Agilent 490 Micro Gas Chromatograph

User Manual

Agilent Technologies

Notices

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Safety Notices

CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Contents

1
Introduction

This chapter provides important information about using the Agilent 490 Micro Gas Chromatograph (Micro GC) safely. To prevent any injury to you or any damage to the instrument it is essential that you read the information in this chapter.

Safety Information

Important safety warnings

There are several important safety notices that you should always keep in mind when using the Micro GC.

WARNING

When handling or using chemicals for preparation or use within the Micro GC, all applicable local and national laboratory safety practices must be followed. This includes, but is not limited to, correct use of Personal Protective Equipment, correct use of storage vials, and correct handling of chemicals, as defined in the laboratory's internal safety analysis and standard operating procedures. Failure to adhere to laboratory safety practices could lead to injury or death.

Hydrogen safety

Hydrogen is a commonly used GC carrier gas. When mixed with air, hydrogen can form explosive mixtures and has other dangerous characteristics.

WARNING

When using hydrogen (H_2) as the carrier gas, be aware that hydrogen gas can create a fire or explosion hazard. Be sure that the supply is turned off until all connections are made.

Hydrogen is flammable. Leaks, when confined in an enclosed space, may create a fire or explosion hazard. In any application using hydrogen, leak test all connections, lines, and valves before operating the instrument. Always turn off the hydrogen supply at its source before working on the instrument.

- Hydrogen is combustible over a wide range of concentrations. At atmospheric pressure, hydrogen is combustible at concentrations from 4 % to 74.2 % by volume.
- Hydrogen has the highest burning velocity of any gas.
- Hydrogen has a very low ignition energy.
- Hydrogen that is allowed to expand rapidly from high pressure into the atmosphere can self-ignite.
- Hydrogen burns with a nonluminous flame which can be invisible under bright light.

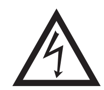
Safety symbols

Warnings in the manual or on the instrument must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions violates safety standards of design and the intended use of the instrument. Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

See accompanying instructions for more information.

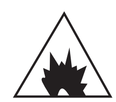
Indicates a hot surface.

Indicates hazardous voltages.

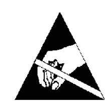


Indicates earth (ground) terminal.

Indicates potential explosion hazard.



Indicates electrostatic discharge hazard.



Indicates a hazard. See the Agilent 490 GC user documentation for the item labeled.

Indicates that you must not discard this electrical/electronic product in domestic household waste

Safety and regulatory information

This instrument and its accompanying documentation comply with the CE specifications and the safety requirements for electrical equipment for measurement, control, and laboratory use (CEI/IEC 1010-1)$_C$CSA$_{US}$ and FCC-b.

This device has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

NOTICE This instrument has been tested per applicable requirements of EMC Directive as required to carry the European Union CE Mark. As such, this equipment may be susceptible to radiation/interference levels or frequencies, which are not within the tested limits.

General safety precautions

Follow the following safety practices to ensure safe equipment operation:

- Perform periodic leak checks on all supply lines and pneumatic plumbing.
- Do not allow gas lines to become kinked or punctured. Place lines away from foot traffic and extreme heat or cold.
- Store organic solvents in fireproof, vented and clearly labeled cabinets so they are easily identified as either toxic, or flammable, or both types of materials.
- Do not accumulate waste solvents. Dispose of such materials through a regulated disposal program and not through municipal sewage lines.

WARNING **This instrument is designed for chromatographic analysis of appropriately prepared samples. It must be operated using appropriate gases or solvents and within specified maximum ranges for pressure, flows, and temperatures as described in this manual. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.**

WARNING **It is the responsibility of the customer to inform Agilent customer support representatives if the instrument has been used for the analysis of hazardous samples, prior to any instrument service being performed or when an instrument is being returned for repair.**

- Avoid exposure to potentially dangerous voltages. Disconnect the instrument from all power sources before removing protective panels.
- When it is necessary to use a non-original power cord and plug, make sure the replacement cord adheres to the color coding and polarity described in the manual and all local building safety codes.
- Replace faulty or frayed power cords immediately with the same type and rating.
- Place this instrument in a location with sufficient ventilation to remove gases and vapors. Make sure there is enough space around the instrument for it to cool off sufficiently.
- Before plugging the instrument in or turning the power on, always make sure that the voltage and fuses are set appropriately for your local power source.
- Do not turn on the instrument if there is a possibility of any kind of electrical damage. Instead, disconnect the power cord and contact your local Agilent sales office.
- The supplied power cord must be inserted into a power outlet with a protective ground connection. When using an extension cord, make sure that the cord is also properly grounded.
- Do not change any external or internal grounding connections, as this could endanger you or damage the instrument.

- The instrument is properly grounded when shipped. You do not need to make any changes to the electrical connections or to the instrument chassis to ensure safe operation.
- When working with this instrument, follow the regulations for Good Laboratory Practices (GLP). Take care to wear safety glasses and appropriate clothing.
- Do not place containers with flammable liquids on this instrument. Spilling liquid over hot parts may cause fire.
- This instrument may use flammable or explosive gases, such as hydrogen gas under pressure. Before operating the instrument be sure to be familiar with and to follow accurately the operation procedures prescribed for those gases.
- Never try to repair or replace any component that is not described in this manual without the assistance of an Agilent service engineer. Unauthorized repairs or modifications will result in rejection of warranty claims.
- Always disconnect the AC power cord before attempting any type of maintenance.
- Use proper tools when working on the instrument to prevent danger to you or damage to the instrument.
- Do not attempt to replace any battery or fuse in this instrument other than as specified in the manual.
- Damage can result if the instrument is stored under unfavorable conditions for prolonged periods. (For example, damage will occur if stored while subject to heat, water, or other conditions exceeding the allowable operating conditions).
- Do not shut off column flow when the oven temperature is high, since this may damage the column.
- This unit has been designed and tested in accordance with recognized safety standards and designed for use indoors.
- If the instrument is used in a manner not specified by the manufacturer, the protection provided by the instrument may be impaired.
- Substituting parts or performing any unauthorized modification to the instrument may result in a safety hazard.
- Changes or modifications not expressly approved by the responsible party for compliance could void the user's authority to operate the equipment.

Shipping Instructions

If your Micro GC must be shipped for any reason, it is very important to follow these additional shipping preparation instructions:

- Place all the vent caps on the back of the Micro GC (see Figure 3 on page 18).
- Always include the power supply.
- Include, if used, the inlet filter(s).

Cleaning

To clean the surface of the Micro GC:

1. Switch the Micro GC off.
2. Remove the power cable.
3. Put protection plugs on the sample and carrier gas inlets.
4. Put protection plugs on the column vents.
5. Use a soft brush (not hard or abrasive) to carefully brush away all dust and dirt.
6. Use a soft, clean cloth dampened with mild detergent to clean the outside of the instrument.
   - Never clean the inside of the instrument.
   - Never use alcohol or thinners to clean the instrument; these chemicals can damage the case.
   - Be careful not to get water on the electronic components.
   - Do not use compressed air to clean the instrument.

Instrument Disposal

When the Micro GC or its parts have reached the end of their useful life, dispose of them in accordance with the environmental regulations that are applicable in your country.

2
Instrument Overview

There are several versions of the Agilent 490 Micro GC. All of them use GC channels, each of which consists of an Electronic Gas Control (EGC) injector, column, and detector.

The Micro GC is a self-contained package with all of the normal GC components. It is available as a dual channel cabinet version (one or two GC channels) or a quad channel cabinet version (up to four GC channels). A computer with a chromatography data system (CDS) is needed to complete the system.

This chapter provides a brief overview of the 490 Micro GC.

Principle of Operation

The 490 Micro GC can be equipped with one to four independent column channels. Each column channel is a complete, miniaturized GC with electronic carrier gas control, micro-machined injector, narrow-bore analytical column and micro thermal conductivity detector (μ TCD), Figure 1.

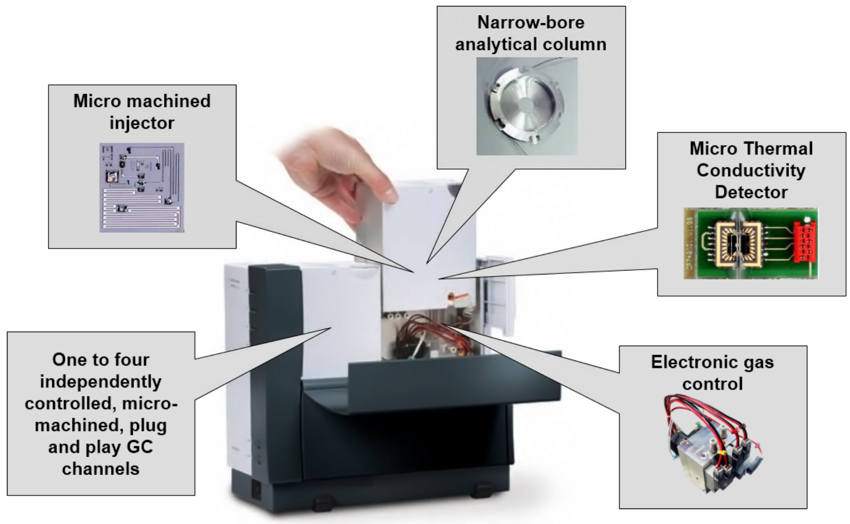


Figure 1 490 Micro GC setup

The 490 Micro GC analytical channels can optionally be equipped with a back flush option. The advantages include the protection of the stationary column phase against moisture and carbon dioxide. Next to that, it results in shorter analysis times as late elution compounds, which are not of interest, do not enter the analytical column.

Front View

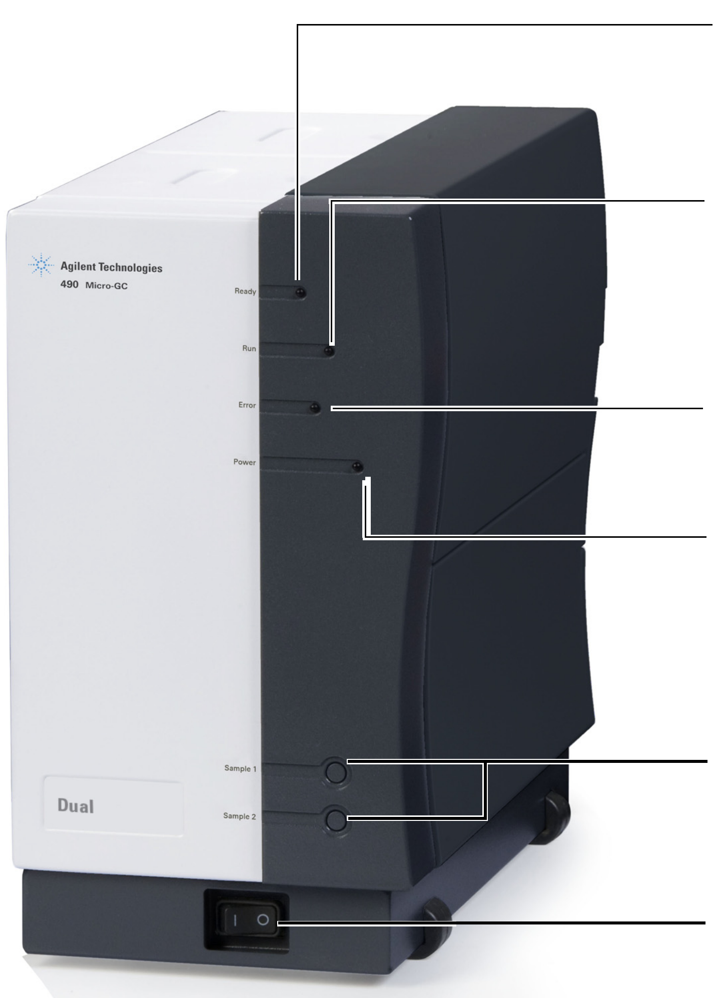


Figure 2 Front view of the 490 Micro GC

Back View

Vents
It is possible to connect long vent lines to these fittings in order to safely guide hazardous fumes to a fume hood or other appropriate vent.

Carrier gas input
Carrier gas input connector
See "Carrier Gas Connection" on page 21

Power connector
Power connector (male)
See "Power" on page 23

Figure 3 Back view of the 490 Micro GC

Inside View

Open the right side cover and the cable connectors will be visible. See Figure 4.

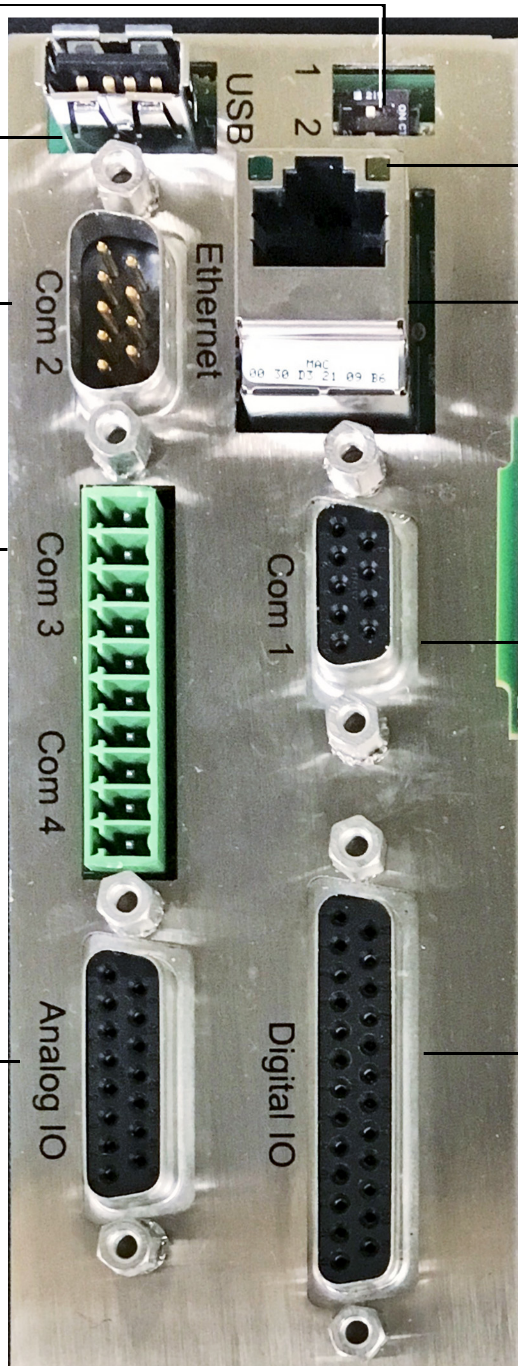
Assign IP address switch
See “Ethernet Networks” on page 111.

USB
communication interface.
See “USB VICI Valve” on page 116 and “USB Wi-Fi” on page 118

COM 2
RS-232 (2-wire) communication interface.
See “490 Chromatography Data Systems” on page 110.

COM 3 and COM 4
RS-485 (4-wire) communication interface.
See Table 1 on page 20.

Analog I/O
External analog I/O signals.
See “External Analog I/O” on page 124.



LAN indicators
Red LED: Transmit data
Green LED: Receive data

Ethernet (LAN) connector
Ethernet RJ45 connector.
See “Ethernet Networks” on page 111.

SD Card Slot
No function supported.

COM 1
RS-232 communication interface

Digital I/O
Digital input and output signals, such as start_stop, ready_out, and start_in.
See “External Digital I/O” on page 123.

Figure 4 Cable connectors (main board G3581-65000 shown)

The Micro GC provides communications ports as shown in Table 1, depending on the model.

Table 1 Micro GC communication ports

Port	Connection	490 Micro GC	490-Mobile Micro GC	490-PRO Micro GC
LAN	Ethernet	Interface with PC	Interface with PC	Interface with PC
COM 1	RS232	Not available	Not available	Valco stream selector; Serial MODBUS*
COM 2	RS232	Valco stream selector Field case LCD†	Valco stream selector Field case LCD†	Valco stream selector; Serial MODBUS*; LCD†
COM 3	RS485 RS232 RS422	Not available Not available Not available	Not available Not available Not available	Serial MODBUS* Not available Not available
COM 4	RS485 RS232 RS422	Not available Not available Not available	Not available Not available Not available	Serial MODBUS* Not available Not available
Analog I/O		Analog I/O	Analog I/O	Analog I/O
Digital I/O		Digital I/O; ready in - ready out; start in - start out; extension boards‡	Digital I/O; ready in - ready out; start in - start out; extension boards‡	Digital I/O; ready in - ready out; start in - start out; extension boards‡
USB		VICI Valves, WIFI interface	VICI Valves, WIFI interface, USB Storage	VICI Valves, WIFI interface, USB Storage

* Optional PRO license required

† Optional accessory

‡ Extension boards not included

Carrier Gas Connection

The carrier gas line is connected to the Micro GC at the back panel **Carrier 1** or **Carrier 2** port.

CAUTION

Do not use any kind of plastic tubing since air will diffuse through the tubing, which may cause noisy baselines and decreased sensitivity. The metal tubing must be clean for GC use. Buy either flamed or chromatographically clean tubing.

Specifications for the carrier gas:

Pressure:	550 kPa ± 10 kPA (80 psi ± 1.5 psi)
Purity:	99.999 % minimum
Dry and free of particles:	Gas Clean filters recommended

Gas Clean filters are recommended to remove any traces of moisture and oxygen. For low-level analysis, consider using a better grade of carrier gas.

Gas Clean filters are filled with nitrogen. If you are not using nitrogen as the carrier gas, flush filters and gas lines after installation of a new filter.

The type of analysis you want to perform dictates the type of carrier gas to use. The difference between the relative thermal conductivity of the carrier gas and the sample components should be as high as possible. See Table 2 for several relative thermal conductivities.

Table 2 Relative thermal conductivities

Carrier gas	Relative thermal conductivities	Carrier gas	Relative thermal conductivities
Hydrogen	47.1	Ethane	5.8
Helium	37.6	Propane	4.8
Methane	8.9	Argon	4.6
Oxygen	6.8	Carbon dioxide	4.4
Nitrogen	6.6	Butane	4.3
Carbon monoxide	6.4		

WARNING

Your Micro GC is configured for a specific carrier gas, either He and H_2 or N_2 and Ar. Make certain that any carrier gas selection in your Agilent data system corresponds to the carrier gas physically connected to your Micro GC. Use only the carrier gas corresponding to this configuration. If you change the carrier gas type plumbed to the Micro GC, you must change the corresponding carrier gas type in the data system.

WARNING

Hydrogen is flammable. If you are using hydrogen as a carrier gas, pay particular attention to possible leaks at connections inside and outside of the Micro GC (use an electronic leak tester).

Power

Power source

- 90 to 264 Vac, frequency between 47 to 63 Hz.
- The room power outlet circuit must be exclusively reserved for the instrument(s).
- The network should be properly grounded.
- Installation Category (overvoltage category): II

Power Requirements

The Micro GC requires 12 V Vdc, 150 W.

The Gasifier requires 12 V Vdc, 150 W.

CAUTION Only use the power supply provided with your Micro GC.

This Power Supply, see Figure 5, is tailored to meet the power needs of your Micro GC. See Table 3 on page 24 for specifications.

Figure 5 Model GST220A12-AG1 (P/N G3581-60080)

Disposal

Disposal of the Power Supply must be carried out in accordance with all environmental regulations applicable in your country.

Specifications

Table 3 Power supply specifications

Feature	Model: GST220A12-AG1
Input voltage	85 Vac to 264 Vac
Input frequency	47-63 Hz
Inrush current	120A/230VAC
Output voltage	12.0 Vdc
Voltage adjust	± 5 %
Output power	180 W
Over voltage protection	105 %-135 % rated output voltage
Ripple and noise	80mV Vp-p
Operating temperature	-30 °C to +70 °C
Storage temperature	-40 °C to +85 °C
Humidity	20 % to 90 % non condensing
Safety standard	UL60950-1, TUV EN60950-1, BSMI CNS14336, CSA C22.2, CCCGB4943, PSE J60950-1 Approved
RFI/EMC standard	In compliance with CISPR22 (EN55022) Class B and FCC Part 15/CISPR 22 class B, CNS13438 class B, GB9254, EN61000-3-2, EN61000-3-3, EN61000-4-2, EN61000-4-3, EN61000-4-4, EN61000-4-5, EN61000-4-6, EN61000-4-8, EN61000-4-11 (light industry level, criteria A)
Dimensions	210 × 85 × 46 mm (L×W×H)
Weight	1.1 kg approximately

Ambient Pressure

The Micro GC automatically shuts down if the ambient pressure is greater than 120 kPa.

Ambient Temperature

The Micro GC automatically shuts down if the ambient temperature exceeds 65 °C.

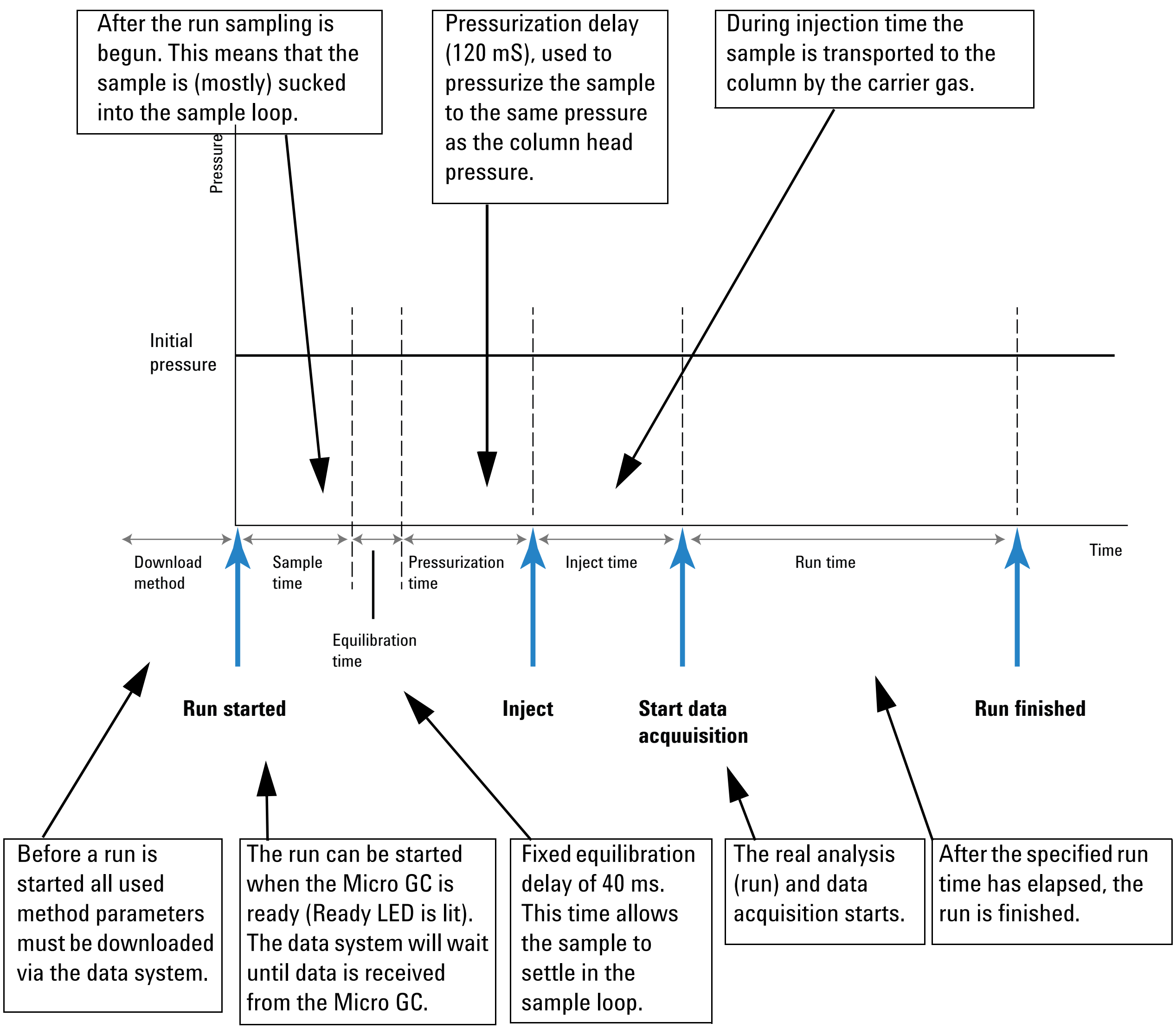
Maximum Operation Altitude

Certified up to 2000 meters above sea level.

Micro GC Cycle with Constant Pressure

The timing diagram below provides an overview of the constant pressure cycle of the Micro GC.

This description is only for one channel. In most cases a dual-channel system is used. When a dual-channel system is used, the sequence is the same, but the timing settings can differ. If the sample time on channel A and channel B are different, the longest time is used for both channels. Also the run time can be specified per channel; the data acquisition stops per channel as soon as the run time has elapsed. The total analysis time depends on the longest run time.

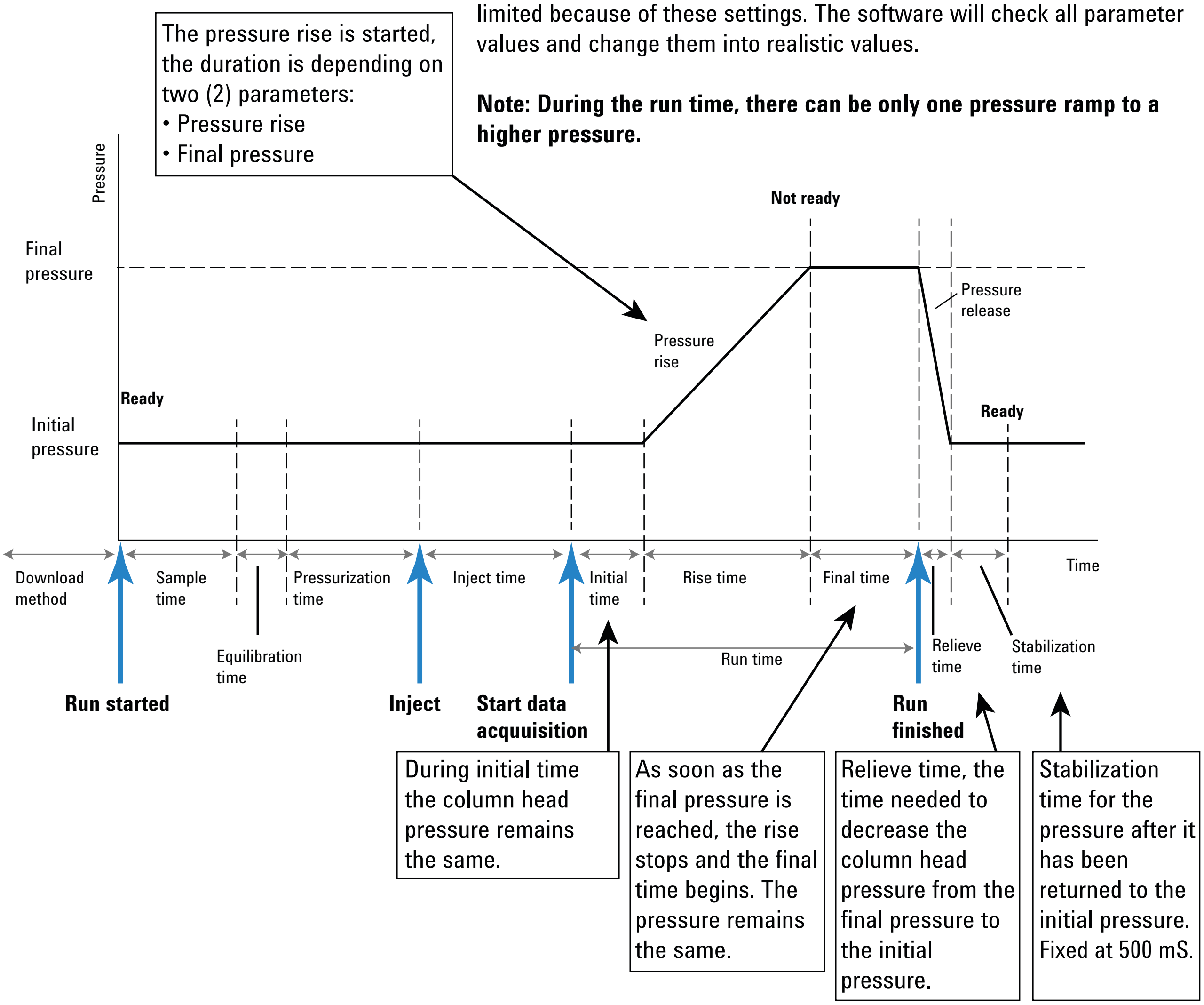


Micro GC Cycle with Ramped Pressure

The timing diagram below provides an overview of the ramped (programmed) pressure cycle of the Micro GC. The timing before the injection is identical to the constant pressure cycle.

The remaining final time depends on the total run time, the duration of the initial time and the pressure rise. This means that it is possible that the final time is zero. Another situation is that the final pressure is limited because of these settings. The software will check all parameter values and change them into realistic values.

Note: During the run time, there can be only one pressure ramp to a higher pressure.



3
Installation and Use

This chapter describes how to install and use the instrument. For an initial installation, an example of a typical packing list is also included. The actual packing list and included parts depend on the options ordered.

Pre-Installation Requirements

Prepare the installation site as described in the Site Preparation Guide (G3581-90002), including the recommended Gas Clean filters.

Inspect the Shipping Packages

The Micro GC will arrive in one large box and one or more smaller cartons. Inspect the cartons carefully for damage or signs of rough handling. Report damage to the carrier and to your local Agilent office.

Unpack the Micro GC

Unpack the Micro GC and accessories carefully and transfer them to the work area using proper handling techniques. Inspect the instrument and accessories carefully for damage or signs of rough handling. Report damage to the carrier and to your local Agilent office.

WARNING **Avoid back strain or injury by following all safety precautions when lifting heavy objects.**

CAUTION The instrument has been protected during shipment by protective caps. See Figure 6. Before use, remove these caps, including those on the back panel.

Figure 6 Protective shipping caps

Review the Packing List

Table 4 shows a typical packing list. The actual packing list and included parts depend on the options ordered.

Table 4 Typical Micro GC packing list

Item	Part number	Quantity	Units of measure
Installation Kit Micro GC	CP740388	1	EA
CD-ROM - Micro GC - User Information	G3581-90010	1	EA
Ethernet crossover cable 2.8m	CP740292	1	EA
Locking nut	CP420200	4	EA
Male luer	CP420100	4	EA
Fittings 1/8 inch Brass 20/pk	5080-8750	1	EA
Tee, 1/8 inch Brass Union 2/PK	5180-4160	1	PK
1/8 in x 0.065in Copper tubing	G3581-20061	5	M
External Sample Filter kit	CP736729	1	EA
Front and Back ferrule 1/16	CP471201	3	EA
1/16inch Ferrule set SST	0100-1490	3	EA
Stainless Nut 1/16 in	0100-0053	3	EA
Manual User Ext. Sample Filter	CP505260	1	EA
Capil. Ext. Filter	CP736879	1	EA
Tubing,SS,pre-tsd,1/16in. OD×1.0mm ID, 1/p	CP4008	80	MM
Tubing, SS,1/16in. OD×1.0mm ID, 1 mL, 1/p	CP4009	0.080	M
Fingertight Fitting PEEK	CP23050	1	EA
5 FILTERS for EXT. FILTER Assembly	CP736467	1	EA
External Filter Male	CP736737	1	EA
External Filter FeMale	CP736736	1	EA
Micro GC power supply, 12V, 150W	G3581-60080	1	EA

490 Micro GC Installation

If you are installing the 490 Micro GC **for the first time**, follow the steps as described below.

If you are performing **a re-installation**, see “Long Storage Recovery Procedure” on page 42.

Step 1: Connect carrier gas

Install gas regulators and set pressures

Carrier gas cylinders should have a two-stage pressure regulator to adjust the carrier gas pressure to 550 kPa ± 10 kPA (80 psi ± 1.5 psi). Set cylinder regulator pressure to match the gas inlet pressure.

Connect carrier gas to the Micro GC

The Micro GC supports the use of helium, nitrogen, argon and hydrogen. The recommended purity for carrier gas is 99.999 % minimum. Connect the carrier gas to the Micro GC **Carrier 1** fitting (and **Carrier 2** fitting, if available) and turn on the gas flow. See “Carrier Gas Connection” on page 21.

Step 2: Connect to calibration gas or checkout sample

Install the external filter unit as described in “Using the external filter unit” on page 46.

For an unheated GC channel: Connect the sample to the Micro GC using the sample-in connector situated at the front of the instrument (see “Front View” on page 17).

For a heated GC channel: Connect the sample to the heated sample as described in “How to connect your sample to the 490 Micro GC” on page 48.

Step 3: Install power supply

Connect the power connector to the Micro GC, and then plug the power cord into an appropriate power source. See “Power” on page 23. Ensure the power supply is placed in such a way that the mains appliance inlet or adapter is easy to reach for the operator, as it functions as a power disconnect switch.

The **Power LED** will light. The **Ready LED** lights when all parameter set points in the system are reached. (See “Front View” on page 17.)

Your Micro GC is shipped from the factory with default settings. The following is relevant information on the factory default states and settings:

- When the Micro GC is turned on, the power LED lights up and the system begins the flush cycle procedure. The flush cycle is a 2-minute cycle in which the various valves are activated and deactivated to flush entrapped air from the manifold, valves, and tubing.
- After the flush cycle is finished, the method (the default method in this case), which was last active before the instrument was shutdown, is activated.
- All heated zones are set at 30 °C.
- The detector filaments are set to OFF.

Step 4: Connect to computer or local network

The 490 Micro GC requires a connection with a computer, that has Chromatography Data System installed, for initial method development. This connection uses TCP/IP over Ethernet or Wi-Fi via USB. For more details and setup procedures see “Ethernet Networks” on page 111 or “USB Wi-Fi” on page 118

Step 5: Install Chromatography Data System

For further instructions about installation of the chromatography data system, see the corresponding installation manual and help file.

Step 6: Assign IP address

Upon arrival from the factory, the Micro GC has a default static IP address configured. The active IP address is specified on the sticker together with the MAC address and the mainboard serial number (see Table 5 on page 35).

Table 5 Factory default IP address settings

Default IP address	192.168.100.100
Subnet mask	255.255.255.0
Host name	microgc
Default Gateway	N/A (not used)

1 To complete this procedure, the Micro GC must be in static IP address Mode. To verify this, be sure the DHCP switch (indicated as **1** on the mainboard), is in the left position. The DHCP switch is located on the back of the mainboard. (See Figure 7).

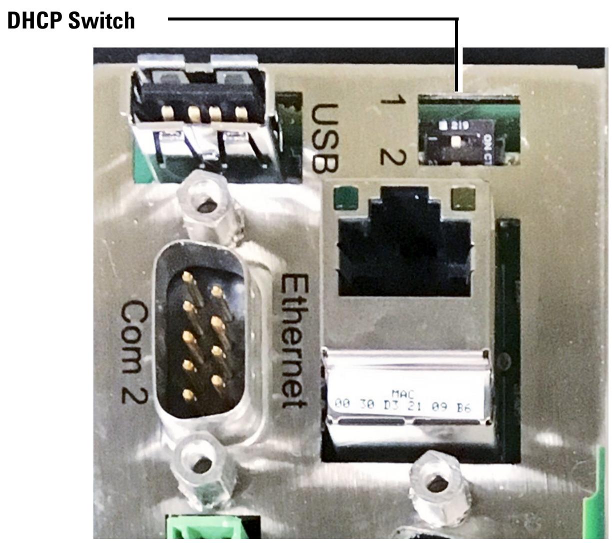


Figure 7 DHCP Switch

2 Change the IP address of your laptop or PC to an address in the same range as the current IP address as the Micro GC.

3 Start up your web browser.

4 Connect to the Micro GC's website. Type the IP address of the Micro GC in the address field of the web browser.

5 On the web page, click **Network**.

6 Log in as administrator. Use the factory default login and password:

- Login name: admin
- Password: agilent

Figure 8 Web server authentication

7 In the network webpage, the upper section shows the current IP configuration. Type the **IP Address**, **Subnet mask,** and **Gateway** you want to assign to the Micro GC in the corresponding fields.

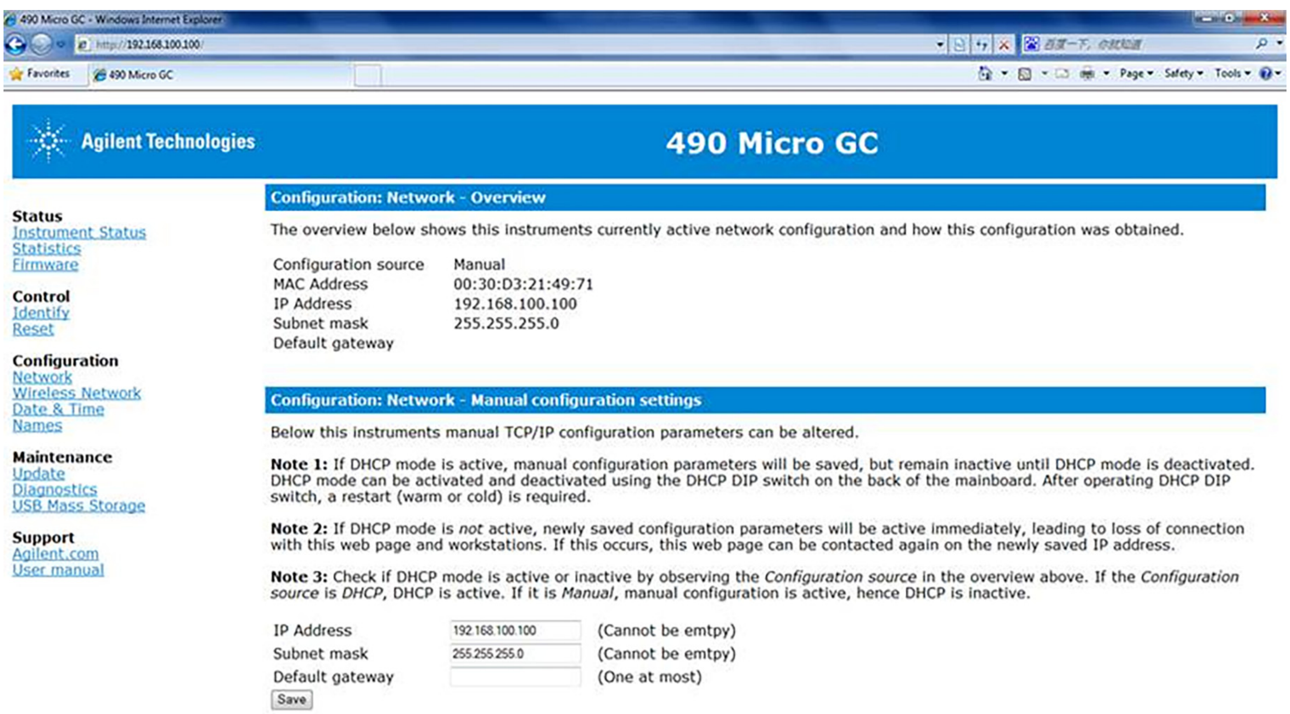


Figure 9 Micro GC website

8 Click **Save** to save the IP configuration.

9 This IP address is now the active IP address. Communication with the Micro GC will be lost, since the active IP address has changed.

10 Change the IP address of your laptop or PC to an address in the same range as the new IP address of the Micro GC.

11 To reestablish communication, type the new IP address in the web browser address bar.

Step 7: Complete Micro GC configuration in Chromatography Data System

1 If not already configured, complete any additional configuration for the Micro GC in the Chromatography Data System. Ensure the carrier gas types match the gas actually supplied to the Micro GC.

2 Start the Micro GC's online instrument session.

Restore the Factory Default IP Address

Shipped from the factory, the 490 Micro GC (with mainboard G3581-65000) is configured with a default static IP address, see Table 6 on page 39 for the settings. A reset button on the mainboard enables the possibility to restore these default IP settings when required. When IP address setting are not known, this functionality can be used to be able to reconnect to the instrument and change to custom IP settings.

Figure 10 Reset button on mainboard

The reset button can be accessed behind the right panel on the mainboard, see Figure 10. To restore the factory default IP address, follow this procedure:

1 Power off the Micro GC.

2 Press and hold the reset button and power on the Micro GC.

3 Release the reset button shortly after powering on the GC (approximately 3 seconds).

   Note 1: When the reset button is released too quickly (less than 1 second), it may result in the IP setting not reverting to its factory defaults.

Note 2: Holding the reset button too long (more than 10 seconds), will result in an instrument reboot, without restoring the default IP settings.

4 The default IP address is now restored. See Table 6 for details.

Table 6 Factory default IP address settings

Default IP address	192.168.100.100
Subnet mask	255.255.255.0
Host name	microgc
Default Gateway	N/A (not used)

Create the Test Method

At first startup, perform a checkout to make sure the Micro GC is functioning properly.

A test method for each standard column type has been provided in the sections listed in Table 7.

CAUTION

If you ordered a Molsieve column, make sure it is conditioned before use. See Table 10 on page 69 for parameters.

Table 7 Test method listings

Column type	Table
Molsieve 5Å	Table 10 on page 69
CP Sil 5 CB	Table 11 on page 70
CP Sil CB	Table 12 on page 71
PoraPlot 10 m	Table 13 on page 72
Hayesep A 40 cm	Table 14 on page 73
CO_x 1 m and AL_2O_3/KCl	Table 15 on page 74
MES(NGA) and CP-WAX 52 CB	Table 16 on page 75

Use the data system to set up the checkout parameters for each GC channel. Apply the checkout method settings to the Micro GC and allow the instrument to stabilize at the initial operating conditions. Monitor the instrument status using the data system’s status display (refer to the data system help for details).

Each test method has been designed to determine if the instrument channel is functioning properly and includes an example test chromatogram.

Perform a Series of Runs

1. Create a short sequence of at least three runs using the test sample and method.
2. Run the sequence.
3. After the first run, the results for each channel should become similar to the example chromatograms.

Shut Down Procedure

CAUTION The detector can be damaged by improper shut down. If shutting down the instrument for more than a few days, carry out the procedure below.

1 Create a method for all channels with these settings:
   - Filaments switched OFF.
   - Column temperature set at 30 °C.
   - Injector temperature set at 30 °C.
   - Pressure set at 50 kPa.
2 Apply the method to the Micro GC.
3 Wait until the temperature of the columns and injectors are < 40 °C (to protect the column), then switch off the Micro GC.
4 Remove the carrier gas tubing and plug all the vents and carrier gas connections with 1/8-inch brass nuts or plastic caps.

Before using the instrument again, perform the “Long Storage Recovery Procedure” described below.

Long Storage Recovery Procedure

Follow this recovery procedure if your Micro GC has been stored for a long period of time.

1 Remove the 1/8-inch brass nuts and plastic caps from all of the vents and carrier gas connections.
2 Connect the carrier gas tubing and apply pressure to the Micro GC. Refer to the Site Preparation Guide for supply pressures and other gas requirements.
3 Wait at least 10 minutes before switching ON the Micro GC.
4 Immediately check if the detector filaments are switched OFF. Switch OFF if necessary.

5 Set the column(s) temperature(s) to the maximum allowed temperature (160 °C or 180 °C depending on the column limit).

6 Condition the GC column, preferably overnight. This will ensure that all the water has been removed from the column module and no damage will occur to the TCD filaments.

4
Sample Gas Handling

The Micro GC is built for the analysis of gases and vapors only. You are advised to prepare a noncondensing gaseous standard sample for routine checkup of the instrument. Sample pressure should be between 0 and 100 kPa (0 to 15 psi), the temperature between 0 and 110 °C ± 5 °C of the analyzer ambient temperature, and it must be filtered, preferably through a 5-mm filter. Agilent *always* recommends the use of the external filter kit (CP736729) between the injector and the sampling device.

For more details, see "Using the external filter unit" on page 46.

CAUTION Liquids will seriously damage the instrument and should be avoided!

Using the external filter unit

The male part of the filter must be hand-tightened into the female part, followed by a 1/8 turn with a 7/16-inch wrench. See Figure 11 as shown below and Figure 12 on page 46. Orient the arrow on the female half of the filter towards the fingertight fitting.

Replace the external filter unit at regular intervals. See “Review the Packing List” on page 32 for part numbers.

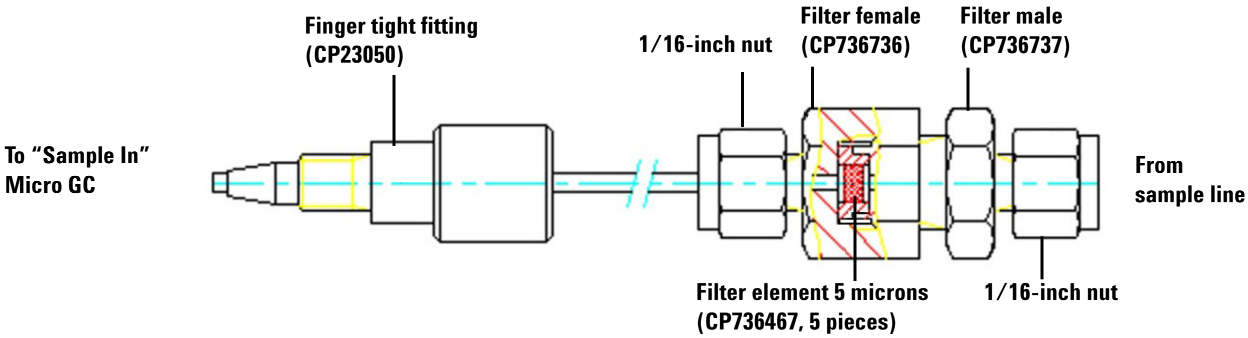


Figure 11 Unheated injector connection

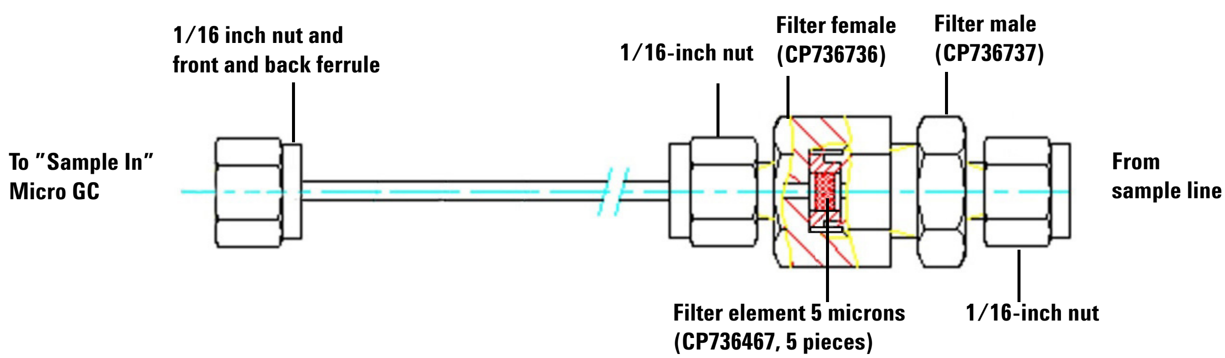


Figure 12 Heated injector connection

Whenever possible, remove moisture from samples introduced to the Micro GC.

Heated sample lines

A heated sample line is always combined with a heated injector. A heated injector and sample line is an option for a channel unit, and is used to prevent sample from condensing in the sample lines when analyzing condensable samples.

The heated sample and injector can be controlled between 30 °C and 110 °C.

How to connect your sample to the 490 Micro GC

The following sections describe how to connect your sample to the 490 Micro GC depending on the sample inlet configuration.

WARNING **The metal surfaces of the sample line heater can be very hot. Before connecting a sample line, allow the sample line heater to cool down to ambient temperature.**

Rear inlet (heated or unheated)

Connect the sample line to the heated or unheated sample inlet at the rear of the Micro GC using 1/16-inch male Swagelok fittings.

Figure 13 Rear sample inlet

CAUTION Insulate the sample line connected to the Micro GC to prevent damage to communications cables.

Internal inlet

For connecting the micro-gasifier, Enrichment and Desorption Unit (EDU) and a heat-traced sample line, the system's internal sample inlet should be used.

Figure 14 Open the side panel, remove the top insulation and loosen the internal sample inlet.

Figure 15 Remove the rear panel by unscrewing the three bolts.

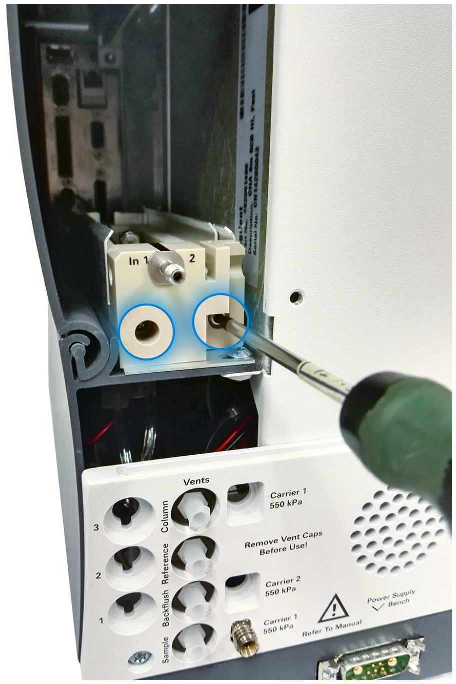


Figure 16 Remove the PEEK block by unscrewing two bolts.

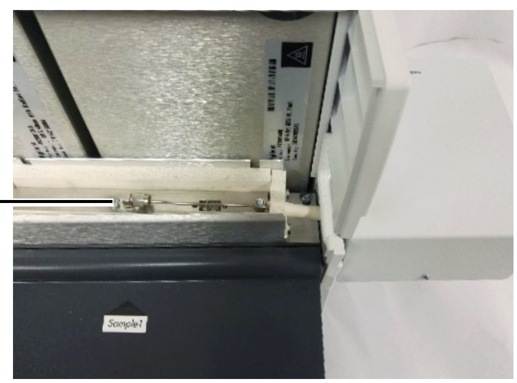


Figure 17 Install the back panel and micro-gasifier, and connect the micro-gasifier sample line to the internal sample inlet using a 1/16-inch Swagelok fitting.

Figure 18 Sample line and vent line connection of the micro-gasifier.

Internal bracket for Genie filter

This section explains how to connect your sample if an optional internal bracket with Genie filter(s) is installed on your 490 Micro GC.

Connect the sample line to the rear inlet of the 490 Micro GC using 1/16-inch Swagelok fittings. The Genie filter outlet is pre-plumbed and connected to the Micro GC column channels.

Figure 19 Internal bracket with Genie filters.

CAUTION Ensure separated liquids are properly drained via the bypass tubing outside of the Micro GC. To operate properly, the bypass must remain free of blockage.

To access the Genie filter membrane for inspection or exchange, unscrew the two bolts, identified in Figure 19, and lift the upper part of the filter.

490-Micro GC Optional Pressure Regulators

Agilent offers two optional sample inlet pressure regulator assemblies for the 490-PRO Micro GC. These assemblies are provided fully assembled and require field installation on the rear of the GC.

G3581-S0003 provides a pressure regulator, Genie filter (for sample drying) and needle valve, along with the required mounting bracket and hardware required for installation.

G3581-S0004 provides a pressure regulator and needle valve, along with the required mounting bracket and hardware required for installation.

Installation instructions for both assemblies are provided below.

G3581-S0003

The Agilent pressure regulator assembly (G3581-S0003) provides a pressure regulator, Genie filter (for sample drying) and needle valve, along with the required mounting bracket and hardware required for installation.

Figure 20 shows the components and connection points for the Agilent pressure regulator assembly (G3581-S0003).

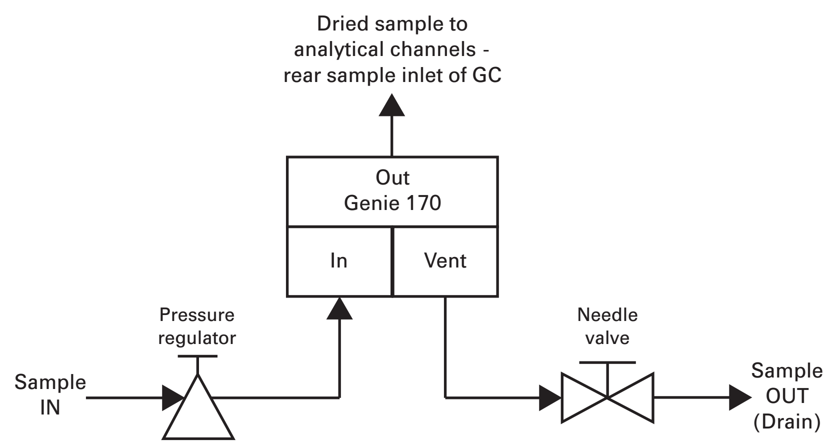


Figure 20 Agilent pressure regulator assembly (G3581-S0003) functional block diagram

The pressure regulator is factory set, and has been tested to the following, fixed specifications:

Attribute	Specification
Input	25 bar (2.5 Mpa)
Output	0.7 bar (10.1 psi or 70 Kpa)
Flow	20 mL/min

The sample flows through the pressure regulator and into the Genie filter. Dried sample is then applied to the rear sample inlet of the GC.

NOTE

The minimum working pressure of the Genie filter is 0.5 bar. Sample will not flow through the filter if this working pressure is not maintained.

Vented sample flows through a needle valve for draining.

G3581-S0003 Installation

The G3581-S0003 pressure regulator assembly is supplied fully assembled, and ready to install at the rear of the GC. To install the assembly, do the following:

1. Shut down the GC, and allow the column and injector to cool. See "Shut Down Procedure" on page 42.

WARNING

The metal surfaces of the column, injector and sample inlet can be very hot. Before connecting a sample line, allow the GC components to cool to ambient temperature.

2. At the rear of the GC, disconnect any existing sample line from the rear sample inlet.

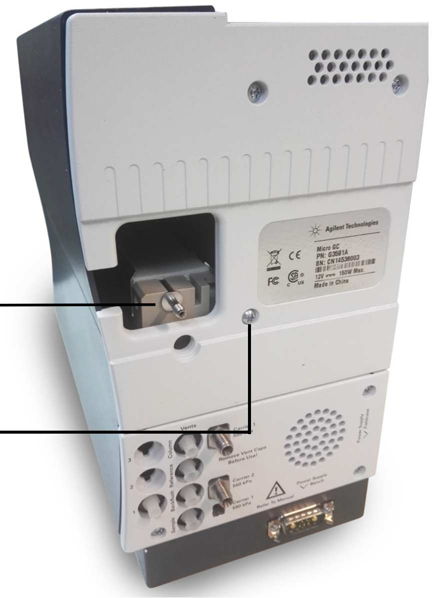


Figure 21 Rear sample inlet and lower mounting bolt

3 Remove the lower mounting bolt from the rear panel of the GC.

4 Position the G3581-S0003 pressure regulator assembly at the rear of the GC, and secure using the lower mounting bolt.

Figure 22 G3581-S0003 pressure regulator assembly installed

5 Connect the filter outlet to the sample inlet on the rear of the GC using a 1/16 inch Swagelok fitting.

WARNING **The pressure regulator has a maximum inlet pressure of 3,000 psi. Applying higher pressures may result in serious personal injury and equipment damage.**

6 Connect the Sample IN port on the pressure regulator to the sample input line.
7 Start the GC (see “Long Storage Recovery Procedure” on page 42).
8 Leak test the system to ensure that all connections are leak free.

G581-S0004

G3581-S0004 provides a pressure regulator and needle valve, along with the required mounting bracket and hardware required for installation.

The block diagram below shows the components and connection points for the G3581-S0004 pressure regulator assembly.

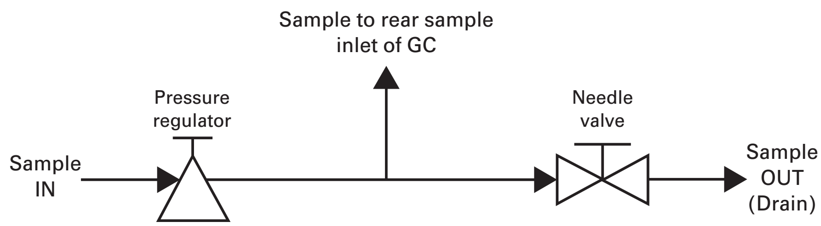


Figure 23 G3581-S0004 pressure regulator assembly functional block diagram

The pressure regulator is factory set and has been tested to the following, fixed specifications:

Attribute	Specification
Input	25 bar (2.5 Mpa)
Output	0.7 bar (10.1 psi or 70 Kpa)
Flow	20 mL/min

The sample flows through the pressure regulator and into the rear sample inlet of the GC.

A needle valve provides for venting the sample for draining.

G3581-S0004 Installation

The G3581-S0004 sample inlet pressure regulator assembly is supplied fully assembled and ready to install at the rear of the GC. The install the assembly, do the following:

1 Shut down the GC and allow the column and injector to cool. See "Shut Down Procedure" on page 42.

WARNING **The metal surfaces of the column, injector and sample inlet can be very hot. Before connecting a sample line, allow the GC components to cool to ambient temperature.**

2 At the rear of the GC, disconnect any existing sample line from the rear sample inlet.

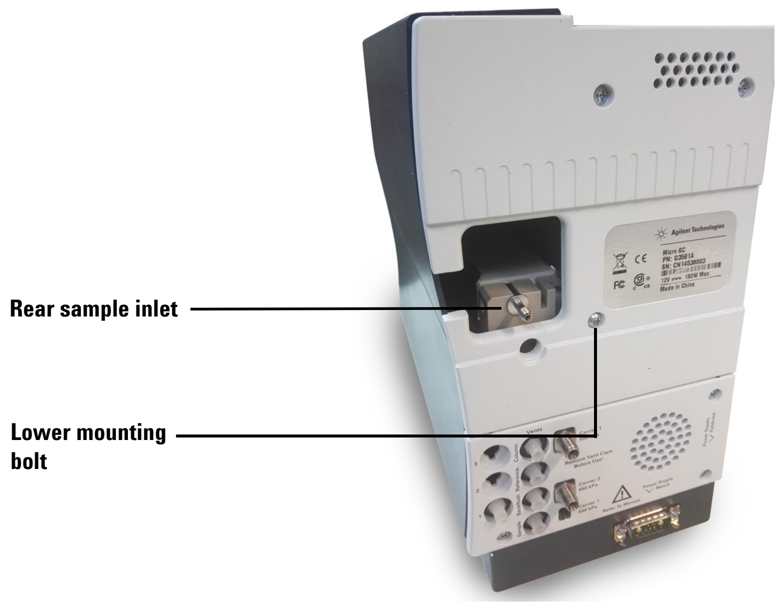


Figure 24 Rear sample inlet and lower mounting bolt

3 Remove the lower mounting bolt from the rear panel of the GC.

4 Position the G3581-S0004 assembly at the rear of the GC and the secure using the lower mounting bolt.

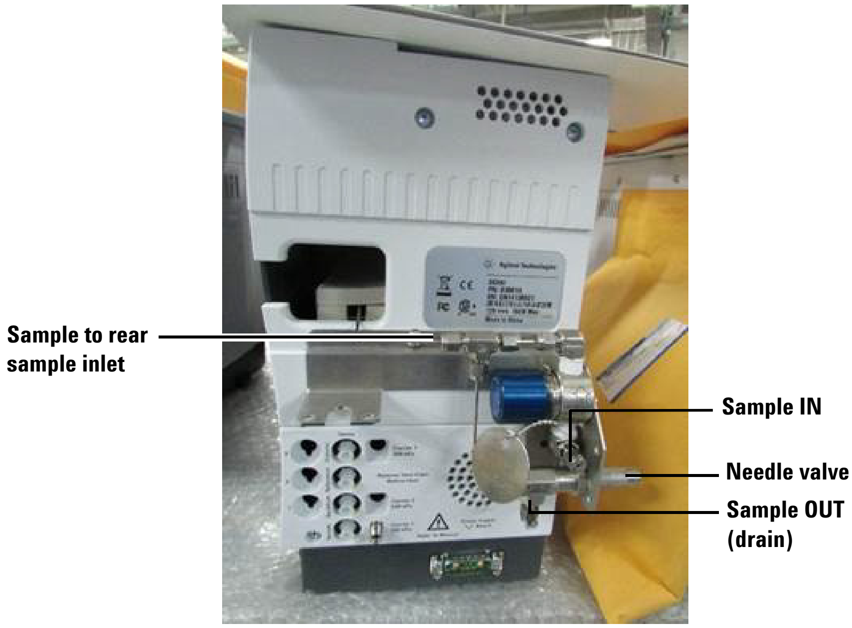


Figure 25 G3581-S0004 installed

5 Connect the regulator outlet to the sample inlet on the rear of the GC using a 1/16 inch Swagelok fitting.

WARNING **The pressure regulator has a maximum inlet pressure of 3,000 psi. Applying higher pressures may result in serious personal injury and equipment damage.**

6 Connect the Sample IN port on the pressure regulator to the sample input line.

7 Start the GC (see "Long Storage Recovery Procedure" on page 42).

8 Leak test the system to ensure that all connections are leak free.

Manual Injection

Manual injection is possible with the optional front inlet installed that can accommodate a 1/16-inch sample line. Refer to the Agilent 490 Micro GC Manual Injection Port Field Kit documentation (G3581-90000) for detailed information.

Figure 26 Front inlet (unheated)

Manual injection guidelines

- Use sample pump mode and set sampling time 10-20 seconds in the method. This clearly marks when injector loop is flushed (sound of the pump). Then gently push the syringe during that period.
- Flush the sample path 6-10 times. Bulkhead union, additional tubing, pressure relieve valve, and ball valve adds dead volume to the system, estimated at 500 to 1000 µl.
- Total sample volume is dependent on the internal volume of the Micro GC (option# 060-063 have different internal volumes) and the number of times flushed and the sampling time in the method.

Injection Procedure

1 Use pump mode (configuration)
2 Measure total pump flow (rear of the instrument)
3 Calculate required pump time that sample path is flushed sufficiently (6 to 10 times)
4 Initiate sequence in software, use **manual** trigger type in method (OLCDS)
5 Insert or connect syringe and start the run
6 Gently inject when pump starts to aspirate

When performing manual injection with a luer lock valve, use a10 ml gas tight syringe (Agilent p/n 5190-1543: syringe 10 ml, PTPE, luer lock valve).

There may be unique syringe requirements when performing Septum nut injection.

NOTE The manual syringe injection would lead to increase the repeatibiltiy (RSD%) compared to automated pump or continous flow mode.

Field upgrade kits

Table 8 Field upgrade kits

Option	PN (Field upgrade kit)	Description
Opt# 060	CP490204	Septum nut injection port
Opt# 061	CP490205	Luer lock injection port
Opt# 062	CP490206	Septum nut injection port and standard sample inlet (incl. ball valve)
Opt# 063	CP490207	Luer lock injection port and standard sample inlet (incl. ball valve)

Manual injection flow diagrams

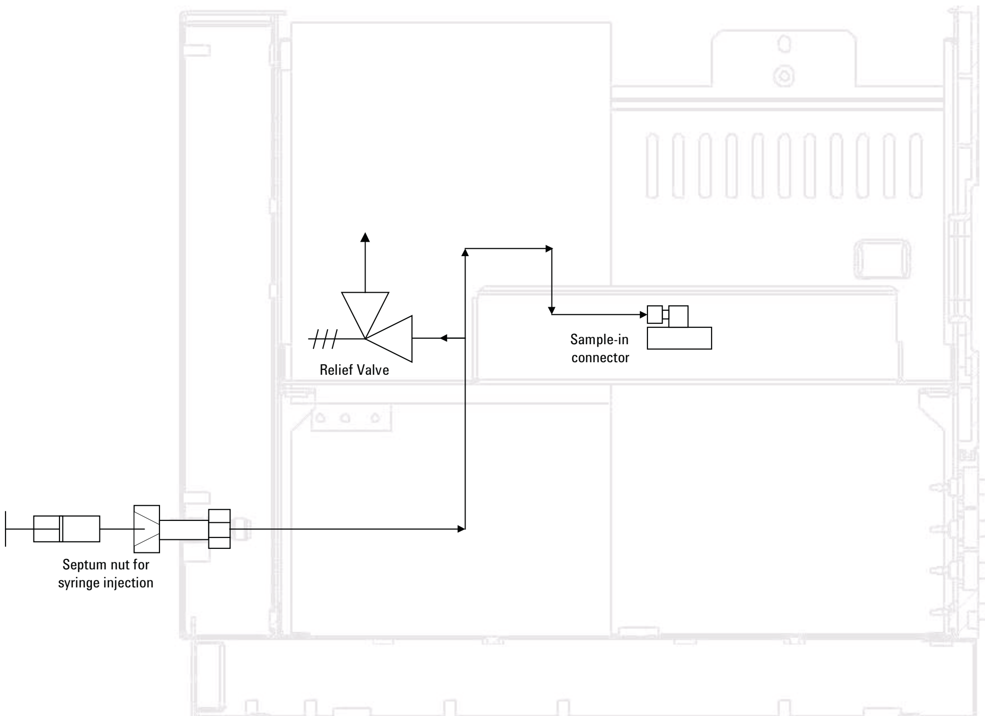


Figure 27 CP742701 Septum Nut for Syringe

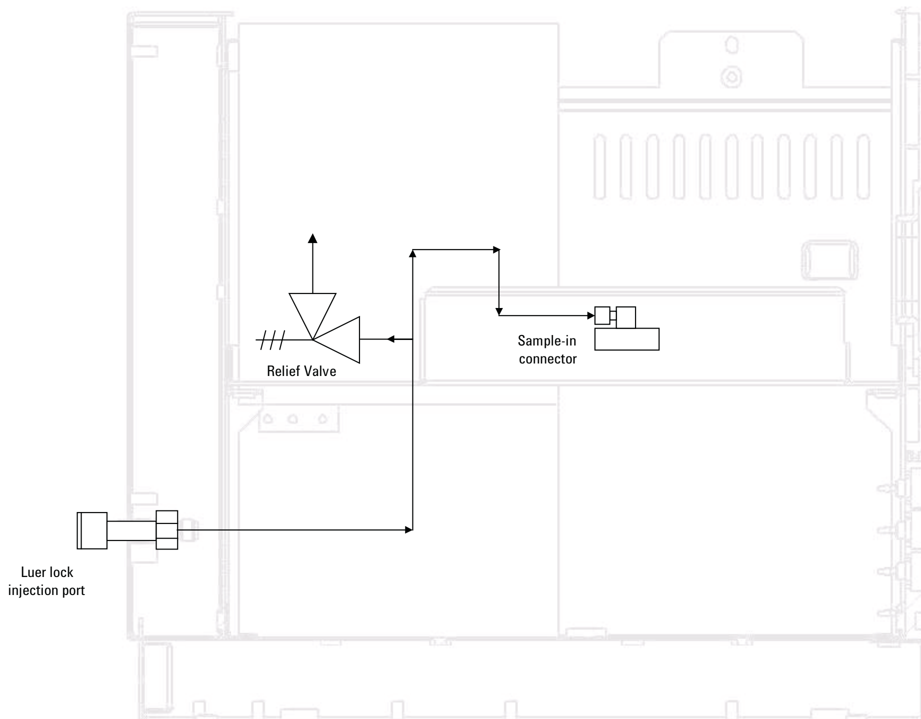


Figure 28 CP742702 Luer lock injection port

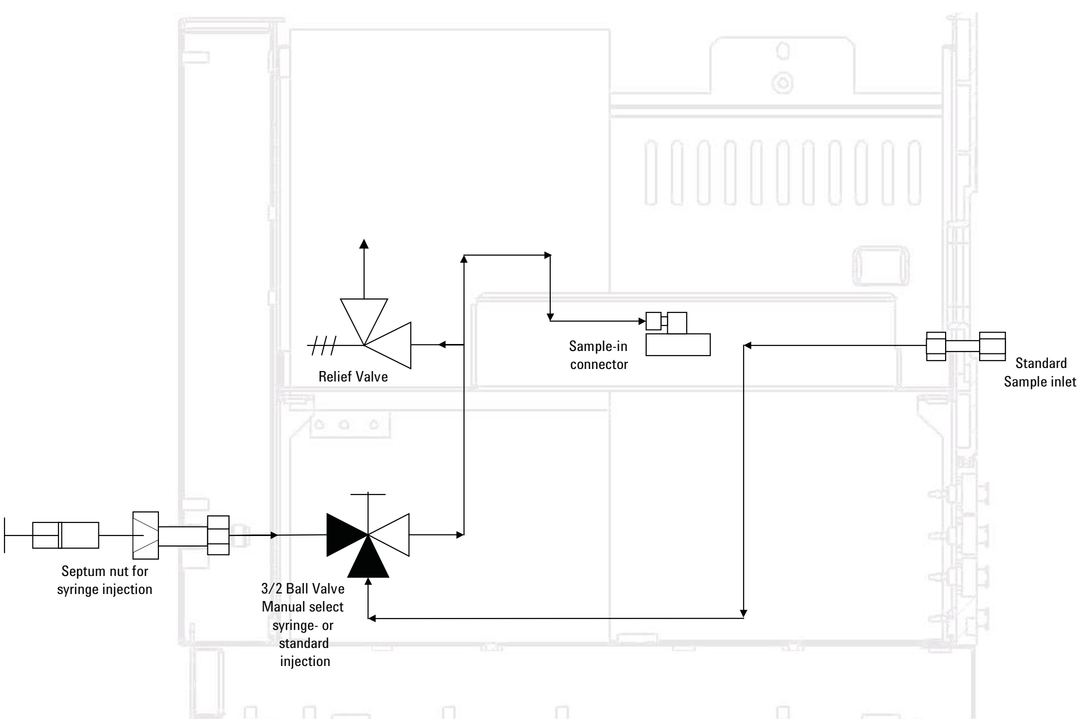


Figure 29 CP742703 Septum Nut for Syringe, Selectable

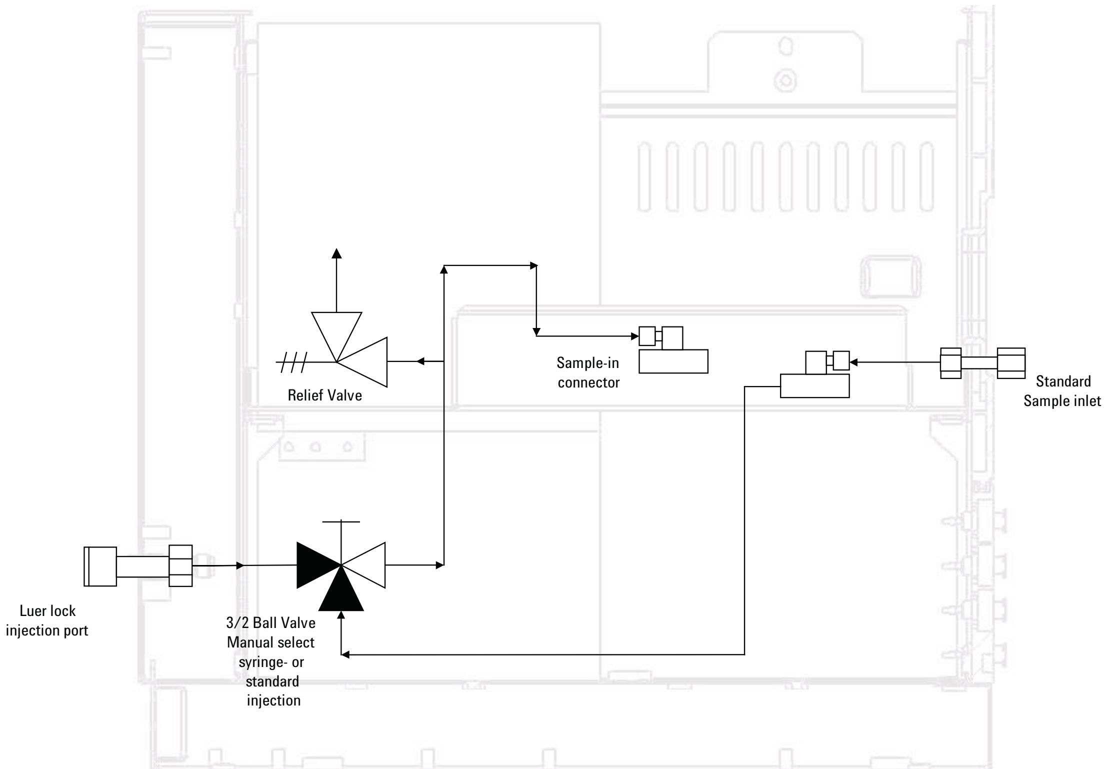


Figure 30 CP742703 Luer lock injection port, Selectable

5
GC Channels

The instrument contains up to 2 channels in a dual channel cabinet, or up to 4 channels for a quad channel cabinet. A GC channel contains a gas regulator, an injector, a column, and a TCD detector. See Figure 31 on page 66.

This chapter provides a brief discussion on the major components in the Micro GC and the backflush option.

Carrier Gas

The Micro GC is configured for use with either He and H_2 or N_2 and Ar.

Agilent recommends you use gases with a minimum purity of 99.999 %. Since the injection valve is operated pneumatically, there is a limit of 550 kPa ± 10 kPA (80 psi ± 1.5 psi) to the main gas supply.

CAUTION Your Micro GC is configured either for carrier gas He and H_2 or N_2 and Ar. Use the carrier gas type for which your instrument is configured, otherwise the detector filaments can be damaged.

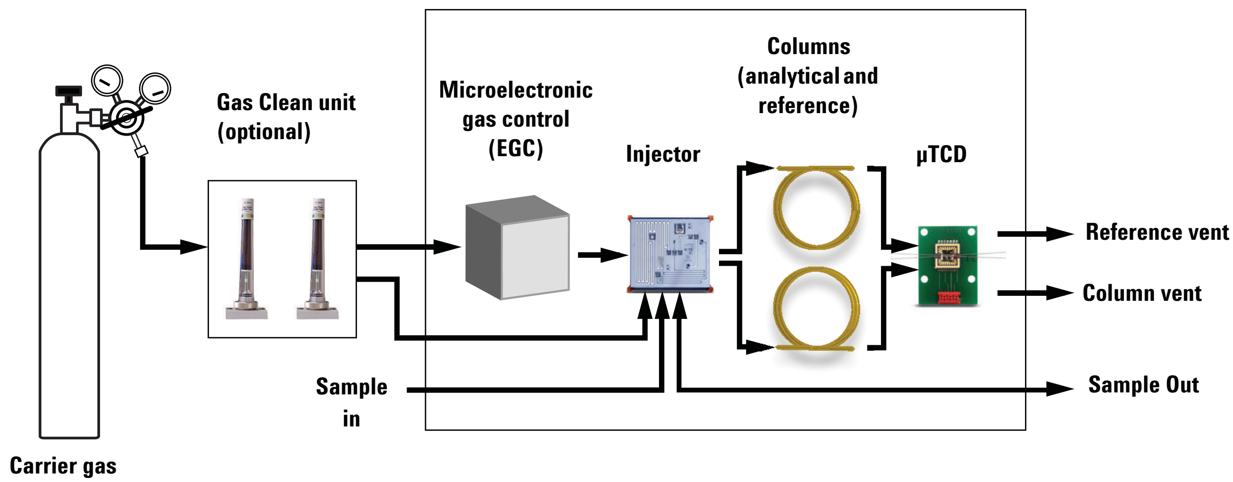


Figure 31 Gas flow diagram

Micro Electronic Gas Control (EGC)

The Micro GCs have built-in regulators that can be adjusted to get a constant or programmed pressure control, which, once constant or programmed pressure control is obtained, results in a constant or programmed flow through the injector, column and detector. The pressure range is from 50 to 350 kPa (7 to 50 psi). This pressure sets a continuous flow of carrier gas of about 0.2 to 4.0 mL/min (depending on column length and type).

A typical pressure rise is 200 kPa/min, which will give a significant pressure increase during the run without excessive baseline disturbance. In most cases baseline subtraction may improve the quality of chromatograms that suffer from baseline drift.

Inert Sample Path

The 490 Micro GC is equipped with an Ultimetal^{TM}-treated sample path. This deactivation method ensures the integrity of the sample and helps to achieve the best detection limits possible.

The deactivation is applied to tubing running from the sample inlet to the injector.

Injector

The injector has a built-in 10-µL sample loop that is filled with the gaseous sample. The pressure of the sample should be between 0 and 100 kPa (0 to 15 psi) and the sample temperature within 5 to 110 °C ± 5 °C of the analyzer.

When the chromatographic data system sends a START command, the vacuum pump draws the gas sample through the loop and the injector injects the gas sample from the sample loop into the gas stream. A typical injection time is 40 milliseconds (ms). This equals an average injection volume of 200 nL. Injection time will be rounded to a multiple of 5 ms. A practical minimum value is 40 ms. A value of 0 to 20 milliseconds might result in no injection.

Column

A variety of column configurations are possible on the Micro GC. The columns you require for your specific analyses have been installed at the factory. Other configurations are, of course, possible, but altering the GC channels is a delicate matter that can only be handled by an Agilent service engineer. Table 9 shows several standard columns as supplied in the Micro GCs and selected applications. Other columns are available by contacting Agilent Technologies.

Table 9 Agilent Micro GC columns and applications

Column/Phase type	Target components
Molsieve 5Å	Permanent gases (N_2/O_2 separation), methane, CO, NO, and so forth. 20 m required for O_2-Ar baseline separation). Natural gas and biogas analysis. Optional Retention Time Stability (RTS) configuration.
Hayesep A	Hydrocarbons C_1–C_3, N_2, CO_2, air, volatile solvents, natural gas analysis.
CP-Sil 5 CB	Hydrocarbons C_3–C_{10}, aromatics, organic solvents, natural gas analysis.
CP-Sil 19 CB	Hydrocarbons C_4–C_{10}, high boiling solvents, BTX.
CP-WAX 52 CB	Polar volatile solvents, BTX.
PLOT Al_2O_3/KCl	Light hydrocarbons C_1–C_5 saturated and unsaturated. Refinery gas analysis.
PoraPLOT U	Hydrocarbons C_1–C_6, halocarbons/freons, anesthetics, H_2S, CO_2, SO_2, volatile solvents. Separation of ethane, ethylene, and acetylene.
PoraPLOT Q	Hydrocarbons C_1–C_6, halocarbons/freons, anesthetics, H_2S, CO_2, SO_2, volatile solvents. Separation of propylene and propane, coelution of ethylene and acetylene.
CP-CO_X	CO, CO_2, H_2, Air (coelution of N_2 and O_2), CH_4.
CP-Sil 19CB for THT	THT and C_3–C_6^+ in Natural Gas Matrix.
CP-Sil 13CB for TBM	TBM and C_3–C_6^+ in Natural Gas Matrix.
MES NGA	Unique column specially tested for MES in natural gas (1 ppm).

CAUTION

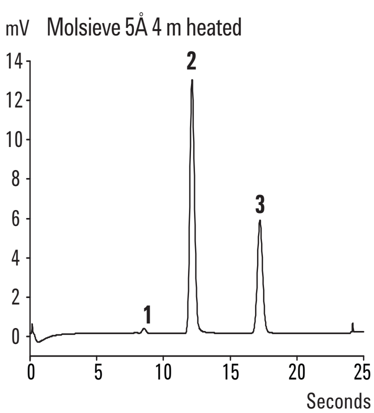
All columns except the HayeSep A (160 °C) and MES (110 °C) columns can be used up to 180 °C, the maximum temperature of the column oven. Exceeding this temperature will cause the column to lose efficiency instantly and the column module will need replacement. All channels have a built-in protection that prevents a setpoint above the maximum temperature.

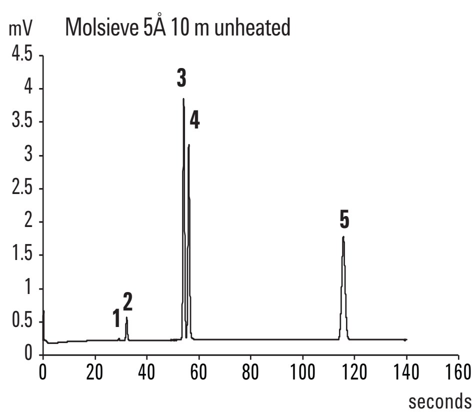
Molsieve 5Å columns

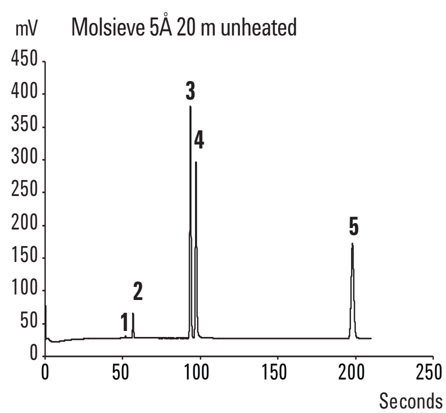
The Molsieve 5Å column is designed to separate: hydrogen, carbon monoxide, methane, nitrogen, oxygen, and some noble gases. Higher molecular weight components have much higher retention times on this column.

Table 10 Molsieve 5Å instrument parameters

Parameter	4m Heated	10m Unheated	20m Unheated
Column temperature	110°C	40°C	40 °C
Injector temperature	110°C	NA	NA
Column pressure	100 kPa (15 psi)	150 kPa (21 psi)	200 kPa (28 psi)
Sample time	30 s	30 s	30 s
Injection time	40 ms	40 ms	40 ms
Run time	25 s	140 s	210 s
Detector sensitivity	Auto	Auto	Auto
Peak 1	Hydrogen 1.0 %	Neon 18 ppm	Neon 18 ppm
Peak 2	Argon/Oxygen 0.4 %	Hydrogen 1.0 %	Hydrogen 1.0 %
Peak 3	Nitrogen 0.2 %	Argon 0.2 %	Argon 0.2 %
Peak 4	________	Oxygen 0.2 %	Oxygen 0.2 %
Peak 5	________	Nitrogen 0.2 %	Nitrogen 0.2 %





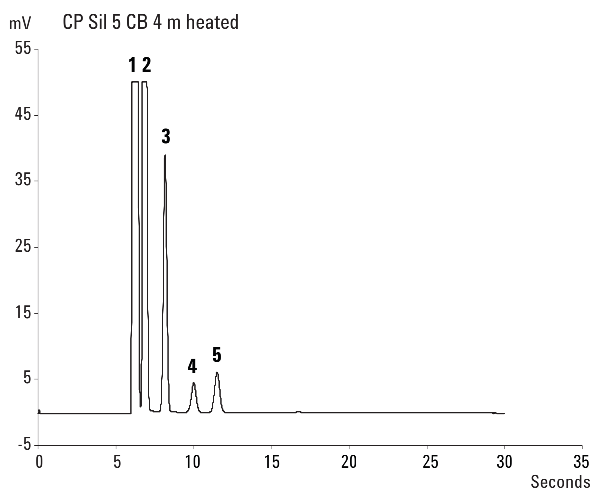


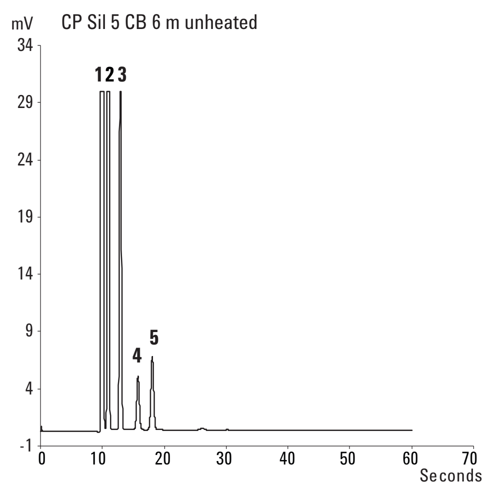
CP-Sil 5 CB columns

The natural gas components, mostly hydrocarbons, separate in the same order on the non-polar and medium-polar CP-Sil CB columns. Nitrogen, methane, carbon dioxide, and ethane are not separated on these columns. They produce a composite peak. For separation of these components, consider a HayeSep A column.

Table 11 CP-Sil 5 CB instrument parameters

Parameters	4m Heated	6m Unheated
Column temperature	50 °C	50 °C
Injector temperature	110 °C	NA
Column pressure	150 kPa (21 psi)	150 kPa (21 psi)
Sample time	30 s	30 s
Injection time	40 ms	40 ms
Run time	30 s	30 s
Detector sensitivity	Auto	Auto
Peak 1	Composite Balance	Composite Balance
Peak 2	Ethane 8.1 %	Ethane 8.1 %
Peak 3	Propane 1.0 %	Propane 1.0 %
Peak 4	i-Butane 0.14 %	i-Butane 0.14 %
Peak 5	n-Butane 0.2 %	n-Butane 0.2 %

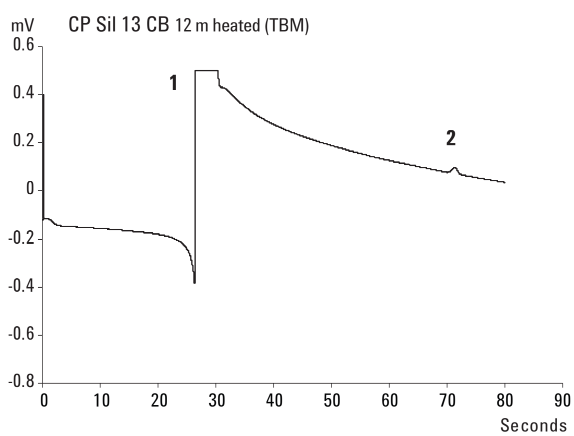


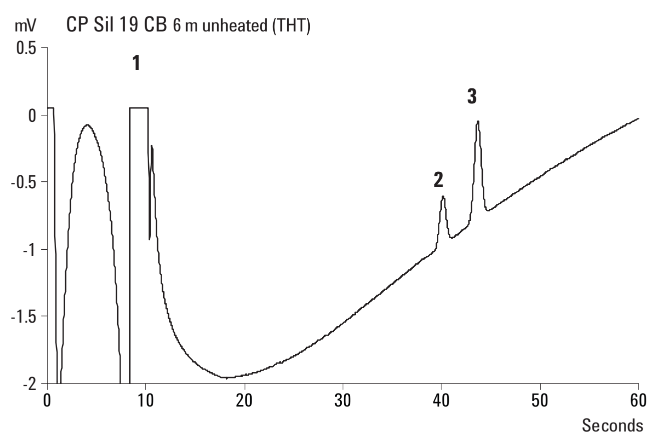


CP-Sil CB columns

Table 12 CP-Sil CB instrument parameters

Parameter	CP-Sil 13 CB 12m Heated (TBM)	CP-Sil 19 CB 6m Heated (THT)
Column temperature	40°C	85 °C
Injector temperature	50°C	85 °C
Column pressure	250 kPa (38 psi)	200 kPa (25 psi)
Sample time	30 s	30 s
Injection time	255 ms	255 ms
Run time	80 s	35 s
Detector sensitivity	Auto	Auto
Peak 1	Methane balance	Helium balance
Peak 2	TBM 6.5 ppm	THT 4.6 ppm
Peak 3	________	n-Decane 4.5 ppm

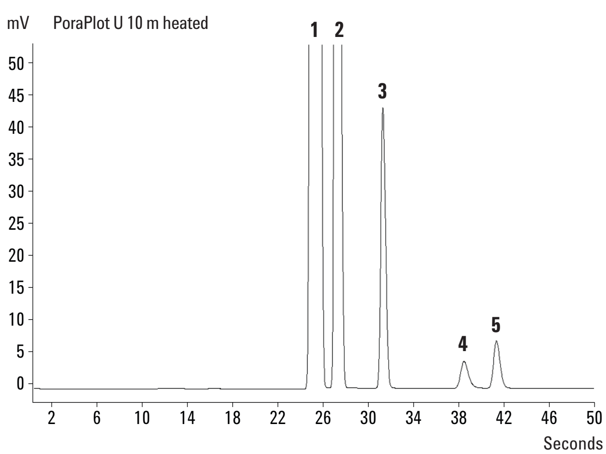


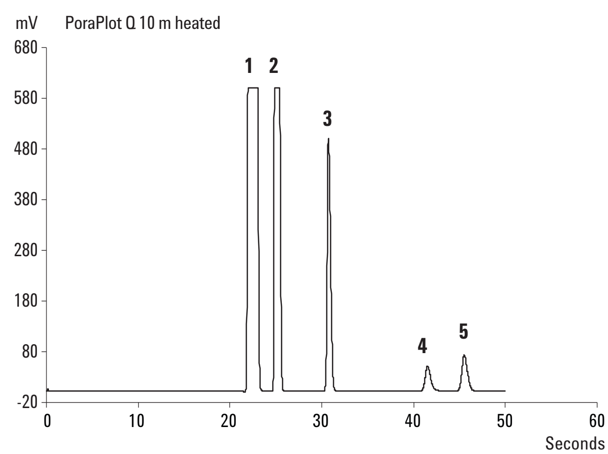


PoraPlot 10m column

Table 13 PoraPlot 10m instrument parameters

Parameter	PoraPlot u 10m Heated	PoraPlot Q 10m Heated
Column temperature	150°C	150 °C
Injector temperature	110°C	110 °C
Column pressure	150 kPa (21 psi)	150 kPa (21 psi)
Sample time	30 s	30 s
Injection time	40 ms	40 ms
Run time	100s	50 s
Detector sensitivity	Auto	Auto
Peak 1	1	Composite Balance
Peak 2	2	Ethane 8.1 %
Peak 3	3	Propane 1.0 %
Peak 4	4	i-Butane 0.14 %
Peak 5	5	n-Butane 0.2 %





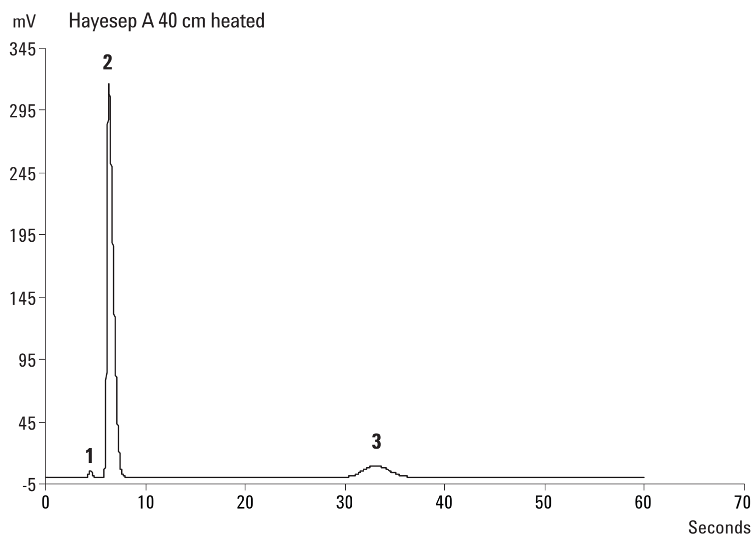
Hayesep A 40 cm heated column

The HayeSep A column separates oxygen, methane, carbon dioxide, ethane, acetylene, ethylene, and selected sulfur gases. Nitrogen coelutes with oxygen. Components with a higher molecular weight than propane have long retention times on this column.

WARNING **Maximum allowable column temperature is 160 °C.**

Table 14 Hayesep instrument parameters

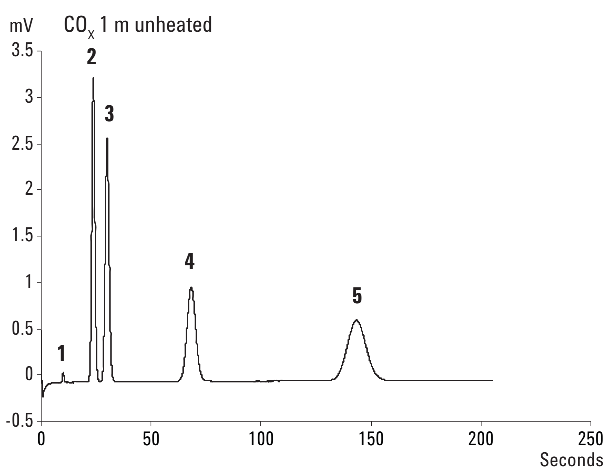
Parameter	Hayesep A 40 cm Heated
Column temperature	50 °C
Injector temperature	110 °C
Column pressure	150 kPa (21 psi)
Sample time	30 s
Injection time	40 ms
Run time	60 s
Detector sensitivity	Auto
Peak 1	Nitrogen 0.77 %
Peak 2	Methane Balance
Peak 3	Ethane 8.1 %

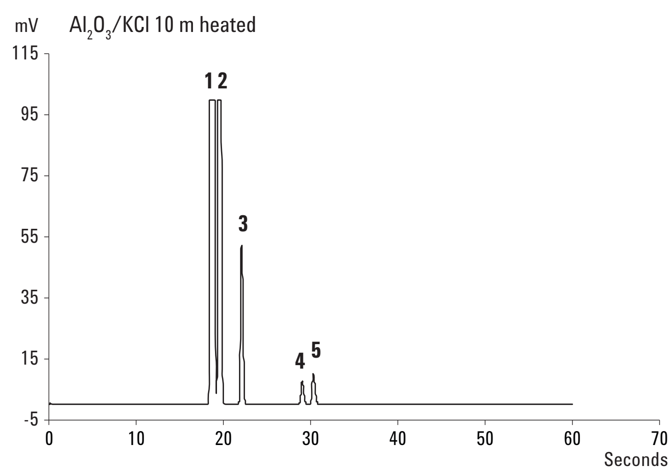


CO_X and AL_2O_3/KCl columns

Table 15 CO_X and Al_2O_3/KCl instrument parameters

Parameter	CO_X 1m Unheated	AL_2O_3/KCl 10m Heated
Column temperature	80 °C	100 °C
Injector temperature	NA	110 °C
Column pressure	200 kPa (28 psi)	150 kPa (21 psi)
Sample time	30 s	30 s
Injection time	40 ms	40 ms
Run time	204 s	60 s
Detector sensitivity	Auto	Auto
Peak 1	Hydrogen 1.0 %	Composite Balance
Peak 2	Nitrogen 1.0 %	Ethane 8.1 %
Peak 3	CO 1.0 %	Propane 1.0 %
Peak 4	Methane 1.0 %	i-Butane 0.14 %
Peak 5	CO_2 1.0 %	n-Butane 0.2 %
	Helium Balance	

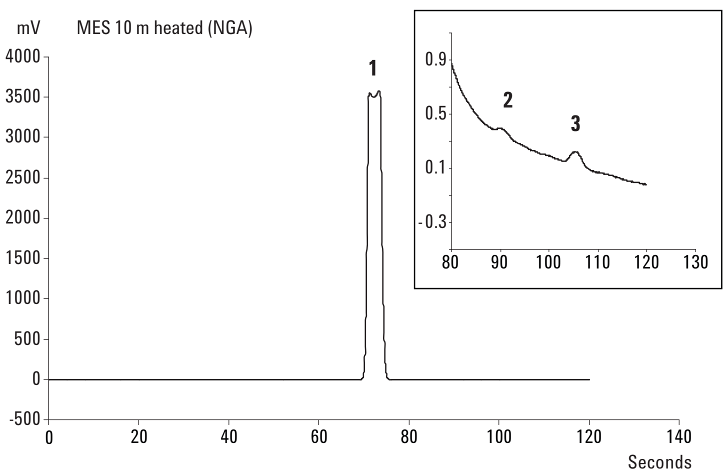


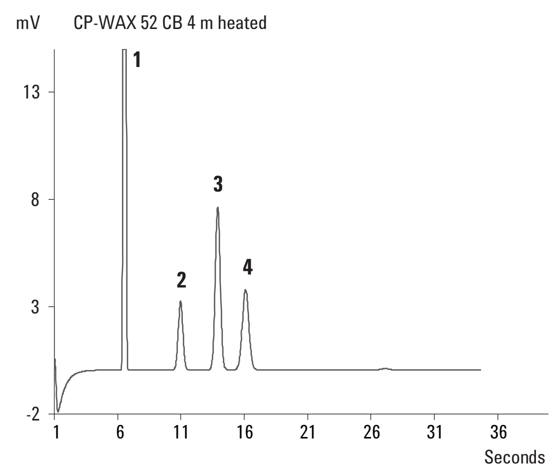


MES (NGA) and CP-WAX 52 CB columns

Table 16 MES (NGA) and CP-WAX 52 CB instrument parameters

Parameter	MES 10m Heated (NGA)	CP-WAX 52 CB 4m Heated
Column temperature	90 °C	60 °C
Injector temperature	110 °C	110 °C
Column pressure	70 kPa (10 psi)	150 kPa (21 psi)
Sample time	30 s	30 s
Injection time	500 ms	40 ms
Run time	120 s	35 s
Detector sensitivity	Auto	Auto
Peak 1	Nitrogen Balance	Nitrogen 0.75 %
Peak 2	n-Decane 11.2 ppm	Acetone 750 ppm
Peak 3	MES 14. 2 ppm	Methanol 0.15 %
Peak 4	________	Ethanol 0.30 %
		Helium Balance





Column conditioning

Follow this procedure to make sure that any water that might be present inside the analytical column is removed before the TCD is switched on.

Also follow this procedure if the Micro GC module has been stored for a long period.

CAUTION

The detector filaments may be damaged by improper conditioning. Follow this procedure to avoid damaging the detector filaments.

Column conditioning procedure

1 Switch off the TCD filaments in the method.
2 Set the column temperature of the module to the maximum temperature (160 °C or 180 °C depending on the column limit). Leave the filaments off.
3 Download this method to the Micro GC.
4 Run the downloaded method to condition the column, preferably overnight.

This will assure you that all the water has been removed from the column and no damage will occur to the TCD filaments.

Nitrogen and oxygen merging in Molsieve columns

On a properly activated column, nitrogen and oxygen will be well separated. However, in time you will find that these two peaks begin to merge together. This is caused by water and carbon dioxide present in the sample or carrier gas, adsorbing to the stationary phase.

To restore the column efficiency, condition the column, described above, for about an hour. After reconditioning, you can test the column performance by injecting plain air. If you have a proper separation between nitrogen and oxygen again, the column separation power has been restored. If the Micro GC frequency of use is very high, you might consider routinely leaving the oven temperature at 180 °C overnight. The longer the reconditioning period, the better the column performance.

Backflush Option

Backflush to vent is an advanced technique used to prevent later-eluting compounds from reaching the analytical column and detector. The main reason for applying this technique is to keep the analytical column clean and reduce analysis time.

The Micro GC is optionally available with GC modules that incorporate backflush capabilities.

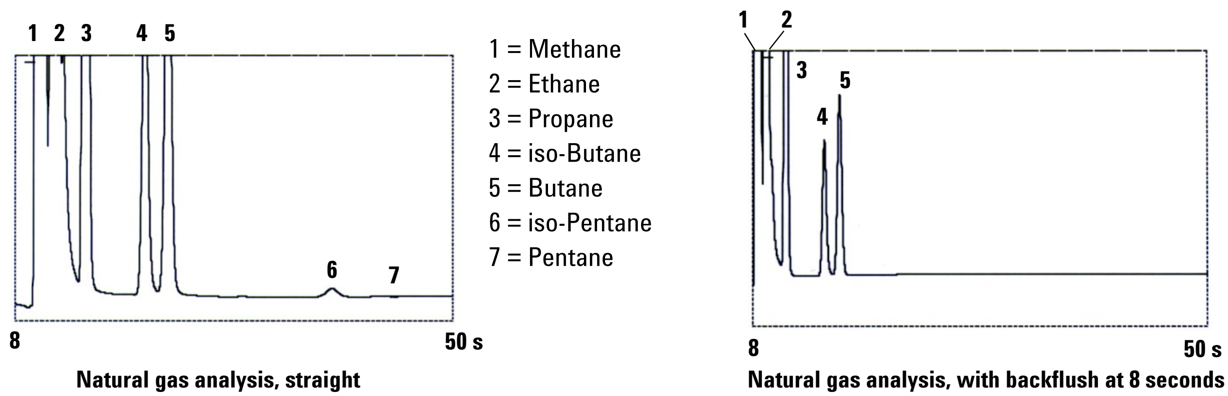


Figure 32 Natural gas analysis

A backflush system always consists of a pre-column and an analytical column. The two columns are coupled at a *pressure point*, which makes it possible to invert the carrier gas flow direction through the pre-column at a preset time, called the *backflush time*. See Figure 34 on page 78.

The injector, two columns, and detector are in series.

The sample is injected onto the pre-column where a pre-separation takes place; injection takes place in normal mode. See Figure 33 on page 78.

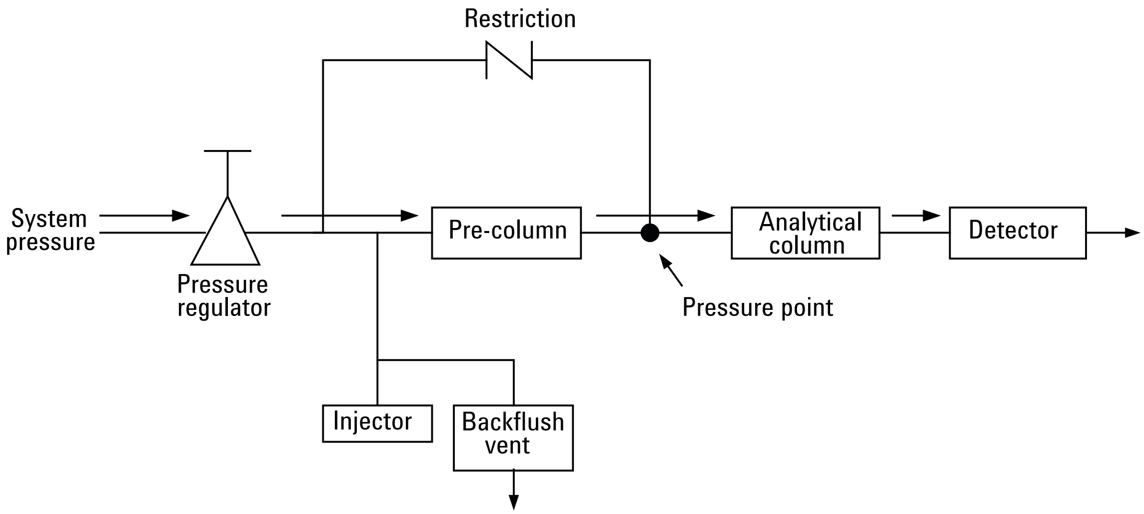


Figure 33 Backflush system normal flows

When all compounds to be quantified are transferred to the analytical column, the backflush valve switches (at the backflush time). On the pre-column, the flow inverts and all compounds left on the pre-column now backflush to the vent. On the analytical column the separation continues because there the flow is not inverted. See Figure 34.

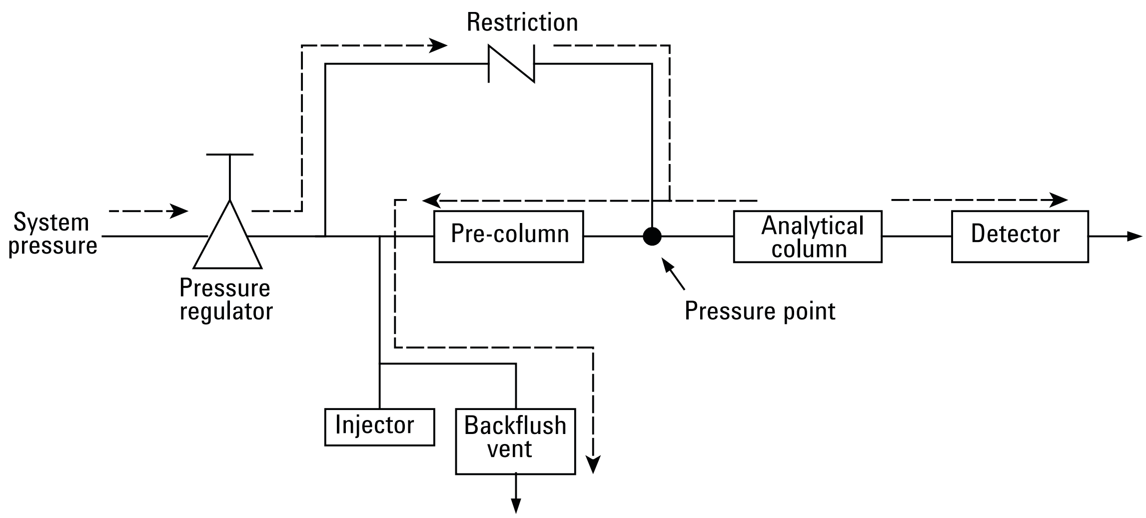


Figure 34 Backflush flows

The standby mode is the backflush configuration (if the instrument is equipped with the optional backflush valve).

Backflushing saves the time required to elute high boiling components that are not of interest and ensures that the pre-column will be in good condition for the next run.

Tuning the backflush time (except on a HayeSep A channel)

Tuning the backflush time is necessary for each new channel. This chapter describes how to tune the backflush time on all channels except HayeSep A.

Tuning procedure for the backflush time

1. Set the backflush time to 0 seconds and analyze the checkout sample or a proper sample for the specific channel. The goal of this is to identify the components in the calibration standard.
2. Change the backflush time to 10 seconds and perform a run. The following can be observed:
   - When the backflush time is set too early, the peaks of interest are partially or totally backflushed.
   - If the backflush time is set too late, the unwanted components are not backflushed and show up in the chromatogram.
3. Perform runs with different backflush times until there is no huge difference in the peak of interest. To fine tune the backflush time, set smaller steps (for example 0.10 seconds) until you find the optimal backflush time.

Figure 35 shows a simple example of tuning the backflush time for the CP-Molsieve 5A channel.

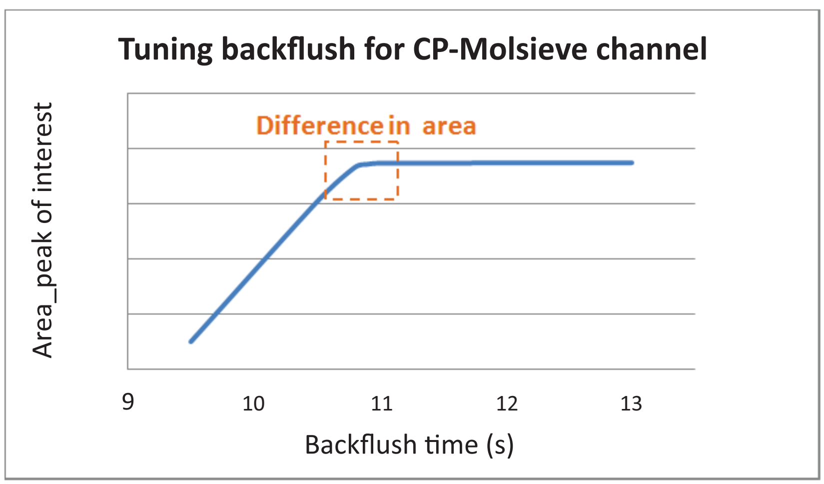


Figure 35 Effect of the backflush time on the peak of interest

Tuning the backflush time on a HayeSep A channel

For each new HayeSep A channel, with a backflush option, it is necessary to tune the backflush time properly. The tuning procedure of the HayeSep A channel is different than the tuning procedure of other channels.

The goal for tuning the backflush time for the HayeSep A channel is get all peaks of interest, components up to propane, on the HayeSep A column while all unwanted peaks that elute after propane are backflushed.

Tuning procedure for HayeSep A channel

1 Set the backflush time of the HayeSep A channel to 0 seconds.
2 Set an appropriate run time for the first analysis (for example 300 seconds or longer).
3 Analyze the NGA Gas Calibration standard and identify all components in the calibration standard.
4 When all peaks of interest are identified, select a proper backflush time after propane peak.

Figure 36 shows an example of the tuning procedure of HayeSep A channel. In this example the propane peak elutes around 90 seconds, proper backflush time for the HayeSep A here is around 120 seconds.

Consider that the total run time must be sufficient to backflush all unwanted components from the column. The ideal total run time is approximately twice the backflush time or higher. So in this example, a total run time of 240 seconds is sufficient to backflush all unwanted components from the HayeSep A channel.

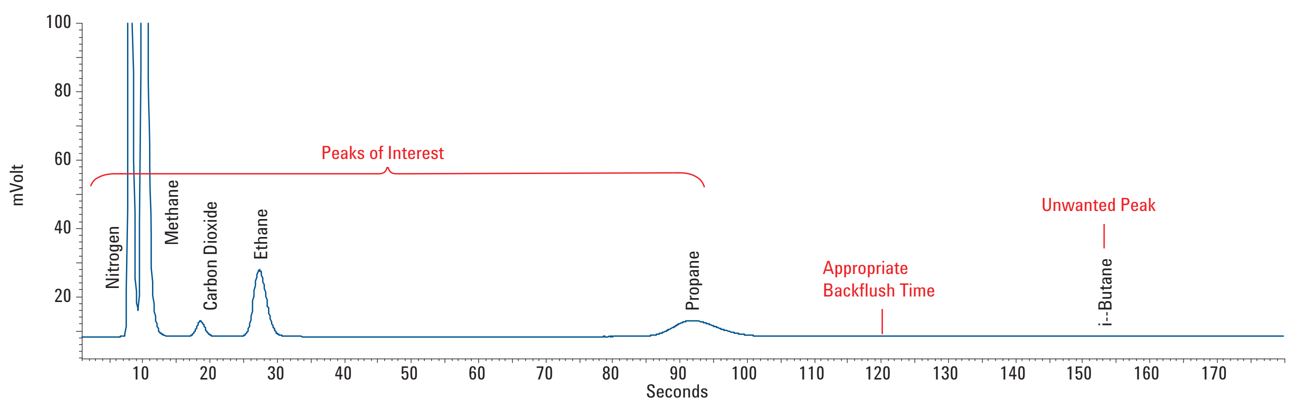


Figure 36 Selecting backflush time for a HayeSep A channel

To disable backflush

To disable backflushing, set the **Backflush Time** to **0**. This puts the system in normal mode during the entire run.

Backflush to Detector

Backflush to detector is an advanced technique to elute high boiling point compounds as a group through the reference column, and show as one peak on the chromatogram just before the low boiling point compounds. The benefit of this technique is that the analysis time is reduced. In some cases, the analysis could even be done on just one channel.

The Agilent 490 Micro GC offers two types of backflush to detector channels. A CP-Sil 5 CB for natural gas analysis and Al2O3 for refinery gas analysis. The backflush to detector channel is factory tuned to group the C6+ components.

CP-Sil 5 CB Backflush to detector

The CP-Sil 5 CB backflush to detector micro GC channel is configured with an 8 m CP-Sil 5 CB analytical column and a 0.5 m CP-Sil 5 CB pre-column. It elutes C6+ in natural gas as one peak through the reference column, and shortens analysis time to 90 seconds. It is compliant with GPA2172 for calorific value calculation.

Al2O3 Backflush to detector

The Al2O3 back flush to detector micro GC channel is configured with a 10 m Al2O3/KCl analytical column and a 1 m CP-Sil 5 CB pre-column. It elutes C6+ in refinery gas as one peak through the reference column, and shortens analysis time to 210 seconds.

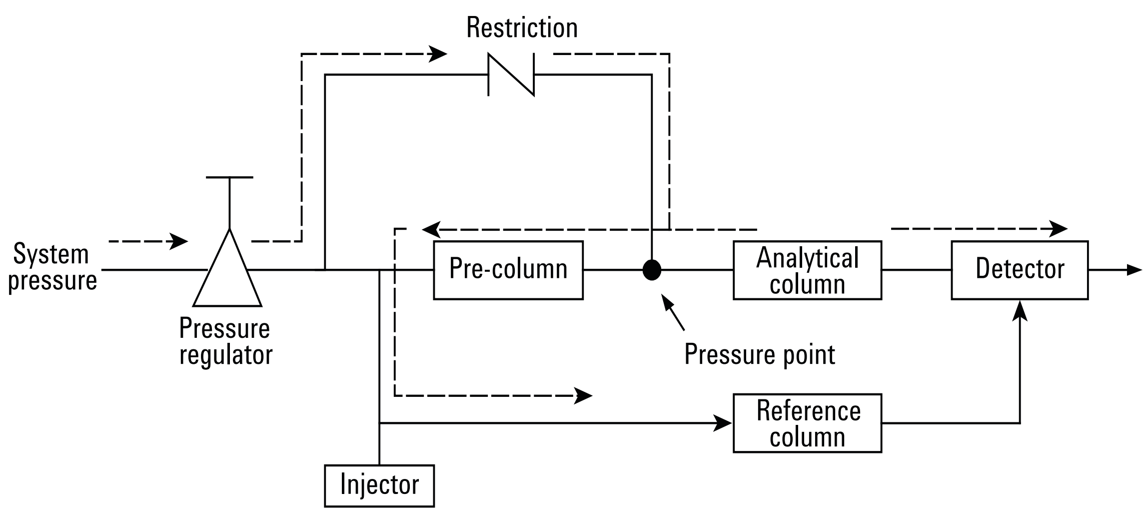


Figure 37 Backflush to detector flow

Tuning the backflush time

To set the proper backflush time for each new backflush to detector channel, follow either the "8m 5CB BF2D procedure" or the "10m Al2O3/KCl BF2D procedure" on page 84.

8m 5CB BF2D procedure

Table 17 8m 5CB BF2D settings

Parameter	Settings
Column pressure	150 kPa
Injection temperature	110 °C
Column temperature	72 °C
Injection time	40 ms
Run time	90 s
Sample gas	NGA gas

1. Set backflush (BF) time to 0 sec. Start a run to obtain the peaks of all eluted components. Record the retention time (RT) of *n*-pentane and 2,2-dimethylbutane.
2. Set run time to a value which is 10 sec longer than the RT of 2,2-dimethylbutane. Set BF time to 5 sec. Start a run again.
3. Increase BF time by 0.5 sec steps, and start a run. Observe the peak height of 2,2-dimethylbutane. Continue increasing BF time until the 2,2-dimethylbutane peak is observed (peak height > 3 µV).
4. Finely tune the BF time, find the data point when the 2,2-dimethylbutane peak is observed. Decrease BF time by 0.1 sec steps, and start a run until the peak disappears (peak height < 3 µV). Set BF time for this channel to that value minus 0.2 sec. A typical "clean cut" time range of 8m 5CB BF2D channel is approximately 0.3-0.5 sec. (See Figure 38 on page 84.)

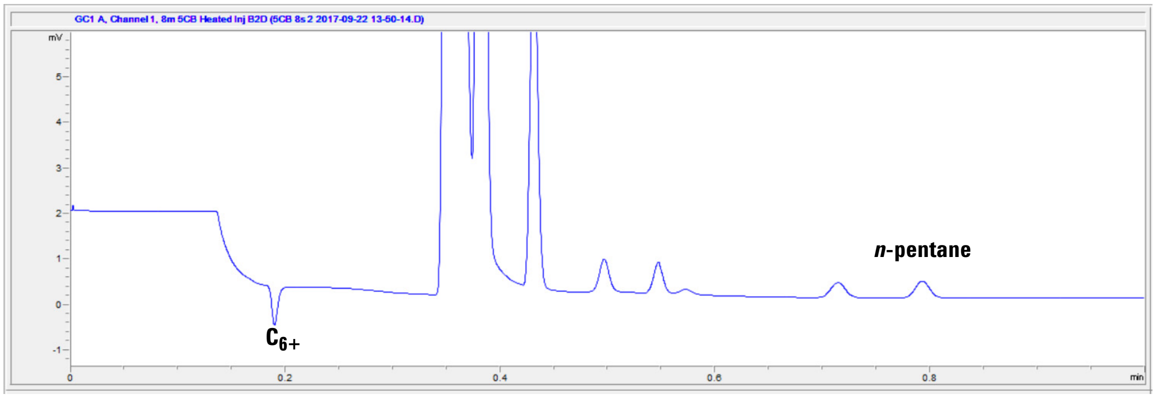


Figure 38 8m 5CB Column for natural gas analysis

10m Al2O3/KCl BF2D procedure

Table 18 10m Al_2O_3/KCl BF2D settings

Parameters	Settings
Column pressure	300 kPa
Injection temperature	100 °C
Column temperature	90 °C
Injection time	40 ms
Run time	600 s
Sample gas	RGA gas

1 Set backflush (BF) time to 0 sec. Run method to obtain the peaks of all eluted components. Record the retention time (RT) of *cis*-2-pentene and *n*-hexane.

2 Set run time to a value which is 10 sec longer than the RT of *n*-hexane. Set BF time to 5 sec. Start a run.

3 Increase BF time by 0.5 sec steps, and start a run. Observe the peak height of *n*-hexane. Continue increasing BF time until the *n*-hexane peak is observed (peak height > 3 µV).

4 Finely tune the BF time, find the data point when the *n*-hexane peak is observed. Decrease BF time by 0.1 sec steps, and start a run until the peak disappears (peak height < 3 µV). Set BF time for this channel to that value minus 0.4 sec. A typical “clean cut” time range of 10m Al2O3 BF2D channel is approximately 1-2 sec. (See Figure 39 on page 85.)

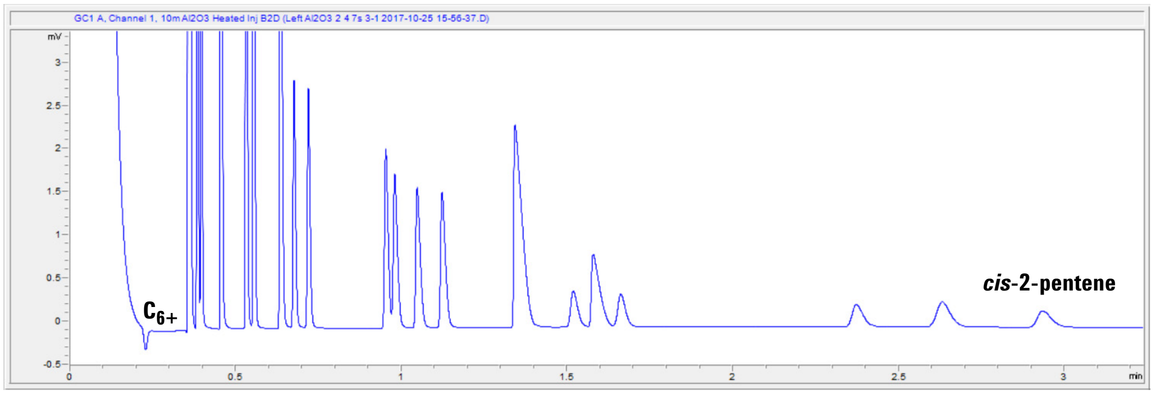


Figure 39 10m Al2O3 Column for refinery gas analysis

To disable backflush

To disable backflushing, set the **Backflush Time** to **0**. This puts the system in normal mode during the entire run.

Set invert signal time

Invert signal time enables the backflush to detector channel to plot the signal from a negative peak to a positive peak in the selected time interval. See Figure 40 for the OpenLAB CDS configuration and Figure 41 on page 86 for the PROstation SW configuration.

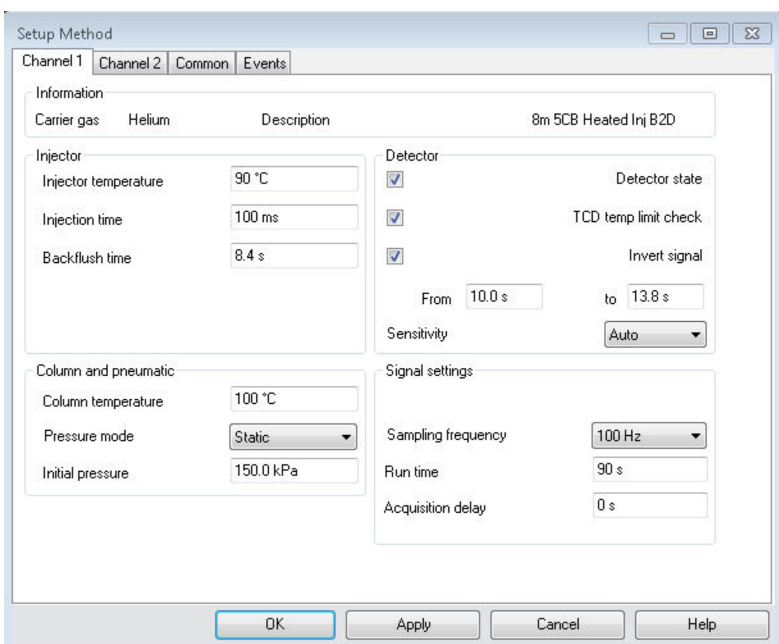


Figure 40 Method configuration in OpenLAB CDS

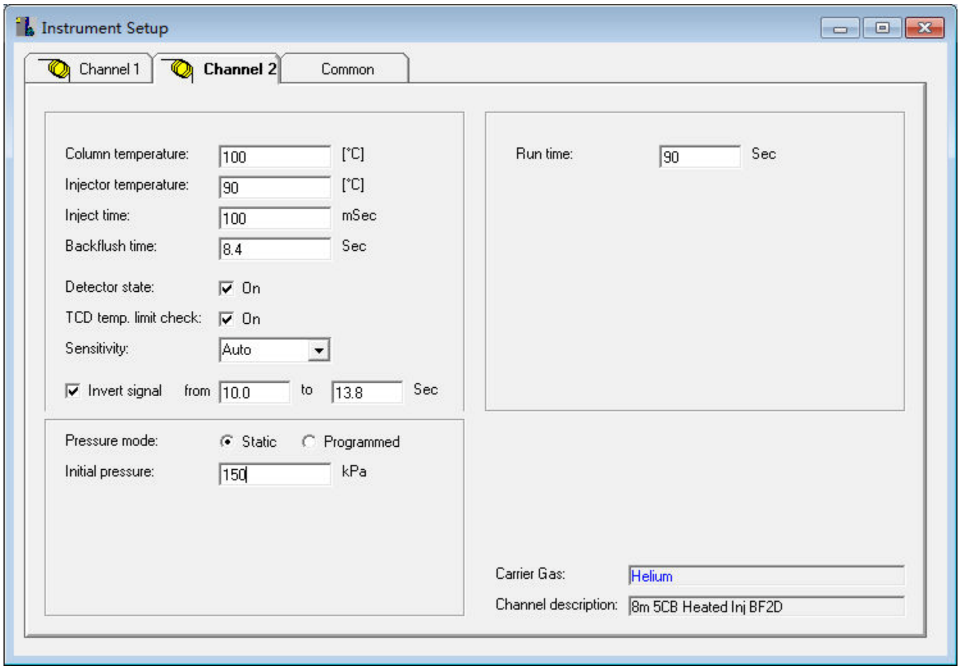


Figure 41 Method configuration in PROstation SW

Checkout information

Table 19 8m 5CB BF2D and 10m Al2O3/KCl BF2D instrument method parameters

Method settings	8m 5CB Heated BF2D	10m Al2O3/KCl Heated BF2D
Carrier gas	Helium	Helium
Column temperature (°C)	72	90
Injector temperature (°C)	110	100
Column pressure (kPa)	150	300
Sample line temperature (°C)	110	100
Sample time (s)	30	30
Injection time (ms)	40	40
Run time (s)	90	600
Detector sensitivity	Auto	Auto

Table 20 8m 5CB BF2D and 10m Al2O3/KCl BF2D peak identification

Peak identification	8m 5CB Heated BF2D	10m Al2O3/KCl Heated BF2D
Peak 1	Composite balance	Propane 1.99%
Peak 2	Ethane 4.06%	Propylene 0.980%
Peak 3	Propane 0.520%	Acetylene 1.06%
Peak 4	*i*-Butane 0.0502%	Propadiene 1.01%
Peak 5	*n*-Butane 0.0495%	*i*-Butane 0.295%
Peak 6	Neopentane 0.0101%	*n*-Butane 0.295%
Peak 7	*i*-Pentane 0.0306%	*trans*-2-Butylene 0.303%
Peak 8	*n*-Pentane 0.0306%	*i*-Butylene 0.295%
Peak 9	C_{6+}	*i*-Butylene 0.307%
Peak 10		*cis*-2-Butylene 0.306%
Peak 11		Methyl acetylene 1.01%
Peak 12		*i*-Pentane 0.104%
Peak 13		1,3-Butadiene 0.311%
Peak 14		*n*-Pentane 0.097%
Peak 15		*trans*-2-Pentene 0.098%
Peak 16		2-Methyl-2-butene 0.046%
Peak 17		*i*-Pentene 0.097%
Peak 18		*cis*-2-Pentene 0.094%
Peak 19		C_{6+}

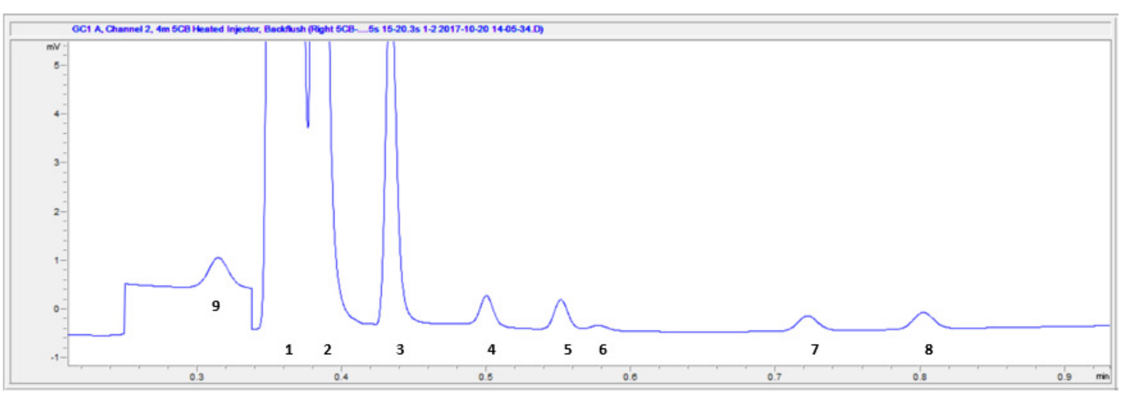


Figure 42 8m 5CB BF2D for natural gas analysis

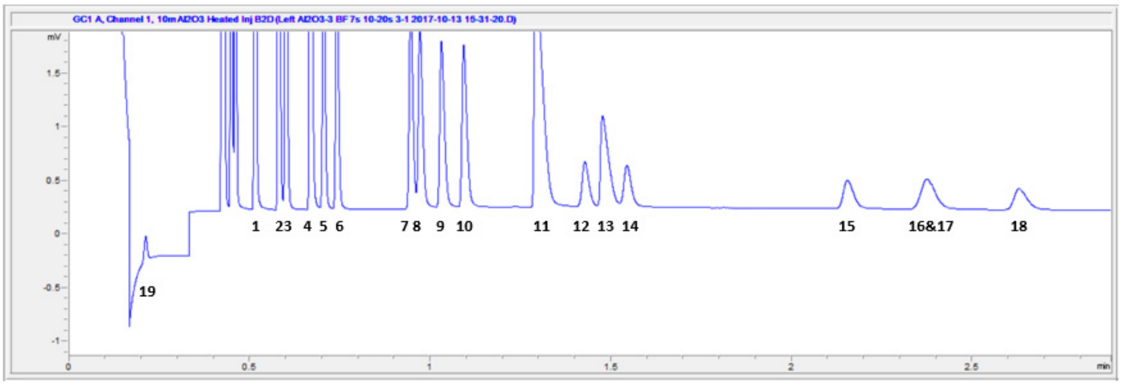


Figure 43 10m Al_2O_3/KCl BF2D for refinery gas analysis

C6+ Calorific value calculation

For calorific value calculation and application setup, please refer to the “calorific power” section from the *490-PRO Micro GC Manual* or designated energy meter software.

TCD Detector

Each GC channel is equipped with a thermal conductivity detector (TCD). This detector responds to the difference in thermal conductivity between a reference cell (carrier gas only) and a measurement cell (carrier gas containing sample components). The construction of a TCD is such that the changing thermal conductivity of the carrier gas stream, due to components present, is compared to the thermal conductivity of a constant reference gas stream.

6
Channel Exchange and Installation

WARNING **Before removing the Micro GC covers, allow all heated zones to cool down. Turn off the power and disconnect the power cord at their source.**

WARNING **Remove any tubing connected to the sample-in and carrier gas inlet connectors.**

Tools required

The following tools are required to perform the replacement procedure described following section. Allow approximately 15-20 minutes to complete this process.

- Open-end wrenches:
  - 7/16- x 1/2-inch (CP8452)
  - 5/16- x 1/4-inch (CP8451)
  - 3/16- x 1/4-inch (VLOEW1)
  - 6- x 7-inch (CP696110)
- Flathead screwdriver
- Torx T-10 (CP69023)
- Torx T-20 (CP69024)
- Hexagon socket key 3 mm modified (CP742997)

Figure 44 Required tools

Replacement procedure for Micro GC channel

1 Remove power cord.

2 Remove sample-in and carrier gas connections.

3 Open the side cover.

4 Remove the side cover by removing the two (2) Torx T-20 screws.

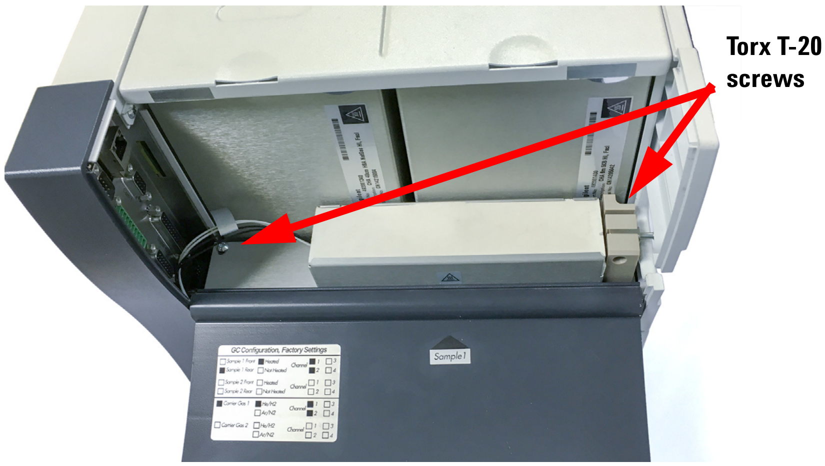


Figure 45 Side cover open

5 Carefully lift the side cover up and remove it.

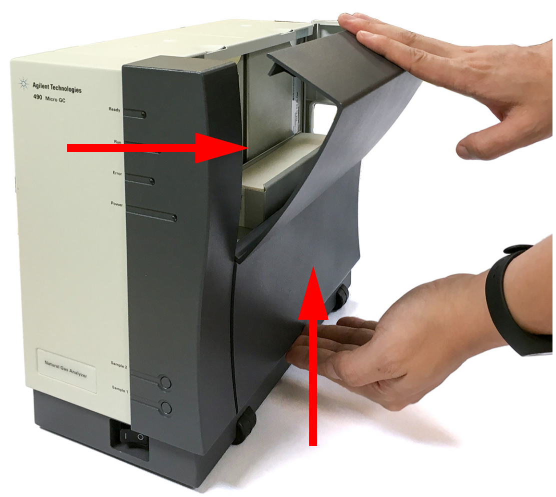


Figure 46 Remove side cover

6 At the back of the Micro GC remove the two (2) Torx screws that hold the top cover.

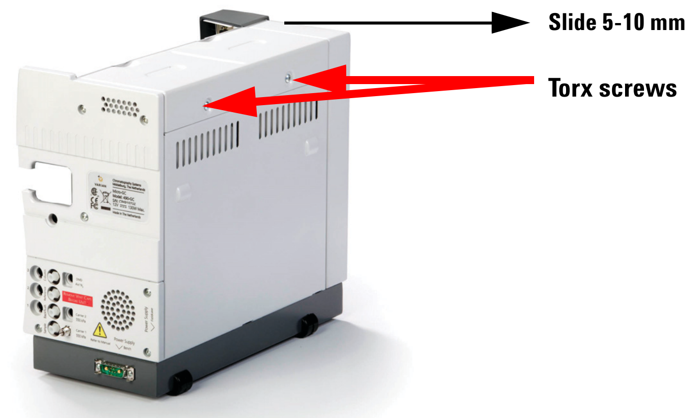


Figure 47 Remove screws

7 Slide the top cover 5-10 mm in the arrow direction and lift the top cover up.

8 If NO heated sample line is present, please proceed to step 15.

9 Remove the top and side insulation (heated sample line only).

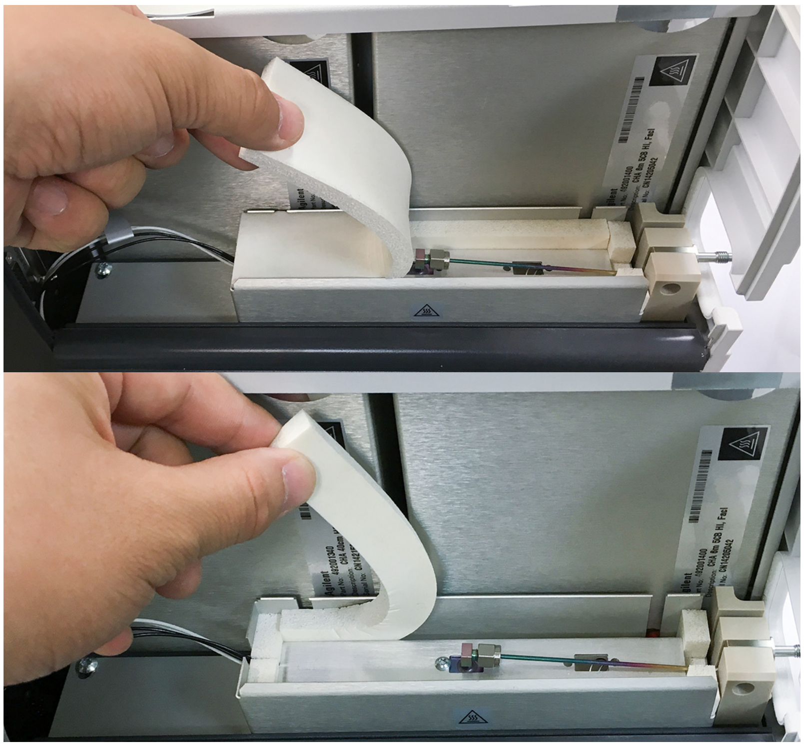


Figure 48 Remove top and side insulation

10 Disconnect the back sample inlet from the sample inlet connector manifold

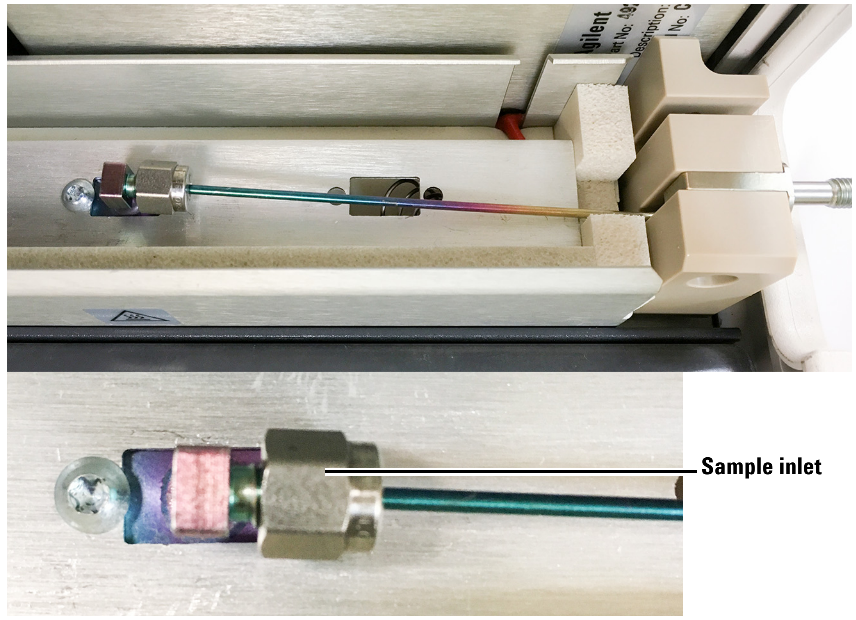


Figure 49 Back sample inlet with sample inlet connector manifold

11 Remove the Torx T-10 screw.

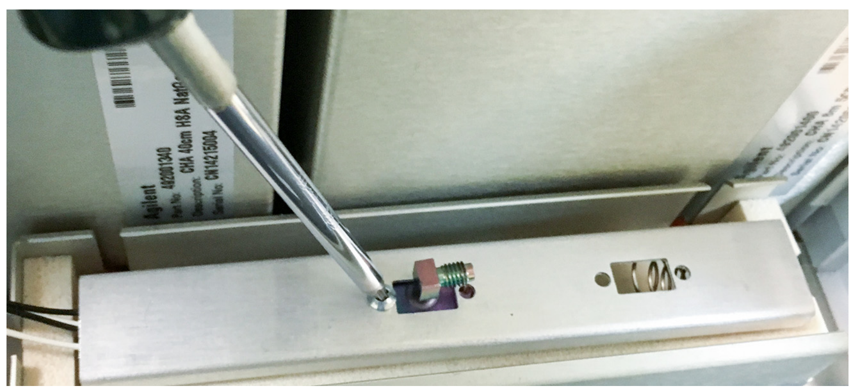


Figure 50 Remove the Torx T-10 screw

12 Lift the heated sample bracket up and remove it.

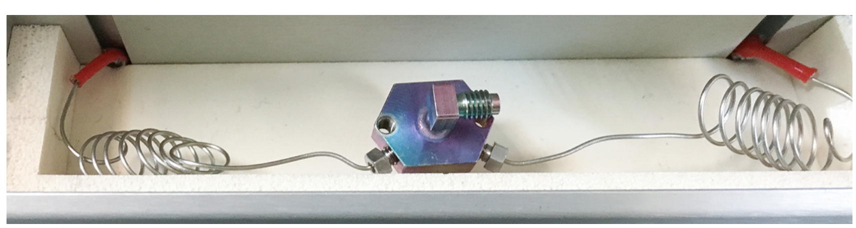


Figure 51 Heated sample bracket removed

13 Holding the sample-in manifold with a adjustable wrench, remove using a 3/16-inch open wrench the sample inlet connector of the channel that has to be removed.

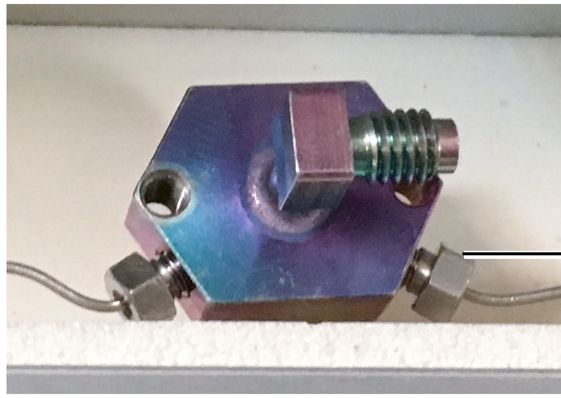


Figure 52 Sample-in manifold

14 For a channel with RTS option, skip to the section "Replacement procedure for Micro GC channel with RTS option" on page 99

15 Loosen (do not remove) both (2-channel) carrier gas inlet tubes with the help of a Phillips screwdriver, paying extra attention to the O-ring(s).

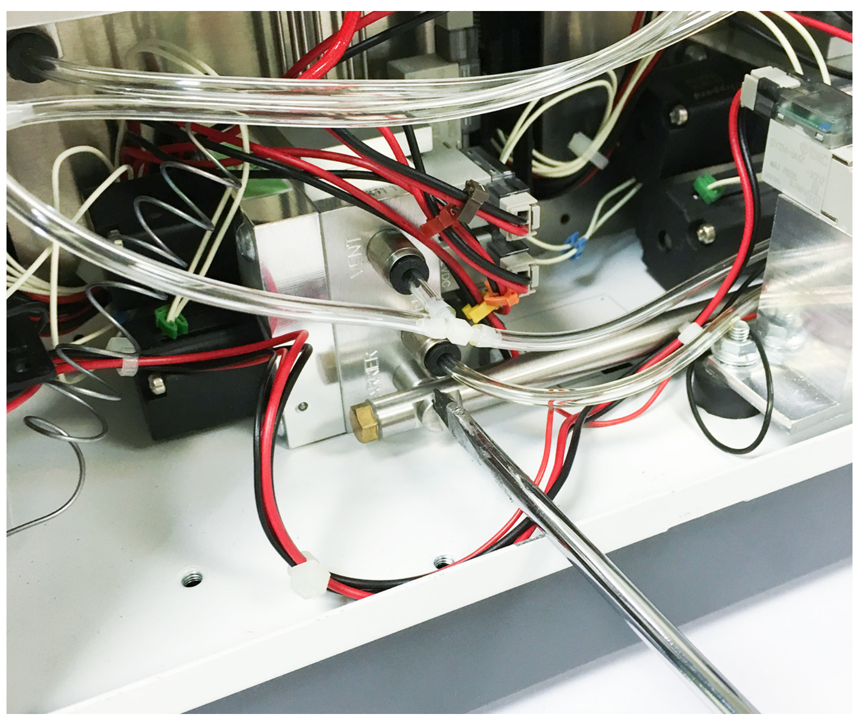


Figure 53 Inlet tube

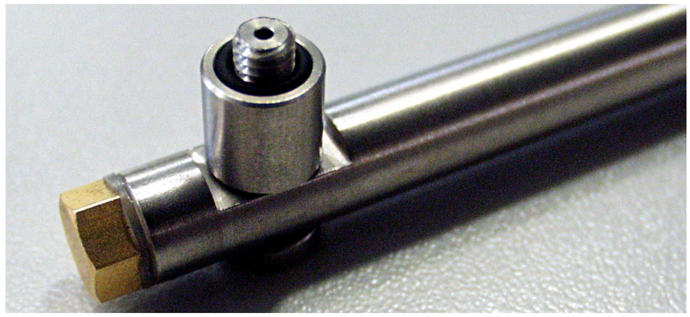


Figure 54 O-ring location

16 Mark the transparent tubing before removal! Using the correct procedure, carefully remove all transparent tubing connected to the analytical module unit and EGC manifold block.
All Micro GC systems produced from mid July 2002 are supplied with a new type of quick release fittings.
To remove the transparent tubing just push and pull.

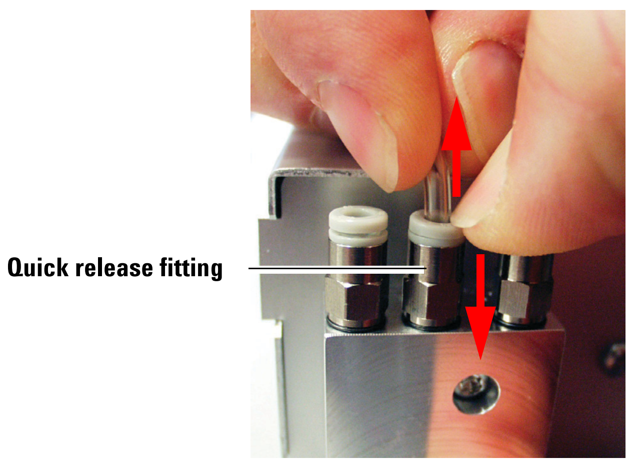


Figure 55 Tube removal with quick release fitting

CAUTION

The transparent tubing of systems produced before mid July 2002 must only be removed using the procedure given below.
1. Place a flathead screwdriver under the end of the tubing.
2. Rotate the screwdriver slowly lifting the tubing of the tube.

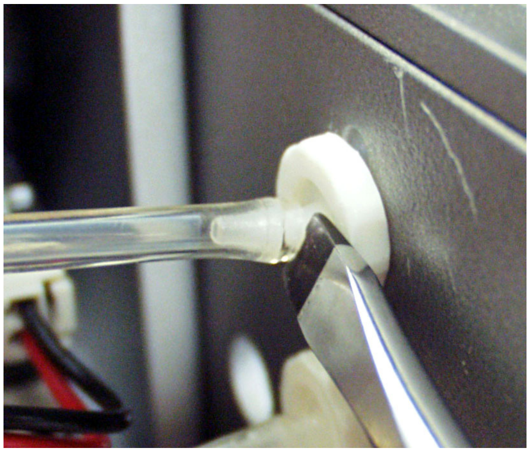


Figure 56 Transparent tubing

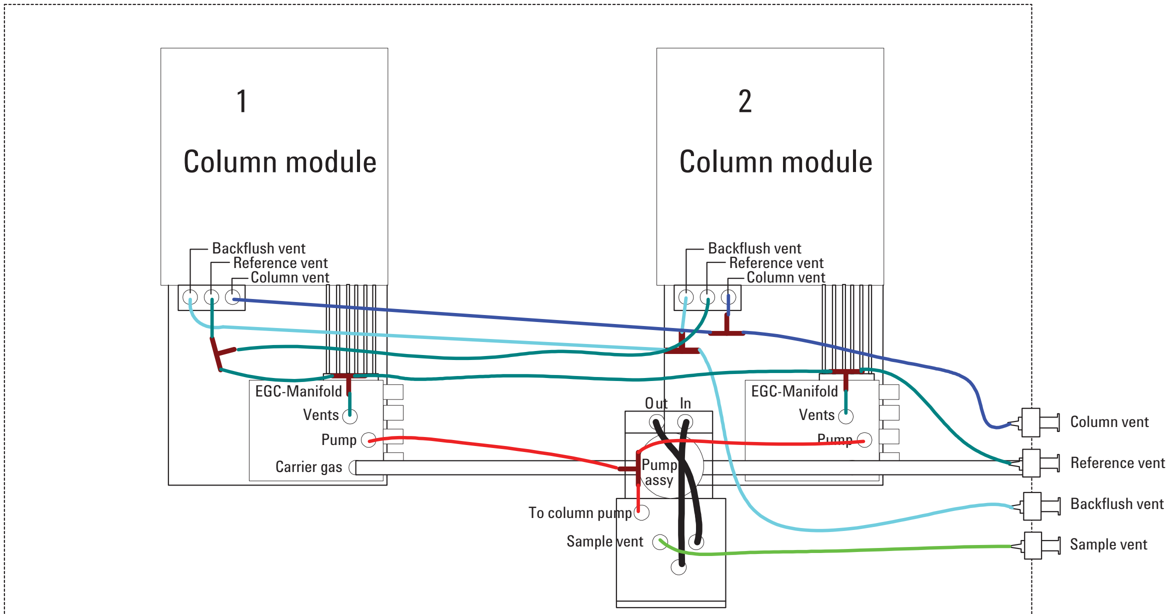


Figure 57 Column module tubing diagram

17 Remove the sample inlet nut (or heated sample line) and pull out the capillary tubing.

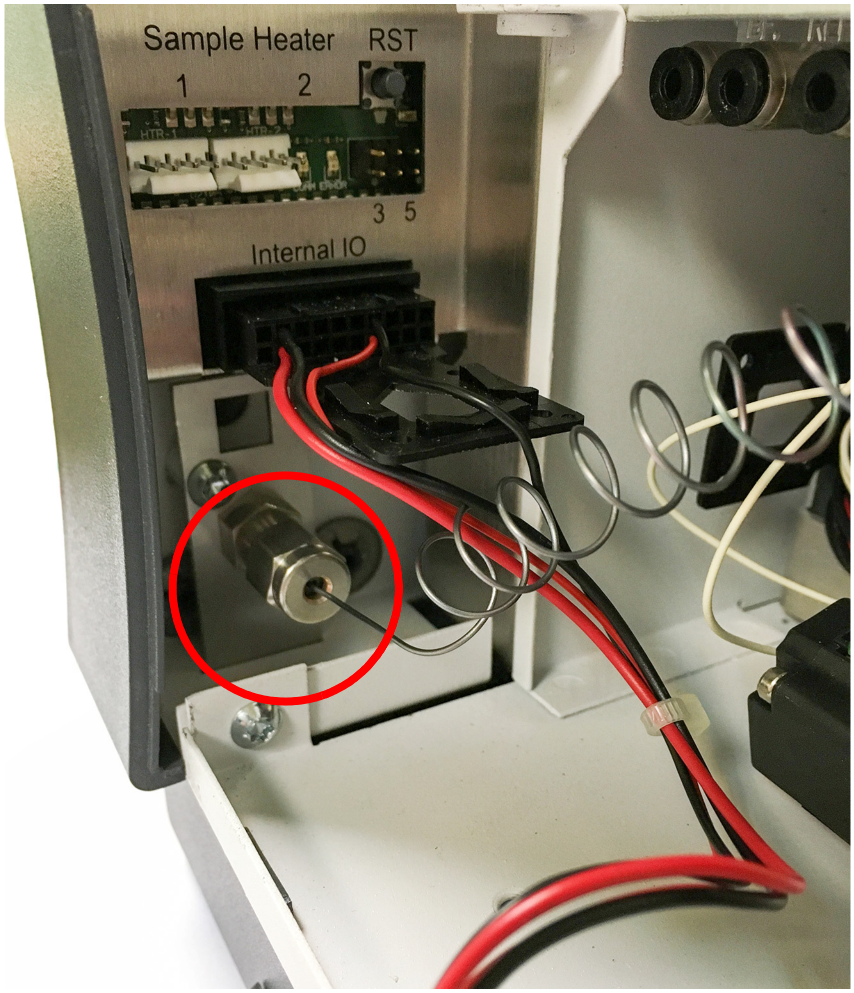


Figure 58 Pull out capillary tubing

18 Carefully lift the analytical module out of its socket and replace it.

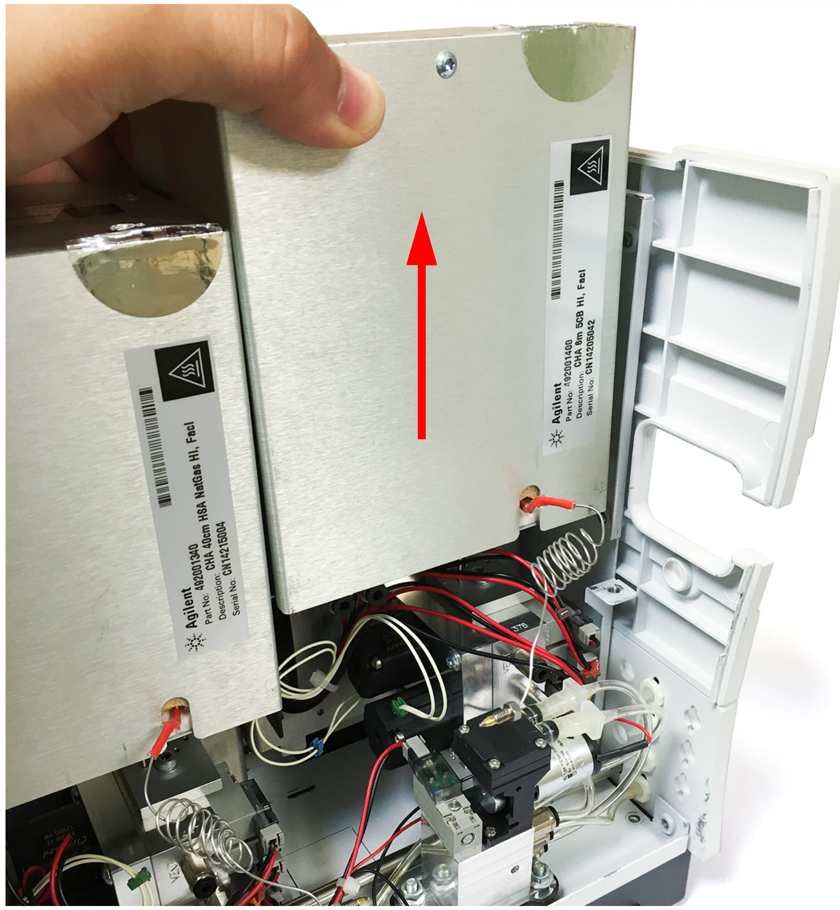


Figure 59 Lift analytical module

19 Reassembly is the reverse of removal.

NOTE

During reassembly, inspect the carrier gas tube O-ring(s) and heated sample connection block O-ring. Replace if necessary.

Check for leaks after reassembly.

Upload the NEW configuration in the workstation software.

Replacement procedure for Micro GC channel with RTS option

1 Follow step 1 through step 13 in section "Replacement procedure for Micro GC channel" on page 91.

2 Remove the pump assembly for easier access to the channel with RTS option.

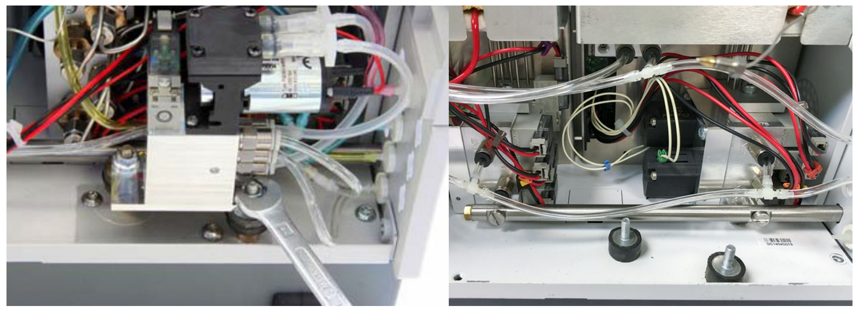


Figure 60 Removing pump assembly

3 Loosen, do not remove, the screw on the carrier gas inlet tube with the help of a flathead screwdriver, paying extra attention to the O-ring(s).

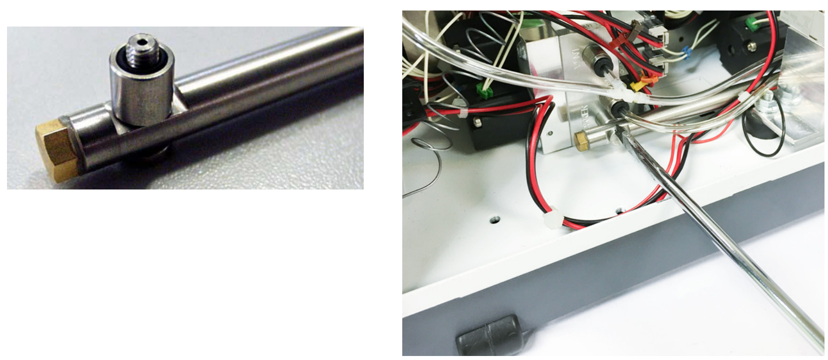


Figure 61 Carrier gas inlet

4 Carefully remove all colored tubing connected to the analytical module unit and EGC manifold block. All Micro GC systems are supplied with quick release fittings. To remove the colored tubing just push and pull.

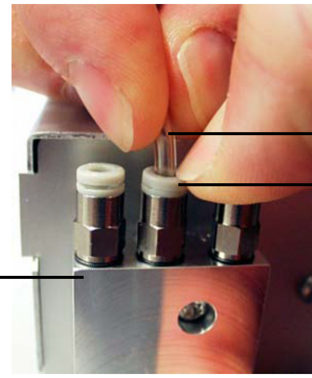
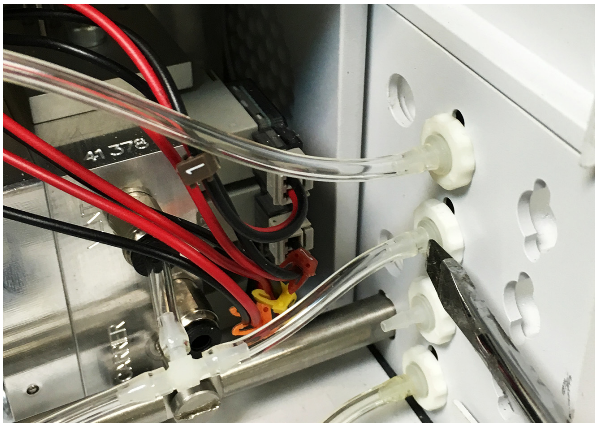


Figure 62 Tube release



The tubing of systems must only be removed using this procedure:

1. Place a flathead screwdriver under the end of the tubing.

2. Rotate the screwdriver slowly lifting the tubing out of the tube.

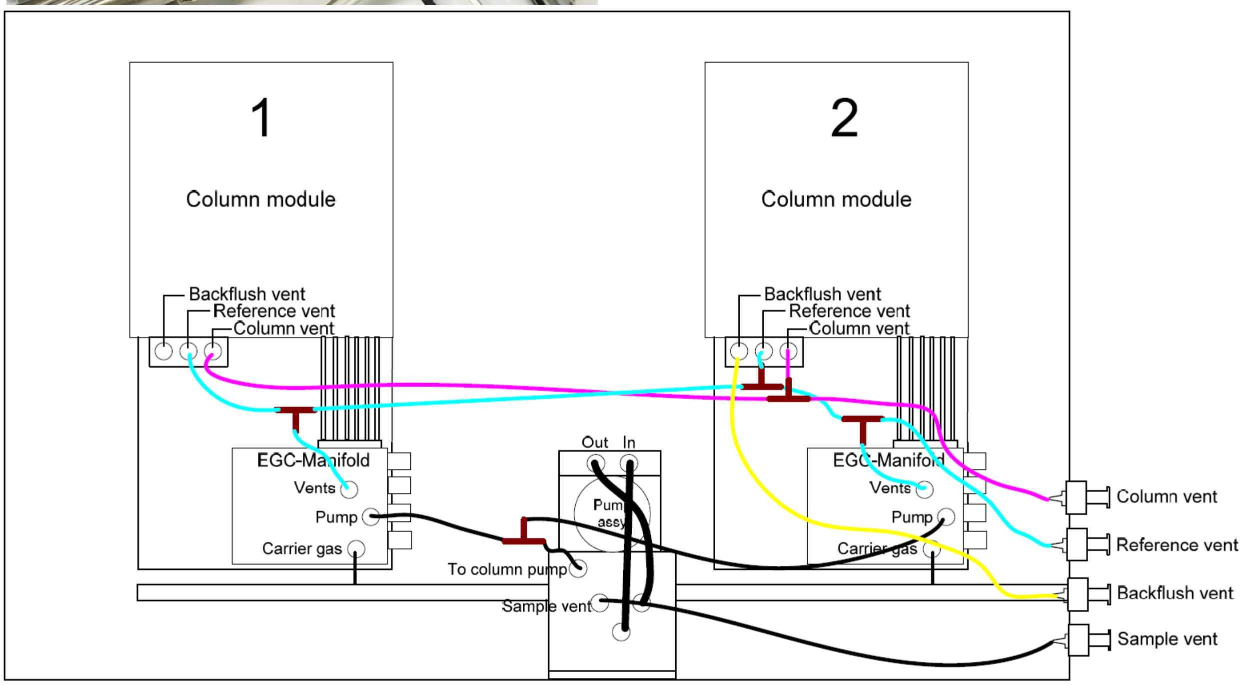


Figure 63 Tubing diagram

5 Remove the sample inlet nut (or heated sample line) and pull out the capillary tubing.

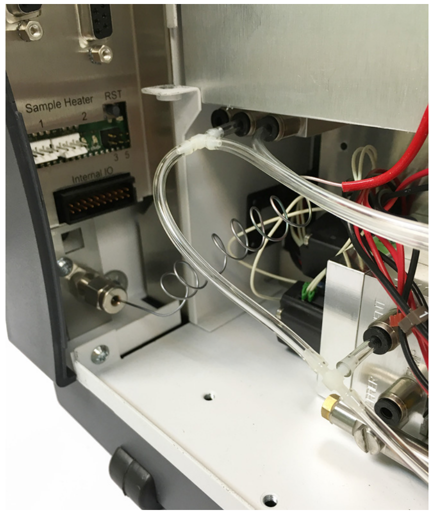


Figure 64 Remove sample inlet nut and capillary tubing

6 Carefully lift the analytical module out of its socket and remove it.

7 Reinstall the new channel with RTS option in the reverse order of the removal.

8 Either install the pump assembly in front of a channel not containing an RTS option, or use a pump bracket (CP742978).

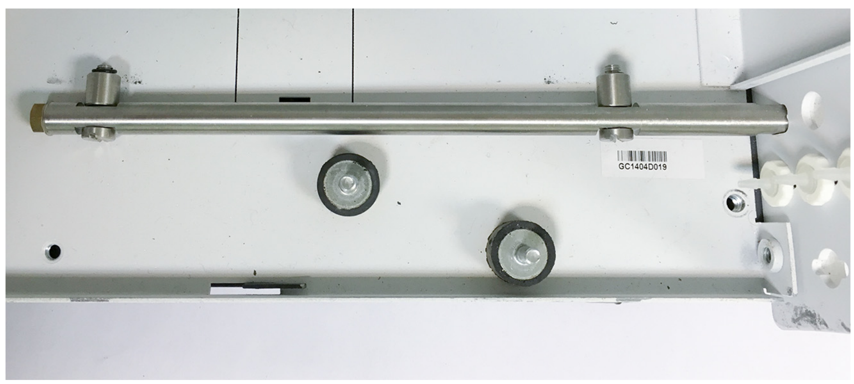


Figure 65 Pump bracket

NOTE

During reassembly, pay close attention to the carrier gas tube, O-ring(s), and heated sample connection block O-ring. Replace if necessary.

Check for leaks after reassembly.

Upload the NEW configuration in the workstation software.

Replacement procedure for Molsieve filters with the RTS option

Figure 66 Channel with RTS option.

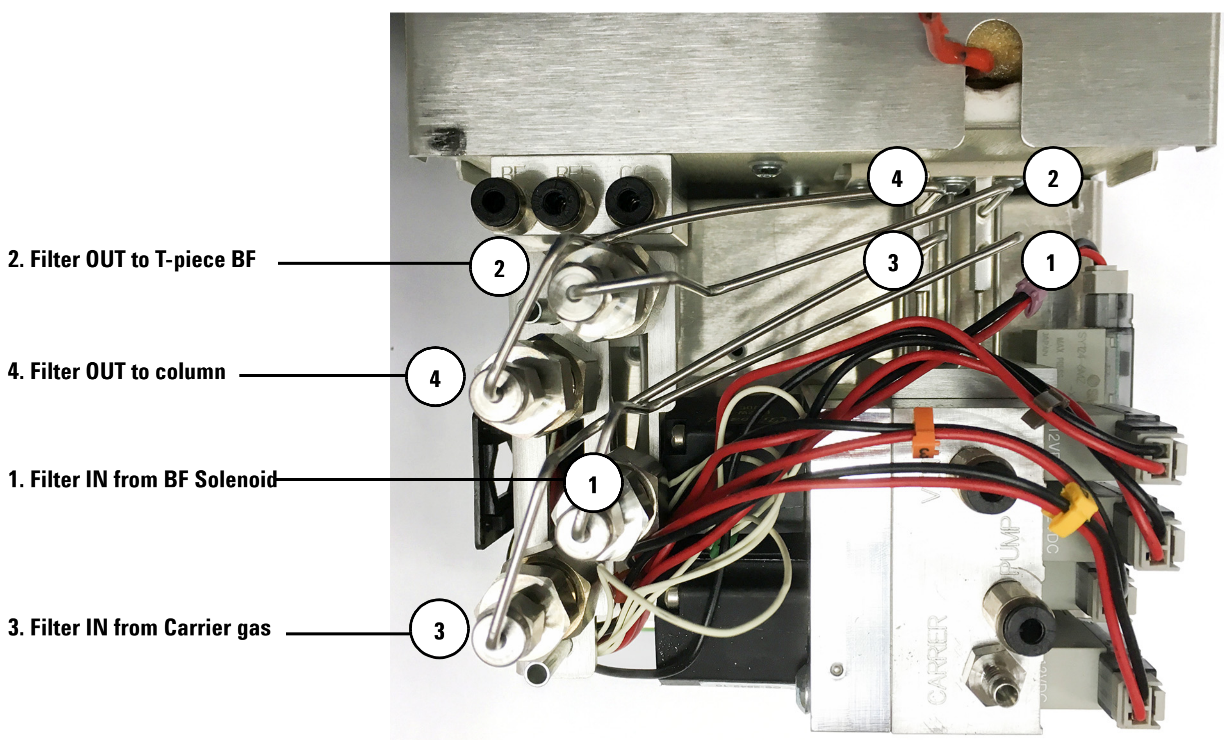


Figure 67 Filter connections on the manifold

1 Remove the SS tubing from the Molsieve filters using two wrenches.

2 Remove the two Torx screws on the bracket.

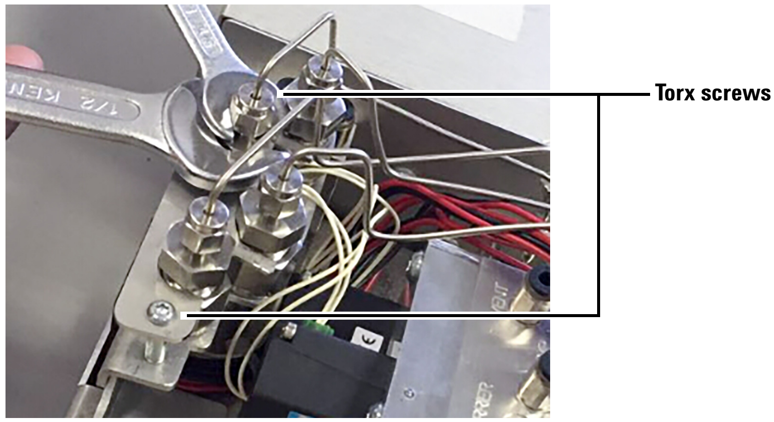


Figure 68 Remove SS tubing and Torx screws on bracket

3 Remove the bracket and then the Molsieve column can be exchanged or conditioned.

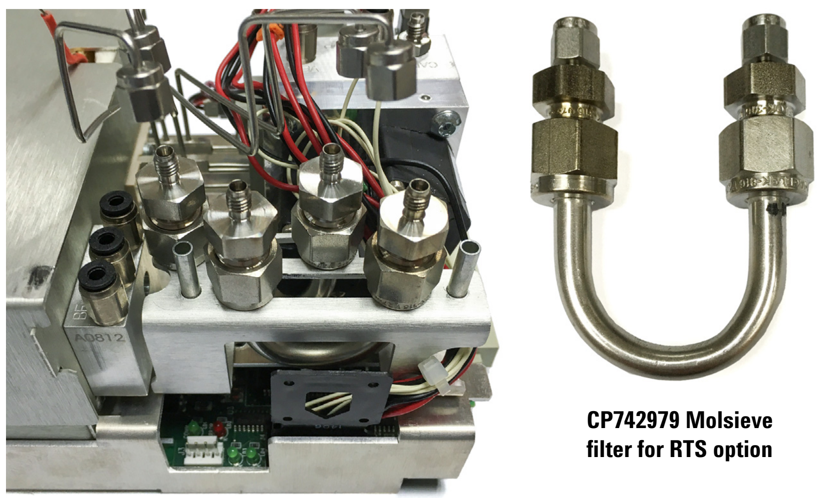


Figure 69 Molsieve filter

Conditioning the Molsieve column can be done by installing it into a GC oven, with Nitrogen flow of 20 mL/min and with an initial oven temperature of 50 °C, ramp with 3 °C/min to 400 °C and leave for two hours, or condition overnight at 300 °C.

Carrier gas Tube Stop Modification Kit

This kit CP740828 contains:

- CP740029 Viton O-rings 2x
- CP740209 Stop carrier tube
- CP740210 Nut for stop carrier tube

Figure 70 Carrier gas tube stop modification kit parts

1 Install the O-rings over the stop and nut.

Figure 71 Installed O-rings

2 Uninstall the GC-channel according to the Channel Exchange replacement procedure on page 91

3 Install the stop and nut on the carrier gas tube.

7
Communications

This chapter describes the input and output ports accessible inside the Micro GC for interfacing with external devices. Also included is an overview of the constant pressure cycle and the ramped (programmed) pressure cycle of the Micro GC.

Access the Connection Ports

1 Open the cover (Figure 72).

Figure 72 Instrument cover

2 At the front of the instrument, the external device connectors are visible (Figure 73).

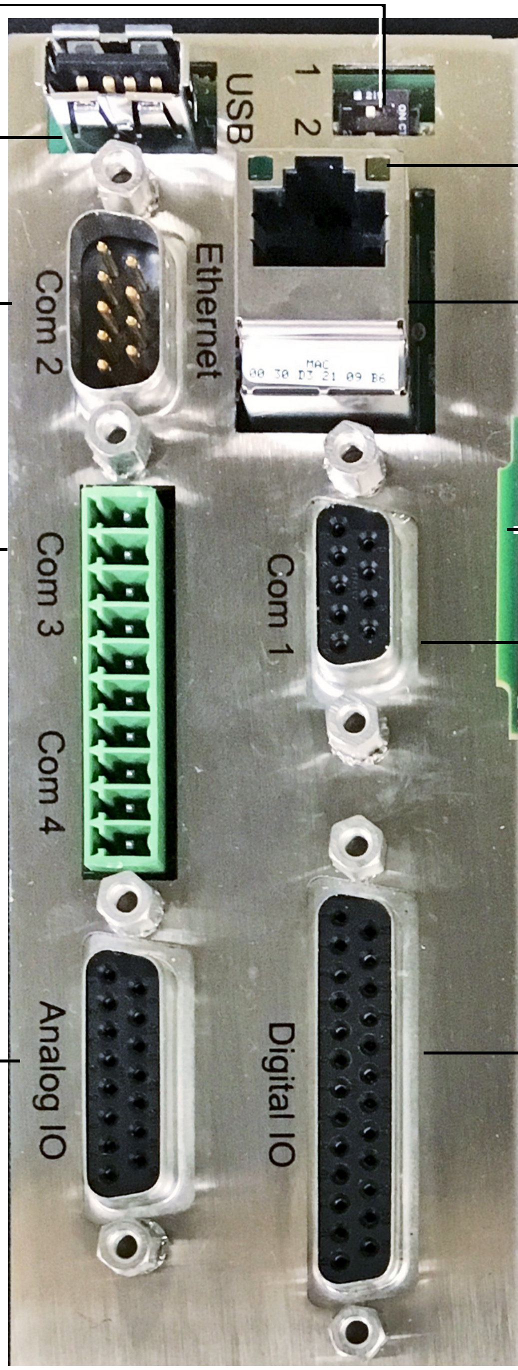
Assign IP address switch
See "Ethernet Networks" on page 111.

USB
communication interface.
See "USB VICI Valve" on page 116 and "USB Wi-Fi" on page 118

COM 2
RS-232 (2-wire) communication interface.
See "490 Chromatography Data Systems" on page 110.

COM 3 and COM 4
RS-485 (4-wire) communication interface.
See Table 1 on page 20.

Analog I/O
External analog I/O signals.
See "External Analog I/O" on page 124.



LAN indicators
Red LED: Transmit data
Green LED: Receive data

Ethernet (LAN) connector
Ethernet RJ45 connector.
See "Ethernet Networks" on page 111.

SD Card Slot
No function supported.

COM 1
RS-232 communication interface

Digital I/O
Digital input and output signals, such as start_stop, ready_out, and start_in.
See "External Digital I/O" on page 123.

Figure 73 External device connectors (mainboard G3581-65000 shown)

3 Close the cover after connecting the cables.

490 Chromatography Data Systems

The 490 Micro GC requires an Agilent chromatography data system (CDS) for control, peak identification, integration, data analysis, reporting, and so forth. See Table 21. The CDS requires a LAN (Ethernet) connection or USB Wi-Fi adapter. Multiple Micro GCs can be controlled using an Agilent data system such as EZChrom, OpenLAB EZChrom Edition, or OpenLAB Chemstation Edition. The maximum number of Micro GCs controlled is limited by your software license. For detailed information on setting method parameters, see the help files in the data system.

Table 21 Chromatography data system control for the Micro GC

	OpenLAB CDS EZChrom Edition	OpenLAB CDS Chemstation Edition
Communication	Ethernet, USB via Wi-Fi adapter	Ethernet, USB via Wi-Fi adapter
IP Setting via	BootP	BootP
COM 1	Not available	Not available
COM 2	For Valco stream selector valve (maximum 3)	For Valco stream selector valve (maximum 3)
COM 3	Not available	Not available
COM 4	Not available	Not available
Analog I/O	Status only	Status only
Digital I/O		
External start in:	Yes	Yes
External ready in:	Yes	Yes
External start out:	Yes	Yes
External ready out:	Yes	Yes
Relay Control		
Timed Relay:	Yes	Yes
Alarm Relay:	Yes	Yes
Solenoids:	Yes	Yes
USB	For Wi-Fi and Vici Valve connection	For Wi-Fi and Vici Valve connection

See “External Digital I/O” on page 123.

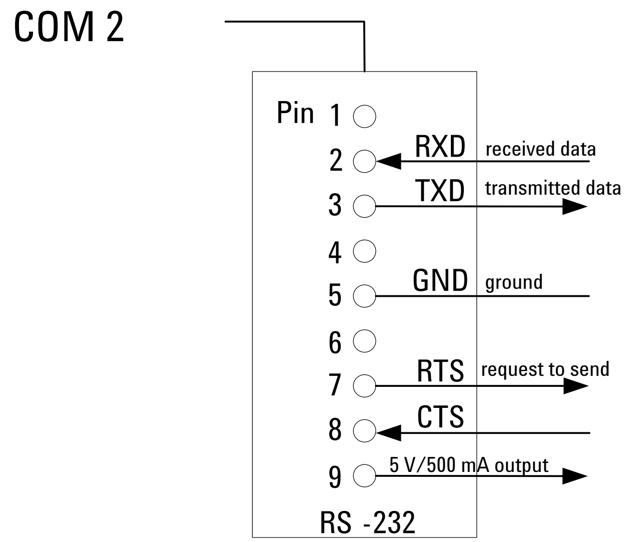


Figure 74 Communication ports

NOTE COM 1 (standard RS232) and COM 2 (special RS232) not pin compatible.

Ethernet Networks

About the internet protocol:

- Developed to allow cooperating computers to share resources across a network.
- TCP and IP are the two best-known protocols in the Internet Protocol Suite.
- Other protocols/services are FTP, Remote Login (Telnet), Mail, and SMTP.

The Agilent data systems require an Ethernet network for data communications with the Micro GC. This network can be a local area network (LAN) or wide area network (WAN).

General requirements:

- Micro GC with main board G3581-65000 installed (100 Mbps connection)
  - Cat 6, Cat5e, or Cat 5 UTP/STP cabling.
  - The network should comply with Standard Ethernet (IEEE 802.3).

- The network must be 100BASE-T, 10/100BASE-TX, or 10/100/100BASE compatible hubs or switches.
- TCP/IP should be used on the network.

The Micro GC ships with an Ethernet crossover cable (RJ-45 connector, 2.8 meter) for direct connection between the Micro GC and a PC with a chromatography data system (CDS).

IP Addresses

- An IP address uniquely identifies a computer or device on the network or internet.
- IP addresses are made up of four 8-bit numbers, and each of these numbers is separated by a decimal point.
- Each of the 8-bit numbers can represent a decimal value of 0-255.
- Each part of an IP address can only be in that range (for example, 198.12.253.98).

A network can be *public* (addressable from the internet) or *private* (not addressable from the internet). A private network can also be *isolated*, that is, physically not connected to the internet or other networks. In many cases, you can set up an isolated LAN for instruments. For example, an isolated, private LAN may consist of a workstation computer, four Micro GCs, a printer, a LAN switch, and cabling. Isolated LANs must use IP addresses in the "private" ranges shown in Table 22.

Table 22 Private (isolated) LAN IP address ranges

Starting IP	Ending IP	Subnet mask	Type
0.0.0.0	255.255.255.255	N/A	Public
10.0.0.0	10.255.255.255	255.0.0.0	Private
172.16.0.0	172.31.255.255	255.255.0.0	Private
192.168.0.0	192.168.255.255	255.255.0.0	Private

Example network configurations

Peer-to-peer

A peer-to-peer network (See Figure 75) is required to assign or change the IP address of a Micro GC. It can also be used when no network is required or available. The cable(s) used for peer-to-peer connections depend on the installed main board.

- For a Micro GC with main board G3581-6500 installed, either a crossover cable (CP740292) or a regular (non-crossed) patch cable can be used.

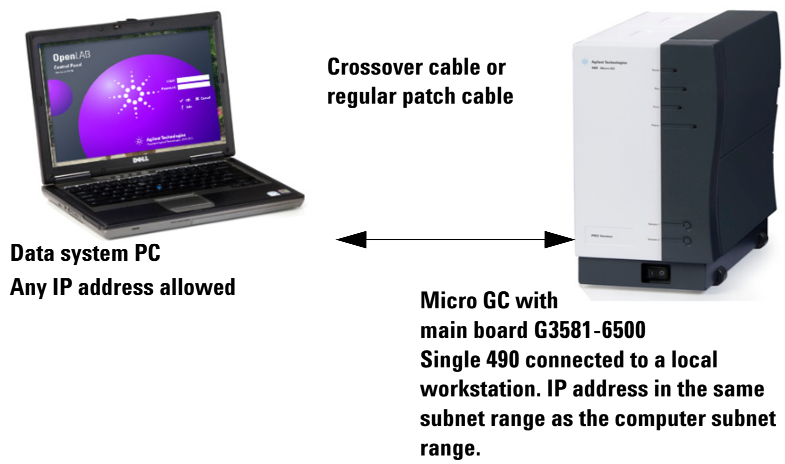


Figure 75 Peer-to-peer (single instrument)

Peer-to-peer communication requires IP addresses in the same subnet range for the computer and the Micro GC.

After assigning or changing the IP address of a Micro GC, you can remove the connection cable and connect the computer and Micro GC to a local network using normal cabling.

See “Inside View” on page 19.

Local Area Network (LAN)

An example of a LAN configuration is shown in Figure 76.

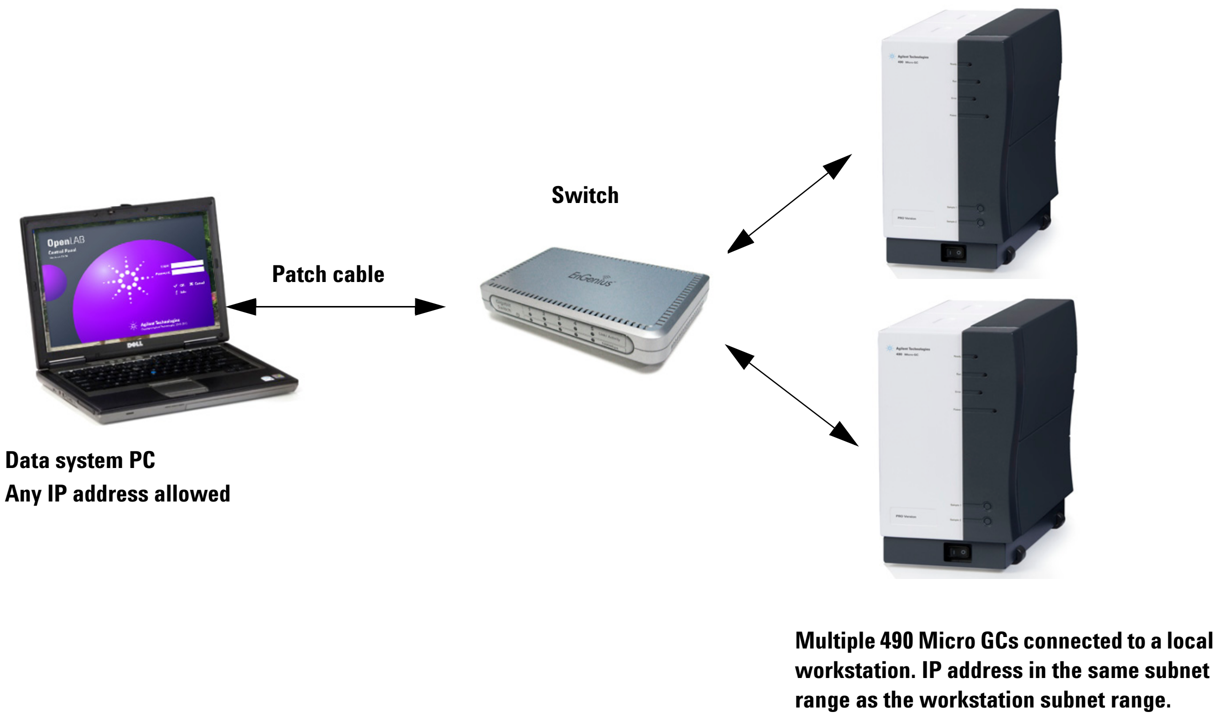


Figure 76 Local network (multiple instruments)

OpenLAB CDS maximum connections are limited by the computer speed, license, and network performance.

Global network (WAN)

An example of a Global network is shown in Figure 77.

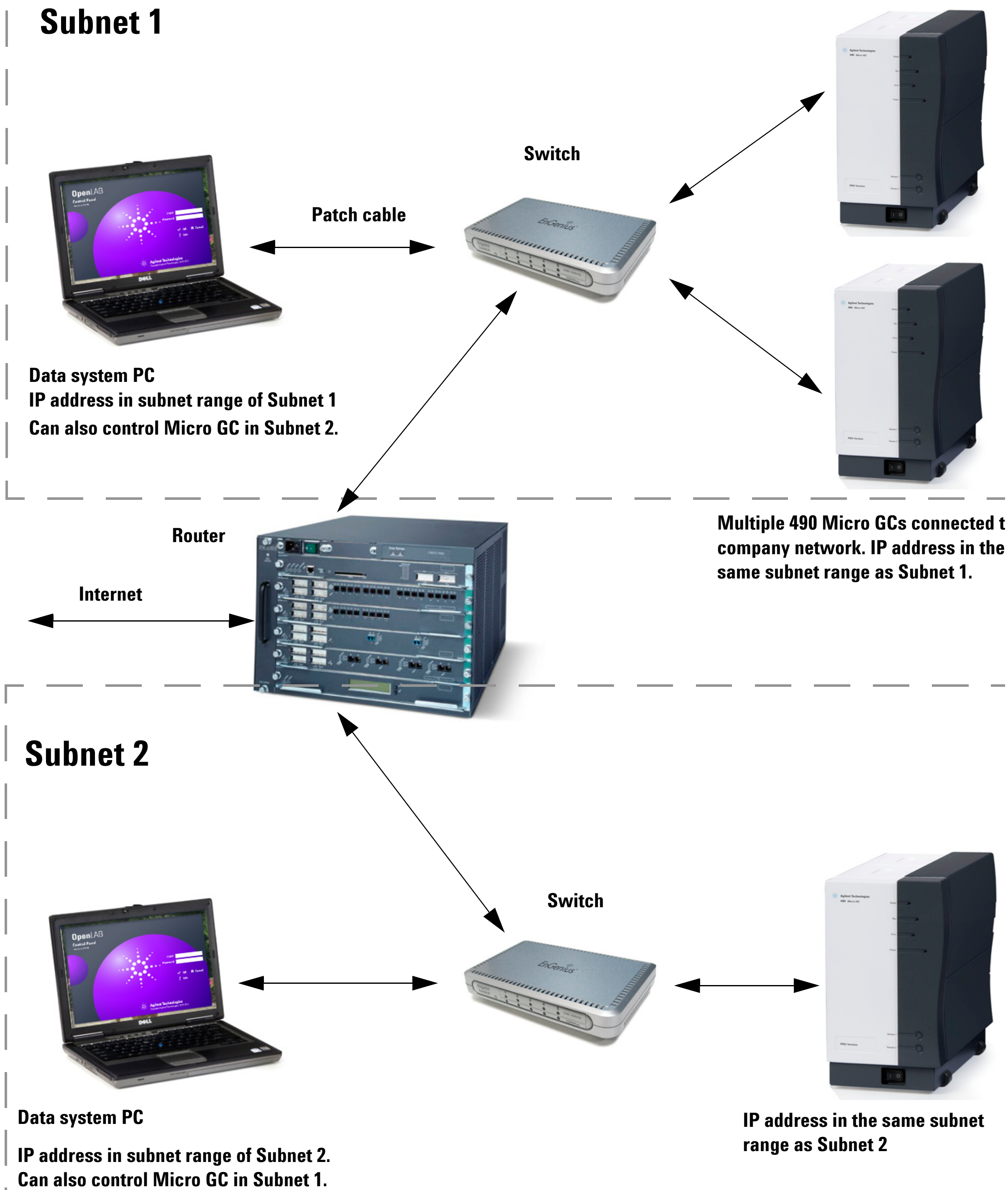


Figure 77 Global network with multiple instruments

USB VICI Valve

The 490 Micro GC with main board G3581-65000 includes a USB port. USB VICI Valve has the following characteristics:

- Requires a USB-to-Serial Convertor
- OpenLab Ezchrom: Supports 1–3 VICI Valves
- Supports hotpluging

Configure Multiple VICI Valves with OpenLab EZchrom

NOTE Before launching OpenLab EZChrom, make sure you have installed the latest version of the 490 Micro GC driver. The GC license can be PRO or Non-PRO, however, if the USB VICI was configured in PROstation, this can cause a conflict

1 Open the VICI Valve configurator. Configure the IDs of two VICI Valves to '1' and '2' separately. The OpenLab driver requires VICI IDs be set to 1, 2 and 3 separately

.

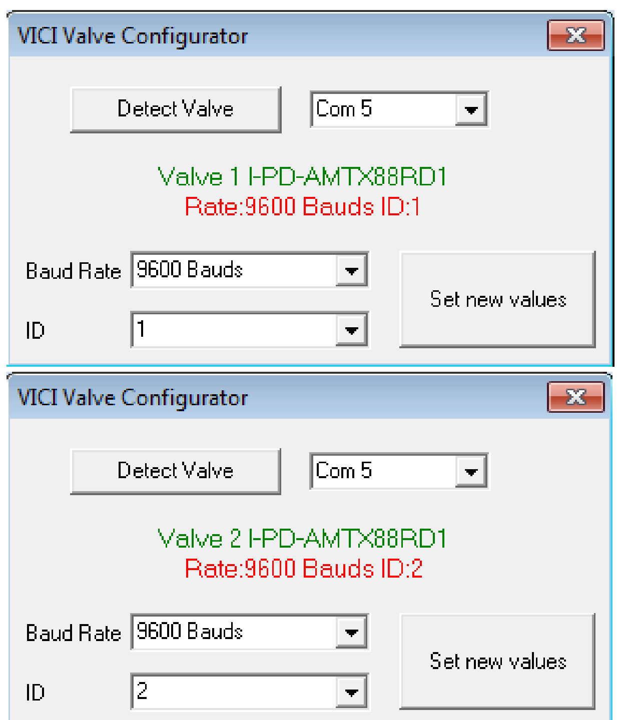


Figure 78 VICI Valve ID values

2 Configure the micro GC with OL EZChrom as follows: The 'VICI USB' is selected as the auto sampler. Select **Check VICI communication** to check connection. If the IDs are set correctly the check will pass.

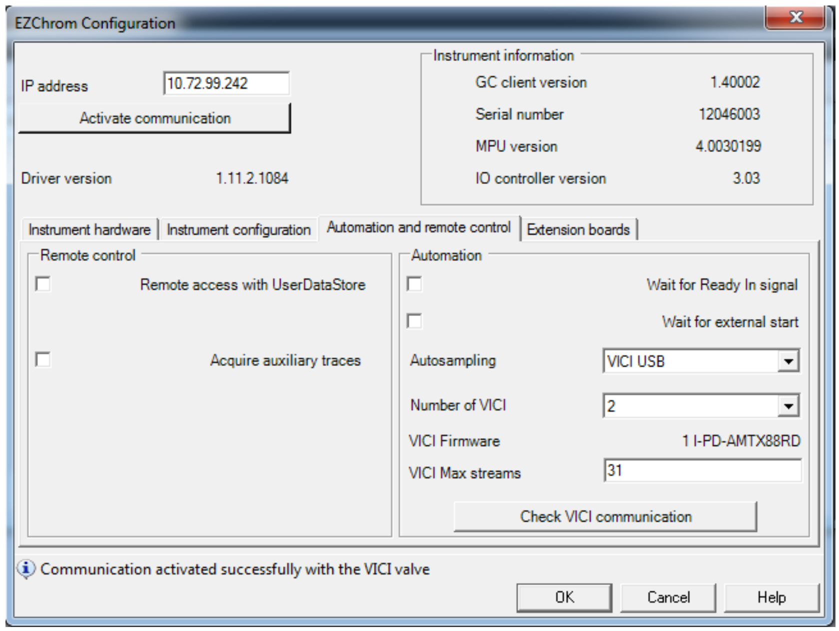


Figure 79 Check VICI communication

3 Other than configuration, there is no difference between using USB VICIs and Serial VICIs in OpenLab EZChrom.

USB Wi-Fi

The 490 Micro GC with main board G3581-65000 includes a USB port. USB Wi-Fi has the following functions:

- Supports 1 USB Network Interface Card (NIC)
- Supports NIC running in AP mode (ad-hoc mode)
- Supports configuration via GC web page.
- Supports hotpluging

Preparation: One USB Network Interface Card (NIC) (Requires Realteck RTL8188 family chipset.)

1 Insert the USB NIC into USB port of 490 Micro GC or via a USB hub.
2 On your PC desktop, open the wireless connection panel. Find the WIFI hotspot named AP-490. Note the name 'AP-490' is the default SSID name of USB NIC attached to micro GC. You are able to change this name via GC web page later.
3 Connect to the AP-490 hotspot. You will be prompted to input the WPA passphrase. The default passphrase is 12345678. You are able to change it in web page.
4 The wireless IP address of Micro GC is fixed to 192.168.0.2 (Submask 255.255.255.0). Then please make sure the wireless settings of your PC is in the same network range. You are free to set your local PC wireless IP from 192.168.0.3 to 192.168.0.255.

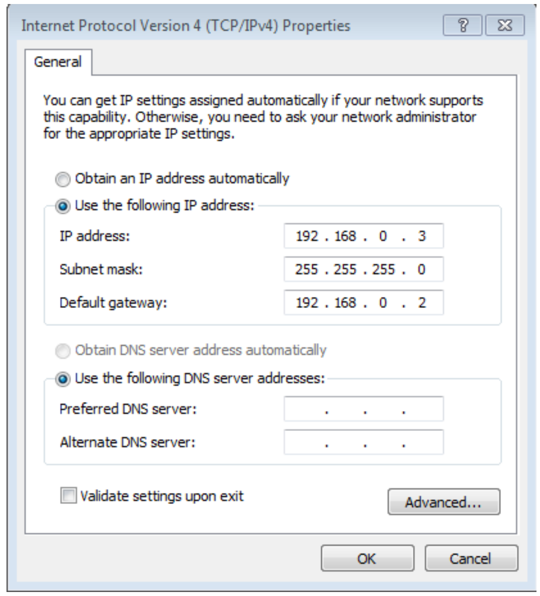


Figure 80 IP properties

5 Now it is able to access to GC's webpage via IP address 192.168.0.2.

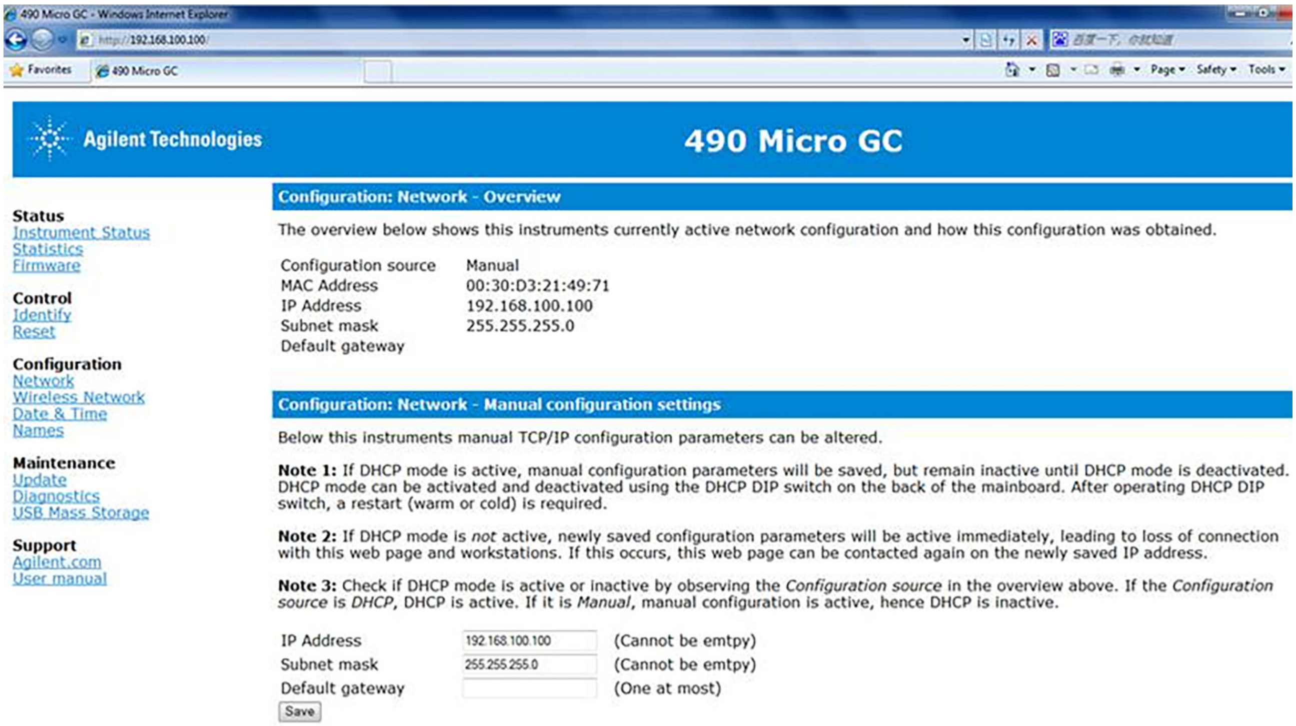


Figure 81 GC Webpage

NOTE USB Storage is currently not enabled except in PROstation

Frequently Asked Questions (FAQ)

Q: Can I connect the Micro GC to my site network?

A: Yes, if the network is standard Ethernet and uses TCP/IP with UTP cabling.

Q: I'm using a DHCP server; can I use this to assign an IP address to the Micro GC?

A: If you have a Micro GC with main board G3581-65000 installed, yes.

Q: How do I assign an IP address to the Micro GC?

A: See “Step 6: Assign IP address” on page 34.

Q: Are the network settings saved if the Micro GC is restarted, or after loss of power?

A: Yes, the network settings of the Micro GC are stored in flash memory, and will not be erased at loss of power.

Q: Can I control my Micro GC from anywhere in the world via the Internet?

A: Yes, if your network is designed for this, and has internet access or remote access facilities (the ports 4900, 4901 and 4902 must be open).

Glossary of network terms

Crossover cable A cable used to connect two, and **only two**, Ethernet devices directly without the use of a hub or switch.

Domain One of several settings within the TCP/IP configuration that identifies paths used to communicate with Ethernet devices. The Domain is an IP address.

Ethernet address (MAC address) This is a unique identifier that every Ethernet communication device has assigned to it. Typically, the Ethernet address cannot be changed and is the permanent way of identifying a particular hardware device. The Ethernet address consists of 6 pairs of hexadecimal digits.

Gateway This is one of several settings within the TCP/IP configuration that identifies paths used to connect with Ethernet devices on a different subnet. The Gateway is assigned an IP Address.

Host name The host name is an alternate way of identifying a device that is friendlier to people. Frequently the host name and the IP address may be used interchangeable.

IP address This is a unique number for each Ethernet device within the set of connected devices. Two PCs may have identical IP addresses so long as they are not interconnected to each other through the Internet. The IP Address consists of a series of four sets of decimal numbers (between 1 and 255) that provide routing information used by the TCP/IP protocol to establish a reliable connection. Without the IP Address, communications would be bogged down trying to establish connections to Ethernet addresses at unknown locations.

Patch cable A cable that is used to connect Ethernet devices to hubs, switches, or your company network.

Protocol A set of rules that govern how computers send and receive information.

RJ45 connector A telephone jack style connector used for a Universal Twisted Pair (UTP) hardware connection for 10/100Base-T Ethernet connections. RJ45-style connectors are used by the Micro GC.

TCP/IP An international standard protocol used by the Internet. We use this protocol for communication to the Micro GC. You may find several network protocols, such as IPX/SPX and NetBEUI, installed on your computer.

External Digital I/O

Connections between Micro GCs and external devices are made with the appropriate cable to the External Digital I/O port.

Ready/Not Ready signal

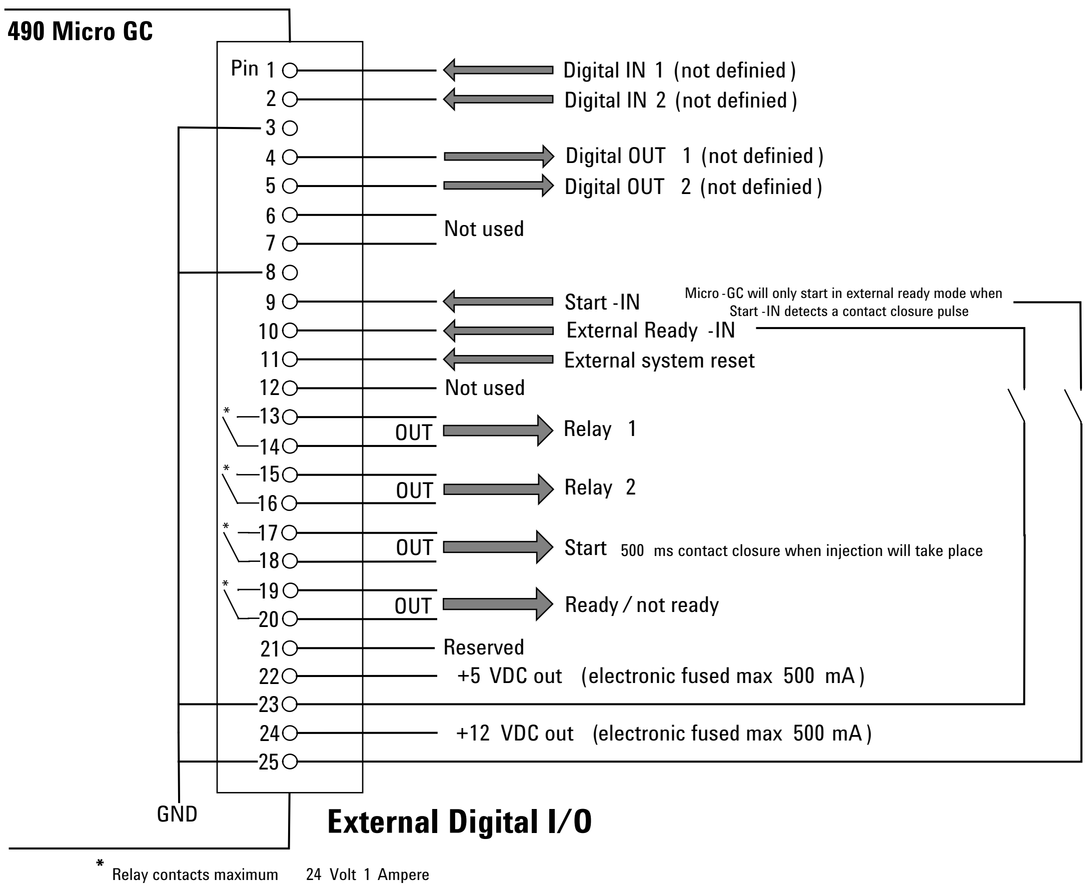


Figure 82 External digital connections

External Analog I/O

The external analog I/O port can handle six (6) analog inputs (input 0 to 10 Volt).

The user interface receives this analog information and translates it into actions to be taken by the local user interface, events, or data to be shown or stored in the remote user interface. In OpenLAB EZChrom and OpenLAB ChemStation only status is visible.

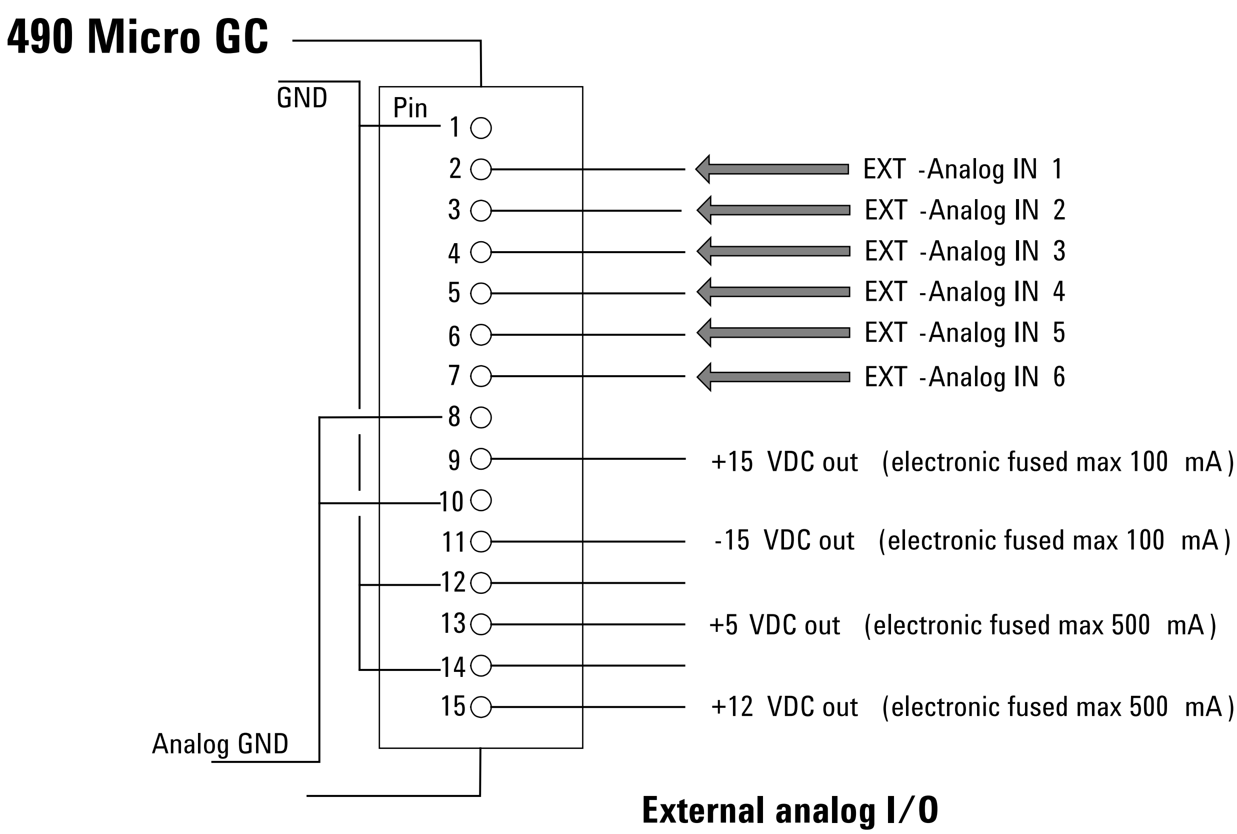


Figure 83 External analog connections

8
Errors

Error Handling

During operation a series of events and error messages are generated indicating start or finishing of certain actions and procedures as well as smaller and fatal errors somewhere in the instrument. This section describes how the Micro GC reacts to these events or messages.

The following error classes as well as the subsequent actions are available:

Class 0 *Internal event.* These are events indicating a certain procedure has started or finished. In no way do they influence the proper functioning of the instrument.

Class 1 *Advisory fault*; the instrument continues. These are the less critical advisory errors not requiring immediate action by the user. The ongoing run may be minimally effected by it and thus need not be stopped. Class 1 error messages indicate certain malfunctions of the instrument. Some errors of this type keep the instrument from becoming ready.

Class 2 *Critical errors* for logging; error LED ON. These are critical errors for which the user needs immediate warning (a popup or warning may appear in the data system and the Error LED lights). The run in progress is stopped since its results will definitely be wrong. Corrective action by the user or instrument service may be required.

Class 3 *Fatal errors* for logging; instrument shutdown, error LED and buzzer ON. These are fatal errors for which the user needs immediate warning. The Error LED lights. An instrument shutdown occurs. Corrective action by the user or service is required.

All errors, regardless of class, are available to the data system under instrument status (for troubleshooting). All Class 1 and higher errors are also logged in the instrument’s flash memory.

Individual numbers identify all errors; these numbers are built using the error class and a number. Events are not numbered.

Error List

The General Error State as stored in UserDataStore (only valid for EZChrom 3.3.2) address 1219 is composed of the following items.

The error must be handled as CLNNN in which:

C = error class (severity)
L = location
NNN = error number or event number.

The Error class can be one of the following values:

- 0=diagnostic error.
- 1=advisory error.
- 2=critical error.
- 3=fatal error.

There are five locations:

- 0=main board.
- 1=channel 1.
- 2=channel 2.
- 3=channel 3.
- 4=channel 4.

Table 17 lists the possible errors.

Table 23 Error list

Error number	Error class	Event/error code	Description	Action needed
1	0	Init passed (event)	End of initialization phase	
2	0	Pressure restored	Pressure restored after Too Low Pressure	
3	0	Start flush cycle	Is a part of the initialization cycle	
4	0	Flush cycle passed	Is a part of the initialization cycle	
5	0	TCD calibrating	Automatic generation after method activation or download.	TCD off and temp. control to default
6	1	Too low pressure	Pressure drops below 35 kPa	Check gas supply
7	1	Pressure fault	Pressure state not ready after 5 minutes	Check gas supply or replace manifold

Table 23 Error list (continued)

Error number	Error class	Event/error code	Description	Action needed
8	1	Low battery 1	Battery 1 low power (portable Micro GC only)	Recharge battery
9	1	Low battery 2	Battery 2 low power (portable Micro GC only)	Recharge battery
10	2	Sample line sensor fault	Sample line temperature sensor error	Heater turned off
11	2	Sample line temperature fault	Temperature not reached within 35 min (heater error)	Replace sample line heater
12	2	Injector temperature fault	Temperature not reached within 35 min (heater error)	Replace module
13	2	Column temperature fault	Temperature not reached within 35 min (heater error)	Replace module
14	1	TCD Temperature limit activated	Hardware protection activated	
15	0	EDS logging error	Unable to update EDS log	Call service
16	1	Low power supply	Voltage < 10 Volt	Recharge battery
17	2	Injector sensor fault	Injector temperature sensor error	Replace module
18	2	Column temperature sensor fault	Column temperature sensor error	Replace module
19	2	TCD control error	TCD voltage not or incorrectly set	Call service
20	2	TCD calibration failed	Any error during TCD calibration	Replace module or TCD controller board
21	2	Hardware reset	Instrument reset request from WS	
22	2	Pressure too high	Pressure > 450 kPa for at least 2 minutes	Replace manifold
23	3	Initialization error	During initialize	Call service
24	3	Internal communication error	During/after initialization, between MPU and IOC/IOE	Call service
25	3	Instrument EDS incorrect	Instrument Electronic Data sheet incorrect	Call service
26	3	EDS incorrect	Electronic Data sheet incorrect	Call service
27	3	Internal power failure	During/after initialization, internal supplies	Call service
28	0	Flush cycle aborted	Flush cycle stopped before completion	
29	0	GC module changed	Changing a channel (controller or module) and restarting the instrument	
30	0	TCD Gain calibrated	End TCD Gain calibration	
31	0	TCD Offset calibrated	End of Offset calibration	

Table 23 Error list (continued)

Error number	Error class	Event/error code	Description	Action needed
32	0	Null String	Not used	
33	0	ADC reading out of range	Analog Digital Control out of range	
34	0	EDS Analytical Module incorrect	Electronic Data Sheet Analytical Module incorrect	
35	0	EDS Config checksum incorrect	Electronic Data Sheet Configuration checksum incorrect	
36	0	EDS Logbook checksum incorrect	Electronic Data Sheet Logbook checksum incorrect	
37	0	EDS Protected checksum incorrect	Electronic Data Sheet Protected checksum incorrect.	
38	0	EDS C.C. Config checksum incorrect	Electronic Data Sheet Channel Control checksum incorrect.	
39	0	EDS C.C. Logbook checksum incorrect	Electronic Data Sheet Channel Control Logbook checksum incorrect	
40	0	EDS C.C. Protected checksum incorrect	Electronic Data Sheet Channel Control Protected checksum incorrect	
41	0	EDS A.M. Config. checksum incorrect	Electronic Data Sheet Analytical Module Configuration checksum incorrect	
42	0	EDS A.M. Logbook checksum incorrect	Electronic Data Sheet Analytical Module Logbook checksum incorrect	
43	0	EDS A.M. Protected checksum incorrect	Electronic Data Sheet Analytical Module Protected checksum incorrect	
44	0	EDS Config SVER incorrect	Electronic Data Sheet Configuration Structure Version incorrect	
45	0	EDS Protected SVER incorrect	Electronic Data Sheet Protected Structure Version incorrect	
46	0	EDS C.C. Config SVER incorrect	Electronic Data Sheet Channel Control Structure Version incorrect	
47	0	EDS C.C. Protected SVER incorrect	Electronic Data Sheet Channel Control Protected Structure Version incorrect	
48	0	EDS A.M. Config SVER incorrect	Electronic Data Sheet Analytical Module Configuration incorrect	
49	0	EDS A.M. Protected SVER incorrect	Electronic Data Sheet Analytical Module Protected Structure Version incorrect	
50	0	Pressure Offset calibration complete	Notification Pressure Offset calibration is completed	

Table 23 Error list (continued)

Error number	Error class	Event/error code	Description	Action needed
51	0	Pressure Offset calibration Failed	Calibration offset out of range	
52	0	Unable to store pressure offset	Pressure off set is out of valid range	
53	2	Temperature sensor disconnected	Temperature sensor not connect to instrument	Call Service
54	1	Not ready to start run	Issued by Safety Control Object in Hardware domain. Bridge Call to GC domain (Reporting Not Ready To Start Run Error)	Check method
54	1	Stream selection failed	Stream selector (VICI) failed switching	Check valve
55	1	Ambient pressure or temperature alarm	Issued by Safety Control Object in Hardware domain whenever ambient temperature has passed a certain value.	
56	1	Column cleaning	Instrument in column cleaning state	NA
57	1	Equilibrating temperature zones	Instrument stabilizing after column cleaning	Wait until Ready
76	3	IOC Communication error	MPU is not able to communicate with IOC	Call service
77	3	Read main board EDS error	Not able to read Main board EDS	Call service
78	3	Read channel controller EDS error	Unable to read EDS controller	Call service
79	3	Read channel analytical module EDS error	Not able to read analytical module EDS	Call service
990	3	Watchdog Error: Store Application report on flash error	Internal Software Error, can't store application report on flash memory.	Auto reboot
991	3	Watchdog Error: Store ErrorLog report on flash error	Internal Software Error, can't store ErrorLog report on flash memory.	Auto reboot
992	3	Watchdog Error: Instrument frozen (hazardous error)	Internal Software Error, software hanging	Auto reboot
993	3	Watchdog Error: OOA Timer error	Internal Software Error, OOA Timer could not be created.	Auto reboot
994	3	Watchdog Error: ACE reactor stopped	Internal Software Error, ACE reactor stopped.	Auto reboot
995	3	Watchdog Error: Event pump stopped for 20 s	Internal Software Error, Event pump stopped.	Auto reboot
996	3	Watchdog Error: IOC Fatal error 0	Internal Software Error, IOC fatal error 0	Auto reboot

Table 23 Error list (continued)

Error number	Error class	Event/error code	Description	Action needed
997	3	Watchdog Error: IOC Fatal error 1	Internal Software Error, IOC fatal error 1	Auto reboot
998	3	Watchdog Error: IOC Fatal error 2	Internal Software Error, IOC fatal error 2	Auto reboot
999	3	Watchdog Error: IOC Fatal error 3	Internal Software Error, IOC fatal error 3	Auto reboot

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