

GC Tips and Tricks

Your guide to integrated, intuitive GC intelligence





What Pressing Challenges Do Lab Managers Face Today?

Recently, Agilent commissioned an independent global survey of lab managers from different market segments. Our goals were to better understand their pain points and learn how to address the most urgent challenges faced by labs today.

For a summary of the results, download **our infographic**.



Spend More Time on What Matters

Instruments in the Agilent GC portfolio aren't just smart, they're insightful. They go beyond collecting system information to helping you increase productivity, minimize downtime, and improve efficiency. And, that means you can keep your lab moving toward a successful future.

Smart diagnostics

Real-time feedback and a unique smart-key flow path reduce downtime.

Configuration capabilities

Address a broad range of routine analysis with options for inlets, detectors, and valves.

Reliable robust performance

Temperature and pressure compensation ensure more stable chromatographic performance.

Optional electronic pneumatic regulation (EPR) delivers easy, precise manual operation with digital display.

Intuitive interface

Gain real-time access to instrument status, data monitoring, and maintenance guidance.

Remote monitoring

Unparalleled diagnostics, real-time feedback, and a unique smart-key flow path reduce downtime.

Flexible software

Maintain full control of your analysis with Agilent OpenLab and MassHunter.



How Do I Use This Resource?

Streamline your GC analyses and educate your staff

In this ebook, you'll find ways to take your GC lab to the next level—and address your analytical and workflow challenges. To instantly access literature, webinars, videos, and more, simply choose one of these topics or use the navigation bar at the bottom of the page.



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How Does GC Work?

Review the basics of gas chromatography and learn about the industries where GC is applied. Use these “Chromatography 101” resources to:

- Explore GC principles and hardware, and learn how the techniques are used.
- Discover the most common ways of getting samples into the GC.
- Learn how GC columns separate samples into components.
- Take the mystery out of choosing the right GC detector.
- Understand how to identify peaks and determine the amounts of each component.

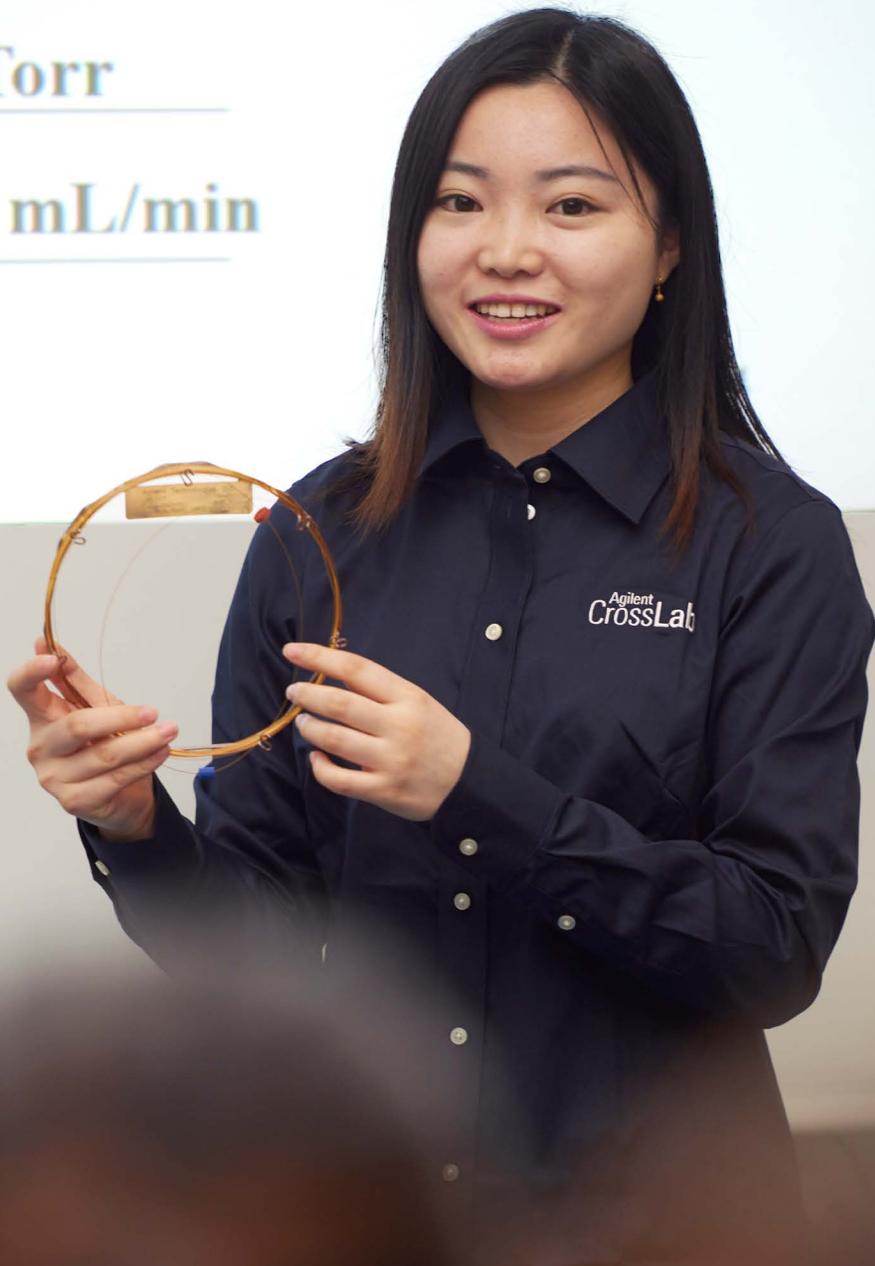
Resources

-  [Fundamentals of Gas Chromatography ebook](#)
-  [Fundamentals of Gas Chromatography: 4-part video series](#)
-  [Fundamentals of Gas Chromatography video](#)
-  [GC Column Selector Tool](#)
-  [Best Selling GC Supplies](#)
-  [What Is Gas Chromatography?](#)

GC

60 Torr

15 mL/min



Free GC Training Courses

Looking for a brief refresher or overview?

Create a free Agilent University account and get immediate access to these GC courses and tutorials.

- 🌐 GC-0GEN-2001z: Tips on Making Your GC System and Analysis More Robust
- 🌐 GC-0GEN-2040zs: GC Troubleshooting Series
- 🌐 GC-0GEN-1040z: Practical Steps in GC Troubleshooting
- 🌐 GC-7890-2231z: How to Replace the GC Split/Splitless Inlet Liner, Septum, and O-Ring
- 🌐 GC-7890-2233z: How to Perform a GC Inlet Leak Check
- 🌐 GC-MULTI-1240zs: Making Productivity Happen—an Agilent GC eLearning Series
- 🌐 Agilent University Training Course Full Catalog



Sample Preparation

Did you know that unexpected instrument downtime and time spent on rerun often result from errors made during sample preparation?

The following resources will help you realize outstanding analytical performance based on a foundation of consistent, precise sample preparation. You'll learn how to:

- Boost your knowledge of sample preparation techniques and choose the right technique for your application.
- Enhance your productivity by effectively operating and maintaining sample preparation instruments.
- Simplify your sample preparation methods and increase lab productivity.

Resources

[🌐 Agilent University Learning Path](#)

[🌐 GC Sample Preparation and Introduction](#)



Applications and Industries

From quality control, to research, to testing for environmental and food contaminants, GC is a widely used technique across most industries.

For example:

- The renewable energy sector relies on GC to analyze impurities in hydrogen, biofuels, and energy storage devices.
- In pharmaceutical labs, GC is increasingly being used for residual solvent analysis.
- GC is indispensable to the food industry, where it is used for quality control and detecting adulteration.
- Forensic labs use GC for purposes as varied as finding drug compounds in urine to detecting traces of flammable chemicals in items from possible arson sites.



To take a closer look at GC applications for specific industries, use these links.

- 🌐 [Alternative energy testing](#)
 - [Hydrogen analysis](#)
 - [Biofuel analysis](#)
 - [Energy storage—batteries](#)
- 🌐 [Food and beverage testing](#)
- 🌐 [Environmental testing](#)
- 🌐 [Energy and chemicals](#)
- 🌐 [Specialty chemicals testing](#)
- 🌐 [Materials testing and research](#)
- 🌐 [Pharma testing](#)
- 🌐 [Forensics testing](#)
- 🌐 [Cannabis testing*](#)
- 🌐 [Academia](#)

**Agilent products and solutions are intended to be used for cannabis quality control and safety testing in laboratories where such use is permitted under state/country law.*



Smart GC Portfolio Overview

Optimize your workflow with industry-leading GC and GC/MS instruments, consumables, software, and more.

GC

Agilent GC systems deliver excellent reliability and analytical performance, with intelligent technologies that help you avoid problems before they affect your bottom line.

GC/MS

Achieve sensitive, robust, and reliable GC/MS analysis of any sample in a routine setting.

GC columns and supplies

Agilent GC consumables provide the reliability your lab needs, while improving scientific outcomes with innovative functionality.

GC detectors

Selective detectors for advanced GC analysis dramatically improve your ability to measure analytes of interest.

Sample preparation and introduction

Increase the efficiency, performance, and flexibility of your GC systems and automate tedious sample preparation procedures.

GC technologies

Learn about advances like Agilent Capillary Flow Technology, specialty inlets, and LTM Series II Rapid Heating/Cooling for 7890 and 8890 GCs.

Software

Agilent OpenLab CDS for GC: Capture, analyze, and share results anytime, anywhere—and transform your lab into a secure hub that feeds valuable insights to your organization.

Agilent MassHunter software suite for GC/MS: Move from analysis to insight with software that integrates seamlessly across all platforms and techniques.

Financial solutions

Agilent Financial Solutions helps you acquire the latest innovations through flexible installment plans—without a large down payment.

Agilent University

Agilent University offers flexible, cost-effective training options to help your lab manage resources, boost efficiency, and minimize downtime.

CrossLab services

Agilent CrossLab services can help your lab extend uptime, produce reliable data, stay compliant, and have predictable service costs.



GC Calculators and Method Translation Software

Need to optimize your GC method parameters?

Agilent has you covered with these free tools that you can download and use right now. They also are integrated into Agilent OpenLab CDS.

- **Vapor volume calculator.** Prevent overloading and backflash by determining the expansion volume of a GC solvent at a given inlet temperature and pressure for a specific liner.
- **Pressure flow calculator.** Use column dimensions, oven temperature, and detector outlet pressure to calculate the pressure required to achieve a target flow.
- **Solvent vent calculator.** Determine reasonable starting conditions for your large-volume injection (LVI) method.
- **Method translation software.** Use this tool to export a current GC method to another GC while maintaining relative retention order. You can also use it to speed up a current method—or change detectors, carrier gas, or other parameters that affect retention time.

Resource

[Download tools](#)



Building a Culture of Sustainability

How do Agilent smart GC systems measure up to ACT criteria?

My Green Lab is a nonprofit organization dedicated to improving the sustainability of scientific research. To support this essential effort, Agilent has become a top-level sponsor of My Green Lab. Specifically, we are working with the organization to have selected GC instruments independently audited for their Accountability, Consistency, and Transparency (ACT) label.

The ACT label provides information about the environmental impact of manufacturing, using, and disposing of a product and its packaging, so buyers can make sustainable choices.

Agilent 8890 GC system View ACT labels from all regions



ACT. The Environmental Impact Factor Label	
Agilent 8890 GC System	
Wilmington, Delaware, United States	
Environmental Impact Scale Decreasing Environmental Impact	
1 ————— 10	
Manufacturing	—
Manufacturing Impact Reduction	4.0
Renewable Energy Use	No
Responsible Chemical Management	1.0
Shipping Impact	1.0
Product Content	5.0
Packaging Content	1.0
User Impact	—
Energy Consumption (kWh/day)	9.0
Water Consumption (gallons/day)	N/A
Product Lifetime	1.0
End of Life	—
Packaging	5.7
Product	1.0
Environmental Impact Factor:	30.7
Label Valid Through:	November 2022
act.mygreenlab.org	

Agilent 8860 GC system View ACT labels from all regions



ACT. The Environmental Impact Factor Label	
Agilent 8860 GC System	
Wilmington, Delaware, United States	
Environmental Impact Scale Decreasing Environmental Impact	
1 ————— 10	
Manufacturing	—
Manufacturing Impact Reduction	4.0
Renewable Energy Use	No
Responsible Chemical Management	1.0
Shipping Impact	1.0
Product Content	5.0
Packaging Content	1.0
User Impact	—
Energy Consumption (kWh/day)	10.0
Water Consumption (gallons/day)	N/A
Product Lifetime	1.0
End of Life	—
Packaging	5.4
Product	1.0
Environmental Impact Factor:	31.4
Label Valid Through:	November 2022
act.mygreenlab.org	

Agilent Intuvo 9000 GC system View ACT labels from all regions



ACT. The Environmental Impact Factor Label	
Agilent Intuvo 9000 GC System	
Wilmington, Delaware, United States	
Environmental Impact Scale Decreasing Environmental Impact	
1 ————— 10	
Manufacturing	—
Manufacturing Impact Reduction	4.0
Renewable Energy Use	No
Responsible Chemical Management	1.0
Shipping Impact	1.0
Product Content	5.0
Packaging Content	1.0
User Impact	—
Energy Consumption (kWh/day)	4.9
Water Consumption (gallons/day)	N/A
Product Lifetime	1.0
End of Life	—
Packaging	5.7
Product	1.0
Environmental Impact Factor:	28.6
Label Valid Through:	November 2022
act.mygreenlab.org	

General gas chromatography

What types of compounds can be analyzed by gas chromatography?

Gas chromatography can be used to separate, detect, and measure compounds that can be volatilized while remaining thermally stable. Gases also can be introduced into a GC. The technique is widely used for many applications, including alternative energy, cannabis, chemical, consumer products, environmental, food, forensics, petroleum, and pharmaceutical testing. Gas chromatography helps scientists conduct research, ensure product quality, determine product safety, and more.

Helium is getting more expensive and difficult to find. What options do I have?

There are ways to conserve helium, such as performing a helium audit and using GC tools like Agilent Gas Saver and the optional [helium conservation module](#) for 8890, 8860, and 7890 GCs. You can also consider switching to hydrogen or nitrogen as an alternative. If you change carrier gas, method parameters will have to be adjusted to compensate for the different properties. Learn how to [handle the hassles of the helium shortage](#) and [calculate how much you can save if you choose to conserve helium](#).

What are the advantages of large-volume injection?

Large-volume injection, or LVI, can be used in gas chromatography to improve the detection of trace components in a sample. It can also reduce the amount of sample preparation (pre-concentration) because the analytes of interest are focused in the GC inlet liner. Agilent GC systems can perform LVI using either the programmable temperature vaporizing (PTV) inlet or the [Multimode inlet](#) (MMI). Learn more about LVI in this [tutorial](#).

What is backflush and why should I consider it?

[Backflush](#) reverses the column flow in a GC system after the last compound of interest has been transferred to a primary analytical column (pre-column backflush), transferred to a secondary analytical column (mid-column backflush), or eluted (post-column backflush). This process removes high-boiling components that can increase background, shift retention times, and result in frequent maintenance. Backflush can also reduce cycle time, increase throughput, improve data quality, and extend column life by eliminating the need to remove high boilers with a “bake out” step. Your lab will analyze more samples at lower costs.

Agilent [Capillary Flow Technology](#) modules facilitate fast, flexible implementation of backflush in our [8890](#) and [7890A](#) GC systems. The [Intuvo 9000 GC](#) can be quickly and easily configured for backflush using standard [Flow Chip](#) options. The [990 Micro GC](#) offers channels with integrated backflush capabilities.

What is 2D-GC?

Two-dimensional GC (2D-GC) is a [technique](#) that is useful for analyzing complex samples where there may be co-eluting peaks. Two examples are GC x GC and heart-cutting GC (Deans switch). It is accomplished by adding a second column with a different stationary phase chemistry into the flow path to increase the GC resolving power. Peaks that cannot be fully separated on the first column can be separated on the second column. The ability to resolve overlapping peaks without having to perform a second injection leads to greater accuracy, more complete characterization of your samples, and higher throughput.

Headspace sampling

What types of samples are typically analyzed using headspace with gas chromatography?

Headspace is used to analyze volatile compounds in liquid and solid samples that cannot be injected directly into a gas chromatograph (GC). Examples would be creams and lotions, blood, soil, electronic components, and polymers. Headspace sampling can accommodate virtually any matrix.

How does headspace sampling work?

The sample is placed in a vial leaving sufficient room over the solid or liquid matrix. Next, the vial is sealed and heated, and the low-boiling analytes move into the gas phase above the sample (the headspace) until equilibrium is reached. At this point, they are swept into the GC for analysis.

What are some common applications of headspace GC?

[Blood alcohol determination*](#), [residual solvent analysis in pharmaceutical](#) and [cannabis**](#) products, [flavors in foods and beverages](#), fragrances in cosmetic products, [residual monomers and solvents in polymers](#), [volatile organic compounds in soils and sediments](#), and [extractables and leachables in packaging](#) are just some of the many applications that use headspace GC analysis.

What is multiple headspace extraction (MHE)?

Typical headspace involves a single sampling per vial. However, when interfering matrices are present, or when a calibration standard cannot be made with the same matrix composition, quantitation can be inaccurate. Multiple Headspace Extraction (MHE) involves a series of sampling cycles using the same vial. The sample is pressurized and an aliquot is taken from the headspace and injected into the GC. The vial is vented, re-pressurized, and sampled again. This process is repeated multiple times to obtain final results. With MHE, the total peak area from consecutive headspace injections is calculated and the amount of analyte can be determined by comparison to an external standard.

What is multiple headspace concentration (MHC)?

This technique is the same as MHE but instead of injecting into the GC after every headspace aliquot is taken, the sample is concentrated in the GC inlet using a cryo trap. After the final extraction, the inlet is rapidly heated causing the entire sample to be introduced into the column for analysis.

I'm not getting any peaks when analyzing samples on my headspace sampler. What happened?

Assuming you have confirmed that the GC is working as expected, the first thing you can do is check the vial pressurization gas pressure setting. If it is less than the pressure developed in the vial during equilibration, you actually will be venting your sample. If that is not the problem, you can run a gas supply pressure check, enable dynamic leak checking, confirm that the six-port valve is rotating, check for leaks in the headspace sampler, and look for restrictions that may be blocking the vial pressurization flow path for filling the sample loop. For more details and advice on other issues you may encounter, read our troubleshooting guides for the [8697](#) and [7697A](#) headspace samplers.

**For Forensic Use.*

***Agilent products and solutions are intended to be used for cannabis quality control and safety testing in laboratories where such use is permitted under state/country law.*

GC problem solving

I need to reduce cycle time and increase GC throughput. What options are available for fast GC?

There are several ways to implement fast GC. One is to increase the heating and cool-down rates of your GC system. Agilent offers an oven insert that accomplishes this, but it does prevent the use of the front inlet and detector positions. Another option is the [Low Thermal Mass \(LTM\) Series 2](#) for 8890 and 7890 GC systems. Direct resistive column heating allows rapid temperature programming and fast cool-down for significantly faster analytical cycle times compared to conventional air bath ovens. The [Intuvo 9000 GC system](#) is designed for fast GC and higher throughput with ballistic direct column heating built in. If you are performing gas analysis, consider the [990 Micro GC](#), which can perform analyses in a fraction of the time of benchtop gas chromatographs.

You can also attain faster gas chromatography by switching from helium to hydrogen carrier gas.

A simple, yet often overlooked approach for reducing analysis time is to shorten the column. Many GC methods have excess resolution. Using a column that is half its length results in run times that are twice as fast, with chromatographic resolution reduced only by 1.41 (square root of 2).

Agilent provides a free [method translation software](#) tool that calculates adjustments to head pressures, oven temperature program rates, and relative run times so you can quickly implement new parameters to speed up a current GC method while ensuring that relative retention order is maintained.

To learn more, [watch this webinar](#).

How do I prevent my active compounds from adsorbing to the GC components?

If you are analyzing active compounds, especially at trace levels, you need to ensure that the entire GC flow path is deactivated. Our [Inert Flow Path split/splitless inlet](#) and Ultra Inert consumables ([inlet liners](#), [columns](#), [gold seals](#) and [gold-plated flexible metal ferrules](#)) contribute to an inert flow path that gives improved performance for sensitive analytes at very low concentration levels, extending the range and confidence of quantification and detection.

Why am I getting extraneous peaks in my gas chromatogram?

Extraneous peaks can be caused by several things, such as impurities in your carrier gas supply or sample solvent, dirty delivery tubing, contaminants in the syringe or inlet components, or carryover from a previous injection. Be sure you are using high-purity solvents and gases, as well as [inert liners](#) and clean septa. Always use a [filter](#) in your gas line before the GC and be sure to [change it when needed](#). You can consider using [backflush](#) to eliminate carryover. If you are using an autosampler, use sufficient solvent washes to avoid cross-contamination from sample to sample.

GC problem solving (continued)

Why won't my FID ignite?

Some common causes of ignition issues in a GC flame ionization detector are:

- The Lit Offset or detector temperature settings are not correct
- The gas flows are not set properly, or the quality of the gas is poor
- There is a hardware issue, such as a malfunctioning ignitor or plugged jet
- There is a leak
- The collector is not grounded
- Column flow is too high

Read our [troubleshooting article](#) that addresses these issues.

I suspect a leak in my split/splitless inlet. How can I troubleshoot?

A leak in your split/splitless inlet can manifest itself in different ways. With a large leak, the inlet might not be able to reach its pressure setpoint. For smaller leaks, diagnostic tests may fail or there could be chromatographic issues like poor retention time or peak area reproducibility, higher than normal background, baseline drift, or peak tailing. To help troubleshoot a possible leak, read this informative [article](#), access our [8890](#) and [7890](#) troubleshooting guides, or consider these Agilent University courses for the [8890](#) and [7890](#) GC platforms.

How can I avoid backflash?

Backflash is caused by overloading the inlet liner on the gas chromatograph. This phenomenon can result in poor reproducibility, sample loss, ghost peaks, carry-over, split peaks, tailing peaks, loss of resolution, and system contamination. To ensure you won't inject too much sample, use our [Vapor Volume Calculator](#), which determines the expansion volume of the GC sample solvent at a given inlet temperature and pressure for a specific liner. The calculator provides a quick visual indication of whether the liner capacity will be exceeded.

Where can I find firmware updates for my Agilent GCs, headspace samplers, or autosamplers?

[Download our utility](#) that includes firmware files for many current and older GC systems and GC-related products, such as autosamplers and headspace samplers. Once the tool has been installed on your computer, it guides you through a simple process to update the firmware for your specific instruments. Instructions for using the utility are provided in different languages. Note that firmware files for our latest gas chromatography instruments are not included in the utility but can be downloaded from the update page and installed using the tool.

GC problem solving (continued)

What is column bleed and how can I minimize it?

Column bleed is the normal background signal caused by slow degradation of the stationary phase over time. All columns bleed and the extent to which they do is influenced by the phase type, temperature, and film thickness.

Bleed is typically low and does not interfere with the chromatography. High bleed is when something causes the stationary phase to break down faster and more significantly than usual. This breakdown results in a high, rising background at elevated temperatures (starting at about 30 °C before the upper temperature limit) and can make accurate quantitation difficult, especially for low-concentration analytes. It's not great for your mass spec, and it reduces your column life resulting in increased operational costs.

Excessive column bleed can be caused by leaks that introduce oxygen into the column, conditioning the column above the maximum temperature limit, operating at high temperatures with insufficient gas flow rates, or the presence of inorganic acids and bases in your sample.

You can keep bleed at a manageable level and extend your column life by:

1. Ensuring your flow path is leak free (check out our [self-tightening column nuts](#))
2. Using a [gas filter](#) to remove oxygen and [changing it when needed](#)
3. Conditioning the column according to the manufacturer's recommendations
4. Ensuring your carrier gas flow rate is set properly
5. Minimizing the presence of inorganic acids and bases thorough sample dilution, reducing injection volume, using higher split ratios, etc.

It also helps to use low-bleed columns with high thermal stability, such as [Agilent Ultra Inert GC Columns](#). In addition, [backflush](#) can help minimize excessive column bleed by eliminating the need to "bake out" high-boiling compounds at elevated temperatures.

For additional information, watch this [video](#) and our on-demand [webinar](#).

Frequently Asked Questions in GC

Smart GC features

What is the GC browser interface?

This unique interface is one of the intelligent features of the [Intuvo 9000](#), [8890](#), and [8860](#) gas chromatograph systems. It allows you to connect to your GC from anywhere using an internet browser. No data system is needed. Using the IP address for your GC system, you can view instrument status, run diagnostics, check maintenance logs, or view service videos from any computer or a mobile device. To learn more, access our [video](#), [webinar](#), and [white paper](#).

What are Smart Keys?

A [Smart Key](#) is a device that is included with GC columns. It plugs into the [8890](#) (front panel) or [Intuvo 9000](#) (oven compartment) and stores information about that specific column, such as age, temperature limits, serial number, and use. It also includes default parameters for configuration that help automate method setup and reduce the possibility of manual entry errors. You can keep track of column information using the the Early Maintenance Feedback (EMF) screens in the GC touchscreen, Agilent data system, or browser interface.

In addition, a Smart Key is included with every [Intuvo Flow Chip](#) to enable automatic system configuration and help set specific method parameters.

I still have some GC questions. Where can I go for help?

Find answers and insights in the [Agilent Community](#), which is more than 10,000 members strong. There, you can review curated support materials, ask questions, and get notified about new resources relevant to your work.

In addition, [Agilent University](#) offers flexible, cost-effective training options to help you boost efficiency and minimize downtime. Plus, you can choose the training format that suits you best—including in person, virtual, and online.

Eight Tips for Tighter GC Connections and Better Results

Inspecting your GC column connections is a laboratory practice that you cannot afford to overlook. This illustration highlights critical GC connection “hotspots,” helping you fix problems before they compromise your results.

1 Use the appropriate supplies for your application

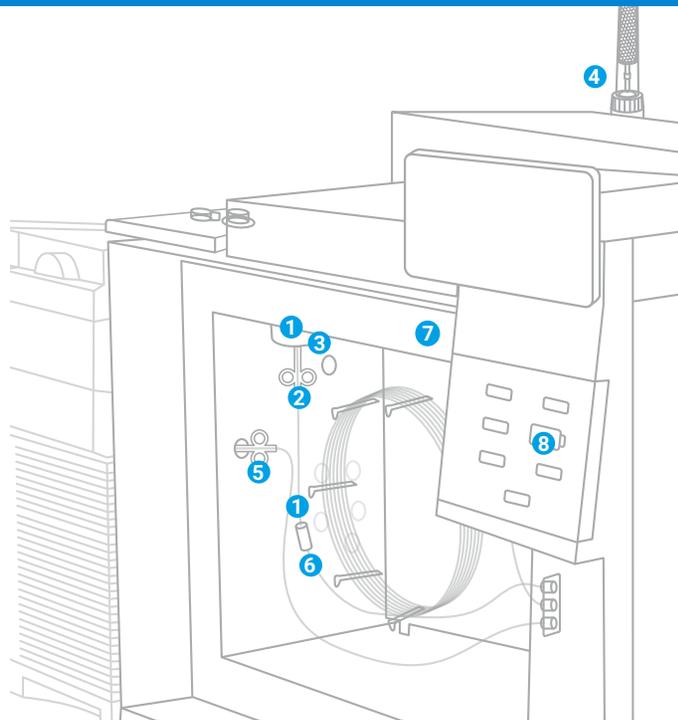
To ensure leak-free column connections, use Agilent Self Tightening Winged column nuts. If your application requires flow path inertness, choose Agilent UltiMetal Plus Flexible Metal ferrules. Using CFT? Try our gold-plated Flexible Metal ferrules for a leak-free seal.

Remember, too, that Agilent Ultra Inert glass-fritted liners can help maximize flow path inertness, and feature a filter frit instead of glass wool.

2 Don't overtighten fittings

Agilent Self Tightening Winged column nuts provide a leak-free connection without the need for wrenches. Their unique locking collar holds your column in place for accurate installation depth and ferrule positioning.

The Agilent Self Tightening Winged column nut employs a spring-drive piston to apply continuous pressure against the ferrule. The result: a leak-free seal even after hundreds of injections—without retightening.



3 Install the column at the correct height

Our easy-to-use Column Depth Guide helps you properly install and maintain your column, regardless of application.

4 Cleanliness matters

To reduce flow path contamination during column installation, wear gloves or limit your handling of supplies. You can also remove oxygen, moisture, or other contaminants using an Agilent Gas Clean filter system.

Optimize cleanliness using Agilent UltiMetal Plus stainless steel tubing and fittings for carrier gas lines and GC system plumbing.

5 Reduce or eliminate MS interface leaks

Agilent Winged and Self Tightening Winged column nuts with graphite/polyimide ferrules ensure that your connections will last cycle after cycle. You can also use a leak detector to reveal leaks at all flow path connections.

6 Select the proper supplies for more complex analyses

For example, the Agilent Ultimate Union with UltiMetal Plus Flexible Metal ferrules is a good choice for worry-free guard column/retention gap connections.

7 Choose a durable detector jet

Sturdy Agilent detector jets reduce deforming, galling, and bending. They fit all GC platforms and minimize the chance of column damage. Plus, they do not require thread lubricant, which can cause contamination.

8 Know the status of your GC capillary column

Agilent J&W column Smart Keys give you immediate information on column use, configuration, age, temperature, and number of injections.

Learn more about creating and maintaining leak-free GC connections.

www.agilent.com/chem/bettergcconnections

Put Our Insight to Work for You

CrossLab is an Agilent capability that integrates services and consumables to support workflow success, improve productivity, and enhance operational efficiency. In every interaction, we strive to provide insight that helps you achieve your goals. We offer a wide range of products and services—from method optimization and training to full-lab relocations and operations analytics—to help you manage your instruments and your lab for best performance.

Learn more about Agilent CrossLab at www.agilent.com/crosslab

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From Insight to Outcome

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