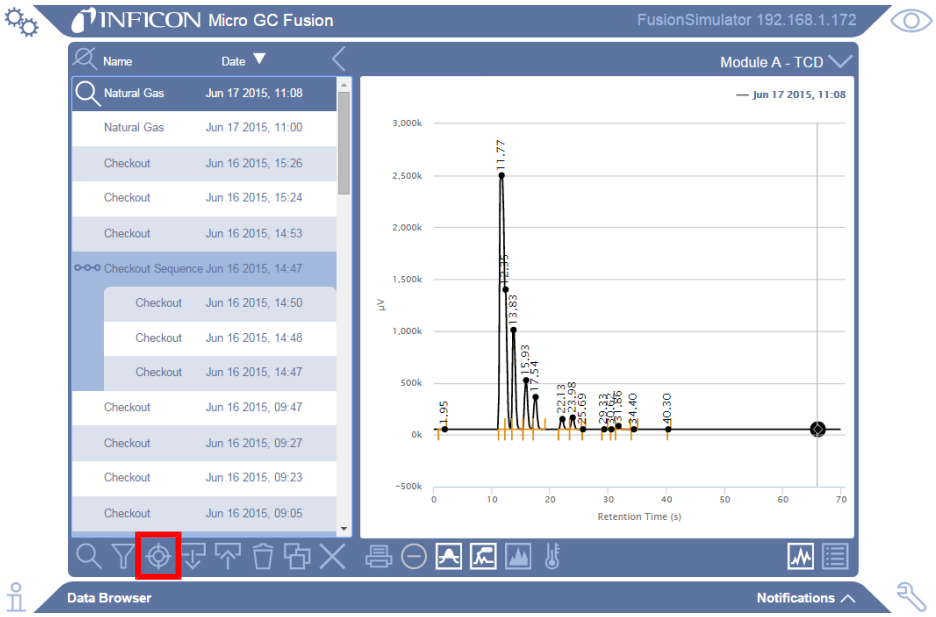
1 Click the icon.

2 Click **Data Browser** to open the data browser window.

3 Select a run to calibrate. Only one run can be calibrated at a time.

4 Click the icon to open the calibration window.

⇨ Clicking this icon opens the integration parameters and calibration information from the data file selected, which may differ from the current method. To access the current method's calibration information, click on the icon in the **Methods / Sequences** window.

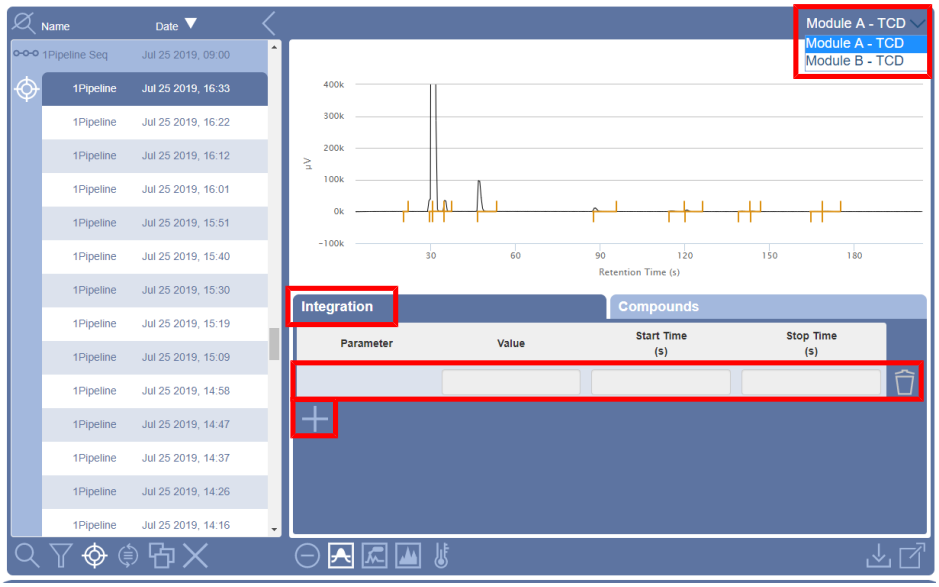


10.10.10.2 Integration Parameters

Micro GC Fusion uses a default set of integration parameters to calculate the area under each peak.

The method must be recalibrated after integration parameters have been saved to the method, as area counts may have changed. Once the method is saved, all future runs will have the integration events applied. Runs conducted before the change can be reprocessed to reflect the new changes.

1. In the data browser, ensure that the desired run is selected.
2. Click the icon to enter the calibration window.
3. Click the **Integration** tab.
4. Click the icon. Select the module from the shortcut menu.
5. Click the icon to add an integration parameter to the list. A blank row is displayed.



6 For more control over peak integration, edit the **Parameters**. Integration parameters can be set for the entire duration of the run, or can be specified for a specific retention time range using the **Start Time (s)** and **Stop Time (s)** columns.

Parameter	Value	Start Time (s)	Stop Time (s)
Baseline Window	1	0	60
Group Peaks	On	60	100
Manual Integration	On	50.5	51
Min Height Threshold	500	0	100
No Peaks	On	0	10
Start Sensitivity	50	0	0
Stop Sensitivity	50	0	100
Peak Sensitivity	50	0	100
Forced Baseline	On	20	0
Negative Peaks	On	15	17

7 Click on any of the **Parameter** shortcut menus to select an integration parameter. For additional information on integration events, please see the relevant section:

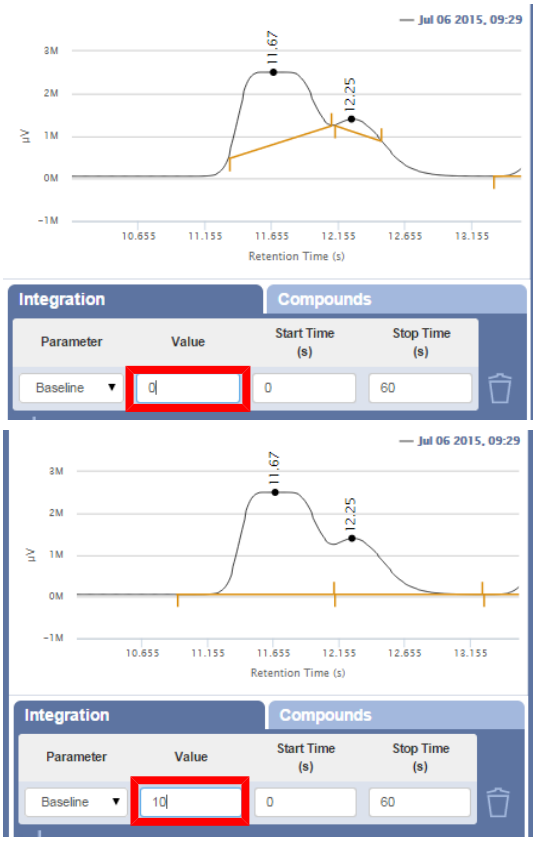
- ⇨ Baseline Window . . . . . .See Baseline Window [▷ 187]
- ⇨ Group Peaks . . . . . .See Group Peaks [▷ 187]
- ⇨ Manual Integration . . . . . See Manual Integration [▷ 188]
- ⇨ Min Height Threshold. . . . . .See Min Height Threshold [▷ 188]
- ⇨ No Peaks . . . . . .See No Peaks [▷ 189]
- ⇨ Start Sensitivity . . . . . See Start Sensitivity [▷ 190]
- ⇨ Stop Sensitivity. . . . . .See Stop Sensitivity [▷ 190]
- ⇨ Peak Sensitivity . . . . . .See Peak Sensitivity [▷ 191]
- ⇨ Forced Baseline . . . . . .See Forced Baseline [▷ 191]
- ⇨ Negative Peaks . . . . . See Negative Peaks [▷ 192]
- ⇨ Integration changes are applied to the chromatogram automatically, but are not automatically saved.

8 Click the icon to delete an integration parameter.

9 Click the icon to save the changes to the method, or click the **Compounds** tab to proceed to compound calibration.

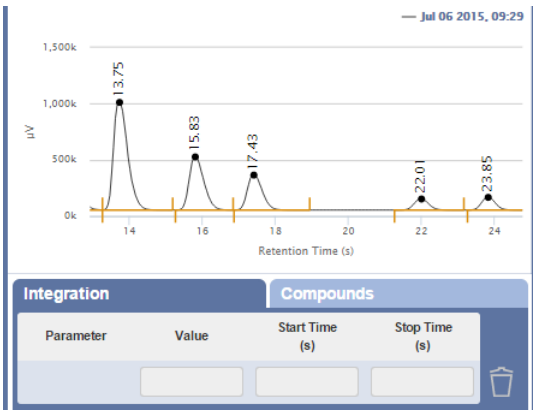
10.10.10.2.1 Baseline Window

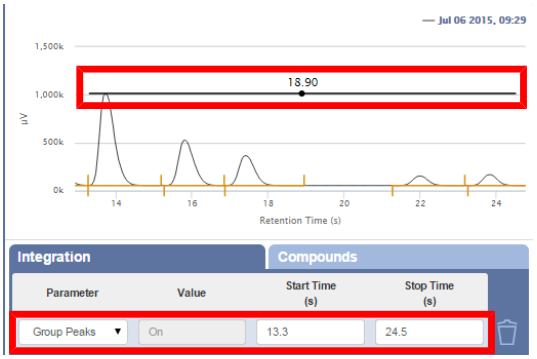
The **Baseline Window** parameter changes the size of the search window used at each point along the peak. Valid **Value** set points are between 0 and 20. Changing this parameter changes the way the peak integrates to the baseline.



10.10.10.2.2 Group Peaks

The **Group Peaks** parameter sums the area underneath all peaks within a specified retention time range. A black bar is displayed above the grouped peaks.

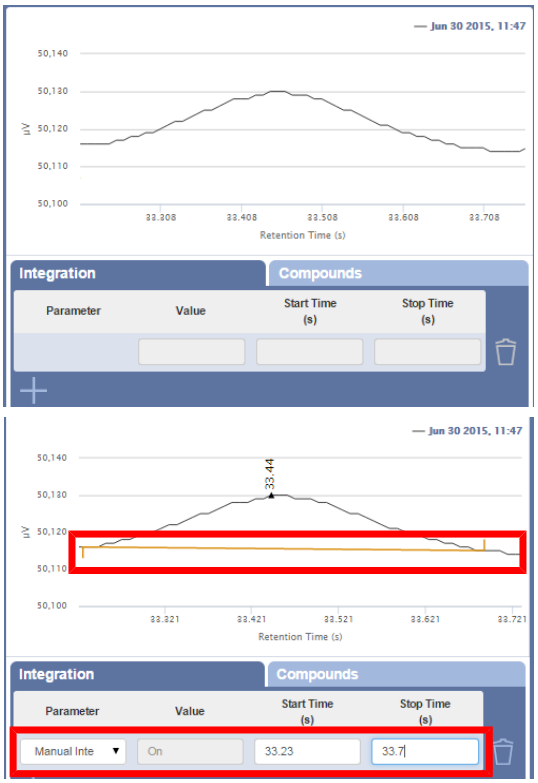




Once a retention time range is specified, the group can be calibrated in the **Compound** tab.

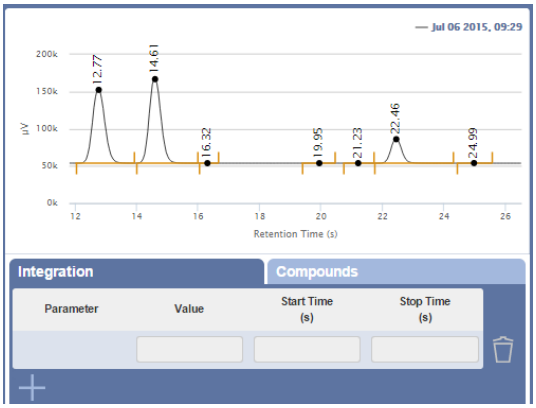
10.10.10.2.3 Manual Integration

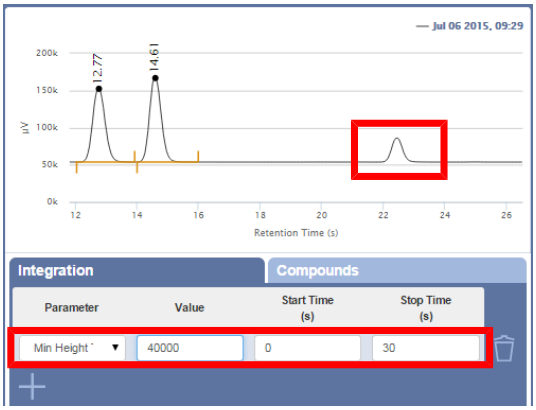
The **Manual Integration** parameter allows the user to enter a start and stop time to manually integrate a peak. Manual integration provides finer control of the baseline integration for a specified retention time range.



10.10.10.2.4 Min Height Threshold

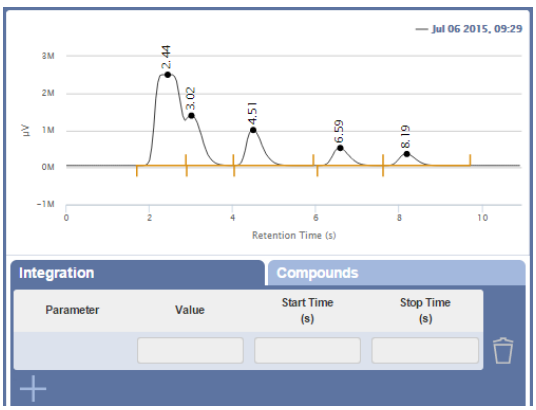
The **Min Height Threshold** parameter allows the user to specify the minimum peak height the integrator detects.

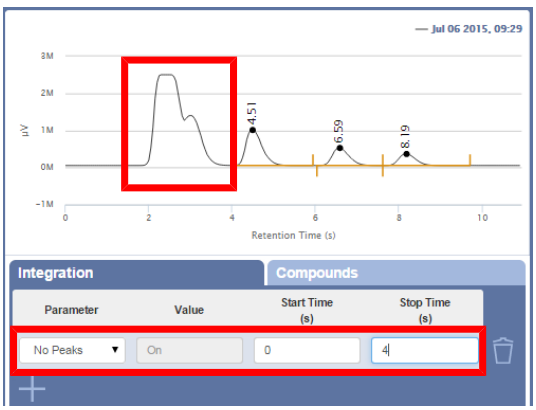




10.10.10.2.5 No Peaks

The **No Peaks** parameter stops integration within a specified retention time range.





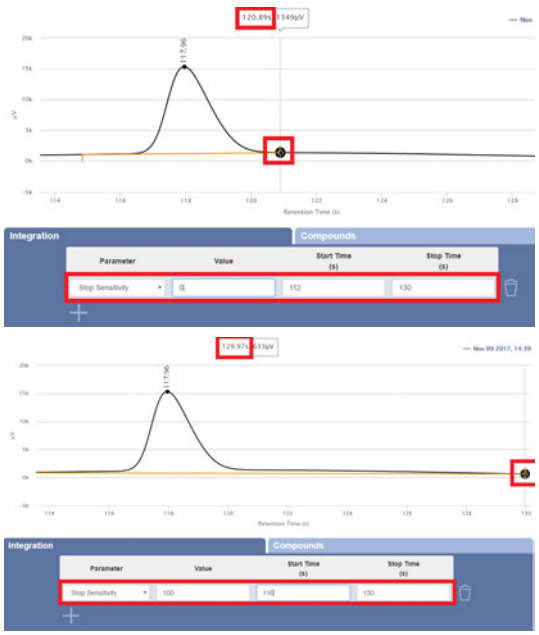
10.10.10.2.6 Start Sensitivity

The **Start Sensitivity** parameter influences the start point of peaks within a specified retention time range. Valid **Value** set points are 0 to 100, with 50 being the default. Values closer to 0 start the peak sooner, values closer to 100 start the peak later. It is recommended to increment the **Value** by steps of 1 from the default setting to move the start point of the peaks.



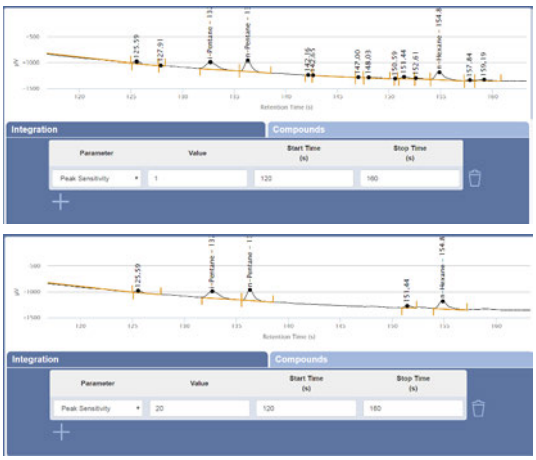
10.10.10.2.7 Stop Sensitivity

The **Stop Sensitivity** parameter influences the stopping point of peaks within a specified retention time range. Valid **Value** set points are 0 to 100, with 50 being the default. Values closer to 0 will stop the peak sooner, values closer to 100 will stop the peak later. It is recommended to increment the **Value** by steps of 1 from the default setting to move the end point of the peaks.



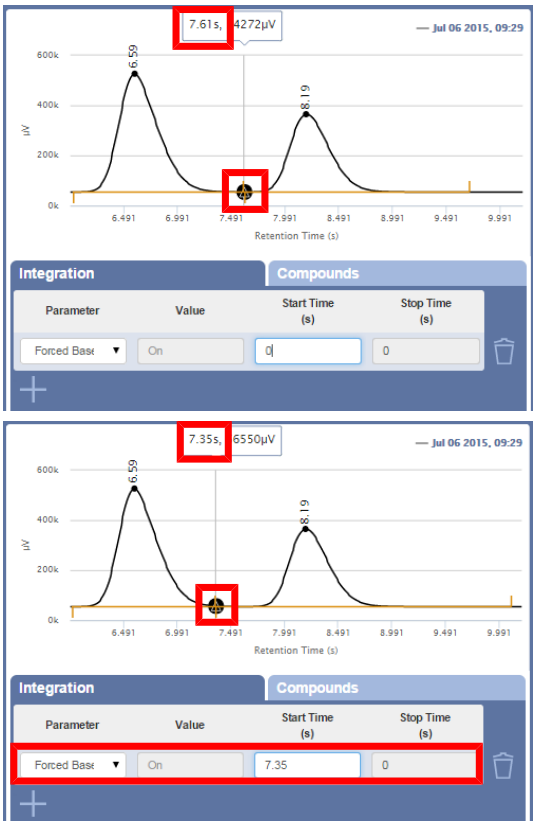
10.10.10.2.8 Peak Sensitivity

The **Peak Sensitivity** parameter allows the increase or decrease of the sensitivity of the auto-integration software. Decreasing the value provides more sensitive results. Increasing the value can reduce noise or undesired peaks.



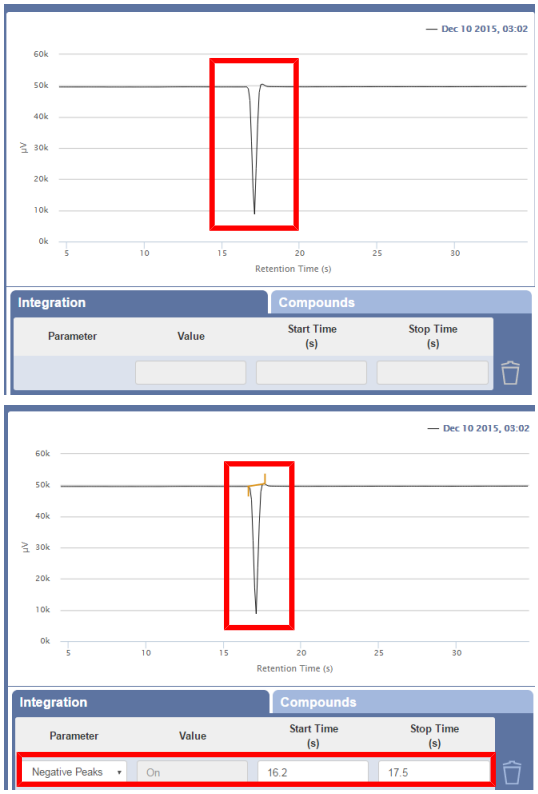
10.10.10.2.9 Forced Baseline

The **Forced Baseline** parameter allows the user to specify a retention time where the baseline starts for succeeding peaks. For peaks eluting before the specified retention time, the baseline end changes when appropriate.



10.10.10.2.10 Negative Peaks

The **Negative Peaks** parameter allows the user to enter a start and stop time to manually integrate a negative peak.

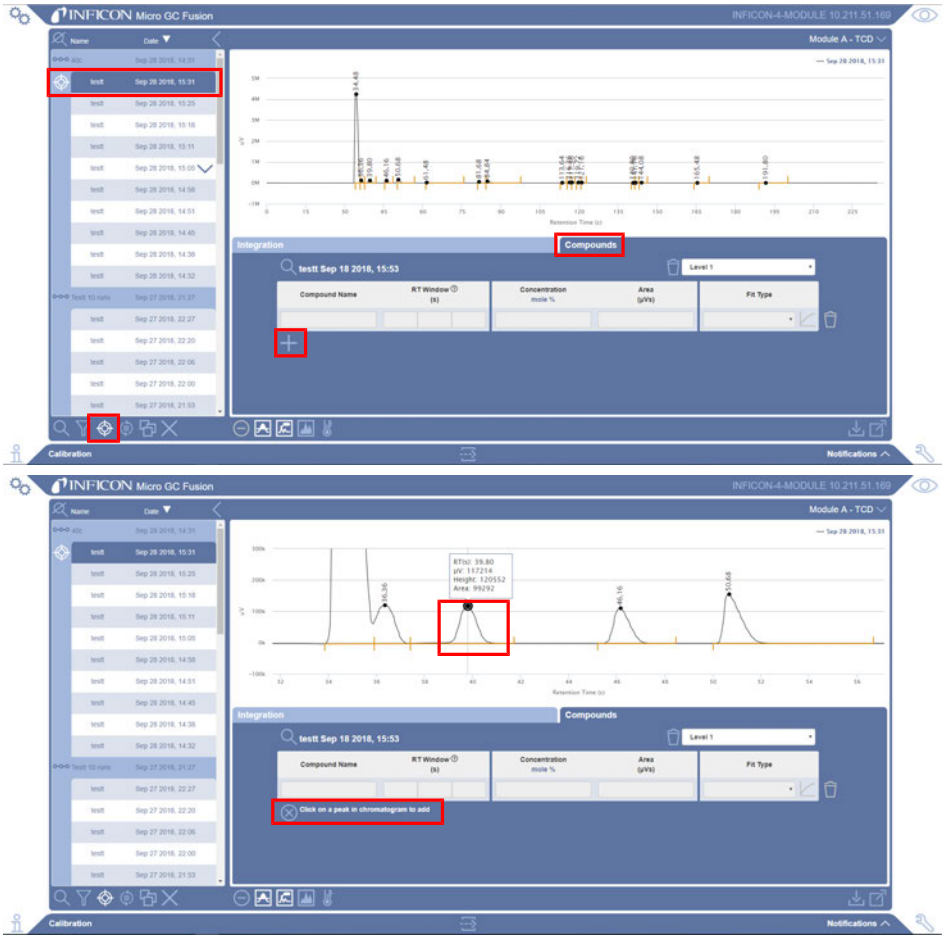


10.10.10.3 Single-Level Calibration

To display compound names and concentrations on the report, the method must contain a list of calibrated compounds. A single-level calibration uses a single data point for a compound in a calibration gas with a known concentration to generate a linear plot of area count (µV) versus concentration (mole% or ppm). This plot will be used to calculate the concentration of an unknown concentration of the calibrated compound.

INFICON recommends conducting multiple runs of the calibration gas and using the last run to perform the calibration. This thoroughly purges the sample path with the calibration gas and ensures the best calibration accuracy.

1. In the **Data Browser** window, select the data file for the calibration gas.
2. Click the icon to enter the calibration window.
3. By default, the Module A **Compounds** tab displays.
4. Click the icon to add a peak.
5. The message **Click on a peak in chromatogram to add** displays. Click on the desired peak to add its corresponding retention time, or **RT(s)**, to the table.



6 Type in the **Compound Name** for the peak.

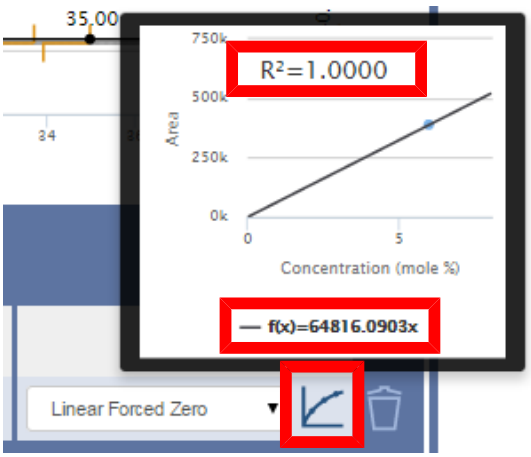
7 The left RT(s) and right RT (s) columns define the retention time window. Edit the retention time start and end points. The retention time window displays as a yellow shaded bar surrounding the peak.



8 Type the concentration of the compound as listed on the calibration gas standard certificate of analysis. Click **mole%** under **Concentration** to change units to **ppm**, and vice versa. An area count (in µVs) is generated in the **Area** column. The **Fit Type Linear Forced Zero** populates by default.



9 Click on the icon to display the calibration curve. A goodness of fit (R^2) value displays. The slope of the calibration curve corresponds to the compound's response factor.



10 Repeat steps 4 to 9 for all compounds.

11 Click the icon to select another module, if configured. If there isn't another module, skip to step 13.

12 Repeat steps 4 to 11 for each additional module.

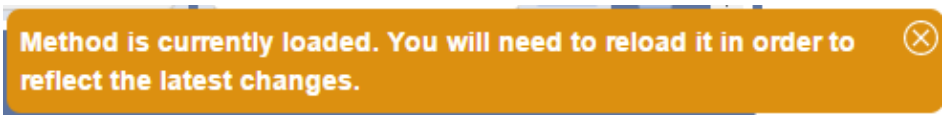


13 Click the icon to save the calibration to the method. A window will prompt the user to save the calibration. To override the current method, use the original method name. An ⚠ icon will indicate that there are unsaved changes.

14 Click the icon.



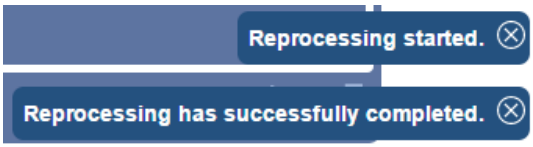
15 A message will prompt the user to reload the method and apply the calibration. The method is now calibrated for a single level.



16 To reprocess the calibrated run with the new information, click the icon. A confirmation message will display **Are you sure you want to reprocess the X selected run(s)?** Click the icon to reprocess the run.



17 A confirmation message will display.



18 Click the icon to exit the calibration window.

10.10.10.4 Recalibration

It is often necessary to recalibrate a method to ensure best analysis accuracy. Causes of recalibration may include a new calibration cylinder is obtained, the instrument is powered on after a long storage time, or to follow an organization established routine recalibration protocol. This procedure will replace all area counts for all compounds.

To recalibrate a method using a new run:

1. Conduct an analysis of the calibration gas standard. INFICON recommends conducting multiple runs of each calibration gas and using the last run to perform the calibration. Doing so thoroughly purges the sample path with the calibration gas, which ensures the best calibration accuracy.
2. In the **Data Browser** window, select the data file for the calibration gas.
3. Click the icon to enter the calibration window.



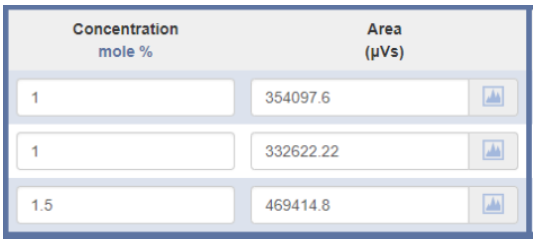
⇨ Ensure the desired data file is selected and click to display a window. Select **Replace calibration** and click the icon.



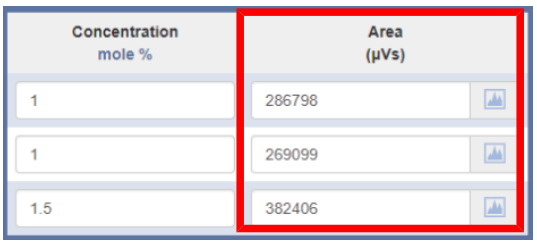
⇨ Average Replicates - Select multiple runs from the calibration gas and click to display a window. Click to confirm you want to average the areas of the individual compounds in the calibrated method. The runs used in average replicates appear with a icon next to each run.



4 The **Area (µV)** column will automatically populate with the new area counts for all compounds in the run. The name of the calibration will be replaced with the currently selected run. When using average replicates, one of the data files used in the calculation will be used as the reference chromatogram for the calibration.



Concentration mole %	Area (µVs)
1	354097.6
1	332622.22
1.5	469414.8



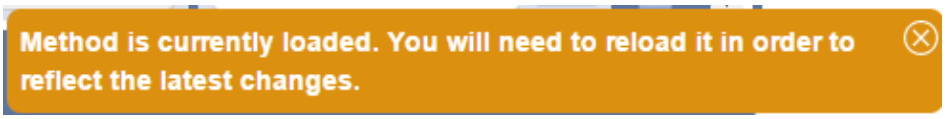
Concentration mole %	Area (µVs)
1	286798
1	269099
1.5	382406

5 If using a new calibration gas standard, type the **Concentration** of the compound as listed on the calibration gas standard certificate of analysis.

6 Click the icon to save the new calibration to the method. A window will prompt the user to save the calibration. To override the current method, use the original method name. An ⚠ icon will indicate that there are unsaved changes.

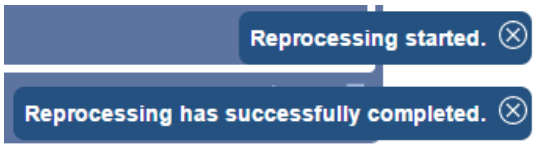
7 Click the icon.

8 A message will prompt the user to reload the method and apply the calibration.



9 To reprocess the calibrated run with the new information, click the icon. A confirmation message will display **Are you sure you want to reprocess the X selected run(s)?** Click the icon to reprocess the run. To apply the new calibration to prior runs, select the desired runs from the list before clicking the icon.

10 A confirmation message will display.



11 Click the icon to exit the calibration window.

12 Click the updated method preset to reload the method.

10.10.10.5 Recalibrate the Area of a Single Peak

Often, it is desired to change integration events for a specific peak from a calibration gas standard run. Many integration events change the area count underneath the peak, which requires an updated area count in the Calibration tab. When calibrating for the first time, area counts for peaks are generated automatically once the peak is entered into the table. When recalibrating, a user may want to only change integration on a single peak.

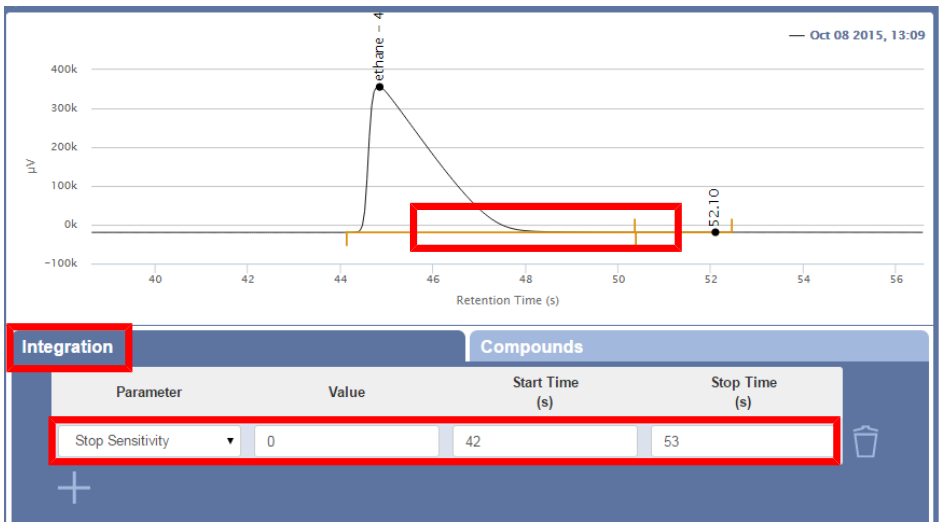
1 Conduct an analysis of the calibration gas standard. INFICON recommends conducting multiple runs of each calibration gas and using the last run to perform the calibration. Doing so thoroughly purges the sample path with the calibration gas, which ensures the best calibration accuracy.

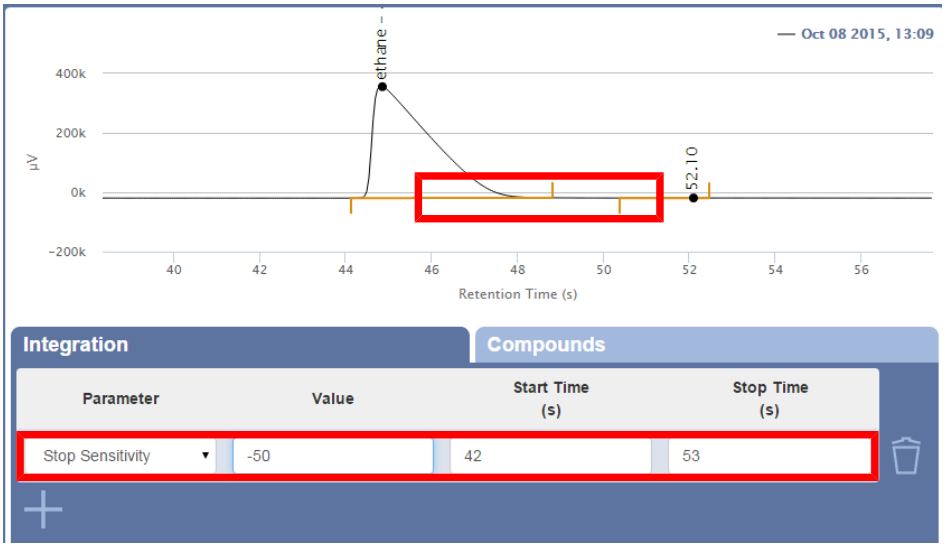
2 In the **Data Browser** window, select the data file for the calibration gas.

3 Click the icon to enter the calibration window.

4 Click the **Integration** tab.

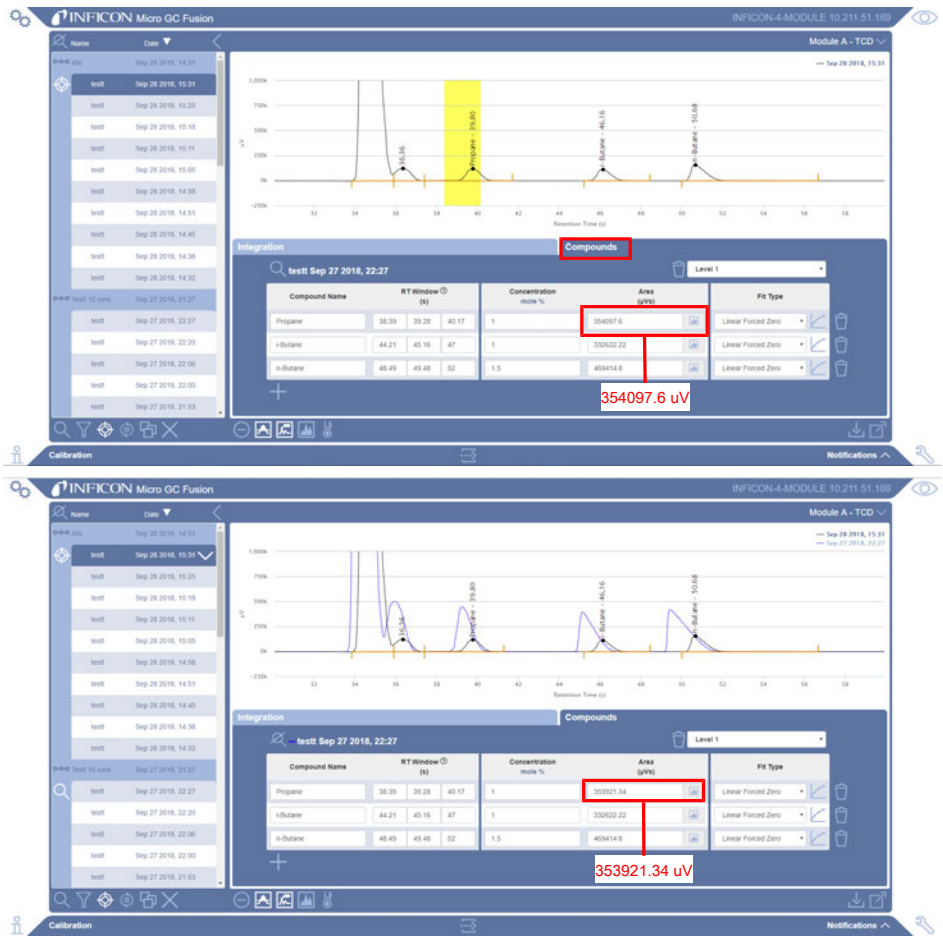
5 Edit the desired integration **Parameter**.





6 Click the **Compounds** tab.

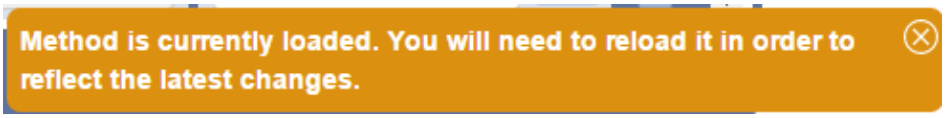
7 Click the icon next to the edited compound to populate a new area count. If the selected run is not the calibration reference data file, the calibration reference data file will open to acquire the new data to update the area. This insures consistency in respect to which data file was used to perform the calibration.



8 Click the icon to save the new calibration to the method. A window will prompt the user to save the calibration. To override the current method, use the original method name. An ⚠ icon will indicate that there are unsaved changes.

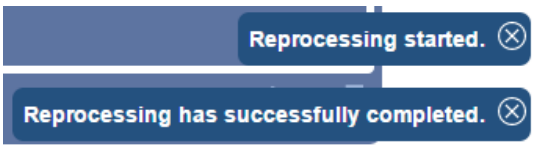
9 Click the icon.

10 A message will prompt the user to reload the method and apply the calibration.



11 To reprocess the calibrated run with the new information, click the icon. A confirmation message will display **Are you sure you want to reprocess the X selected run(s)?** Click the icon to reprocess the run. To apply the new calibration to prior runs, select the desired runs from the list before clicking the icon.

12 A confirmation message will display.



13 Click the icon to exit the calibration window.

14 Click the updated method preset to reload the method.

10.10.10.6 Second-Level Calibration

If a second-level calibration is required, a calibration gas standard of different concentration levels must be run using the same analytical method as the first level calibration. A multi-point calibration utilizes multiple data points from runs of the different calibration gas cylinders. The plot of area count (µV) versus concentration (mol% or ppm) will be used to calculate the concentration of an unknown amount of the calibrated compound.

1 Calibrate a single level by following Single-Level Calibration [▶ 192].

2 Introduce a second-level calibration gas.

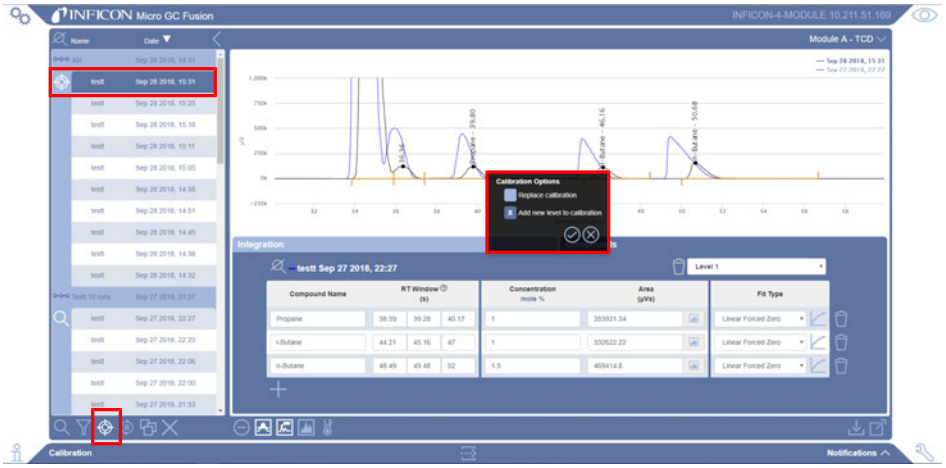
3 Conduct an analysis of the second-level calibration gas. INFICON recommends conducting multiple runs of each calibration gas and using the last run to perform the calibration. Doing so thoroughly purges the sample path with the calibration gas, which ensures the best calibration accuracy.

4 In the data browser, select the data file for the calibration gas corresponding to the second level.

5 Click the icon to enter the calibration window.

6 By default, **Module A** will display.

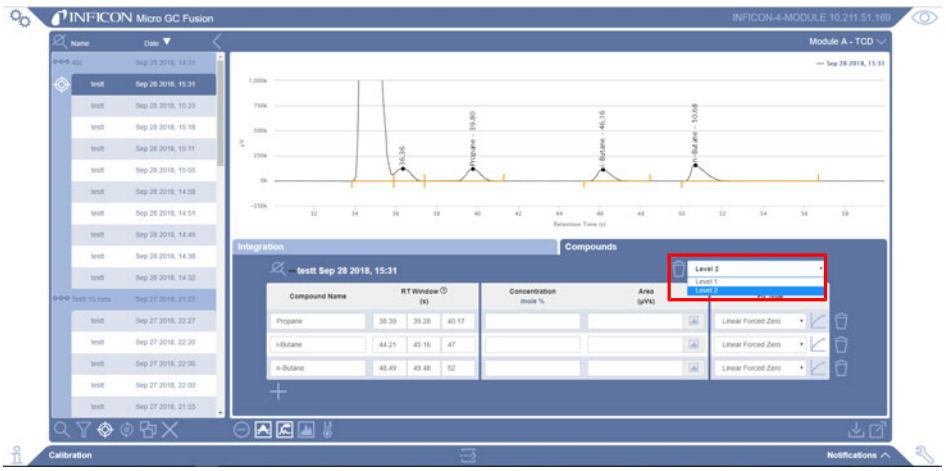
7 Click and a window is displayed. Select **Add new level to calibration.** Click the icon.



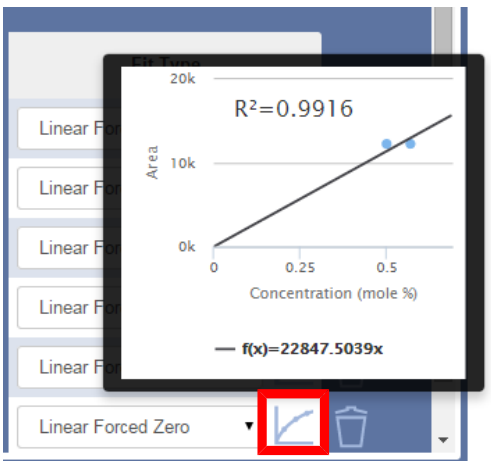
8 The **Concentration** and **Area (µV)** columns will be blank. The name of the calibration will be replaced with the currently selected run.

9 Type the **Concentration** of the compound as listed on the calibration gas standard certificate of analysis. An area count (in µV) will populate in the **Area** column.

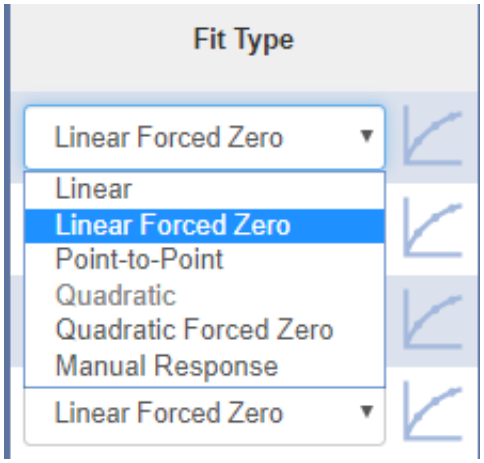
10 To view a different calibration level, select the level from the shortcut menu.



11 Click on the icon to display the calibration curve. A second-level calibration point will display on the curve.



12 Click the **Fit Type** shortcut menu to change the fit type, if desired.

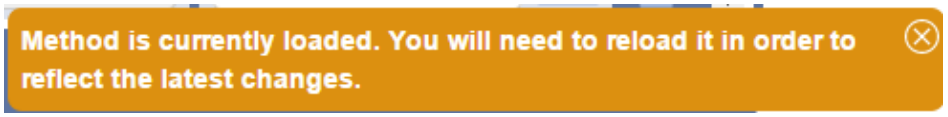


13 Click the icon to select another module, if configured. Otherwise, skip to step 15.

14 Click the icon to save the calibration to the method. A window will prompt the user to save the calibration. To override the current method, use the original method name. An ⚠ icon will indicate that there are unsaved changes.

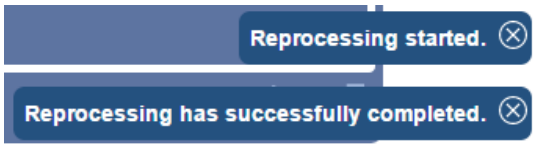
15 Click the icon.

16 A message will prompt the user to reload the method and apply the calibration.



17 To reprocess the calibrated run with the new information, click the icon. A confirmation message will display **Are you sure you want to reprocess the X selected run(s)?** Click the icon to reprocess the run. To apply the new calibration to prior runs, select the desired runs from the list before clicking the icon.

18 A confirmation message will display.



19 Click the icon to exit the calibration window.

20 The method is now calibrated for two levels. Click the icon to return to the main page.

21 Click the updated method preset to reload the method.

22 For more than two calibration levels, repeat steps 2 through 21 as necessary.

10.10.10.7 Manual Response Factors

Often, certain compounds are not available in a calibration gas mix. If the response factor is known or if the response factor can be determined from another compound, a **Manual Response** Factor can be used in lieu of calibration gas.

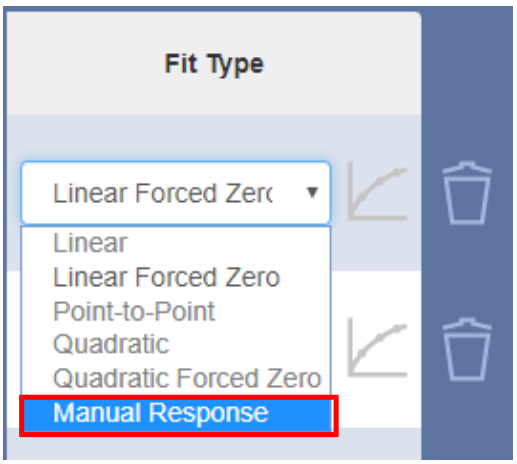
To access the Manual Response Factor:

1. Click the icon.
2. Click **Data Browser** to open the data browser window.
3. Select a run to calibrate. Only one run can be calibrated at a time.
4. Click the icon to open the calibration window.

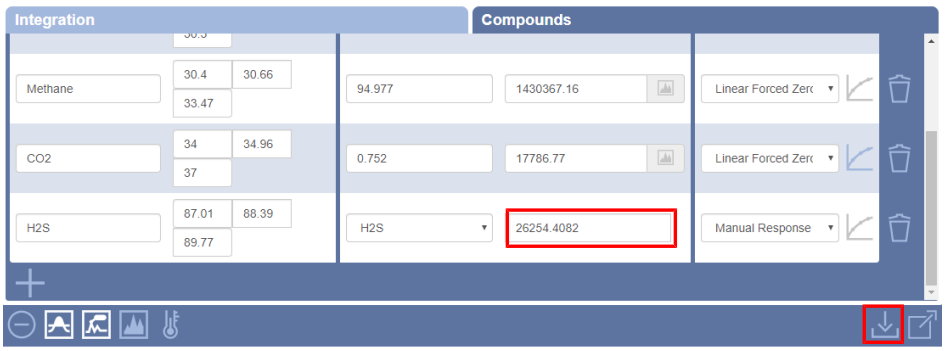
10.10.10.7.1 Typing a Manual Response Factor

To enter a known response factor:

1. In the calibration window, select **Manual Response** from the **Fit Type** shortcut menu for the desired compound.



2. In the area count field, type the known response factor.



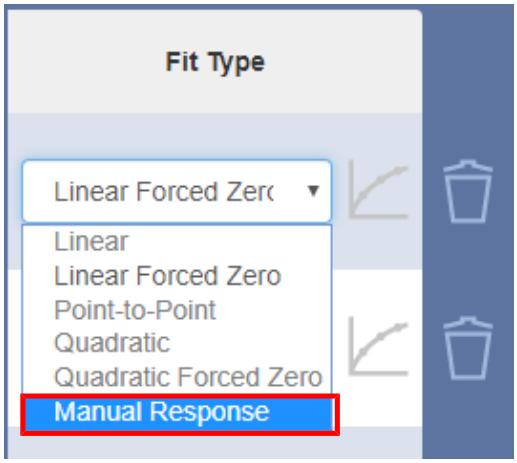
3. Click the icon to save the method.

10.10.10.7.2 Using the Response Factor of a Known Calibrated Compound

If the response factor of the desired compound is close to a previously calibrated compound, a multiplication factor can be used to calibrate the desired compound.

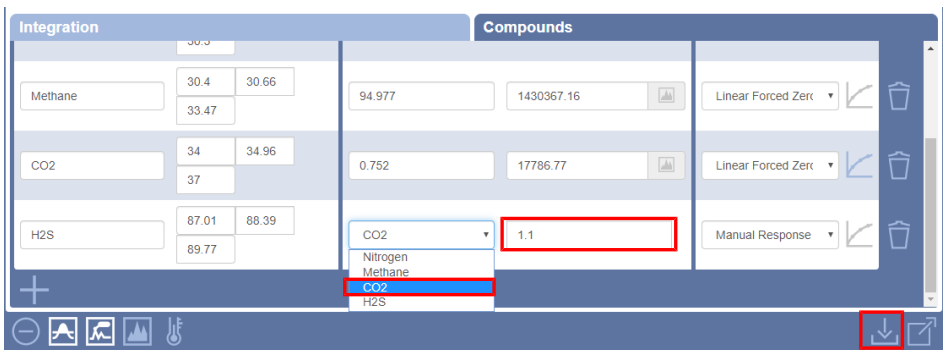
To use the response factor of a calibrated compound:

1. In the calibration window, select **Manual Response** from the **Fit Type** shortcut menu for the desired compound.



2 From the shortcut menu, select the compound to use as a reference (Ex. CO_2).

3 In the area count field, type the known multiplication factor (Ex. 1.1).



4 Click the icon to save to the method.

10.10.10.8 Auto-Calibration

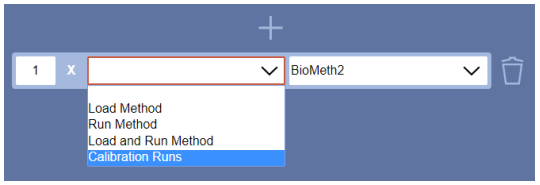
Micro GC Fusion has the ability to automatically recalibrate a previously calibrated method. Depending on the setup of Micro GC Fusion, the auto-calibration can be set up in different ways.

- Single-level calibration
- Multi-level calibration
- Multi-level calibration using a Valco Stream Selector

10.10.10.8.1 Single-Level Calibration

1 Create a **Sequence** called **Calibration**. (See Add Sequence [▶ 158])

2 From the shortcut menu, select **Calibration Runs**.



3 Type the number of step repetitions and the method. If desired, add a delay between each repetition.



4 Type the number of runs to average and the level in which the averaging should take place.

⇨ **Average Last** - The number of previous runs used when averaging component areas. This is known as "Average Replicates."

⇨ **Level** - The level in which the auto-calibration should take place. Within this level the component areas will be replaced as long as the new values are within 10% of the previous value. A single-level calibration should have the number **1** entered after level.

5 Click the icon to save the sequence.

6 Run the sequence. (See Run Sequence [▶ 165].)

10.10.10.8.2 Multi-Level Calibration

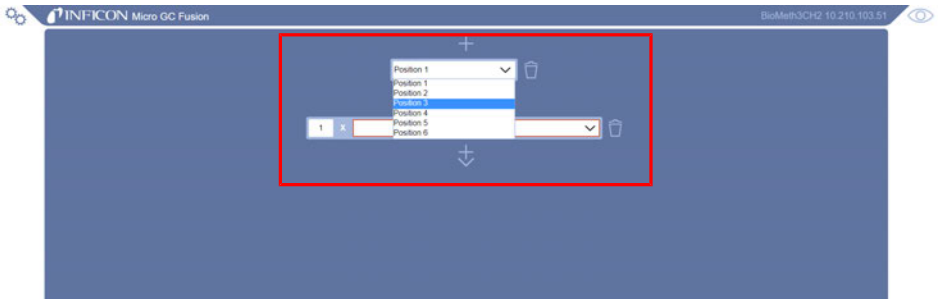
Create several sequences corresponding to the calibration level using the method described in Single-Level Calibration [▶ 204].

Example - An auto-calibration sequence for level 3 would be named **Level 3 Calibration** and have a **3** typed in the **Calibration Runs Level** field.

10.10.10.8.3 Multi-Level Calibration using a Valco Stream Selector

1 Create a sequence called **Auto-Calibration**. See Add Sequence [▶ 158].

2 Add a Valco Stream Selector switching event and switch to the first calibration gas.



3 Click the icon and select **Calibration Runs**.



4 Type the number of step repetitions and the method. If desired, add a delay between each repetition.

5 Type the number of runs to use while averaging the area.

6 Type **1** for a level 1 calibration.

7 Click the icon and select **Add Valve**.

8 Use the valve menu to select the level 2 calibration gas.

9 Select **Calibration Runs**.

10 Type **2** for a level 2 calibration.



11 Repeat steps 7 through 10 until you have reached the desired number of levels.

12 Click to save the sequence.

13 Run the **Auto-Calibration** sequence after all the calibration gases are connected.

10.10.11 Reprocess Runs

Often it is desirable to edit integration parameters and adjust retention time windows after a run is completed, without adjusting the calibration information.

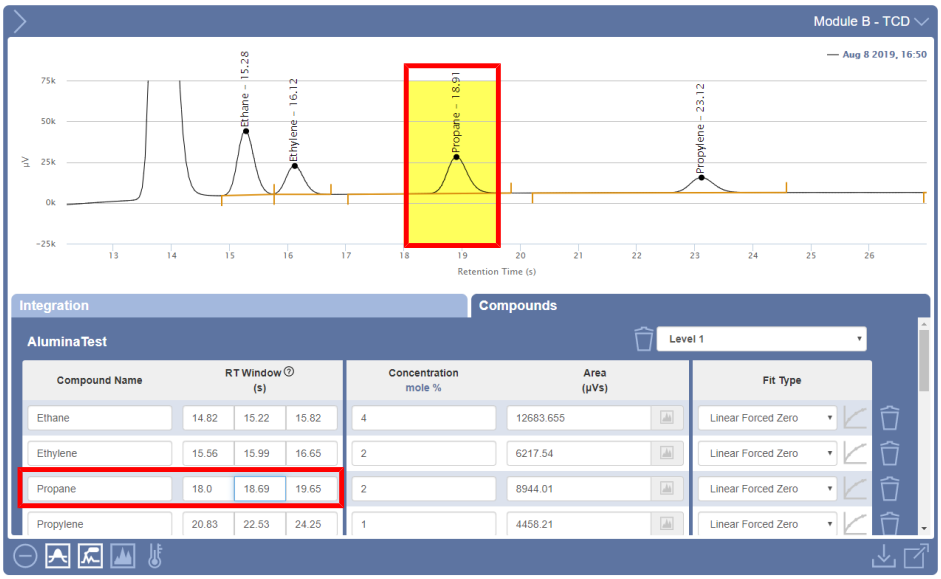
After a run is performed:

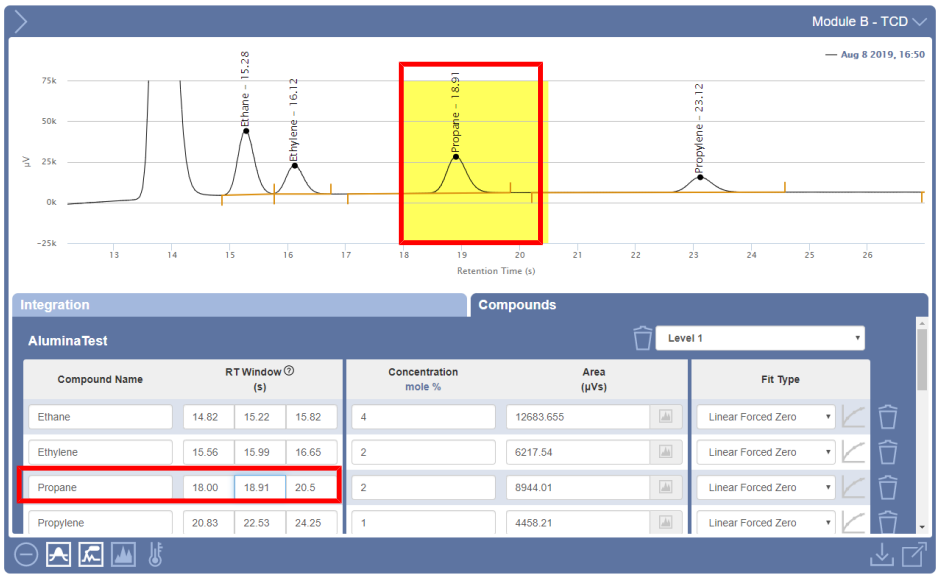
1 In the data browser, click on the run.

2 Click the icon to open the calibration window. By default, **Module A** will display.

3 Click the icon to select another module, if desired.

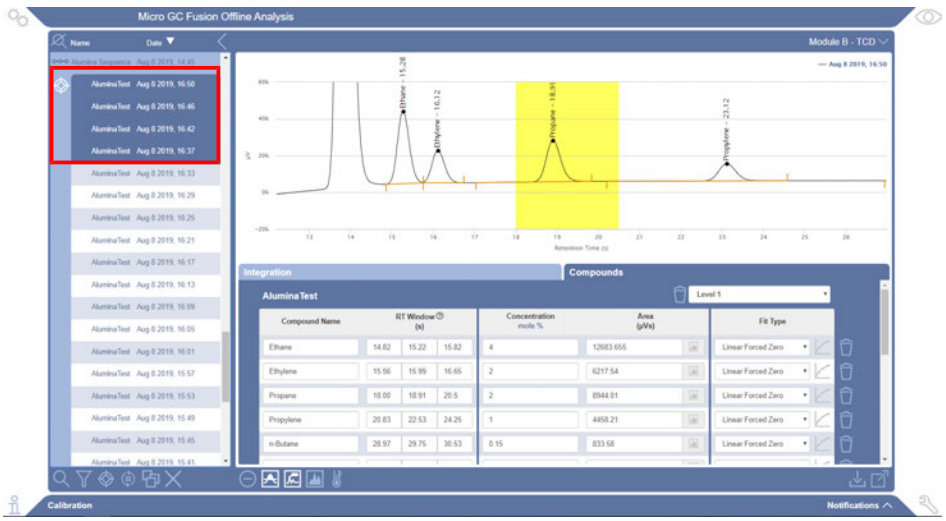
4 Integration parameters can be edited in the **Integration** tab. The retention time windows can be edited in the **Compounds** tab.



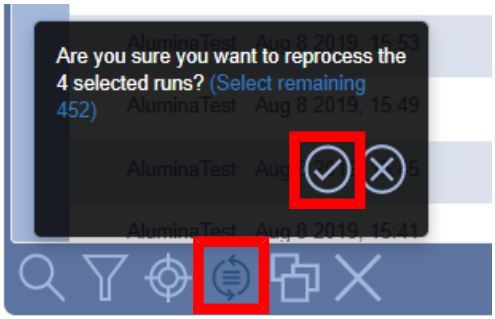


5 Click the icon to save the changes to the method.

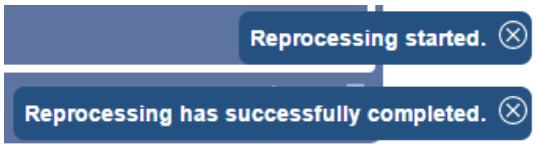
6 Select additional runs to reprocess, if desired, by holding down the CTRL key and clicking on the desired runs.



7 Click the icon to reprocess the runs. A window appears, **Are you sure you want to reprocess the X selected run(s)?**. Click the icon to reprocess or to exit the window.



8 A confirmation message will display.



9 Click the icon to exit the calibration window.

10 View the desired run(s) by double-clicking on the run, or by selecting the run and clicking the icon.

11 The chromatogram(s) and report(s) will display the updated information.

10.11 Micro GC Fusion Offline Analysis

Micro GC Fusion Offline Analysis allows the user to view and reprocess data on a standalone computer. It offers a similar work flow and capability as the Micro GC Fusion Data Browser, but without the need to connect to an instrument. The operation of Micro GC Fusion Offline Analysis, unless otherwise specified, is the same as the Data Browser operation document in Data Browser [▶ 172].

Micro GC Fusion Offline Analysis is a licensed product. The license certificate (PN 952-035-G1) provides the license certificate ID and software download instructions. The software installation procedure is available on the Micro GC Fusion product website.



INFICON

License Certificate
Offline Analysis

Micro GC Fusion®

LICENSE CERTIFICATE ID: XXXXXXXX-XXXXXXXX

Perform the following steps to activate Micro GC Fusion Offline Analysis:

1 Please have the License Certificate ID printed on this certificate available.

2 Download the Micro GC Fusion Offline Analysis software onto your computer from http://www.inficon.com/downloads/software-downloads/

3 Run the Micro GC Fusion Offline Analysis installer. The detailed instructions for setup and installation are available in the Micro GC Fusion Offline Analysis Installation Instruction Sheet, which is available for download on the Micro GC Fusion product website at http://products.inficon.com/en-us/nav-products/product/detail/micro-gc-fusion-gas-analyzer/

10.11.1 Initializing Micro GC Fusion Offline Analysis

The Micro GC Fusion Offline Analysis icon is present on the desktop after the installation of the Micro GC Fusion Offline Analysis software package. Double-click on the Micro GC Fusion Offline Analysis icon and the software will open in your default Internet browser.

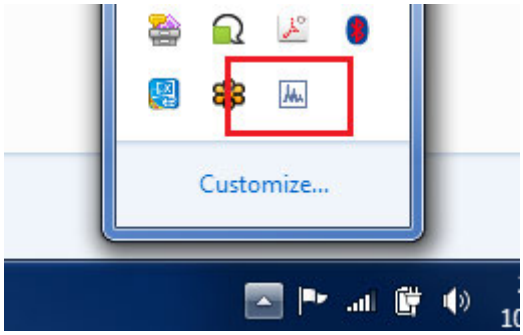
10.11.2 Tray Icon

A system tray icon appears after the software is started, indicating the Micro GC Fusion Offline Analysis service is running in the background. The tray icon is identical to the desktop icon. The tray icon can be used to launch the browser, restart service and exit service.

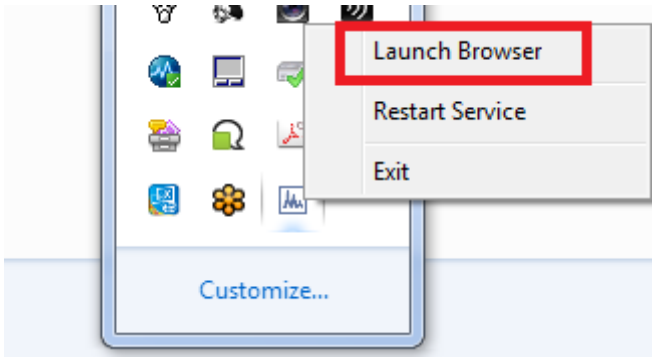
10.11.2.1 Launch the Browser

The Micro GC Fusion Offline Analysis interface can be launched from the tray icon in two ways:

1 Left-click on the tray icon.

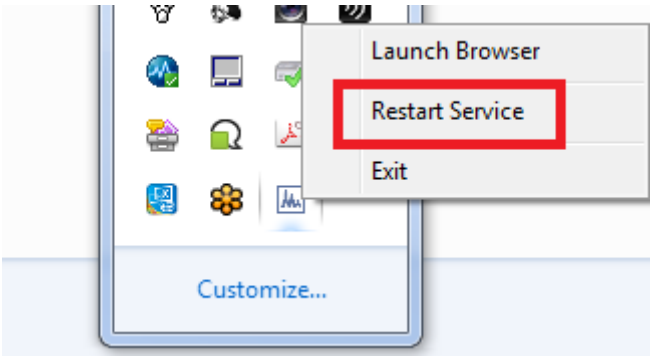


2 Right-click on the try icon and select Launch Browser.



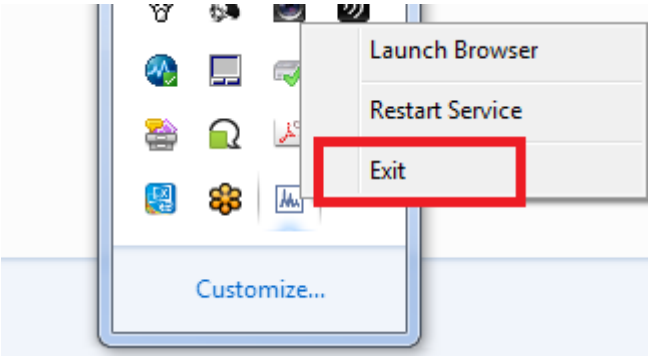
10.11.2.2 Restart Service

Right-click on the tray icon and select **Restart Service**. The background service will restart, resolving any connection issues with the user interface. The background service restart can also be accomplished by double-clicking on the Micro GC Fusion Offline Analysis icon.



10.11.2.3 Exit Service

To stop running the Micro GC Fusion Offline Analysis service, right-click on the system tray icon and click **Exit**. This will shut down the service running in the background. However, all of the data will be saved when restarting the software.

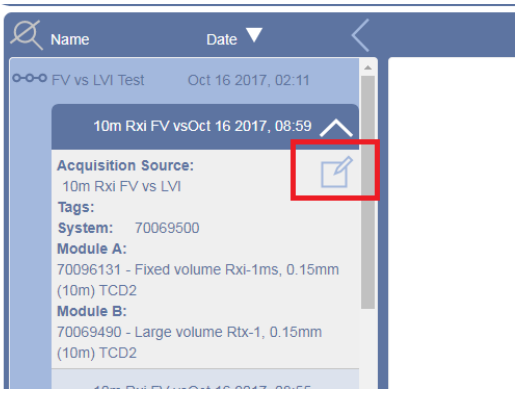


10.11.3 Saving a Method

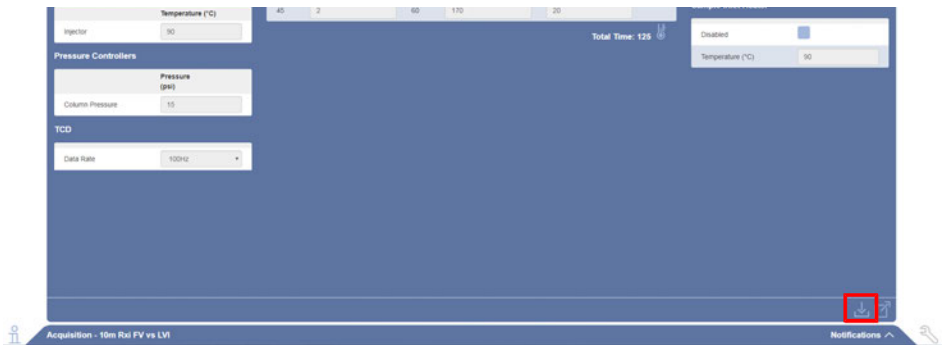
There are two ways to save a method from Micro GC Fusion Offline Analysis.

1 Acquisition parameters:

⇨ Click the icon to view the acquisition parameters such as column temperatures and pressures.



⇨ After reviewing the method, save by clicking the icon and the method will download to the computer.



2 Calibration: While in the calibration screen, click the icon to download the new method. Any method that has been downloaded can be uploaded to an instrument.



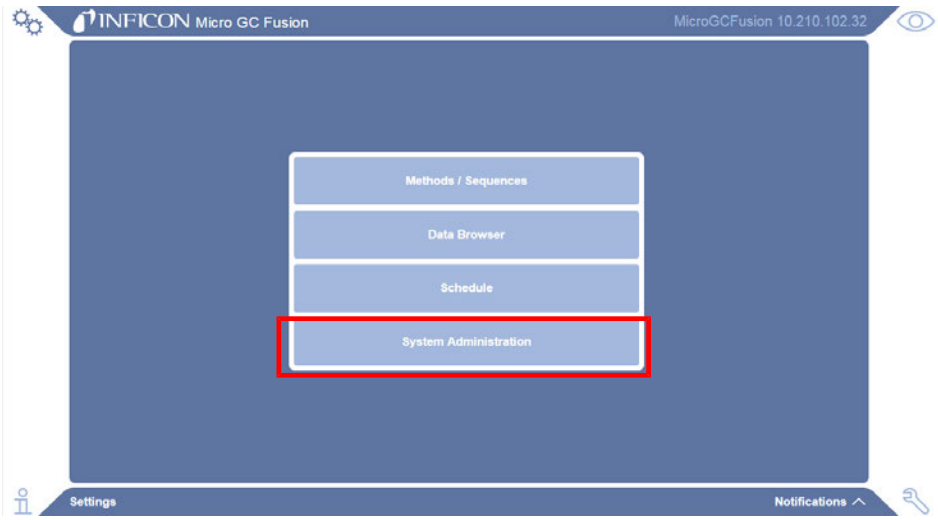
10.12 Valco Stream Selector Operation

Micro GC Fusion can be paired with a Valco stream selector from VICI (Valco Instruments Co. Inc.) to perform analyses on multiple gas streams. Refer to Valco Stream Selector [▶ 75] for an introduction to the connection between a Valco stream selector and a Micro GC Fusion, and supported valve types.

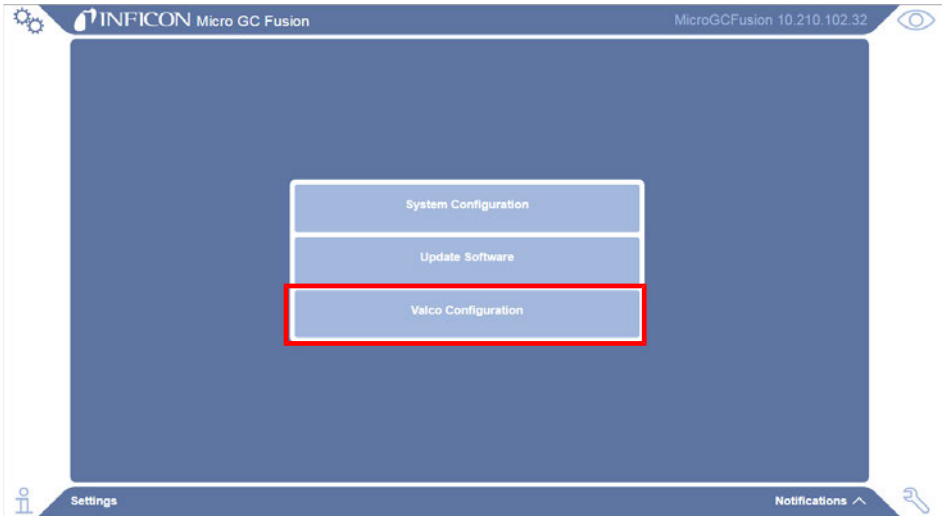
10.12.1 Valco Stream Selector Configuration

To access the Valco stream selector valve configuration:

1. Click the ⚙ icon.
2. Click the **System Administration** button.



3. Click on **Valco Configuration**.



4 The valve **Settings** window will display. Ensure that the **Enabled** option is selected if the Valco stream selector is connected with the Micro GC Fusion.



10.12.1.1 Position Assignments

Individual valve positions can be assigned with unique names.

1 Click on the desired position.

2 Type a name in the field. Unnamed positions will retain their original position number.

10.12.1.2 Purge Position

To assign a purge position:

1 Select the **Returns to Purge Position** option.

2 Click the icon next to the desired purge position. The icon will turn white to indicate that the position has been selected.

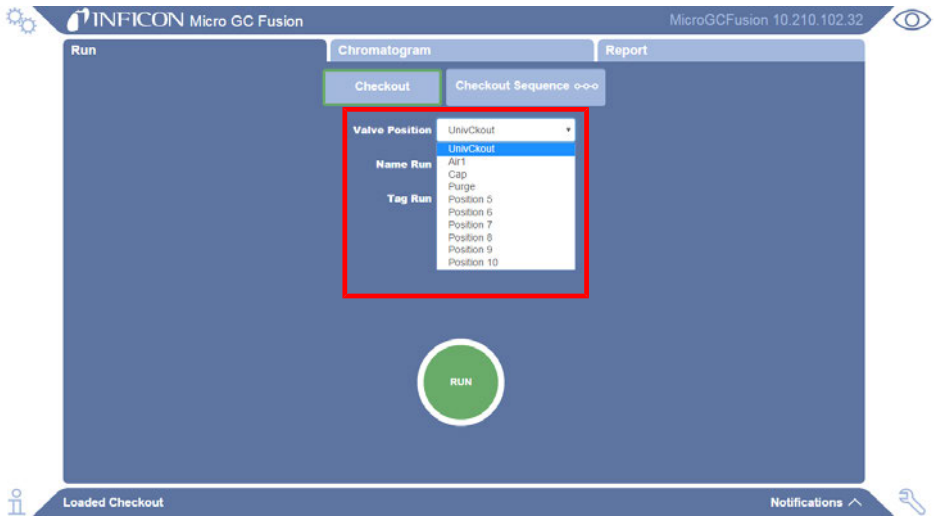


10.12.2 Running a Method Using a Valco Stream Selector

The Micro GC Fusion main page will display a valve position shortcut menu when the valve is enabled.

To start a single method run:

1 Select the desired **Valve Position** from the shortcut menu.



2 Type a sample name in **Name Run** or tags in **Tag Run** desired.

3 Click the **RUN** button to initiate a run and the selected valve position.

10.12.3 Running a Sequence Using a Valco Stream Selector

To create a sequence using a valve:

1 Click the icon.

2 Click the **Method / Sequences** button.

3 Click the icon.

4 In the pop up window, type a sequence name in the **Name:** field.

5 Select the **Sequence** option.

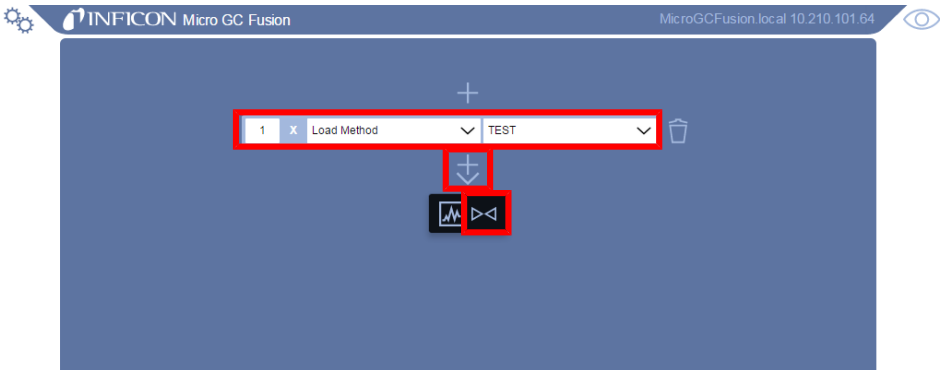
6 Click the icon. The Sequence Editor window opens.

7 Click the step shortcut menu to select an action.

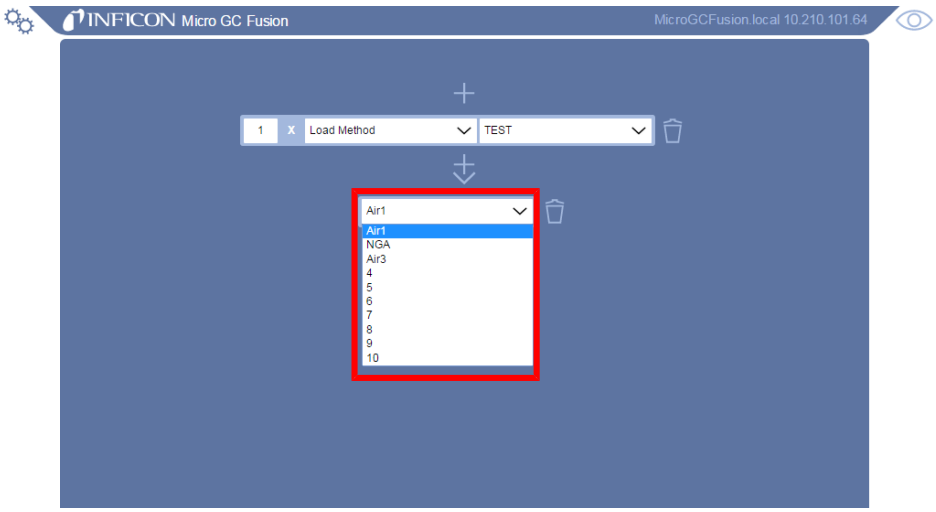
8 To select a method, click the method shortcut menu. Type the number of step repetitions.

9 Click the icon to add an event.

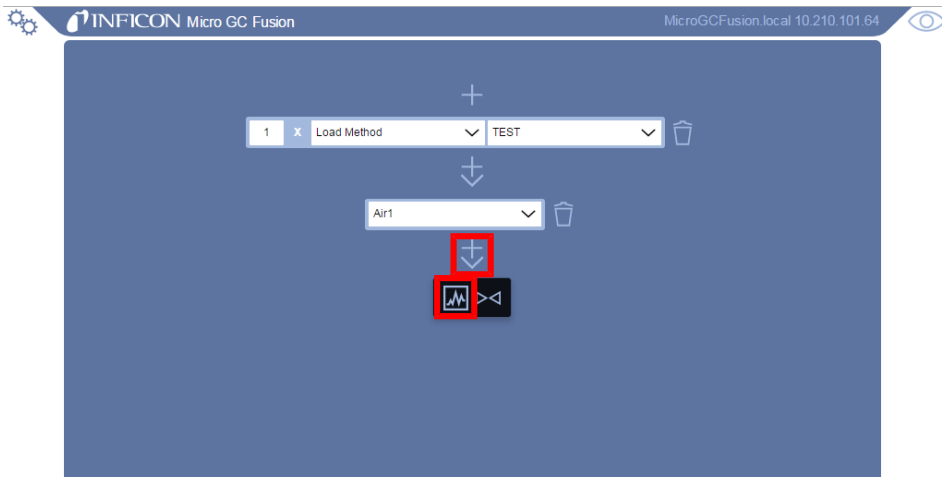
10 Click the icon to add a valve position.



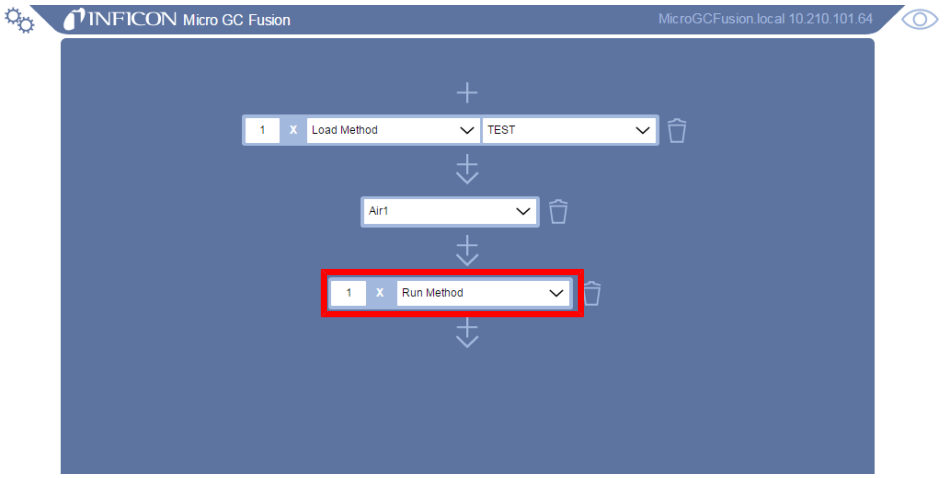
11 Select the desired valve position from the shortcut menu.



12 Click the icon, followed by the icon to add an event.

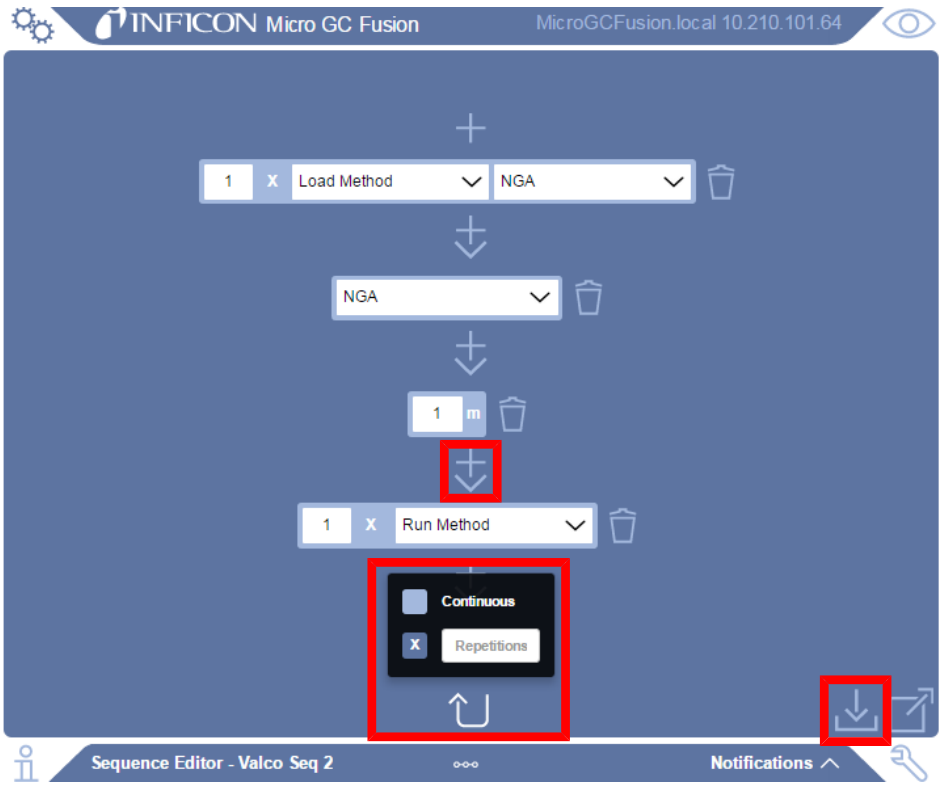


13 Select the desired event from the shortcut menu.



14 Click the icon to add addition events, delays, or port positions.

15 Click the icon to select the number of Repetitions for the defined sequence, or select Continuous to run the sequence indefinitely.



16 Click the icon to save the sequence and return to the **Methods/Sequences** window.

10.13 Automatic Appending CSV File

The procedure below demonstrates how to use Micro GC Fusion to create continuously updated comma separated value (CSV) files from calibrated methods using Python software. Running this CSV script appends a new row of analysis results to the end of a .CSV logfile after each new run has completed.

The CSV file contains the following information:

- time and name of run
- concentration and normalized concentration for each calibrated compound
- area count and retention time for each calibrated compound

At least one compound must be calibrated for a meaningful logfile.

When the Valco Stream Selector is connected, the name of the run field is replaced by the **port name** defined in the **Valve Configuration** screen.

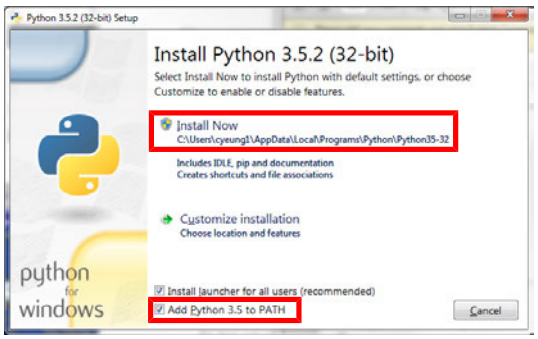
10.13.1 Install Python Software

Python is a free and open source scripting language that is widely used for scientific data analysis. To install Python, download the latest installer from **https://www.python.org/**. Either Python v2.7 or v3.5.2 or above will work for this example. Select v3.5.2 or above, unless integrating with older Python code.

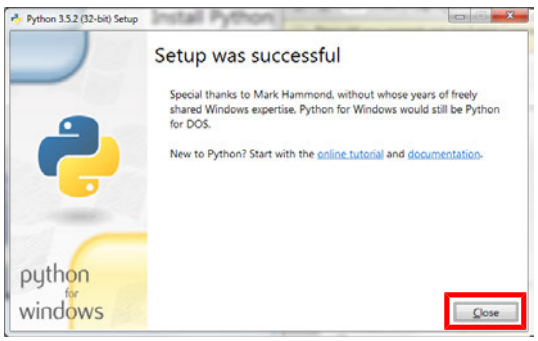
To install Python 3.5.2 or above on Windows:

1. Download the file **python-3.5.2.exe** or latest version.
2. Locate the file on the computer and double click to on **python-3.5.2.exe** or latest version.

   ⇨ When prompted by the installer, check **Add Python 3.5** or **PATH** option.



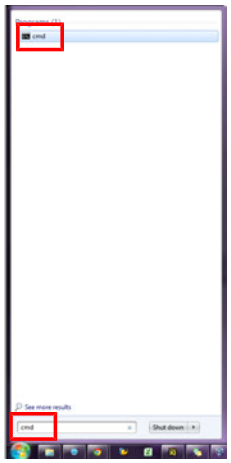
3. Click **Install Now** to continue the installation.
4. Click **Close** to complete the installation.



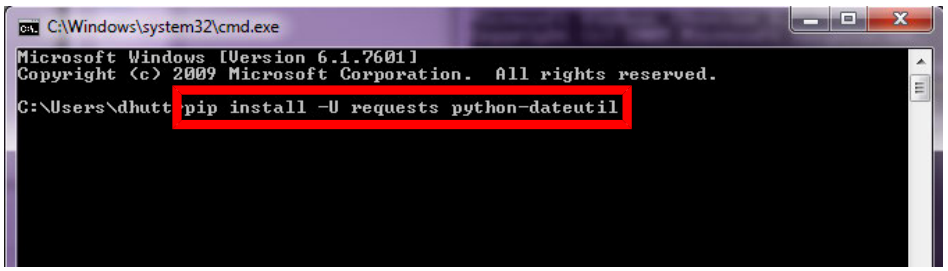
10.13.1.1 Install Python Packages

In order to create an appending CSV file, Python requires certain packages to be installed.

1. Click the Windows Start button and type **cmd** into the search bar. Click the **cmd** program to open the Windows command prompt.



2. In the command prompt window, type **pip install -U requests python-dateutil**.



3. Press the **Enter** key. Once finished, exit the command prompt.

If the error **Pip is not recognized as an internal or external command** appears, check that **python.exe** was added to the path in Step 2. Including **-U** in the command ensures that the packages are up to date.

10.13.2 Copy the CSV Script to the Computer

The CSV script must be saved on the computer in order to generate the file.

1. Open a supported browser.
2. Type **http://products.inficon.com/GetAttachment.axd?attaName=47f0f3f3-ffcf- 4fef-bad2-2ecf34b579eb** in the web browser address bar.
3. Press the **Enter** and the **csv-log.py** file will be saved in the designated download location.

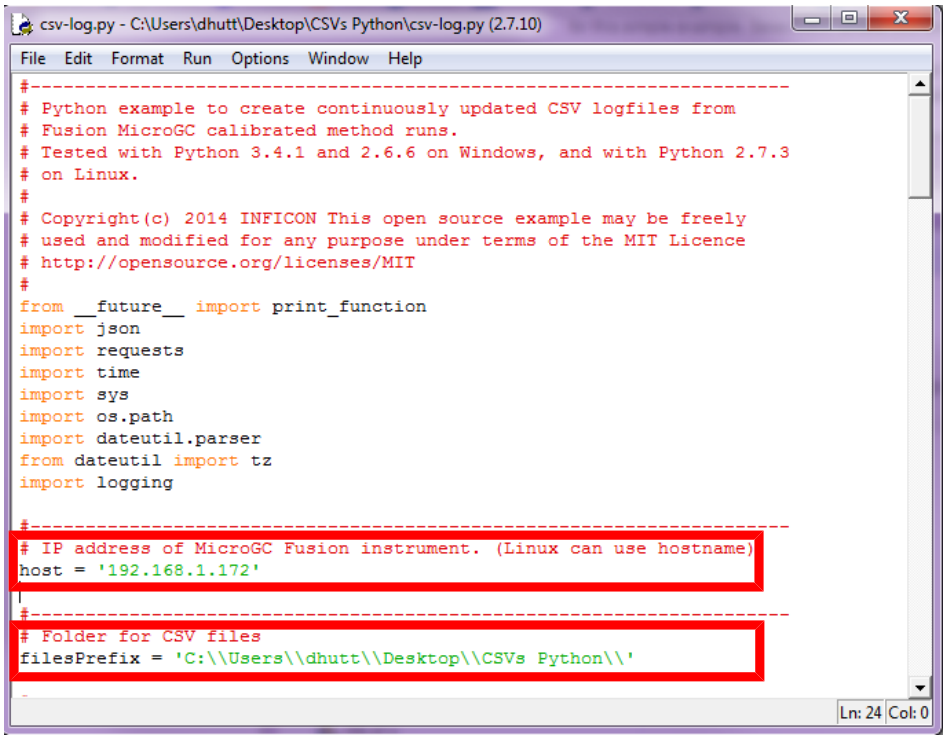
10.13.3 Customize the CSV Script

The CSV script must be updated to connect to Micro GC Fusion and to specify the location for the .CSV logfile on the computer.

1. Once downloaded to the computer, right-click the **csv-log.py** file.
2. Select **Edit with IDLE** or **Open with Notepad**.

3 Under **IP Address of MicroGC Fusion instrument** is a **host** variable which must be changed to the IP address of the instrument. Replace the quoted name with the IP address of the instrument. For example, **host = '192.168.1.172.'**

4 Enter a destination for the files to be stored under **Folder for CSV Files**. Replace the quotes location with the desired file location using double back slashes. For example, **filesPrefix = 'C:\\Desktop\\CSVs Python\\.'**

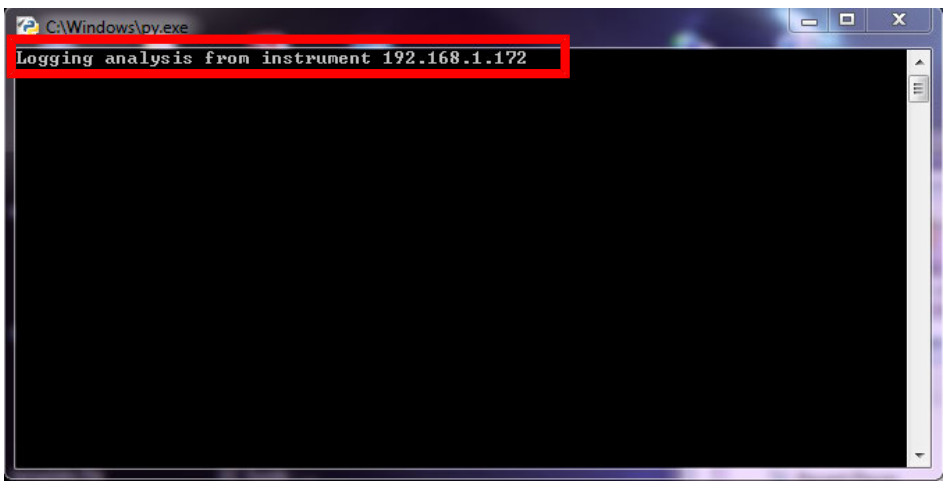


10.13.4 Run the CSV Script

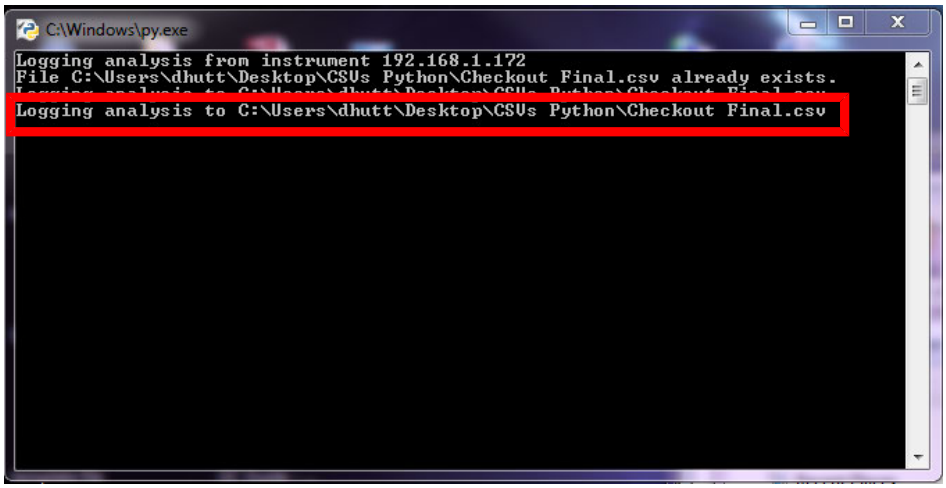
The CSV script can be run using one of two procedures.

10.13.4.1 Run the Script by Double-Clicking the csv-log.py File

1 Double-click on the csv-log.py file. A window and confirmation message will display. This method will not show any errors, if present.



2 Once the script is running, information will be automatically added to the CSV file at the completion of the run. A confirmation message will display in the Python window.

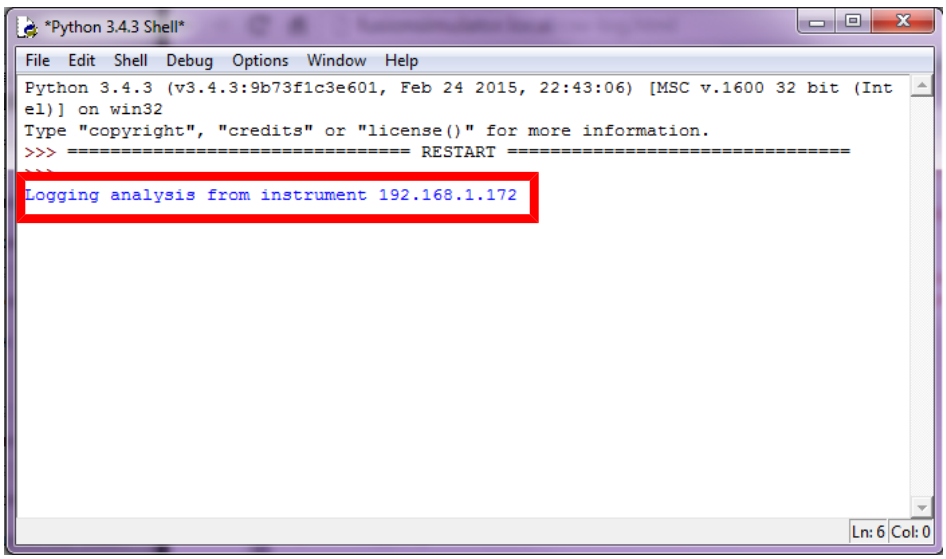


Do not close this Python window when appending to the logfile. Closing the Python window will terminate the Python script.

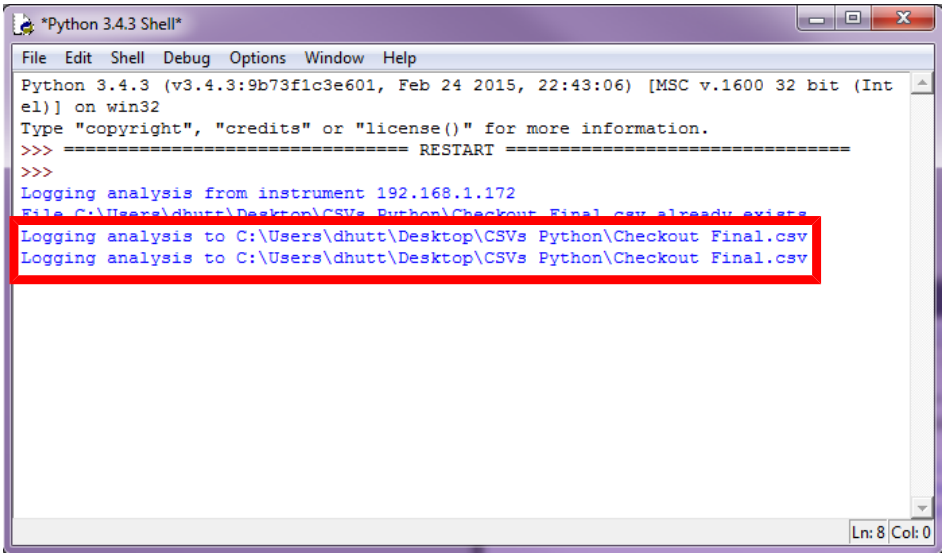
10.13.4.2 Run the Script Through the IDLE Editor

1 Right-click on the csv-log.py file and select **Edit with IDLE**.

2 In the IDLE editor, press the **F5** key. A Python window will display. A confirmation message will display **Logging analysis from instrument X.X.X.X**.



3 Once the script is running, information will be automatically added to the CSV file at the completion of the run. A confirmation message will display in the Python window.

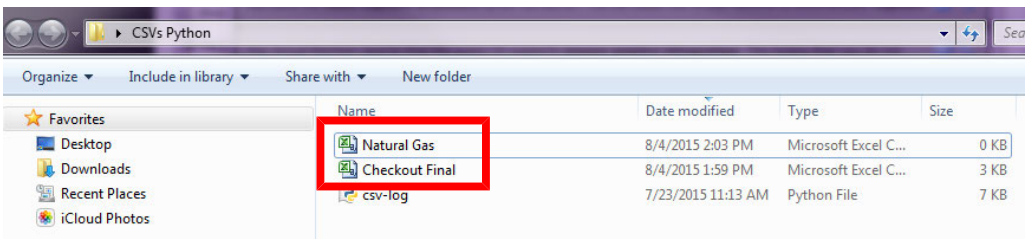


Do not close this Python window when appending to the logfile. Closing the Python window will terminate the Python script.

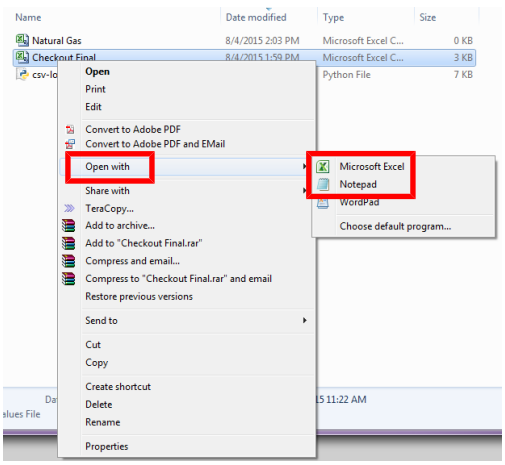
10.13.5 Viewing the CSV File

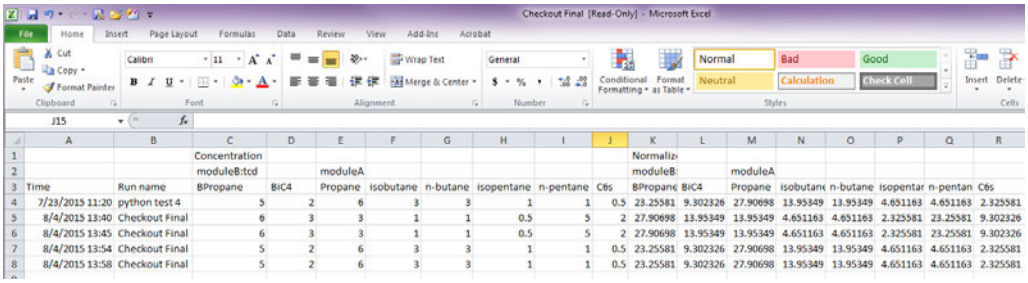
A CSV file will generate with the name of the method. Any run using that method will append to the method specific file.

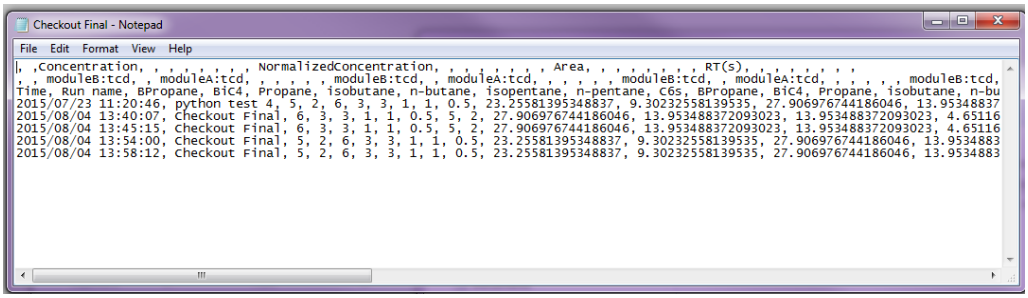
Each method will have its own CSV file.



To view the file, right-click on the file and select **Open with Microsoft Excel** or **Open with Notepad**.




Checkout Final [Read-Only] - Microsoft Excel
File Home Insert Page Layout Formulas Data Review View Add-Ins Acrobat
Cut Copy Format Painter Paste
Calibri 11 Wrap Text General
Merge & Center
Conditional Formatting Format as Table
Normal Bad Good Neutral Calculation Check Cell
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Clipboard Font Alignment Number Styles Cells
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Time Run name BPropane BiC4 Propane isobutane n-butane isopentane n-pentane C6s BPropane BiC4 Propane isobutane n-butane isopentar n-pentan C6s
7/23/2015 11:20 python test 4 5 2 6 3 3 1 1 0.5 23.25581 9.302326 27.90698 13.95349 13.95349 4.651163 4.651163 2.325581
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8/4/2015 13:45 Checkout Final 6 3 3 1 1 0.5 5 2 27.90698 13.95349 13.95349 4.651163 4.651163 2.325581 23.25581 9.302326
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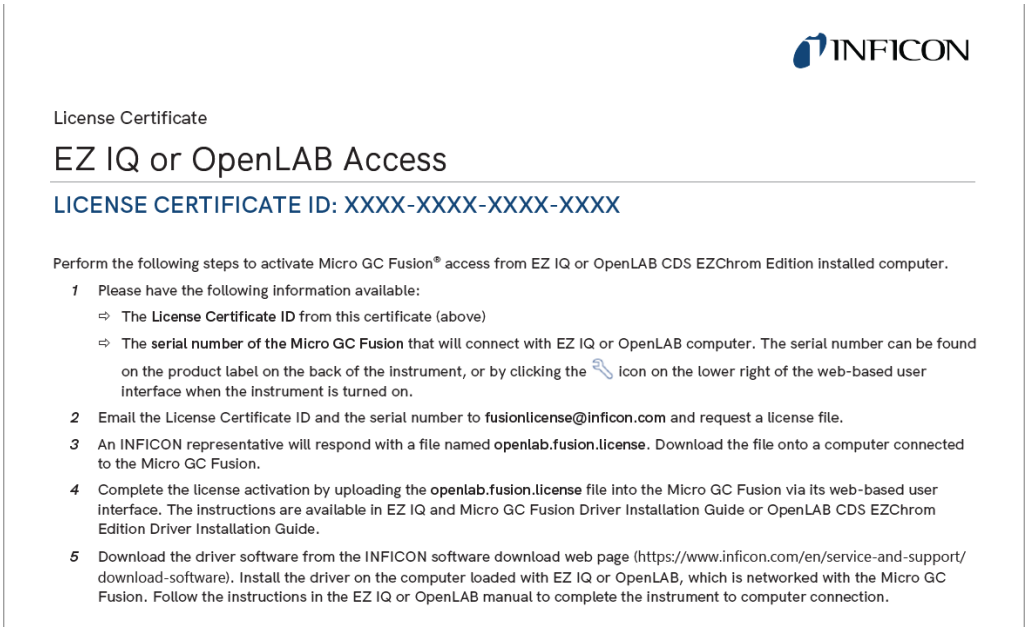

Checkout Final - Notepad
File Edit Format View Help
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, , moduleB:tcd, , moduleA:tcd, , , , , , moduleB:tcd, , moduleA:tcd, , , , , , moduleB:tcd, , moduleA:tcd, , , , , , moduleB:tcd,
Time, Run name, BPropane, BiC4, Propane, isobutane, n-butane, isopentane, n-pentane, C6s, BPropane, BiC4, Propane, isobutane, n-bu
2015/07/23 11:20:46, python test 4, 5, 2, 6, 3, 3, 1, 1, 0.5, 23.25581395348837, 9.30232558139535, 27.906976744186046, 13.95348837
2015/08/04 13:40:07, Checkout Final, 6, 3, 3, 1, 1, 0.5, 5, 2, 27.906976744186046, 13.953488372093023, 13.953488372093023, 4.65116
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10.14 EZ IQ or OpenLab EZChrom Instrument Control

Micro GC Fusion is compatible with INFICON EZ IQ and Agilent OpenLAB CDS EZChrom Edition software (OpenLAB EZChrom). To connect the Micro GC Fusion to either software, the Micro GC Fusion driver for EZ IQ or OpenLAB EZChrom must be installed on the computer and a License Certificate for EZ IQ or OpenLAB Access (PN 952-389-G1) must be purchased from INFICON and installed on the Micro GC Fusion.

Each License Certificate ID enables one Micro GC Fusion to be controlled by EZ IQ or OpenLAB EZChrom. If EZ IQ or OpenLAB EZChrom are to control two Micro GC Fusions, then two License Certificates are needed, one for each Micro GC instrument.

The License Certificate for EZ IQ or OpenLAB Access (PN 952-389-G1) provides step by step instructions on downloading and installing the license file onto Micro GC Fusion.



INFICON

License Certificate

EZ IQ or OpenLAB Access

LICENSE CERTIFICATE ID: XXXX-XXXX-XXXX-XXXX

Perform the following steps to activate Micro GC Fusion® access from EZ IQ or OpenLAB CDS EZChrom Edition installed computer.

1. Please have the following information available:
   - ⇨ The **License Certificate ID** from this certificate (above)
   - ⇨ The **serial number of the Micro GC Fusion** that will connect with EZ IQ or OpenLAB computer. The serial number can be found on the product label on the back of the instrument, or by clicking the icon on the lower right of the web-based user interface when the instrument is turned on.
2. Email the License Certificate ID and the serial number to **fusionlicense@inficon.com** and request a license file.
3. An INFICON representative will respond with a file named **openlab.fusion.license**. Download the file onto a computer connected to the Micro GC Fusion.
4. Complete the license activation by uploading the **openlab.fusion.license** file into the Micro GC Fusion via its web-based user interface. The instructions are available in EZ IQ and Micro GC Fusion Driver Installation Guide or OpenLAB CDS EZChrom Edition Driver Installation Guide.
5. Download the driver software from the INFICON software download web page (https://www.inficon.com/en/service-and-support/download-software). Install the driver on the computer loaded with EZ IQ or OpenLAB, which is networked with the Micro GC Fusion. Follow the instructions in the EZ IQ or OpenLAB manual to complete the instrument to computer connection.

The Micro GC Fusion EZ IQ or OpenLAB EZ Chrom driver is available for download from https://www.inficon.com/en/service-and-support/download-software.

10.15 Externally Triggering Runs

Sample runs can be automatically triggered externally by electrical contact closure via the Micro GC Fusion AUX I/O port. Refer to The AUX I/O Connector [▶ 73] for the AUX I/O port configuration information.

External triggers will not work while using EZ IQ or OpenLab EZChrom.

10.15.1 Start Run(s)

To start a run externally through AUX I/O:

1. Load the desired method or sequence on the Micro GC Fusion. Refer to Run Method [▶ 164] for the detailed procedure.
2. Close the corresponding pins on the AUX I/O connector to trigger the REMOTE_START action. Refer to The AUX I/O Connector [▶ 73] for the AUX I/O pinouts and contact closure actions.

If a run is in progress when the external triggering action is issued, the external triggering action is discarded.

The name of the run will be defaulted to the loaded method name or the loaded sequence name.

10.15.2 Cancel Sequence

To cancel a sequence externally through AUX I/O, close corresponding pins on the AUX I/O connector to trigger the REMOTE_CANCEL action.

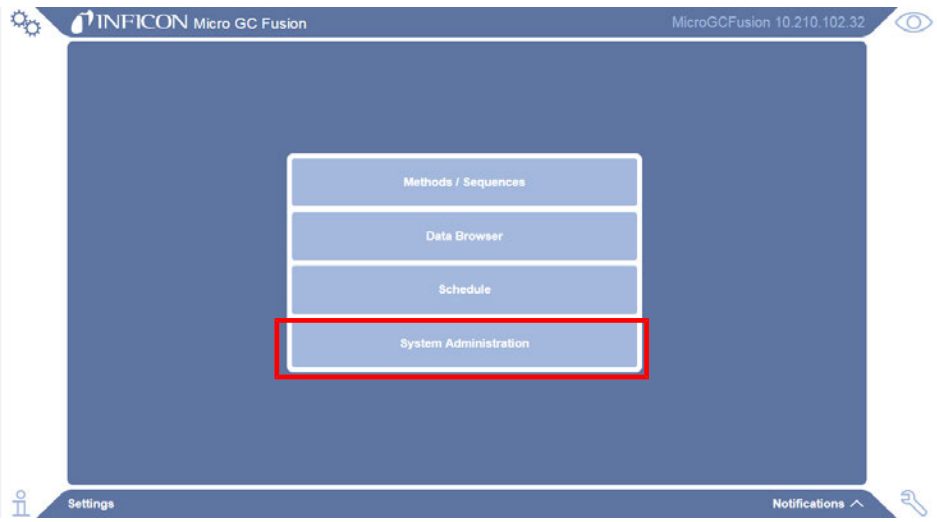
If a sequence is in progress, the current run will proceed to completion. The rest of the sequence will be aborted and the instrument will return to the **ready** state.

10.16 Storage Limit Behavior

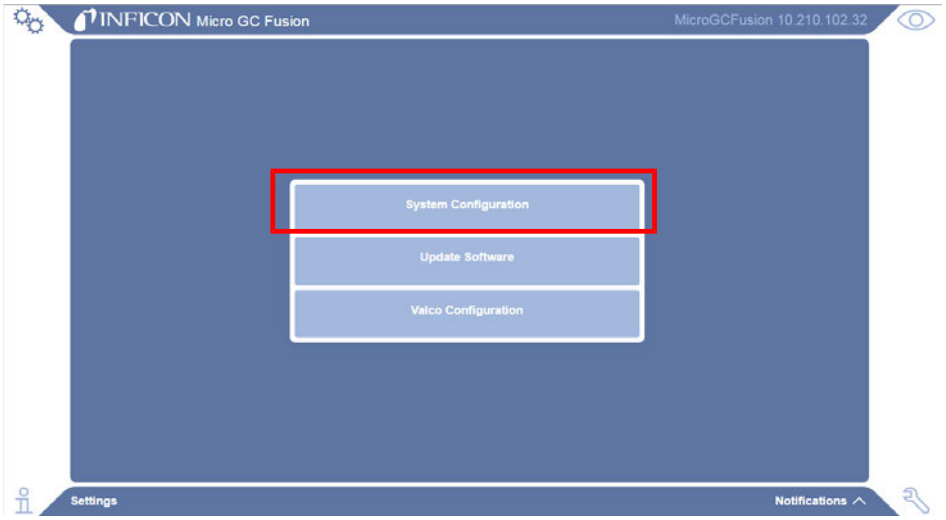
The Micro GC Fusion hard drive is capable of storing thousands of runs. However, when the data browser becomes full and the storage capacity has been reached, the user can specify which files Micro GC Fusion will save. The percentage of storage space currently being used is available in the **System Configuration** window.

To access this setting:

1. Click the icon.
2. Click the **System Administration** button.



3. Click on **System Configuration**.



4 There are two options listed under **Storage Limit Behavior** - **Automatic** and **Manual**. To view a description of each, click on the icon.

⇨ **Automatic** - Once the storage limit reaches 95% capacity, the oldest 100 runs will automatically be deleted.

⇨ **Manual** - System users are responsible for saving and removing data from the system as the storage limit approaches capacity. Upon max capacity, the instrument will no longer save new data.



5 Select the desired setting.

6 Click the icon to save the setting.

11 Routine Operation

11.1 Shutdown Procedure

Press the On/Standby button once to shutdown Micro GC Fusion. This shutdown procedure will cool down the analytical columns before powering down. If the analytical column temperature is high upon shutdown, this procedure may take up to 1 to 2 minutes.

The front panel display will turn off when the instrument is in standby mode.

NOTICE

Bypassing the shutdown procedure and abruptly disconnecting the power supply to Micro GC Fusion may result in instrument damage.

In the event the instrument is unresponsive, the recommended shutdown procedure can be bypassed by pressing the On/Standby button for 3 or more seconds until the front panel display turns off.



⚠ CAUTION

The instrument remains powered while in standby mode. Disconnect the power supply to power off the instrument completely.

NOTICE

Pressing the On/Standby button twice in quick succession will force shutdown of the instrument without cooling down the columns.

This action can lead to column performance degradation.

11.2 Column Conditioning

Over time, small amounts of contaminants may accumulate in the analytical column causing ghost peaks, peak tailing, and/or retention time shifts. Column temperature programmed methods can be optimized to flush contaminants and high boiling point compounds with each run, however, a column bakeout may occasionally still be needed. A bakeout should be performed:

- after the initial installation
- after installing a replacement GC module
- after Micro GC Fusion has been powered off or stored for an extended period of time
- after Micro GC Fusion has been stored in a shipping case for an extended period of time
- periodically as needed to refresh column performance

11.2.1 Bakeout from System Status

Perform the following steps to implement a bakeout on Micro GC Fusion. Depending on the column type, bakeout temperatures will be set according to the isothermal temperatures indicated in Create a Custom Bakeout Method [▷ 227].

1. Click the icon.
2. Click **Methods/Sequences**, followed by the icon.
3. Type a bakeout duration in minutes. The bakeout duration should be within the isothermal temperature duration described in Create a Custom Bakeout Method [▷ 227].



4. Click the icon to begin the bakeout operation.

NOTICE

Carrier gas must be on (flowing) during a bakeout to avoid damaging Micro GC Fusion.

11.2.2 Create a Custom Bakeout Method

Alternately, a bakeout method can be created and customized. A bakeout method can be created by modifying the final temperature and/or hold time of an existing temperature programmed or isothermal analytical method.

NOTICE

Always observe the column phase and module temperature limitations in the table.

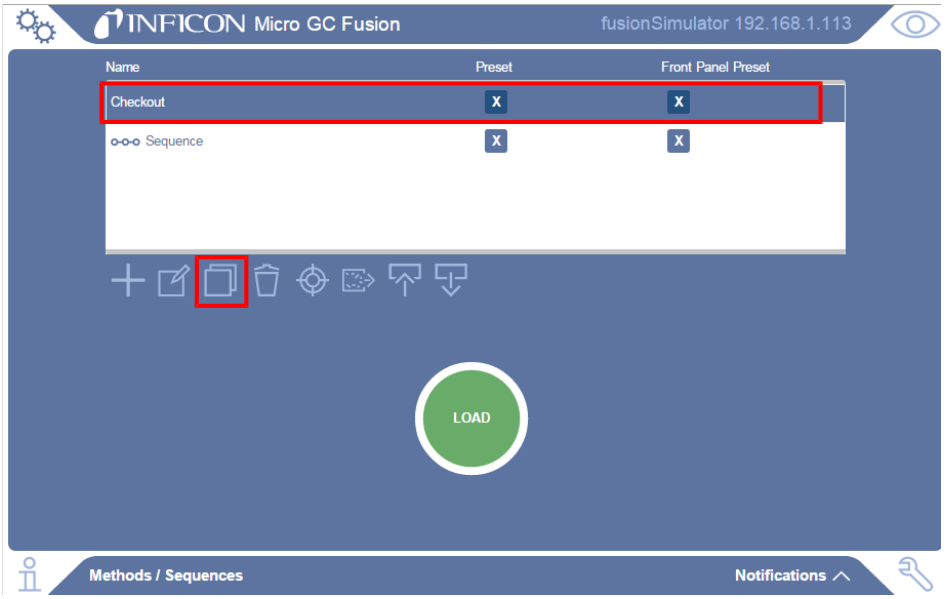
Column Type	Temperature Programmed (Max. °C)	Duration (Max. Minutes)	Isothermal Temperature (Max. °C)	Duration (Max. Minutes)
Rt-Molsieve	250	5	225	120
Rt-U-Bond	120	5	120	120
Rt-Q-Bond	250	5	225	120
Rt-Alumina	200	5	180	120
Rtx-1 or Rxi-1ms	250	5	225	120

To create a bakeout method:

1. Click the icon.
2. Click the **Methods/Sequences** button.

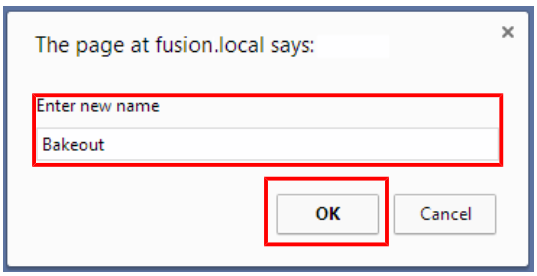
3 In the **Methods/Sequences** window, select the desired method for editing.

4 Click the icon to copy the method.



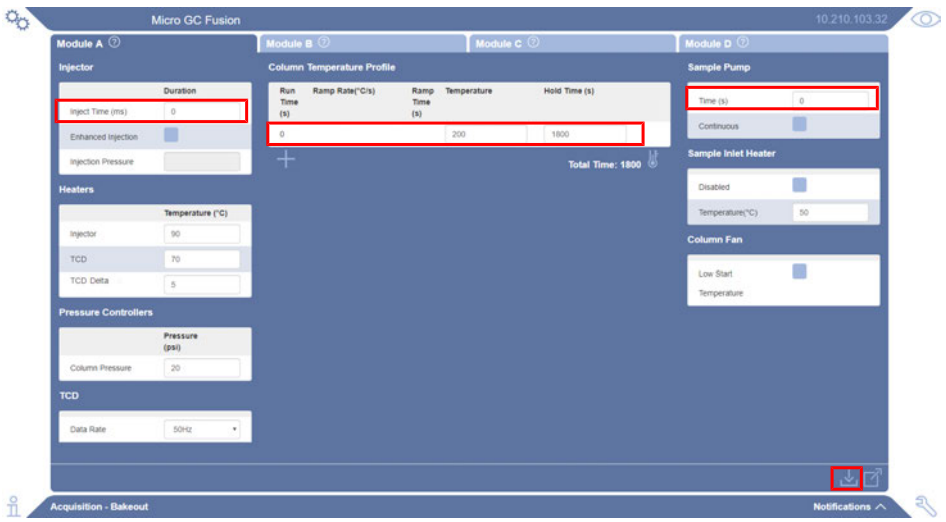
5 Type **Bakeout** in the **Enter new name** box.

6 Click **OK**.



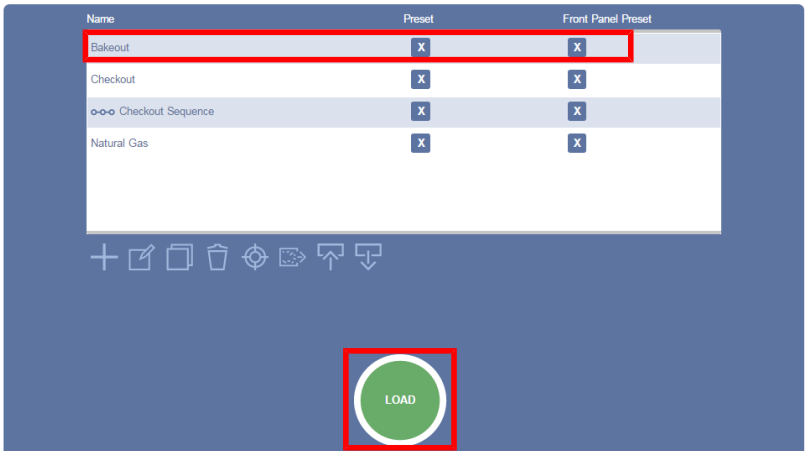
7 Edit **Temperature Profile** to set the column temperature to the recommended bakeout temperature described in the table for each configured module.

⇨ Set the **Inject (ms)** time and **Sample Pump Time(s)** to **0**.



8 Click the icon to save the method. The **Methods/Sequences** window will display.

9 In the **Methods/Sequences** screen, click the **Bakeout** method and click the **LOAD** button to load the Bakeout method onto Micro GC Fusion.



11.3 Updating Micro GC Fusion Software

The software user interface described in this manual references features delivered in the Fusion software v1.8 release.

NOTICE

Do not upgrade Micro GC Fusion instruments that have a 6 in. diagonal front panel display. These instruments have an older style motherboard that is incompatible with current versions of the software.

To update the Micro GC Fusion software to the latest version:

1 Download the latest software from the software download area on the INFICON website.

⇨ Go to www.inficon.com.

⇨ Select **Service & Support** > **Download Software** from the menu at the top of the page.

⇨ Locate and click the Micro GC Fusion software and click the **Download** button.

⇨ Fill in user information requested and click **Submit**.

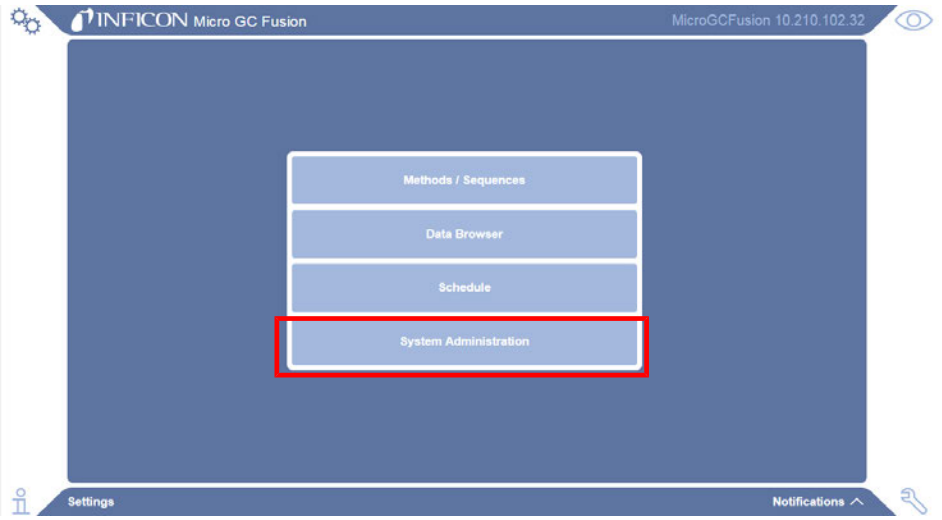
⇨ Receive an email with instructions on how to download the software.

⇨ Follow the download link to download the software installer and complete the installation process according to the instructions provided.

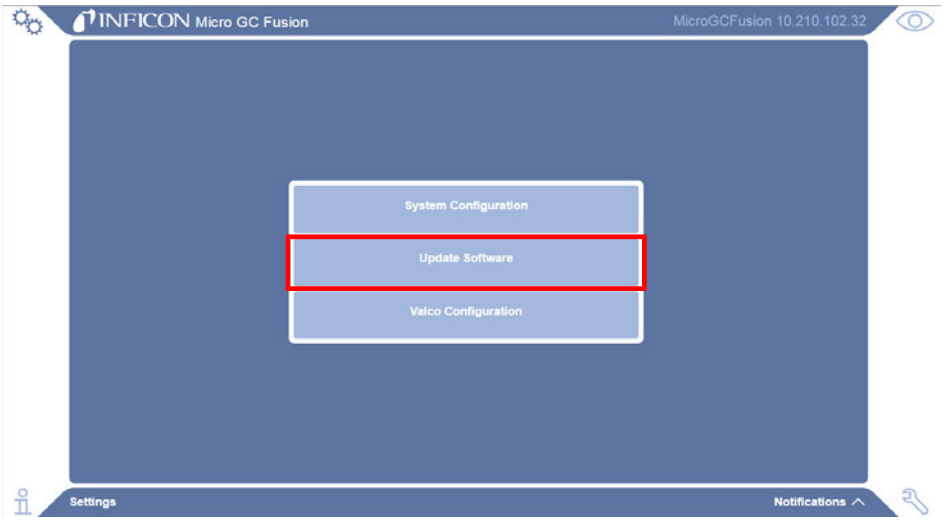
⇨ The software download is in compressed format (.zip). After downloading the .zip file, unzip it or extract the files to obtain the software with the extension **.fusion-update**.

2 Click the icon on the Micro GC Fusion main page.

3 Click the **System Administration** button.



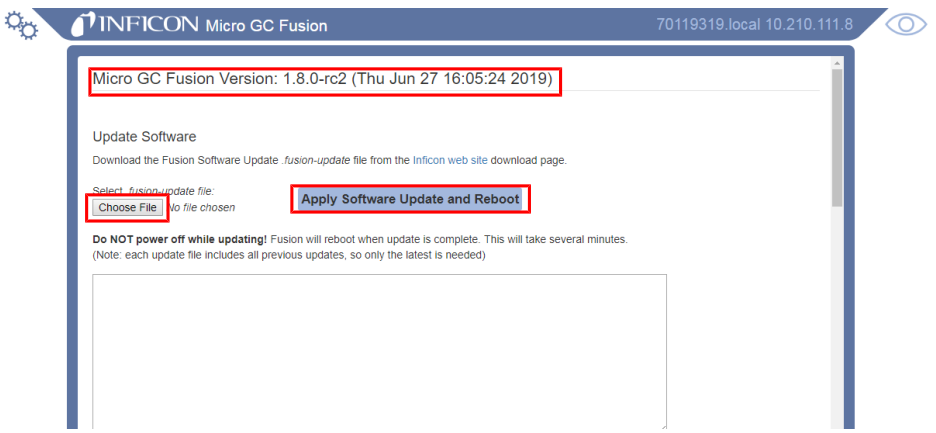
4 Click the **Update Software** button.



5 Micro GC Fusion will display the currently loaded software version.

6 Click the **Choose File** button and choose the software update file.

7 Click the **Apply Software Update and Reboot** button to complete the software update. The instrument will reboot after the software update and may be temporarily unavailable. Refresh the web browser 1-2 minutes after the system reboot to reconnect with the instrument.



8 The **On/Standby** button on the instrument front panel will be temporarily disabled during the system reboot. This prevents unintended instrument shutdown in the software update process.

NOTICE

Do not shutdown or disconnect power from the instrument when a software upgrade is in progress. Doing so may result in an incomplete upgrade and potential data corruption.

11.4 GC Module Replacement

Each Micro GC Fusion GC module contains the analytical components required to perform a GC analysis. This includes an injector, column and detector. GC modules can be easily replaced for maintenance or to configure Micro GC Fusion for different applications.

For Micro GC Fusion instruments built after October 2019 and contain a JP-100, see Removal of the JP-100 [▶ 231] for instructions on how to remove the JP-100 before module replacement.

For Micro GC Fusion instruments built before October 2019 and do not contain a JP-100, proceed to GC Module Removal Procedure for 2-Module System [▶ 238] or GC Module Removal Procedure for 4-Module System [▶ 246].



⚠ CAUTION

Only technically qualified personnel should perform the procedures and maintenance described in this manual.

11.4.1 List of Required Tools

- open-ended wrenches, 1/4 in. and 5/16 in.
- 2.5 mm ball point L-handle hex driver (PN 070-1999)
- 2.0 mm hex wrench (4-module only)
- 2.5 mm hex wrench (4-module JP-100 removal only)
- Phillips screwdriver

11.4.2 Removal of the JP-100

For instruments built after October 2019, the JP-100 must be removed prior to module removal or replacement. Follow the steps below then continue to GC Module Removal Procedure for 2-Module System [▶ 238] or GC Module Removal Procedure for 4-Module System [▶ 246].

11.4.2.1 2-Module JP-100 Removal

1 Shutdown the system by following the system shutdown procedure in Shutdown Procedure [▶ 226].

2 Remove all external electrical cables, including power cable and Ethernet cable.



⚠ WARNING

The Micro GC Fusion power cable must be disconnected before JP-100 removal operation to prevent potential personal injury or electrical damage to the instrument.

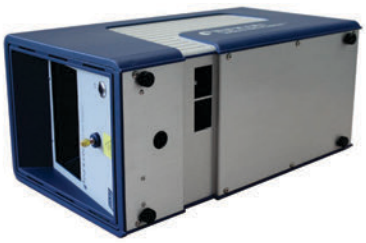
3 Disconnect sample gas connection(s), carrier gas connections and venting connections.



⚠ CAUTION

Sample gas and carrier gas must be properly disconnected before the JP-100 removal to prevent potential personal injury or instrument damage from pressurized gases.

4 Set Micro GC Fusion on its left side as shown.



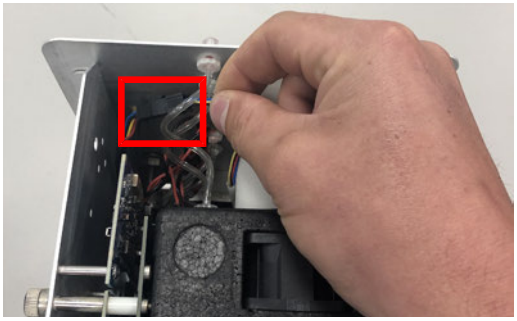
5 Remove the bottom eight screws with the 2.5 mm ball point hex driver.



6 Turn Micro GC Fusion back to its upright position. With finger tips, grasp the bottom lips of the housing on both sides, carefully pull them apart and lift the housing off Micro GC Fusion.



7 Disconnect the fan cable from the cable extension.



8 Remove the retaining screw holding the JP-100 in place with the 2.5 mm ball point hex driver.



9 Slide the JP-100 up and out of the instrument.



10 See GC Module Removal Procedure for 2-Module System [▷ 238] to continue the module removal process.

11.4.2.2 4-Module JP-100 Removal

1. Shutdown the system by following the system shutdown procedure in Shutdown Procedure [▶ 226].
2. Remove all external electrical cables, including power cable and Ethernet cable.



⚠ WARNING

The Micro GC Fusion power cable must be disconnected before JP-100 removal operation to prevent potential personal injury or electrical damage to the instrument.

3. Disconnect sample gas connection(s), carrier gas connections and venting connections.



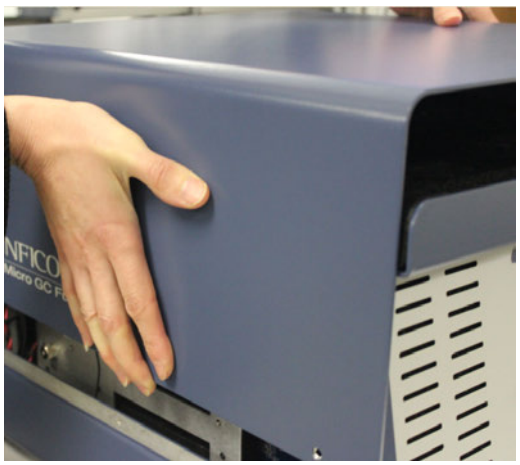
⚠ CAUTION

Sample gas and carrier gas must be properly disconnected before the JP-100 to prevent potential personal injury or instrument damage from pressurized gases.

4. Set Micro GC Fusion upright, and remove the screws, three on each side, as shown.

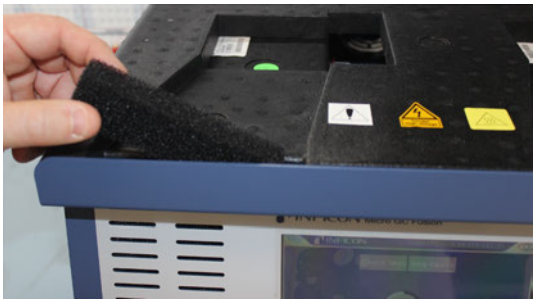


5. With a hand on either side, remove the top cover by pulling straight up.

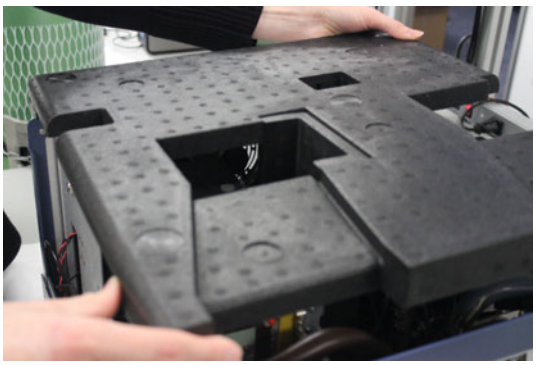


6. Remove the two small air filters on the top at the front of the unit.

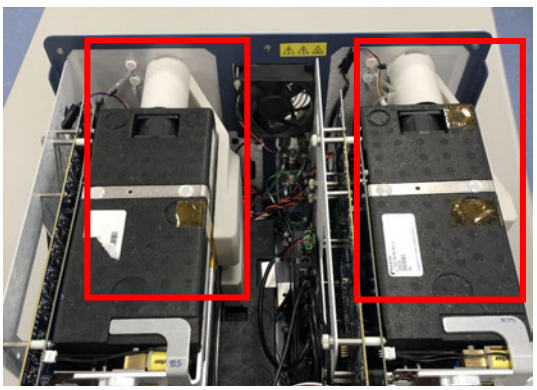
7 Remove the top foam by grasping one front corner and the opposite back corner, and pulling straight up.



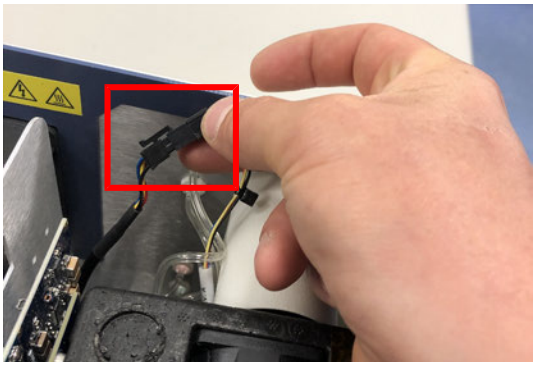
8 Remove the foam by the right side of each module by pulling it straight up out of the unit.



9 The 4-module Micro GC Fusion contains two JP-100 units.



10 Disconnect the fan cable from the cable extension.

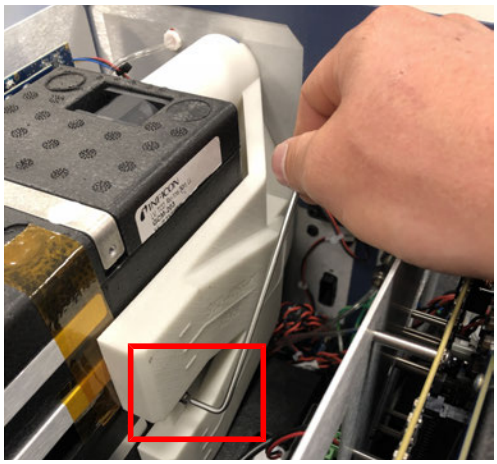


11 Remove the retaining screws:

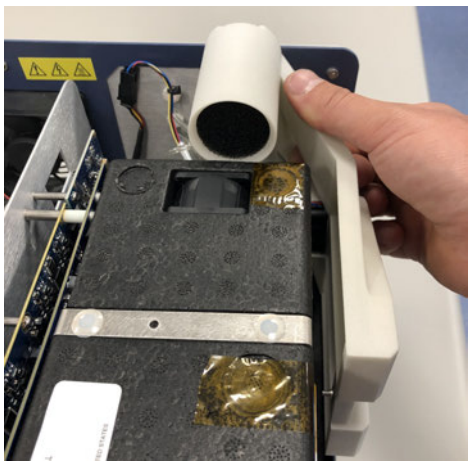
⇨ For modules C/D, remove the retaining screw holding the JP-100 in place with the 2.5 mm ball point hex driver.



⇨ For modules A/B, remove the retaining screw holding the JP-100 in place with the 2.5 mm ball point hex wrench.



12 Slide the JP-100 up and out of the instrument.

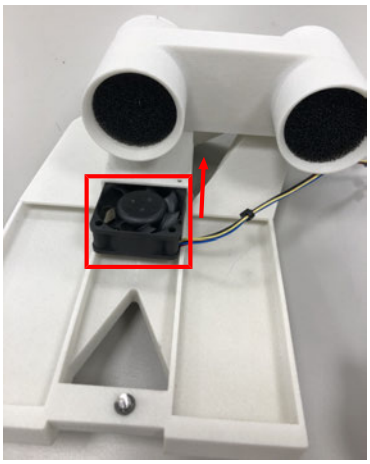


13 See GC Module Removal Procedure for 4-Module System [▷ 246] to continue the module removal process.

11.4.3 Replacing the JP-100

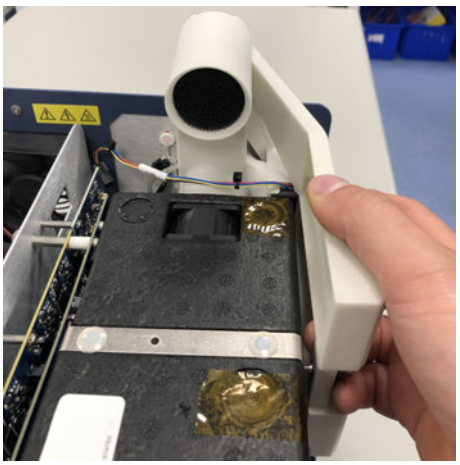
After modules have been replaced, replace the JP-100:

1. Ensure that the fan is properly seated inside the JP-100.



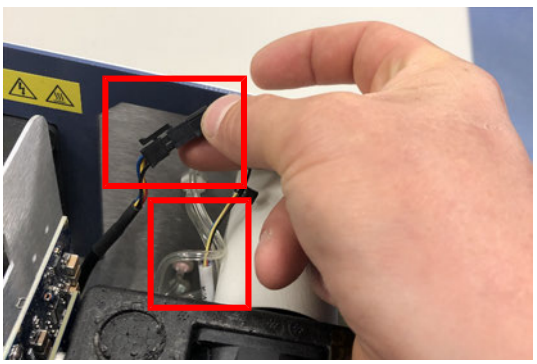
2. Slide the JP-100 into position.

   ⇨ The fan cable should sit between the two fan ports on the JP-100.



3. Connect the fan cable to the cable extension.

   ⇨ The fan cable should be routed between the reference and analytical exhaust vents on the top module.



4. Tighten the retaining screw into the bracket of the bottom module.



5 Repeat for additional JP-100, if configured.

11.4.4 GC Module Removal Procedure for 2-Module System

This procedure is for Micro GC Fusion models built before October 2019 and will not contain a JP-100.

If the lower module needs to be removed, the upper module must be removed first.

1 Shutdown the system by following the system shutdown procedure in Shutdown Procedure [▶ 226].

2 Remove all external electrical cables, including power cable and Ethernet cable.

⚠ WARNING

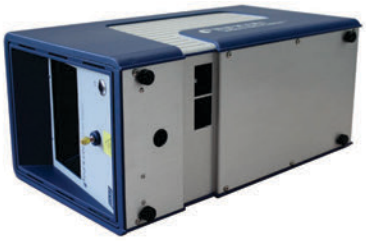
The Micro GC Fusion power cable must be disconnected before module removal operation to prevent potential personal injury or electrical damage to the instrument.

3 Disconnect sample gas connection(s), carrier gas connections, and venting connections.

⚠ CAUTION

Sample gas and carrier gas must be properly disconnected before the module removal to prevent potential personal injury or instrument damage from pressurized gases.

4 Set Micro GC Fusion on its left side as shown.



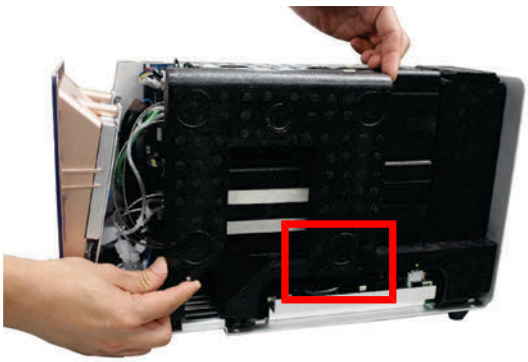
5 Remove the bottom eight screws with the 2.5 mm ball point hex driver.



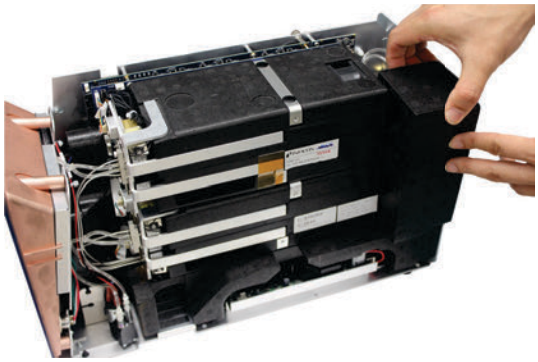
6 Turn Micro GC Fusion back to its upright position. With finger tips, grasp the bottom lips of the housing on both sides, carefully pull them apart and lift the housing off Micro GC Fusion.



7 Remove the side foam by pulling it sideways to free it from the dovetail joint at the bottom.

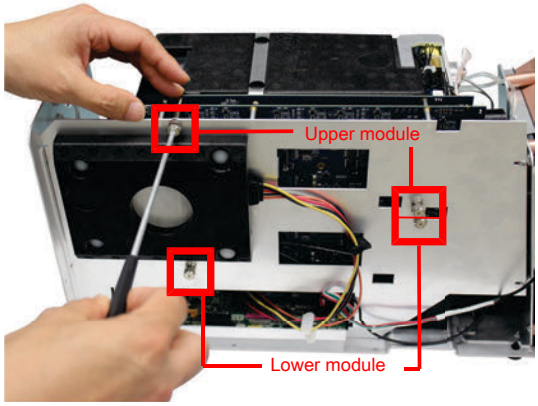


8 Remove the rear foam by pulling it sideways out of the instrument back.



9 From the left side of the Micro GC Fusion chassis frame, use a Phillips head screwdriver to loosen the two captive screws that hold the GC module. To remove the lower GC module, loosen the two captive screws.

⇨ Each GC module is secured by two captive screws (or four for newer models). If only removing the upper module, use a Phillips head screwdriver loosen the uppermost two screws. The figure indicates screw positions for both the upper and lower GC modules.



10 Use a 5/16 in. open end wrench to disconnect the sample line nut.

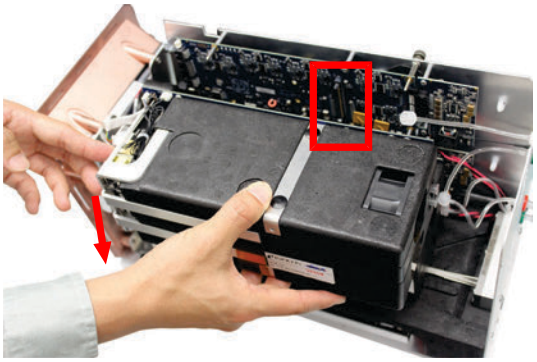




⚠ CAUTION

Sample gas and carrier gas must be properly disconnected before the module removal tto prevent potential personal injury or instrument damage from pressurized gases.

11 Gently pull the GC module off the electrical connector no more than 2 cm (1 in.) and then tilt the injector side outwards.





⚠ WARNING

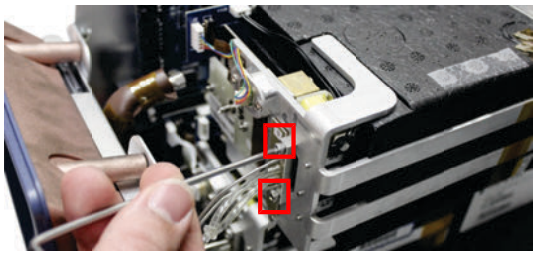
The Micro GC Fusion power cable must be disconnected before module removal operation to prevent potential personal injury or electrical damage to the instrument.

NOTICE

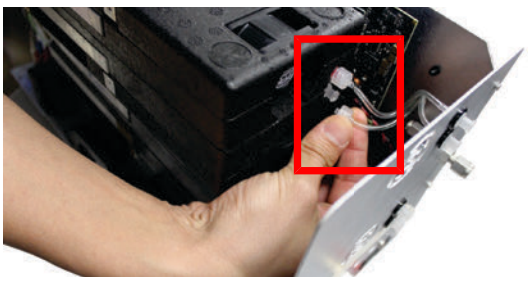
When removing the module, do not lift from the bottom. Pull the module straight out and away from the standoffs and the electrical connector.

Lifting from the bottom may cause damage to both connectors and cause failures when the module is reinstalled or replaced.

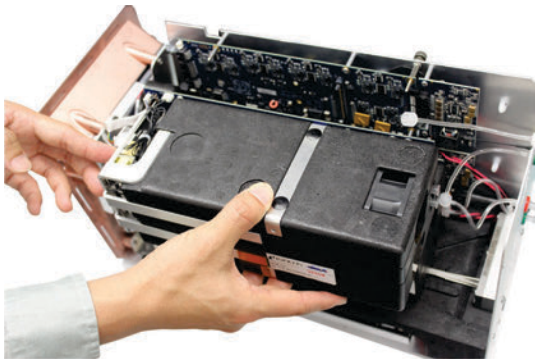
12 Using a 2.5 mm ball point hex driver, unscrew the two carrier gas manifold screws on the upper GC module.



13 Loosen and remove the venting connectors at the rear of the GC module by turning counterclockwise.



14 Remove the GC module by lifting it and pulling it sideways out of the chassis.



15 Repeat the same procedure (steps 9–14) to remove the lower module, if necessary.

11.4.5 GC Module Replacement Procedure for 2-Module System

This section illustrates the replacement of the upper module. If the lower GC module needs to be replaced, remove both upper and lower GC modules, and then replace the lower GC module, followed by the upper GC module.

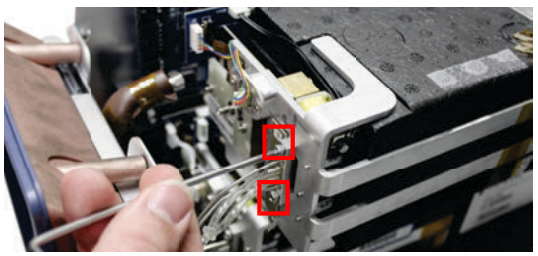
1 Remove the GC module(s) by following the instructions in GC Module Removal Procedure for 2-Module System [▷ 238].

2 Position the replacement module into the chassis.

3 Connect the venting connectors at the rear of the replacement module. Rotate them clockwise until finger-tight.



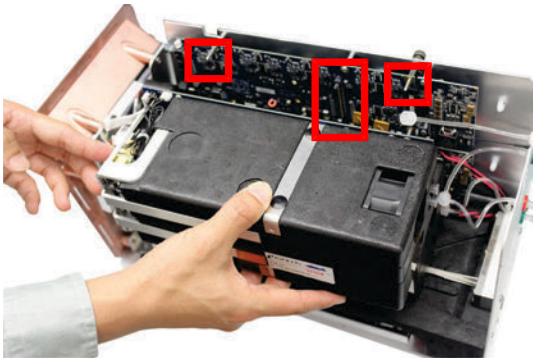
4 Use a 2.5 mm ball point hex driver to replace the two carrier gas manifold screws onto the GC module. Tighten them until they are snug.



NOTICE

Do not over-tighten the screws to avoid O-ring damage.

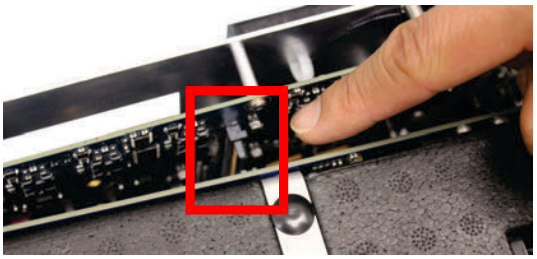
5 Insert the replacement GC module into the module slot by aligning the guiding pins and the 100 pin connectors on the GC module controller board and the GC module interface board.



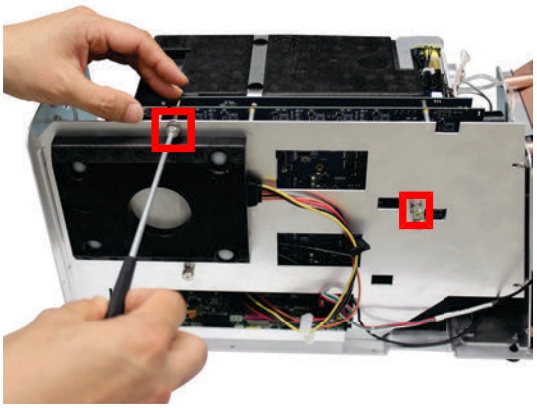
NOTICE

Make sure that the column module is inserted using the guiding pins and that the connector is not damaged during installation.

6 Ensure the 100 pin connectors on the GC module controller board and the GC module interface board are securely connected.



7 From the left side of the chassis frame, use a Phillips head screwdriver to tighten the two captive screws to secure the GC module in place.



NOTICE

Do not over-tighten the screws to avoid module damage.

8 Connect the sample line to the GC module injector manifold. Finger-tighten the connection and then use a 5/16 in. open end wrench to tighten it 1/4-turn past finger-tight.

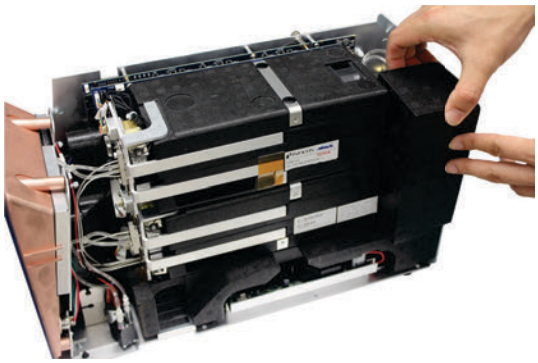


NOTICE

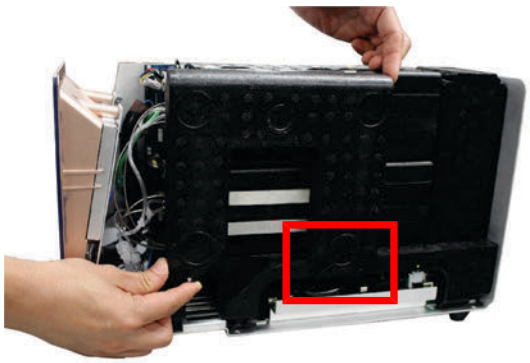
Over-tightening the sample line nut may damage the thread on the GC module.

9 Repeat steps 2 to 8 if replacing both modules.

10 When all the GC modules are replaced, replace the rear foam.



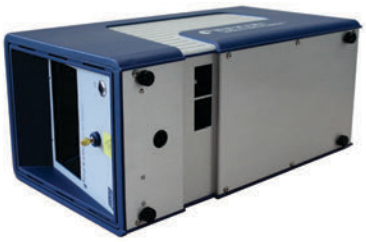
11 Replace the side foam. Ensure the dovetail joint is oriented as shown.



12 With finger tips, grasp the bottom of the housing cover and gently pull it apart. Position the cover over Micro GC Fusion and lower it down over the housing to replace the housing cover back on Micro GC Fusion.



13 Set Micro GC Fusion on its left side as shown.



14 Use a 2.5 mm ball-point hex driver to replace the eight bottom screws.



15 Return Micro GC Fusion to the upright position.

16 Connect the sample gas connection(s), carrier gas connections and venting connections.

17 Connect the external electrical cables, including the power cable and the Ethernet cable.

18 Power up the instrument by pressing the **On/Standby** button on the front panel.

Micro GC Fusion automatically recognizes the new or replacement module configuration when it is turned on. The GC module configuration is stored in the EEPROM located on the GC module interface circuit board.

11.4.6 GC Module Removal Procedure for 4-Module System

This procedure is for Micro GC Fusion models built before October 2019.

If the lower module on for either side needs to be removed, the upper module on the respective side must be removed first.

1 Shutdown the system by following the system shutdown procedure in Shutdown Procedure [▶ 226].

2 Remove all external electrical cables, including power cable and Ethernet cable.



⚠ WARNING

The Micro GC Fusion power cable must be disconnected before module removal operation to prevent potential personal injury or electrical damage to the instrument.

3 Disconnect sample gas connection(s), carrier gas connections, and venting connections.



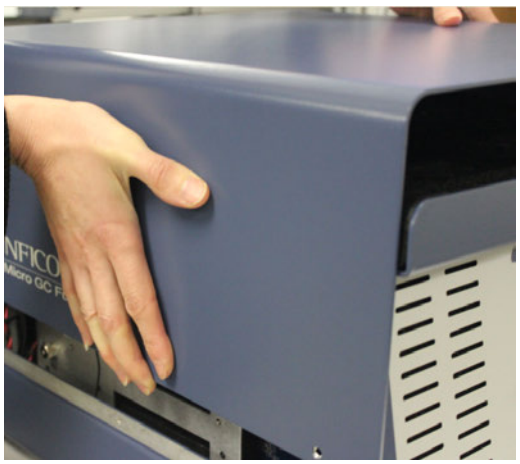
⚠ CAUTION

Sample gas and carrier gas must be properly disconnected before the module removal to prevent potential personal injury or instrument damage from pressurized gases.

4 Set Micro GC Fusion upright and remove the three screws on each side.

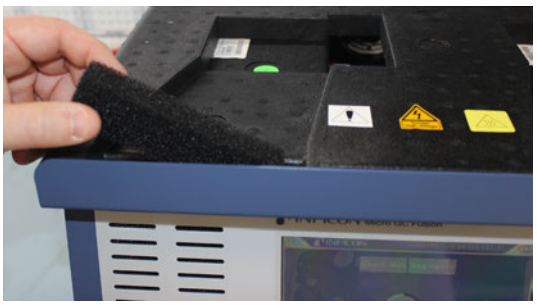


5 With a hand on either side, remove the top cover by pulling straight up.

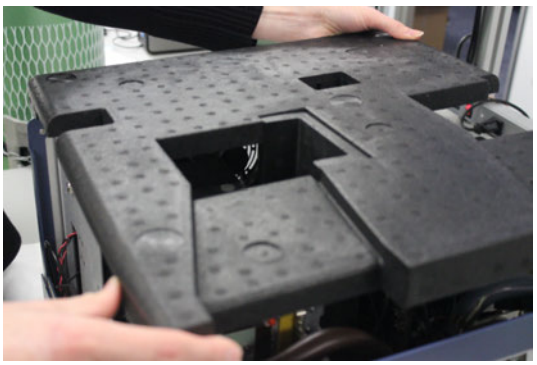


6 Remove the two small air filters on the top at the front of the unit.

7 Remove the top foam by grasping one front corner and the opposite back corner, and pulling straight up.



8 Remove the foam by the right side of each module by pulling it straight up out of the unit.

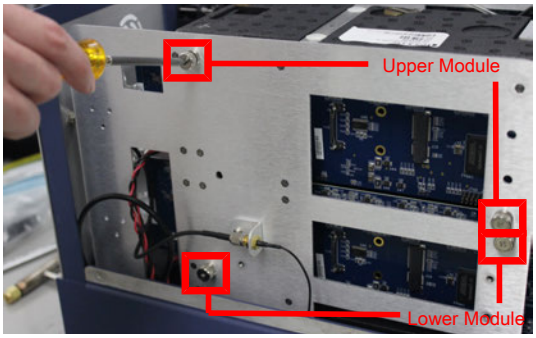


9 Remove the rear foam by pulling it sideways out of the instrument back.



10 From the left side of the Micro GC Fusion chassis frame, use a Phillips head screwdriver to loosen the two captive screws that hold the GC module. To remove the lower GC module, loosen the two captive screws.

⇨ Each GC module is secured by two captive screws (or four for newer models). If only removing the upper module, use a Phillips head screwdriver to loosen the uppermost two screws. The figure indicates screw positions for both the upper and lower GC modules.



11 Use a 5/16 in. open end wrench to disconnect the sample line nut.



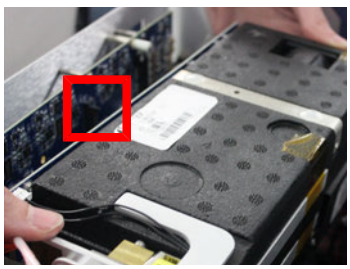
⚠ CAUTION

Sample gas and carrier gas must be properly disconnected before the module removal to prevent potential personal injury or instrument damage from pressurized gases.

⚠ WARNING

The sample inlet may be hot to the touch. Use care when removing the sample line nut.

12 Gently pull the GC module off the electrical connector no more than 2 cm (1 in.) and then tilt the injector side outwards.

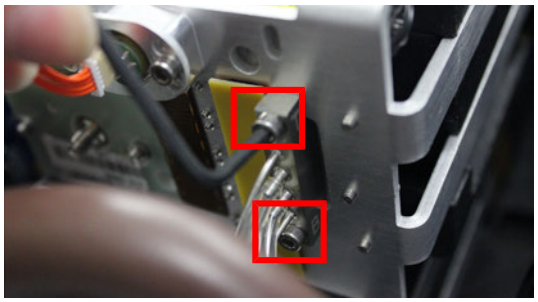


NOTICE

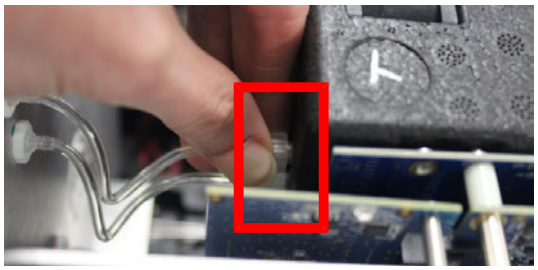
When removing the module, do not lift from the bottom. Pull the module straight out and away from the standoffs and the electrical connector.

Lifting from the bottom may cause damage to both connectors and cause failures when the module is reinstalled or replaced.

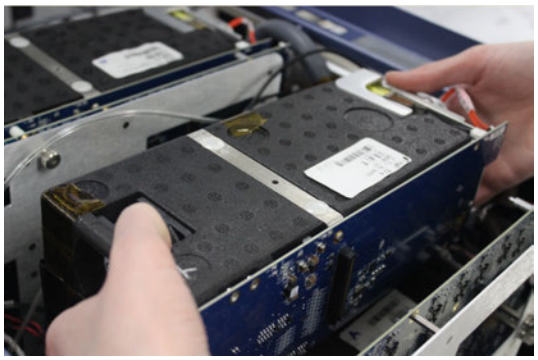
13 Using a 2.5 mm ball point hex driver, unscrew the two carrier gas manifold screws on the upper GC module.



14 Loosen and remove the venting connectors at the rear of the GC module by turning counterclockwise.



15 Remove the GC module by pulling it sideways and then lifting straight up out of the chassis.

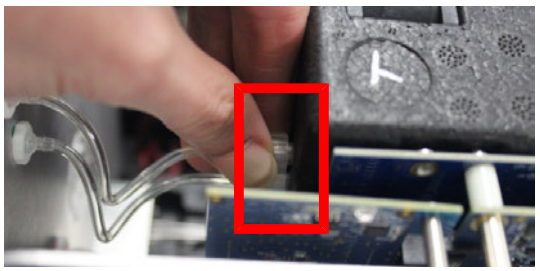


16 Repeat the same procedure (steps 9–14) to remove the lower module, if necessary.

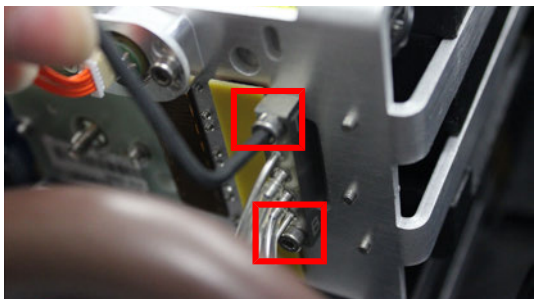
11.4.7 GC Module Replacement Procedure for 4-Module Systems

This section illustrates the replacement of the upper module. If the lower GC module needs to be replaced, remove both upper and lower GC modules, and then replace the lower GC module, followed by the upper GC module.

1. Remove desired GC module(s) by following the instructions in GC Module Removal Procedure for 4-Module System [▷ 246].
2. Position the replacement module into the chassis.
3. Connect the venting connectors at the rear of the replacement module. Rotate them clockwise until finger-tight.



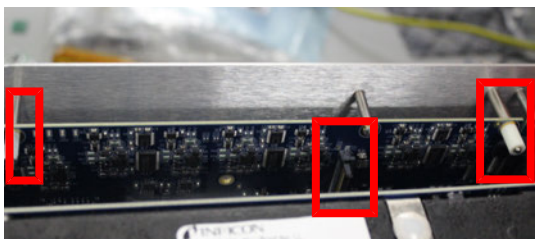
4. Use a 2.5 mm ballpoint hex driver to replace the two carrier gas manifold screws onto the GC module until snug.



NOTICE

Do not over-tighten the screws to avoid O-ring damage.

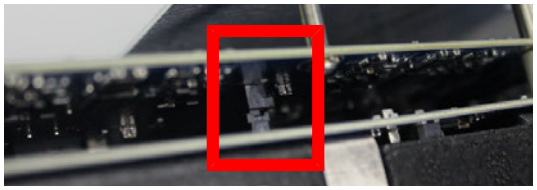
5. Insert the replacement GC module into the module slot by aligning the guiding pins and the 100 pin connectors on the GC module controller board and the GC module interface board.



NOTICE

Make sure that the column module is inserted using the guiding pins and that the connector is not damaged during installation.

6 Ensure the 100 pin connectors on the GC module controller board and the GC module interface board are securely connected.



7 From the left side of the chassis frame, use a Phillips head screwdriver to tighten the two captive screws to secure the GC module in place.



NOTICE

Do not over-tighten the screws to avoid module damage.

8 Connect the sample line to the GC module injector manifold. Finger-tighten the connection and then use a 5/16 in. open-end wrench to tighten it 1/4-turn past finger-tight.

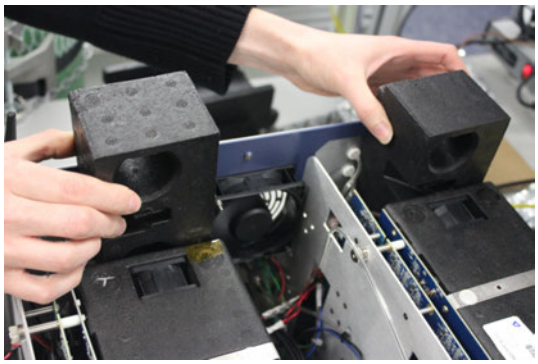


NOTICE

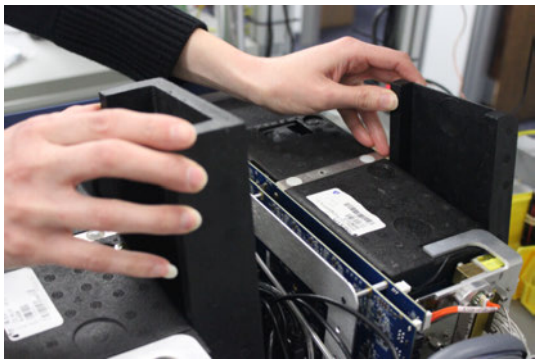
Over-tightening the sample line nut may damage the thread on the GC module.

9 Repeat steps 2–8 if replacing both modules.

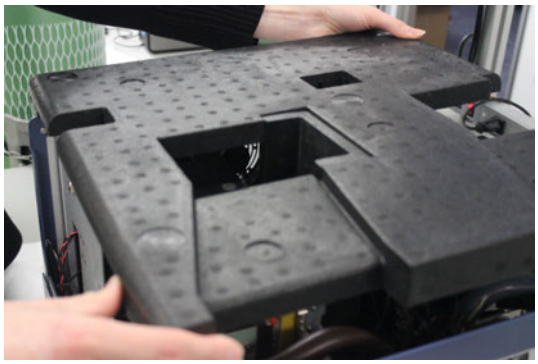
10 When all the GC modules are replaced, replace the rear foam.



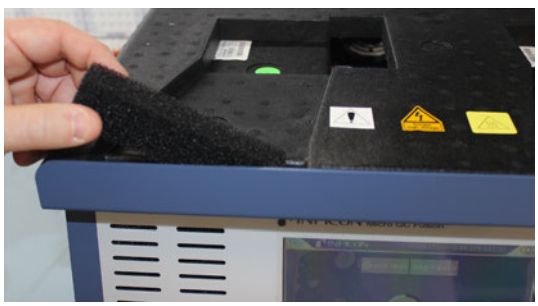
11 Replace the side foam. Ensure the dovetail joint is oriented as shown.



12 Replace the top foam by grasping one front corner and the opposite back corner, and pressing straight down.



13 Replace the two small air filters on the top at the front of the unit.



14 With fingertips, grasp the bottom of the housing cover and gently pull apart. Position the cover over Micro GC Fusion and lower to replace the housing cover back on Micro GC Fusion.



15 Use a 2.5 mm ball-point hex driver, replace the screws, three on each side.



16 Return Micro GC Fusion to the upright position.

17 Connect the sample gas connection(s), carrier gas connections and venting connections.

18 Connect the external electrical cables, including the power cable and Ethernet cable.

19 Power up the instrument by pressing the On/Standby button on the front panel. Ensure the modules heat to ready status.

Micro GC Fusion automatically recognizes the new or replacement module configuration when it is powered up. GC module configuration is stored in the EEPROM located on the GC module interface circuit board.

11.5 Filter Replacement

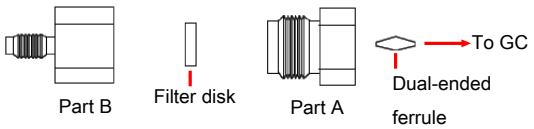
11.5.1 Replacing the External 10 Micron Sample Inlet Filter Disk



⚠ WARNING

Micro GC Fusion has a heated inlet which is hot to the touch.

1. Shut off sample flow to Micro GC Fusion.
2. Reduce the temperature of the sample inlet by loading a method that has low inlet temperature (below 60°C).
3. Wait for the Micro GC Fusion sample inlet to cool.
4. If applicable, disconnect the sample line to the Micro GC Fusion input fitting using the 5/16 in. wrench, while holding the sample inlet filter with a 7/16 in. wrench.
5. Separate Part A and Part B by using two 7/16 in. wrenches, one holding Part A steady and another to loosen Part B counterclockwise.



6. Remove and discard the used filter disk from Part A.
7. Insert a new filter disk (PN 5183-4652) into Part A. Avoid handling the replacement filters. Wear laboratory gloves when performing this procedure.
8. Reassemble the sample inlet filter by using two 7/16 in. wrenches, with one holding the Part A steady and another to tighten Part B clockwise.
9. Place the dual-ended ferrule inside Part A. Connect the sample inlet filter to the sample inlet. Turn Part A clockwise until finger-tight, then use a 7/16 in. wrench to tighten an additional 1/4 turn.

NOTICE

Do not over-tighten the sample inlet filter assembly to Micro GC Fusion.

This will damage the dual-ended ferrule.

10. Finger-tighten the sample line to the male portion of filter Part B and then use a 5/16 in. wrench to tighten an additional 1/4 turn, while stabilizing the sample inlet filter assembly Part B using a 7/16 in. wrench.

11.6 External Sample Conditioner

11.6.1 Replacing the Internal Filter on the External Sample Conditioner

To replace the filter (part of PN 952-019-G1S):

1. Remove the power cord from the Micro GC Fusion external sample conditioner.
2. Ensure the handle is in the vent position and disconnect any sample line(s).
3. Let the device cool for a minimum of 20 minutes.
4. Unscrew the thumb screw on the side of the device.



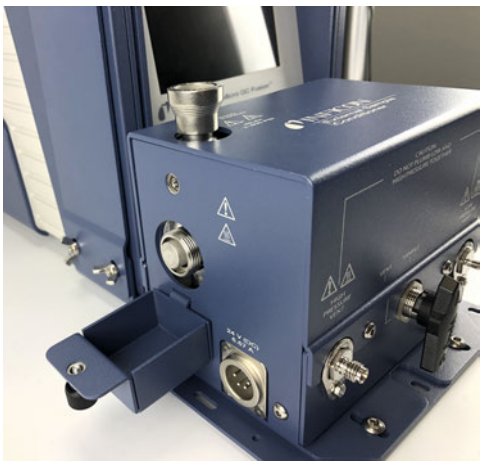
5. Lower the filter door (PN 952-515-P1S).



6. Using a 1 in. open-ended wrench, loosen the bonnet nut (PN 059-0809S) counter-clockwise.

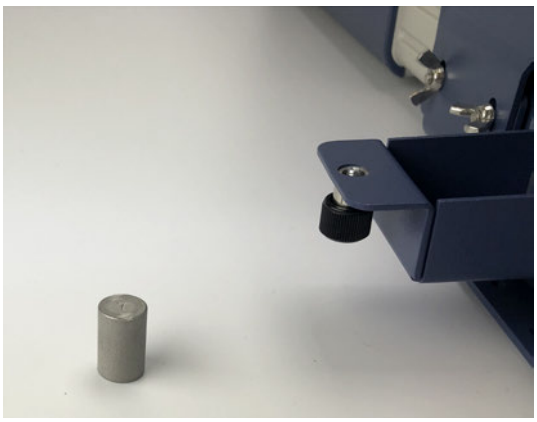


7 Remove the bonnet nut.



The filter assembly nut is tightened 1/8 turn past finger-tight for high-pressure applications.

8 Remove the filter.



9 Replace the 7 µm filter ensuring the **7** is facing outward.



10 Re-install the bonnet nut and hand-tighten.

11 Using a 1 in. open-ended wrench, tighten 1/8 of a turn past finger-tight.



12 Cover the bonnet nut by reattaching the cover door using the thumb screw on the side of the device.



13 Reattach the power cord to the external sample conditioner.



11.6.2 Replacing the Gasket on the External Sample Conditioner

To replace the gasket (part of 952-019-G1S):

1. Remove the power cord from the Micro GC Fusion external sample conditioner.
2. Ensure the handle is in the vent position and disconnect any sample line(s).
3. Let the device cool for a minimum of 20 minutes.
4. Unscrew the thumb screw on the side of the device.



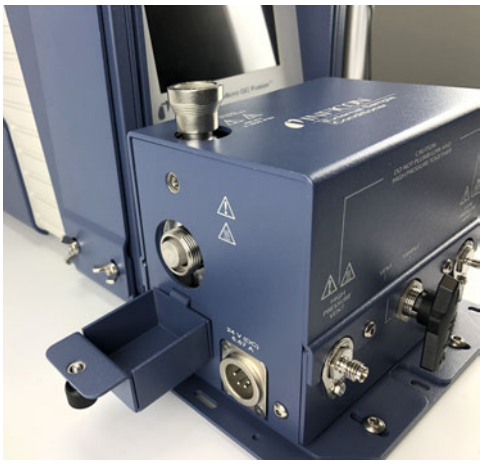
5. Lower the filter door (PN 952-515-P1S).



6. Using a 1 in. open-ended wrench, loosen the bonnet nut (PN 059-0809S) counter-clockwise.

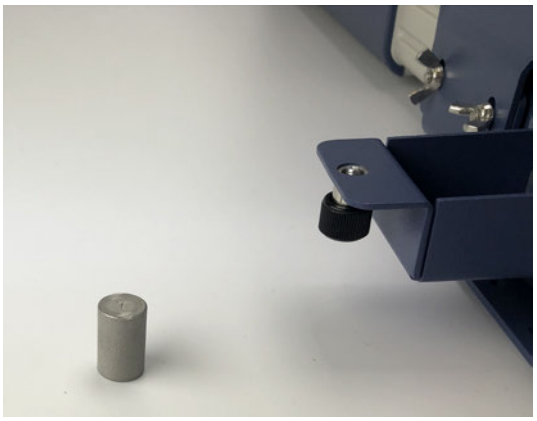


7. Remove the bonnet nut.



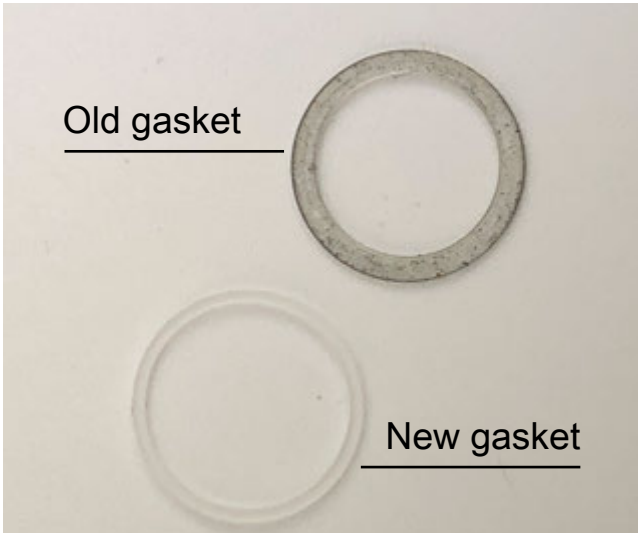
The bonnet nut is tightened 1/8 turn past finger-tight for high pressure applications.

8 Remove the filter.



9 Using a pick, remove the old gasket.





10 Using a pick, insert and seat the new gasket.



11 Replace the 7 µm filter ensuring the **7** is facing outward.



12 Re-install the bonnet nut and hand-tighten.

13 Using a 1 in. open-ended wrench, tighten 1/8 of a turn past finger-tight.



14 Cover the bonnet nut by reattaching the cover door using the thumb screw on the side of the device.



15 Reattach the power cord to the external sample conditioner.



12 Troubleshooting

12.1 Symptom–Cause–Remedy Tables

The following tables identify common symptoms, possible causes, and remedies when operating the instrument. For repair service and technical support contact information, refer to Service and Technical Support [▶ 18].

12.1.1 Common Chromatographic Problems

Symptom	Possible sources of error	Remedy
There is poor sensitivity resulting in reduced area counts for peaks.	The **Sample Pump Time** method parameter is insufficient.	• Increase the **Sample Pump Time** to at least fifteen seconds. If sufficient sample is available, increase to between 30 to 60 seconds.
	The **Inject (ms)** time method parameter is insufficient.	• Increase the **Inject (ms)** time.
	There is contamination in the system.	• Conduct a bakeout to clean the columns. Refer to Bakeout from System Status [▷ 227].
	The instrument not sufficiently warmed up.	• Allow at least 3 minutes for Micro GC Fusion to warm up.
	There is an external leak.	• Check carrier gas lines using a leak detector and tighten all fittings.
	There is a loose fitting.	• Tighten all external fittings and connections, including the carrier gas and sample inlet fittings.
	The carrier gas pressure is too low.	• Carrier gas inlet pressure must be between 400-427 kPa (58-62 psi) **CAUTION! Exceeding 565 kPA (82 psi) may damage Micro GC Fusion and require factory repair.**
	The carrier gas contains impurities.	• Ensure the carrier gas purity is between 99.995% and 99.9995% • Add hydrocarbon/moisture/oxygen traps or particulate filters to the carrier gas line to improve purity. • Replace the carrier gas cylinder.
	There is an internal leak.	• Contact INFICON. Refer to Service and Technical Support [▷ 18].
	There is a malfunction in the column or injector.	• Check the flow rate of the columns by attaching a flow meter to the analytical and reference vents on the back of Micro GC Fusion • If there is no flow from either or both vents, contact INFICON. See Service and Technical Support.
	There is a malfunction in the detector.	• Contact INFICON. Refer to Service and Technical Support [▷ 18]

Symptom	Possible sources of error	Remedy
The chromatogram is displaying a flat line with no peaks	The **Inject (ms)** time method parameter is set to 0 ms.	• Change the **Inject (ms)** time to a value other than 0 ms.
	The **Sample Pump Time** method parameter is set to 0 seconds.	• Ensure that the **Sample Pump Time** is set for at least 15 seconds.
	There is a malfunction in the column or injector.	• Check the flow rate of the columns by attaching a flow meter to the analytical and reference vents on the back of Micro GC Fusion • If there is no flow from either or both vents, contact INFICON. Refer to Service and Technical Support [▷ 18].
	There is a malfunction in the sample pump or the sample pump does not turn on.	• Listen for the noise from the pump when taking a sample. If there is no noise, contact INFICON.
	There is a malfunction in the detector.	• Contact INFICON. Refer to Service and Technical Support [▷ 18].
A peak is missing	The **Backflush Time** method parameter is set too early (if applicable).	• Increase the **Backflush Time** until all peaks of interest appear on the chromatogram.
A peak is saturated	The **Inject (ms)** time method parameter is set too long.	• Shorten the **Inject (ms)** time.
	The **Injector Temperature** method parameter is set too high.	• Lower the **Injector Temperature**.
Chromatograms are not appearing/no data is showing	The web browser requires a restart or refresh.	• Restart or refresh the web browser.
	The web browser requires a cache clear.	• Clear the web browser's cache, then refresh the web browser.
	Micro GC Fusion requires a restart.	• Restart Micro GC Fusion. Refer to Shutdown Procedure [▷ 226].

Symptom	Possible sources of error	Remedy
Calibration is poor. Concentration amounts are not as expected	There is contamination or low volume in the calibration or carrier gas.	• Ensure the carrier gas purity is between 99.995% and 99.9995%. Add hydrocarbon/ moisture/oxygen traps or particulate filters to the carrier gas line to improve purity. • Ensure there are no contaminants in the calibration gas. • Ensure that there is an adequate supply of calibration gas.
	Micro GC Fusion requires a restart.	• Restart Micro GC Fusion. Refer to Shutdown Procedure [▷ 226].
	There is an external leak.	• Check carrier gas and calibration gas lines using a leak detector and ighten all fittings.
	Integration events are not optimized.	• Ensure all of the peaks of interest are identified and fully integrated. Refer to Integration Parameters [▷ 185].
	The **Backflush Time** method parameter is set too early (if applicable).	• Increase the **Backflush Time** until all peaks of interest appear on the chromatogram.
Inverted peaks are present or large, broad humps are present in the chromatogram	The carrier gas is incorrect/ mislabeled.	• Check the carrier gases and ensure that each carrier gas is connected to the correct inlet and configured properly in the user interface. • Check carrier gas lines using a leak detector and tighten all fittings.
	The carrier gas contains impurities.	• Ensure the carrier gas purity is between 99.995% and 99.9995%. • Add hydrocarbon/moisture/oxygen traps or particulate filters to the carrier gas line to improve purity. • Replace the carrier gas cylinder.
	There are carryover peaks from a previous run.	• If broad and sporadic peaks appear, it could indicate carryover from a late-eluting compound. Extend the **Hold Time** or increase **Column Temperature**. An increase in column temperature will change component retention times. • The sampling device of sample filters may be contaminated. Clean or replace the sampling device or filter.

Symptom	Possible sources of error	Remedy
An air peak is present on blank injection	The column head pressure method parameter is set too low.	• Verify that the column head pressure method parameter is above 15 psi. Insufficient carrier gas pressure may prevent the inject valve from sealing fully, creating an air leak.
	The carrier gas pressure is too low.	• Verify that there is sufficient carrier gas pressure from the cylinder. Carrier gas inlet pressure must be between 400 and 427 kPa (58-62 psi) **NOTICE! Exceeding 565 kPA (82 psi) may damage Micro GC Fusion and require factory repair.**
	There is an internal leak.	• Contact INFICON. Refer to Service and Technical Support [▷ 18].
There is a significant negative baseline, but peaks still appear	The reference column is damaged.	• Check the flow coming out of the reference vents. • If there is no flow, contact INFICON. Refer to Service and Technical Support [▷ 18].
There is poor separation resulting in partial or full co-elution of desired compounds	There is contamination in the system.	• Conduct a bakeout to clean the columns. Refer to Bakeout from System Status [▷ 227].
	The **Column Temperature** and **Column Pressure** method parameters are not optimized.	• Reduce the **Column Temperature** and/or **Column Pressure** to achieve better separation.
	There is a malfunction in the detector.	• Contact INFICON. SRefer to Service and Technical Support [▷ 18].
	There is a malfunction in the column.	• Check the flow coming out of the analytical and reference vents • If there is no flow from either or both vents, contact INFICON. Refer to Service and Technical Support [▷ 18].
	The column has degraded due to age or exposure to liquids, contaminants, or reactive compounds.	• Contact INFICON. Refer to Service and Technical Support [▷ 18].

12.1.2 Common User Interface Problems

Symptom	Possible sources of error	Remedy
The user interface front page cannot be accessed.	There is no connection to the computer LAN.	• Verify that the ethernet cable connector is plugged in. Refer to Wired Ethernet Connection [▷ 64]. • Replace the ethernet cable. • Verify that the LAN port on the computer is functioning.
	There is an IP address conflict.	• If using a static IP address, verify that the computer and Micro GC Fusion IP addresses have been set correctly. **NOTICE! If Micro GC Fusion will be connected to a local area network, check with the network administrator prior to changing the IP address to avoid conflicts.**
	There is no connection to the Micro GC Fusion wireless network.	• If using wireless, verify that the device is connected to the Micro GC Fusion wireless connection. Refer to Wireless Connection [▷ 68]. • Verify Micro GC Fusion is powered on. • Connect directly to a PC using an Ethernet cable, to bypass the wireless connection.
	The IP address is incorrect.	• Verify the Micro GC Fusion IP address by looking at the front panel display. Refer to Connecting to a Computing Device [▷ 148].
	The web browser is incompatible.	• Verify that the web browser meets the specifications outlined in Computer Web Browser Requirement [▷ 42].
	Micro GC Fusion requires a restart.	• Restart Micro GC Fusion. Refer to Shutdown Procedure [▷ 226].
	There is an instrument communication failure.	• Contact INFICON. Refer to Service and Technical Support [▷ 18].
The method button is not visible.	The device's screen size is too small.	• Method development can only be done if the screen meets the minimum display resolution. Access methods using a device with a larger screen.
	The web browser requires a restart or refresh.	• Restart or refresh the web browser.
	The web browser requires a cache clear.	• Clear the web browser's cache, then refresh the web browser.
Data cannot be stored.	Data storage has been exceeded.	• Export runs, then delete them. Refer to Export Runs [▷ 180] and Delete Runs [▷ 183].

Symptom	Possible sources of error	Remedy
The method or sequence will not load.	There is an incompatible method or sequence.	• Ensure that temperatures and ramps do not exceed instrument limitations. • Verify that the method was created for use with the desired instrument.
	The web browser requires restart or refresh.	• Restart or refresh the web browser.
	The web browser requires a cache clear.	• Clear the web browser's cache, then refresh the web browser.
Method is 'preparing' and not becoming ready.	The 100 pin connector is loose.	• Remove the chassis cover and reseat the module, ensuring that the 100 pin connector is fully seated.
	The orange cable is loose.	• Remove the chassis cover and verify that the orange cable is fully seated.
The GC will not power on.	The power supply has been damaged.	• Replace the power supply. Refer to Connecting the Power Supply [▷ 69].
	There is a malfunctioning circuit board.	• Contact INFICON. Refer to Service and Technical Support [▷ 18].
	The 4-module chassis fuse is damaged.	• Replace the fuse on the back of the 4-module Micro GC Fusion.
The carrier gas depletes prematurely.	There is an external leak.	• Check carrier gas lines using a leak detector and tighten all fittings.
	There is an internal leak.	• Remove the chassis cover and listen for a hissing noise. If the noise is present, tighten the carrier gas connector on the front of the module. Do not over tighten. If hissing continues, contact INFICON.
The sample pump does not run or runs intermittently.	The **Sample Pump Time** method parameter is set to 0 seconds.	• Ensure that the **Sample Pump Time** is set for at least 15 seconds.
	There is a malfunction in the sample pump.	• Listen for the noise from the pump when taking a sample. If there is no noise, contact INFICON. Refer to Service and Technical Support [▷ 18].
The front panel display will not turn on.	The internal cable is disconnected.	• Open the chassis and verify that the internal cable is connected to the tablet.

12.2 Common Chromatographic and Method Problems

This section provides additional information to help diagnose common operational problems. It is divided into two topics: Chromatographic Problems and Method Problems.

If the issue is not resolved after taking the suggested measure(s), contact INFICON. (Refer to Service and Technical Support [▷ 18].)

12.2.1 Chromatographic Problems

Unexpected chromatographic behavior may be the result of:

- Electronic or mechanical failure
- Contaminants in gas lines, injectors, columns, and detectors
- Incorrect or inappropriate set points
- Leaks, bleed, or other chromatographic difficulties

These conditions often interact. For example, baseline problems may arise from any combination of the conditions. Accordingly, this section is organized by symptoms with reference to the most probable causes.

12.2.1.1 Baseline Symptoms

12.2.1.1.1 Baseline Position

Baseline position changes suddenly during a run. This can result from:

- Detector filament failure
- Valve failure
- EPC failure

Inspect the main page or **System Status** for error messages or faults. Power off Micro GC Fusion, restart, and reload the method.

12.2.1.1.2 Baseline Wander and Drift

Baseline wander or drift is to be expected when a temperature setting is changed. With sufficient time, the problem should subside. The following cases assume that sufficient stabilization time has elapsed.

Running Micro GC Fusion in isothermal mode will help determine if there is a problem with the baseline or if the baseline effects are due to the temperature ramp of the column.

Baseline is erratic; moves up and down (wander):

- Potential column leak
- Change the sample conditioner filter
- If there is a leak at the detector end of the column, the retention times will be stable from run to run, but sensitivity will be reduced

- If there is a leak at the inlet end of the column, there will be reduced flow through the column, an increase in retention time, and reduced sensitivity. If a leak is suspected, contact INFICON.

Baseline moves steadily (drift) upscale or downscale during a run. This problem can be minimized by:

- Conditioning the column
- Operating at a lower temperature
- Substituting an identical or chromatographically equivalent module

12.2.1.1.3 Baseline Noise

Noise is a continuous rapid baseline fluctuation, broadening the baseline and giving a grass like appearance. Noise is different than spiking. Spikes are isolated rather than continuous events. Some noise is inevitable with any detector.

Noise that appears suddenly on a previously clean baseline may be due to:

- Recent changes made to the system
- Loose connections in the detector or its signal path
- Detector contamination
- Contaminated carrier gas

If the carrier gas tank was recently replaced, re-connect the previous tank to see if the noise decreases. If the new carrier gas is contaminated such that it saturates a trap, changing to the old tank may show little improvement until the traps are replaced or regenerated. This problem is most common with nitrogen carrier gas.

Noise gradually increases to an unacceptable level.

- This symptom indicates gradual buildup of the noise source, rather than an abrupt change as described above. If the cause of the noise is not found, contact INFICON.

12.2.1.1.4 Baseline Spiking

Spikes are isolated baseline disturbances and usually appear as sudden large upscale movements. If these spikes are accompanied by noise, address the noise problem first, as this may correct the spiking issue as well.

If spikes appear when a run is in progress, the cause is almost always electronic in origin.

Loose connections are often the most likely cause of spikes. Check all accessible cable connections.

External interference from local radio transmission equipment can also cause baseline spiking.

12.2.1.2 Retention Time Symptoms

12.2.1.2.1 Retention Time Drift

Retention time drift is a steady increase or decrease of retention times in a series of successive runs.

Erratic retention times are discussed in Retention Time Wander (Reproducibility) [▷ 271].

If a backflush injector is configured, verify that the **Backflush Time** set point is optimized for that GC module. If the **Backflush Time** is set improperly, undesired components can enter the column, resulting in retention time drift.

Retention times suddenly increase significantly due to:

- Decreased carrier flow or reduced column temperature. In the **System Status** window, ensure the actual pressures and temperatures match their set points
- Low carrier gas pressure. The carrier gas tank may be empty. Replace if necessary

Retention time suddenly decreased significantly due to:

- Increased carrier flow or increased column temperature. In the **System Status** window, ensure the actual pressures and temperatures match their set points

If the actual pressures and temperatures do not match the set points, power Micro GC Fusion off, restart, and download the method again. If this does not solve the problem, contact INFICON.

12.2.1.2.2 Retention Time Wander (Reproducibility)

Reproducibility is erratic for successive runs of similar composition.

- Temperature or pressure variations within the run may be the cause. This may indicate possible heater or pressure control failure

Reproducibility is acceptable later in the run but not for early eluting peaks.

- When the earliest peaks elute very rapidly, they may not achieve chromatographic equilibrium with the stationary phase. They act as solvent peaks and are carried straight through the column
- If peaks were separated, but are no longer baseline resolved, lower the column temperature to achieve better separation

Retention time changes with large sample concentrations.

- When there is more sample than the column can handle, peaks will be deformed and will shift to earlier retention times. Reduce the **Inject (ms)** time.

12.2.1.3 Peak Symptoms

12.2.1.3.1 No Peaks

No peaks are typically due to insufficient **Sample Pump Time**, low detector sensitivity, or a short **Inject (ms)** time.

Verify if there is flow present by connecting a flow meter to the reference and analytical vents on the back of each module. No flow could indicate a broken column. The presence of flow could indicate an injector or TCD malfunction. Contact INFICON.

12.2.1.3.2 Inverted Peaks

Inverted peaks are usually caused by poor quality carrier gas. The carrier gas must be 99.995% to 99.9995% pure. Inverted peaks often indicate that the carrier gas is contaminated, or that the incorrect carrier gas is being used or configured.

Carrier gas configuration can be checked on Micro GC Fusion through the System Status window. Refer to Carrier Gas Requirement [▶ 50] to change the carrier gas.

12.2.1.3.3 Extra Peaks

Extra, or ghost peaks are peaks that appear during a blank or sample run. Ghost peaks appear even when no sample is injected (and are also found among the actual component peaks during a sample run).

Ghost peaks appear during a blank run when:

- The column has been heated and idle for an extended period of time
- Carrier gas and plumbing contain impurities such as oils, greases, or other materials
- There is a reaction of the stationary phase with trace levels of oxygen, water, and other materials in the carrier gas
- The inlet is contaminated. Residues in the inlet are volatilized or pyrolyzed and swept onto the head of the column
- The sample conditioner is contaminated. If the sample conditioner contains a filter, replace the filter
- There is sample carryover from a previous run

Additional peaks appear when:

- Sample is not pure. Run a blank sample (carrier gas only). If the peaks persist, they are not sample related
- Thermal degradation of one or more components occurs due to an overheated inlet. Reduce the **Sample Inlet Heater Temperature**
- The run time is not adequate for all the sample compounds to elute. Compounds carry over and appear as traveling broad peaks during subsequent runs. This can be eliminated by increasing **Column Temperature** or increasing the sample **Hold Time**. If applicable, adjust the **Backflush Time** until all sample components appear during a run

12.2.1.3.4 Deformed Peaks

The ideal chromatography peak is a pure Gaussian shape, although some asymmetry is always present, particularly near the baseline. Some common types of deformed peaks are described below.

12.2.1.3.4.1 Peak Fronting

The peak rises normally, then drops sharply to the baseline.

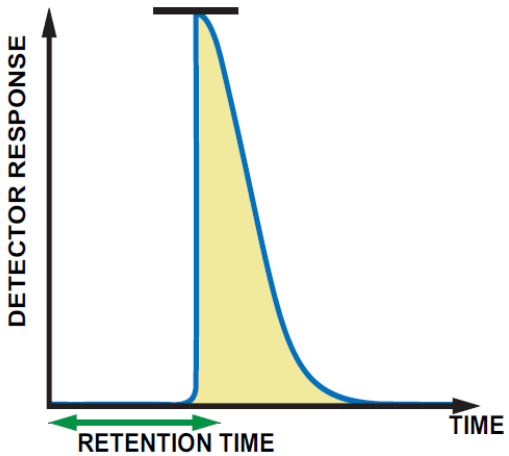


Fronting is usually caused by column overload. Reduce the sample **Inject (ms)** time. If using a variable volume or fixed volume injector, do not reduce the **Inject (ms)** time to less than 15 ms to avoid repeatability issues.

Fronting could also result from two (or more) closely unresolved peaks. Decrease the column temperature by 30°C and repeat the analysis. If peaks separate at the lower temperature, the fronting was caused by unresolved peaks.

12.2.1.3.4.2 Peak Tailing

The peak rises sharply, then falls normally to baseline.



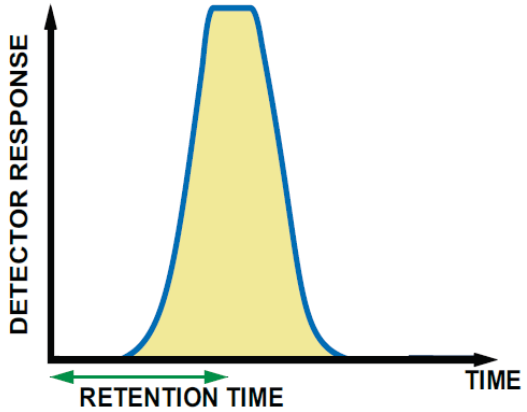
Tailing is usually caused by column overload. Reduce the sample **Inject (ms)** time. If using a variable volume or fixed volume injector, do not reduce the **Inject (ms)** time to less than 15 ms to avoid repeatability issues.

Tailing could also result from two (or more) closely unresolved peaks. Decrease the column temperature by 30°C and repeat the analysis. If peaks separate at the lower temperature, the tailing was caused by unresolved peaks.

Tailing can also be caused by a low **Sample Inlet Heater Temperature**. Increase the **Sample Inlet Heater Temperature** and repeat the analysis.

12.2.1.3.4.3 Deformed Peak Apex

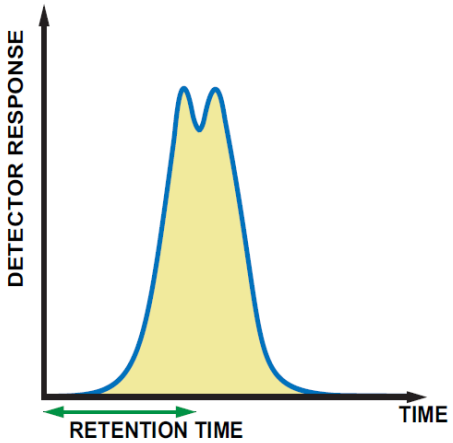
Top (apex) of the peak is deformed or flat.



A deformed peak apex is usually caused by detector saturation. Reduce the sample **Inject (ms)** time. If using a variable volume or fixed volume injector, do not reduce the **Inject (ms)** time to less than 15 ms to avoid repeatability issues.

A deformed peak apex can also result from a detector **Sensitivity** set to **High**. Ensure that the **Sensitivity** is set to **Standard**. Sensitivity setting is not applicable for the FAST Enabled Micro GC Fusion.

12.2.1.3.4.4 Split Peak Apex



Ensure that this is not a merged peak by conducting a run at a lower column temperature. If the peaks separate at the lower column temperature, the split peak is due to unresolved compounds.

Hydrogen peaks, analyzed with a thermal conductivity detector and helium carrier gas, often show a split peak apex. Reduce the **Inject (ms)** time until the split is resolved. If using a variable volume or fixed volume injector, do not reduce the **Inject (ms)** time to less than 15 ms to avoid repeatability issues.

12.2.2 Method Problems

This section describes how to troubleshoot a method and solve problems that arise from incorrect Micro GC Fusion parameter settings, wrong peak identification windows, and inappropriate peak detection parameters. These conditions cause an

erroneous calculation of the mole percent composition of samples. Troubleshoot the method if the following symptoms are observed in the reports and chromatograms when running a calibration standard.

- Zero mole percent composition for components known to be present
- Peaks are not being integrated, or are being integrated incorrectly
- Unusually high or low mole percent composition
- Samples with unnormalized totals outside the 95 to 105% range

12.2.2.1 Correcting Instrument Parameter Settings - Adjusting Column Head Pressure

Column head pressure controls flow through the column, and directly affects the retention time of all peaks in the run.

1. Determine the retention time for the start of the first peak for all modules in the calibration standard.
2. Adjust column head pressure so that all peaks elute within method defined peak windows.
3. Save the method.

12.2.2.2 Correcting Instrument Parameter Settings - Recalibrating

Changes to Column Pressure, Column Temperature, Inject (ms) time, and Backflush Time (if applicable) may cause peak retention times to shift and peak areas to change. The retention times and associated peak windows will require adjustment. Therefore, the method should be recalibrated. Recalibrate Micro GC Fusion as instructed in Calibration [▷ 184].

13 Checkout Gases and Replacement Parts

13.1 Checkout Gases

Three standard checkout gases are available to validate chromatography performance of Micro GC Fusion both at the factory and at the user site during installation. Their compositions are defined to demonstrate instrument performance for common Micro GC applications.

At the factory, the Universal checkout gas is used by default unless otherwise specified. The checkout gas selection is made when configuring a Micro GC Fusion instrument part number.

INFICON PN	Description
952-607-P1	Universal Checkout Gas Cylinder
952-607-P3	Natural Gas Checkout Gas Cylinder
952-607-P4	Refinery Gas Checkout Gas Cylinder

INFICON PN	Description
5184-3559	Regulator for Checkout Gas Cylinders

13.1.1 Universal Checkout Gas

Universal checkout gas contains fixed gases and C1-C6 components in a nitrogen balance. See the table below for the component concentrations.



Universal checkout gas is not intended to be a substitute for a calibration standard for any specific applications. INFICON recommends acquiring a calibration standard gas that meets composition requirements appropriate for the specific application.

Components	Concentration (Mole %)
hydrogen	10.00%
oxygen	1.00%
nitrogen	balance
methane	5.00%
ethane	0.10%
ethylene	0.20%
carbon dioxide	1.00%
carbon monoxide	1.00%
acetylene	0.05%
propane	0.1%
propylene	0.05%
n-butane	0.05%
n-pentane	0.05%
n-hexane	0.05%

13.1.2 Natural Gas Checkout Gas

Natural gas checkout gas simulates the content of pipeline quality natural gas. It contains fixed gases and C1-C7 components in a methane balance. See the table below for the component concentrations.



Natural gas checkout gas is not intended to be a substitute for a calibration standard for any specific applications. INFICON recommends acquiring a calibration standard gas that meets composition requirements appropriate for the specific application.

Components	Concentration (Mole %)
nitrogen	1.50%
methane	balance
ethane	9.00%
carbon dioxide	1.50%
propane	6.00%
isobutane	3.00%
n-butane	2.00%
isopentane	1.00%
n-pentane	0.50%
n-hexane	0.10%
n-heptane	0.05%

13.1.3 Refinery Gas Checkout Gas

Refinery gas checkout gas contains fixed gases, C1-C7 saturated hydrocarbons and C2-C5 olefins in a nitrogen balance. See the table below for the component concentrations.



Refinery gas checkout gas is not intended to be a substitute for a calibration standard for any specific applications. INFICON recommends acquiring a calibration standard gas that meets composition requirements appropriate for the specific application.

Components	Concentration (Mole %)
hydrogen	10.00%
oxygen	0.19%
nitrogen	balance
carbon monoxide	1.00%
carbon dioxide	3.00%
methane	5.00%
ethane	4.00%
ethylene	2.00%
acetylene	1.00%

Components	Concentration (Mole %)
propane	2.00%
propylene	1.00%
isobutane	0.30%
n-butane	0.15%
1-butene	0.30%
isobutylene	0.15%
trans-2-butene	0.15%
cis-2-butene	0.30%
1,3-butadiene	0.30%
isopentane	0.10%
n-pentane	0.05%
cis-2-pentene	0.05%
trans-2-pentene	0.05%
methyl-2-butene	0.05%
n-hexane	0.05%
n-heptane	0.05%

13.2 Replacement Parts

Replacement parts are available to ensure Micro GC Fusion runs at optimal performance with minimal down time. There are three categories of replacement parts on Micro GC Fusion that can be used for maintenance or application optimization purposes.

- GC Module Replacement
- Accessory parts
- Spare and consumable parts

13.2.1 GC Module Replacement

A GC module is a self-contained gas chromatograph that can perform sample injection, separation, and detection. GC modules can be changed in the instrument for either maintenance or application adaption purposes. Refer to GC Module Replacement [▷ 231] for instructions on how to remove and replace a GC module.



The following table provides a list of INFICON part numbers (PN) and descriptions for GC module replacements.

Injector Codes:

- BF - Backflush
- VV - Variable Volume
- VLV - Variable large volime
- FV - Fixed Volume

INFICON PN	Injector	Analytical Column	Analytical Column Length, ID	Pre-Column	Pre-Column Length, ID	Detector	Status
GCMR-W02	BF	Rt-Msieve 5A	10 m, 0.25 mm	Rt-Q-Bond	3 m, 0.25 mm	TCD2	Active
GCMR-RC2	FV	Rt-Msieve 5A	10 m, 0.25 mm	N/A	N/A	TCD2	Active
GCMR-TC2	VV	Rt-Msieve 5A	10 m, 0.25 mm	N/A	N/A	TCD2	Active
GCMR-UC2	VLV	Rt-Msieve 5A	10 m, 0.25 mm	N/A	N/A	TCD2	Active
GCMR-RG3	FV	CP-Molesieve 5A	20 m, 0.25 mm	N/A	N/A	TCD2	Active
GCMR-TG3	VV	CP-Molesieve 5A	20 m, 0.25 mm	N/A	N/A	TCD2	Active
GCMR-UG3	VLV	CP-Molesieve 5A	20 m, 0.25 mm	N/A	N/A	TCD2	Active
GCMR-RC0	FV	Rt-Q-Bond	8 m, 0.25 mm	N/A	N/A	TCD2	Active
GCMR-TC0	VV	Rt-Q-Bond	8 m, 0.25 mm	N/A	N/A	TCD2	Active
GCMR-UC0	VLV	Rt-Q-Bond	8 m, 0.25 mm	N/A	N/A	TCD2	Active
GCMR-RR2	FV	Rt-Q-Bond	12 m, 0.25 mm	N/A	N/A	TCD2	Active
GCMR-TR2	VV	Rt-Q-Bond	12 m, 0.25 mm	N/A	N/A	TCD2	Active
GCMR-UR2	VLV	Rt-Q-Bond	12 m, 0.25 mm	N/A	N/A	TCD2	Active
GCMR-RR4	FV	Rt-U-Bond	12 m, 0.25 mm	N/A	N/A	TCD2	Active
GCMR-TR4	VV	Rt-U-Bond	12 m, 0.25 mm	N/A	N/A	TCD2	Active
GCMR-UR4	VLV	Rt-U-Bond	12 m, 0.25 mm	N/A	N/A	TCD2	Active
GCMR-W81	BF	Rt-U-Bond	8 m, 0.25 mm	Rt-Q-Bond	1 m, 0.25 mm	TCD2	Active
GCMR-RG0	FV	Rt-U-Bond	8 m, 0.25 mm	N/A	N/A	TCD2	Active
GCMR-TG0	VV	Rt-U-Bond	8 m, 0.25 mm	N/A	N/A	TCD2	Active
GCMR-UG0	VLV	Rt-U-Bond	8 m, 0.25 mm	N/A	N/A	TCD2	Active
GCMR-RW2	FV	Rxi-1ms	5 m, 0.15 mm	N/A	N/A	TCD2	Active

INFICON PN	Injector	Analytical Column	Analytical Column Length, ID	Pre-Column	Pre-Column Length, ID	Detector	Status
GCMR-TW2	VV	Rxi-1ms	5 m, 0.15 mm	N/A	N/A	TCD2	Active
GCMR-UW2	VLV	Rxi-1ms	5 m, 0.15 mm	N/A	N/A	TCD2	Active
GCMR-R03	FV	Rxi-1ms	10 m, 0.15 mm	N/A	N/A	TCD2	Active
GCMR-T03	VV	Rxi-1ms	10 m, 0.15 mm	N/A	N/A	TCD2	Active
GCMR-U03	VLV	Rxi-1ms	10 m, 0.15 mm	N/A	N/A	TCD2	Active
GCMR-R43	FV	Rxi-1ms	20 m, 0.15 mm	N/A	N/A	TCD2	Active
GCMR-T43	VV	Rxi-1ms	20 m, 0.15 mm	N/A	N/A	TCD2	Active
GCMR-U43	VLV	Rxi-1ms	20 m, 0.15 mm	N/A	N/A	TCD2	Active
GCMR-R83	FV	Rt-Alumina Na_2SO_4	10 m, 0.25 mm	N/A	N/A	TCD2	Active
GCMR-T83	VV	Rt-Alumina Na_2SO_4	10 m, 0.25 mm	N/A	N/A	TCD2	Active
GCMR-U83	VLV	Rt-Alumina Na_2SO_4	10 m, 0.25 mm	N/A	N/A	TCD2	Active
GCMR-VC4	BF	Rt-Alumina Na_2SO_4	10 m, 0.32 mm	Rt-Alumina Na_2SO_4	1 m, 0.32 mm	TCD2	Active
GCMR-RG5	FV	Rt-Stabilwax DB	15 m, 0.25 mm	N/A	N/A	TCD2	Active
GCMR-TG5	VV	Rt-Stabilwax DB	15 m, 0.25 mm	N/A	N/A	TCD2	Active
GCMR-UG5	VLV	Rt-Stabilwax DB	15 m, 0.25 mm	N/A	N/A	TCD2	Active
GCMR-R45	FV	CP-Sil13CB	16 m, 0.15 mm	N/A	N/A	TCD2	Active
GCMR-T45	VV	CP-Sil13CB	16 m, 0.15 mm	N/A	N/A	TCD2	Active
GCMR-U45	VLV	CP-Sil13CB	16 m, 0.15 mm	N/A	N/A	TCD2	Active
GCMR-RM4	FV	CP-Sil19CB	4 m, 0.15 mm	N/A	N/A	TCD2	Active
GCMR-TM4	VV	CP-Sil19CB	4 m, 0.15 mm	N/A	N/A	TCD2	Active
GCMR-UM4	VLV	CP-Sil19CB	4 m, 0.15 mm	N/A	N/A	TCD2	Active
GCMR-R44	FV	CP-Sil19CB	12 m, 0.15 mm	N/A	N/A	TCD2	Active
GCMR-T44	VV	CP-Sil19CB	12 m, 0.15 mm	N/A	N/A	TCD2	Active
GCMR-U44	VLV	CP-Sil19CB	12 m, 0.15 mm	N/A	N/A	TCD2	Active
GCMR-R85	FV	HP-FFAP	25 m, 0.20 mm	N/A	N/A	TCD2	Active
GCMR-T85	VV	HP-FFAP	25 m, 0.20 mm	N/A	N/A	TCD2	Active
GCMR-U85	VLV	HP-FFAP	25 m, 0.20 mm	N/A	N/A	TCD2	Active
GCMR-RC5	FV	HP-INNOWax	10 m, 0.25 mm	N/A	N/A	TCD2	Active
GCMR-TC5	VV	HP-INNOWax	10 m, 0.25 mm	N/A	N/A	TCD2	Active
GCMR-UC5	VLV	HP-INNOWax	10 m, 0.25 mm	N/A	N/A	TCD2	Active

13.2.2 Micro GC Fusion Accessories

Accessories are available to optimize instrument performance and facilitate effective use of the instrument.

INFICON PN	Description
G2801-60618	Remote start cable (AUX I/O)
075-541	Transit case for 2-module chassis
952-021-G1	Ship kit - install/maintenance
952-029-G1	Gas-liquid separator
952-024-G1	Ship kit - syringe luer adapter
952-025-G1	Ship kit - 50 ml syringe and luer adapter
952-026-G1	Ship kit -SS adapter for sample bag
952-027-G1	Ship kit - SS adapter and 10/pack 3 L ALTEF
952-033-G1	Pressure reducer and gas-liquid separator
952-415-P1	Dual-stage regulator with a CGA 350 connection
952-416-P1	Dual-stage regulator with a CGA 580 connection
952-429-G1	Valve SD, 10 way, 11 port, 1/16 tube, SS
952-430-G1	Valve SF, 10 way, 21 port, 1/16 tube, SS
952-4100-G1	Ship kit - rack mount - 4-module
952-039-G1	External sample conditioner

13.2.3 Spare and Consumable Parts

Stocking the following spare and consumable parts is recommended to facilitate instrument maintenance and minimize downtime.

INFICON PN	Description
FRL-1269	Dual end ferrule for 1/16 in. inlet
G2870A-01	Hydrocarbon/moisture trap for carrier gas
HDW-2170	Replacement genie membrane filters 5/pk
035-0137	Antenna, swivel, 2.4 GHz, SMA-M, WI-FI
059-0682	Filter element 7 µm pore SS RoHS for sample conditioner
059-0701	Filter, inline, 0.125-tube, 2 µm pore brass RoHS for carrier gas
059-0718	Frit disk, 10 µm, 0.062 OD, 5 pack, RoHS for sample inlet
068-0419	Power cord SL-16+SL-3, Australia, 1.8 m
068-0433	Power cord, USA, 10A / 125V, 6 ft
068-0434	Power cord, Euro, 10A / 250V, 2.5 m
068-0590	Power cord, UK,10A, BLK PVC, 220V, RoHS
069-0115	1/8 OD, 0.065 ID, copper, 50 ft, cleaned
070-1726	3 liter sample bag (10 pcs per pack)
600-1546-P1S	Cable assembly 24 V (dc)
952-423-P1	Filter and holder assembly 0.062 for sample inlet
952-435-P1S	Power supply 24 V (dc) desktop
952-291-G1S	Sample pump and wiring harness spare (old style)

13.2.4 External Sample Conditioner Spare Parts

The following is a list of orderable spare parts:

Part Number	Description
952-018-G1S 	Transfer line kit (includes one 1/16 in. sample transfer tubing with rubber insulation sleeve and 1/16 in. nut and ferrules)
952-019-G1S  	Filter element kit (includes six 7 µm filters and one gasket)
033-0074S 	Power supply kit (includes one)
952-515-P1S 	Filter cover kit (includes one)
059-0809S	Bonnet nut kit (includes one)

Part Number	Description
	
144-374S 	M5 wing nut kit (includes four)
059-0808S 	Male quick stem connector kit (includes one)

13.3 Software and Computers

The web-based software embedded in Micro GC Fusion provides easy instrument control, method development and data management. In addition, software add-ons and computers are available to support customer operation.

Software add-ons:

INFICON PN	Description
952-035-G1	Micro GC Fusion Offline Analysis
952-390-P1	Diablo EZReporter 4.0 software, standard ed.
952-391-P1	Diablo EZReporter 4.0 software, natural gas ed.
952-389-G1	License certificate for EZ IQ or OpenLAB Access
	License certificate for Modbus

Computers:

INFICON PN	Description
930-760-G1	Laptop computer Windows 10 (USA)
930-760-G2	Laptop computer Windows 10 (Europe)
930-760-G3	Laptop computer Windows 10 (UK)
930-760-G4	Laptop computer Windows 10 (China/Australia)

13.4 Installation and Familiarization Training

Micro GC Fusion installation and familiarization trainings are available to install the instrument and familiarize the user with chromatography basics and instrument specifics.

INFICON PN	Description
952-8001-P1	Micro GC Fusion - One Day Install and Familiarization

INFICON PN	Description
952-8002-P1	Micro GC Fusion - Two Days Install, Familiarization and Advance Operation
MGCTRAVEL3-6K	Addition MGC Travel Cost - total mileage between 3000-6000 miles from nearest INFICON office
MGCTRAVEL6K+	Addition MGC Travel Cost - total mileage exceeds 6000 miles from nearest INFICON office
952-8003-P1	Micro GC Fusion Remote Refresher Training
952-8004-P1	Micro GC Fusion Remote Install and Basic Training
952-8005-P1	Micro GC Fusion Remote Install and Advanced Training

14 Checkout Gas Chromatograms

14.1 Introduction

Standard checkout gases are used in the factory to validate the chromatography performance of Micro GC Fusion. Chromatograms created with these checkout gases on Micro GC Fusion columns are provided in this chapter to demonstrate typical peak elution order, when these checkout gases are used at the customer site during product acceptance.

Actual retention times and area counts will vary from column to column.

The following column types are included in this chapter:

- Rt-Msieve 5A, see 10 m Rt-Msieve 5A [▷ 286]
- Rt-Q-Bond, see 12 m Rt-Q-Bond [▷ 288]
- Rxi-1ms, see 10 m Rxi-1ms [▷ 290]

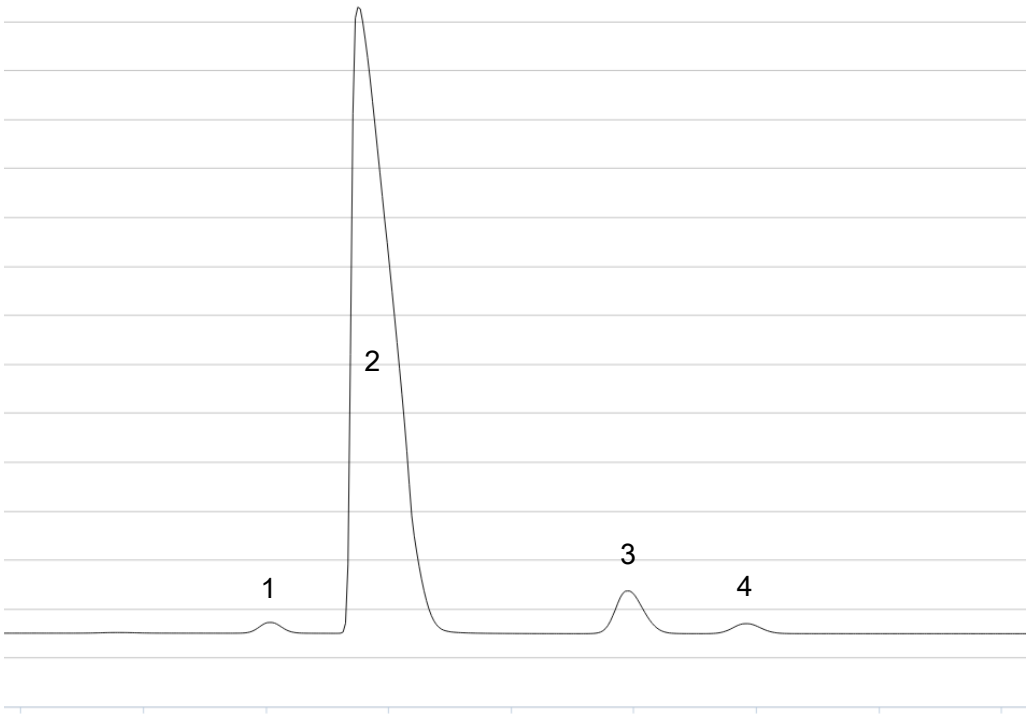
For a complete list of checkout gases and the corresponding concentrations, see Checkout Gases [▷ 276].

14.2 10 m Rt-Msieve 5A

14.2.1 Universal Checkout Gas Using Helium Carrier Gas

Peak Number	Compound	Concentration (mole %)
1	oxygen	1.00
2	nitrogen	81.24
3	methane	5.00
4	carbon monoxide	1.00

Helium is not an acceptable carrier gas for hydrogen analysis.

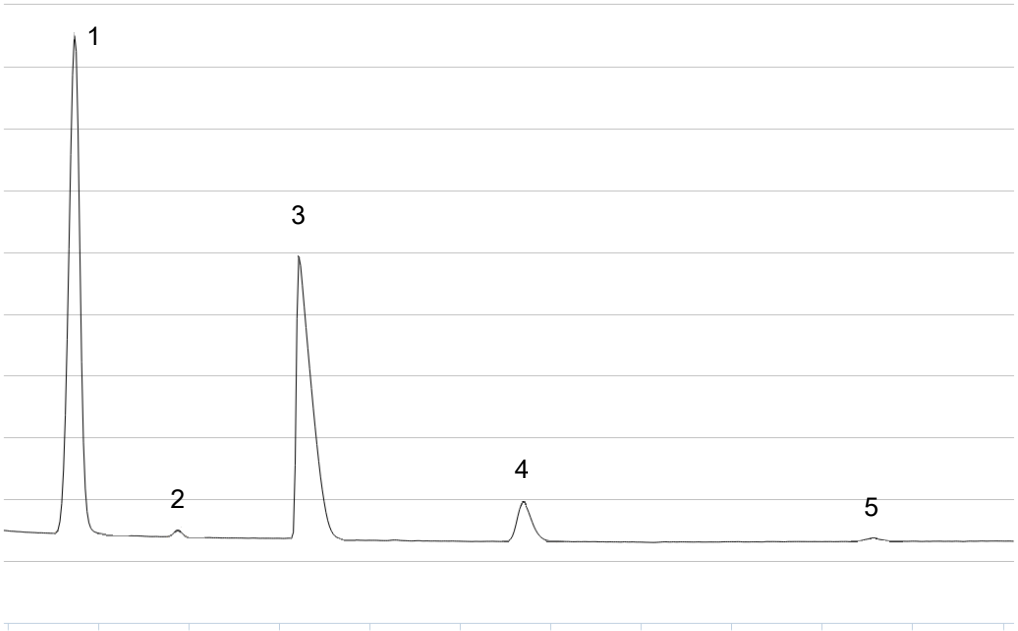


- **Column Temperature Profile**: 110°C (10 s hold) -> 200°C (30 s hold), 2.5°C/s
- **Column Pressure:** 25 psi
- **Inject (ms) Time:** 30 ms
- **Backflush Time:** 10 s

14.2.2 Universal Checkout Gas Using Argon Carrier Gas

Argon carrier gas is used for the analysis of hydrogen in a sample. Analysis of other fixed gases is possible using argon carrier gas but with reduced sensitivity when compared with helium carrier gas.

Peak Number	Compound	Concentration (mole %)
1	hydrogen	10.00
2	oxygen	1.00
3	nitrogen	81.24
4	methane	5.00
5	carbon monoxide	1.00



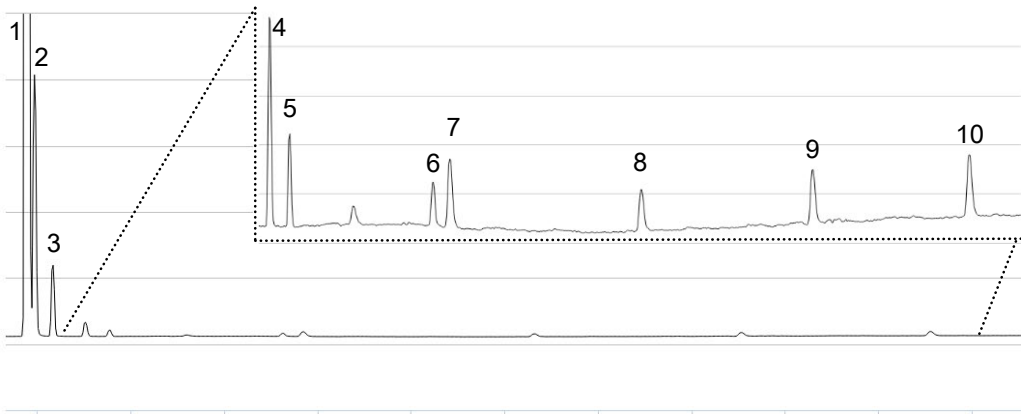
- **Column Temperature Profile**: 100°C (90 s hold)
- **Column Pressure:** 35 psi
- **Inject (ms) Time:** 30 ms
- **Backflush Time:** 10 s

14.3 12 m Rt-Q-Bond

14.3.1 Universal Checkout Gas Using Helium Carrier Gas

Peak Number	Compound	Concentration (mole %)
1	composite air	93.24
2	methane	5.00
3	carbon dioxide	1.01
4	combined ethylene/ acetylene	0.25
5	ethane	0.10
6	propylene	0.05
7	propane	0.10
8	n-butane	0.05
9	n-pentane	0.05
10	n-hexane	0.05

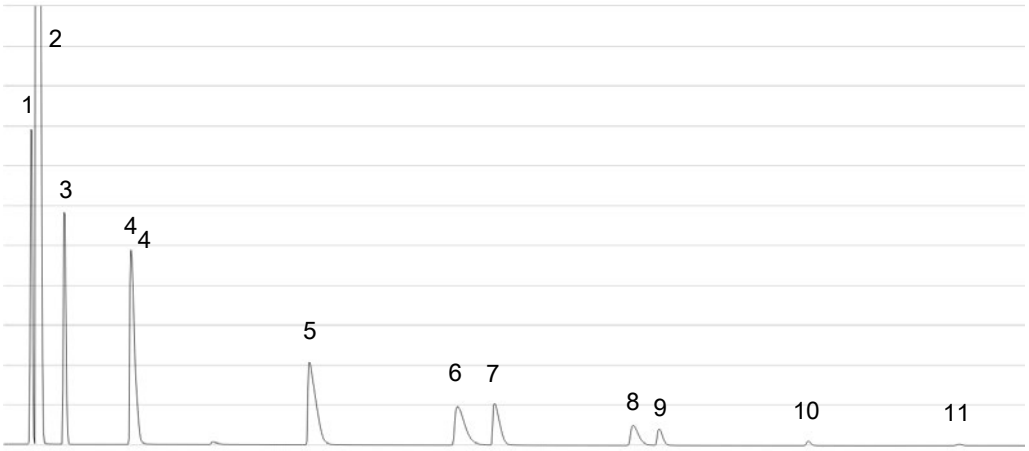
Ethylene and acetylene co-elute on Rt-Q-Bond column.



- **Column Temperature Profile**: 65°C (20 s hold) -> 220°C (50 s hold), 1°C/s
- **Column Pressure:** 30 psi
- **Inject (ms) Time:** 30 ms

14.3.2 Natural Gas Checkout Gas Using Helium Carrier Gas

Peak Number	Compound	Concentration (mole %)
1	nitrogen	1.50
2	methane	75.32
3	carbon dioxide	1.50
4	ethane	8.99
5	propane	6.00
6	isobutane	3.01
7	n-butane	2.00
8	isopentane	1.02
9	n-pentane	0.50
10	n-hexane	0.10
11	n-heptane	0.05

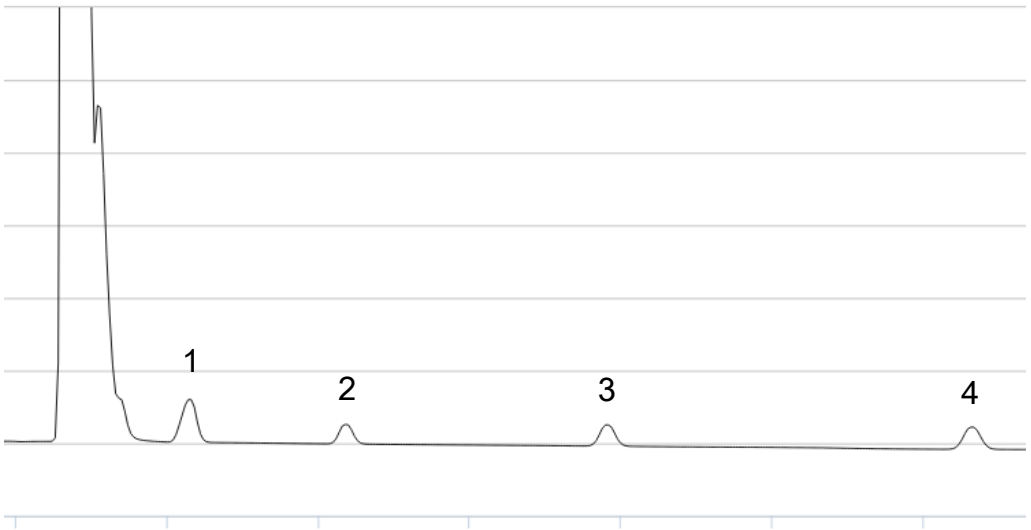


- **Column Temperature Profile**: 55°C (20 s hold) -> 230°C (50 s hold), 1°C/s
- **Column Pressure:** 30 psi
- **Inject (ms) Time:** 30 ms

14.4 10 m Rxi-1ms

14.4.1 Universal Checkout Gas Using Helium Carrier Gas

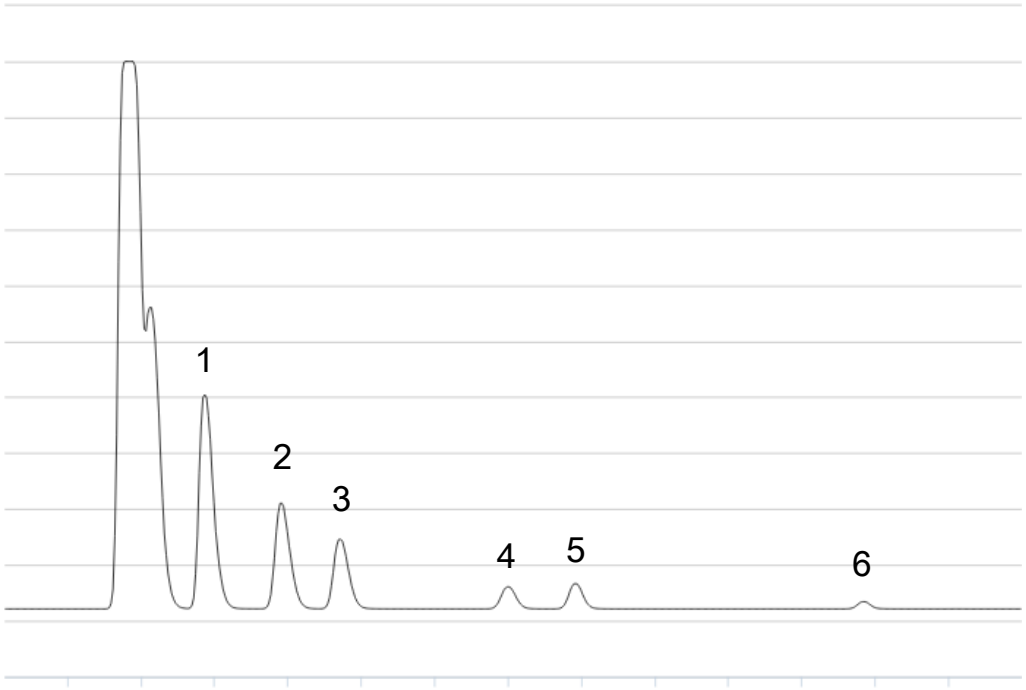
Peak Number	Compound	Concentration (mole %)
1	propane	0.10
2	n-butane	0.05
3	n-pentane	0.05
4	n-hexane	0.05



- **Column Temperature Profile**: 60°C (20 s hold) -> 110°C (20 s hold), 0.8°C/s
- **Column Pressure:** 17 psi
- **Inject (ms) Time:** 30 ms

14.4.2 Natural Gas Checkout Gas Using Helium Carrier Gas

Peak Number	Compound	Concentration (mole %)
1	propane	6.00
2	isobutane	3.01
3	n-butane	2.00
4	isopentane	1.02
5	n-pentane	0.50
6	n-hexane	0.10



- **Column Temperature Profile**: 50°C (10 s hold) -> 150°C (20 s hold), 2°C/s
- **Column Pressure:** 20 psi
- **Inject (ms) Time:** 30 ms

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