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Agilent 7890B Gas Chromatograph

Operation Manual

Agilent Technologies

Notices

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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.

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1
Introduction

This document provides an overview of the individual components that make up the Agilent 7890B Gas Chromatograph (GC).

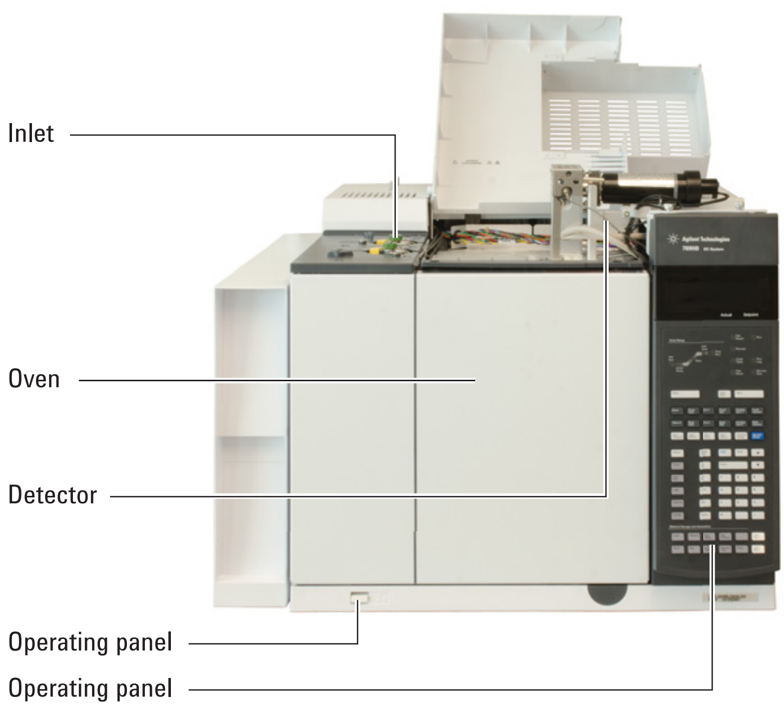
Chromatography Using a GC

Chromatography is the separation of a mixture of compounds into individual components.

There are three major steps involved with separating and identifying components of a mixture using a GC. They are:

1 **Injecting** a sample into the GC. (This takes place at the inlet.)
2 **Separating** the sample into individual components. (This takes place inside the column in the oven.)
3 **Detecting** what compounds were in the sample. (This is done in the detector.)

During this process, status messages from the GC are displayed, and user changes to parameter settings can be made through the operating panel or data system.



Refer to the Advanced Operating Manual and the Getting Started manual for more details.

The Operating Panel

The operating panel consists of the display, status lights, and keypad. See “Keypad Operation” and the Advanced Operation Manual, along with the complete suite of documentation included on the *Agilent GC and GC/MS User Manuals & Tools* DVDs that are included with your GC shipment for more detailed information.

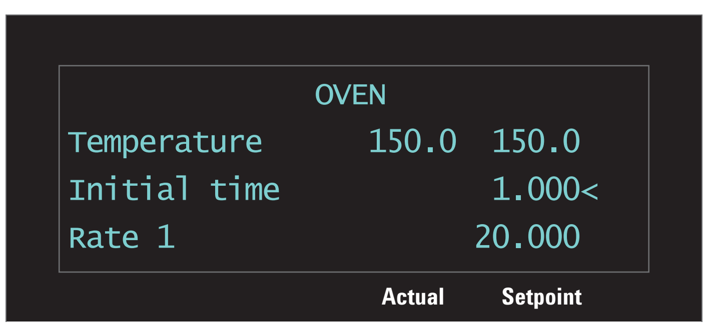
Display
Shows status, setpoints, current activity, and messages.

Status lights
LEDs indicate general status, run state, program state, external control, and maintenance due.

Keyboard
Use to enter settings and program the GC.

The display

The display shows details of what is currently happening in the GC and allows you to make changes to parameters as necessary.

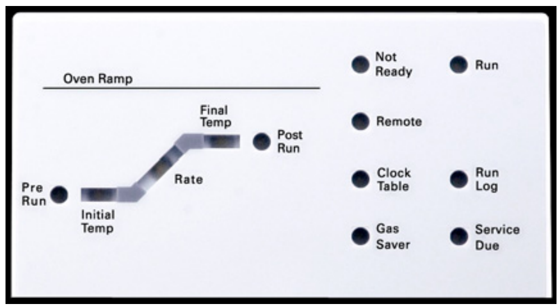


The cursor, <, shows the current active line. Use the scroll keys ▲ ▼ to select a different line in the display and to view additional lines in the display.

A blinking asterisk (*) prompts you to press **[Enter]** to store a value or **[Clear]** to abort the entry. You cannot perform any other task until this is done.

Status lights

The status lights provide a basic look at what is currently happening inside the Agilent 7890B GC.



A lit LED on the status board indicates:

- The current progress of a run (**Pre Run**, **Post Run**, and **Run**).
- Items that may require attention (**Rate**, **Not Ready**, **Service Due**, and **Run Log**).
- The GC is controlled by an Agilent data system (**Remote**).
- The GC is programmed for events to occur at specified times (**Clock Table**).
- The GC is in gas saver mode (**Gas Saver**).

Beeping instrument

A single beep means that a problem exists, but the problem will not prevent the GC from executing the run. The GC will emit one beep and display a message. The GC can start the run and the warning disappears when a run starts.

A series of warning beeps sound if the GC encounters a more serious problem. The GC starts with one beep. The longer the problem persists, the more the GC beeps. For example, a series of beeps sound if the front inlet gas flow cannot reach setpoint. The message **Front inlet flow shutdown** is briefly displayed. The flow shuts down after 2 minutes. Press **[Off/No]** to stop the beeping.

A continuous beep sounds if a hydrogen flow is shut down or a thermal shutdown occurs. Press **[Clear]** to stop the beep.

Fault messages indicate hardware problems that require user intervention. Depending on the type of error, the GC will beep once or not at all.

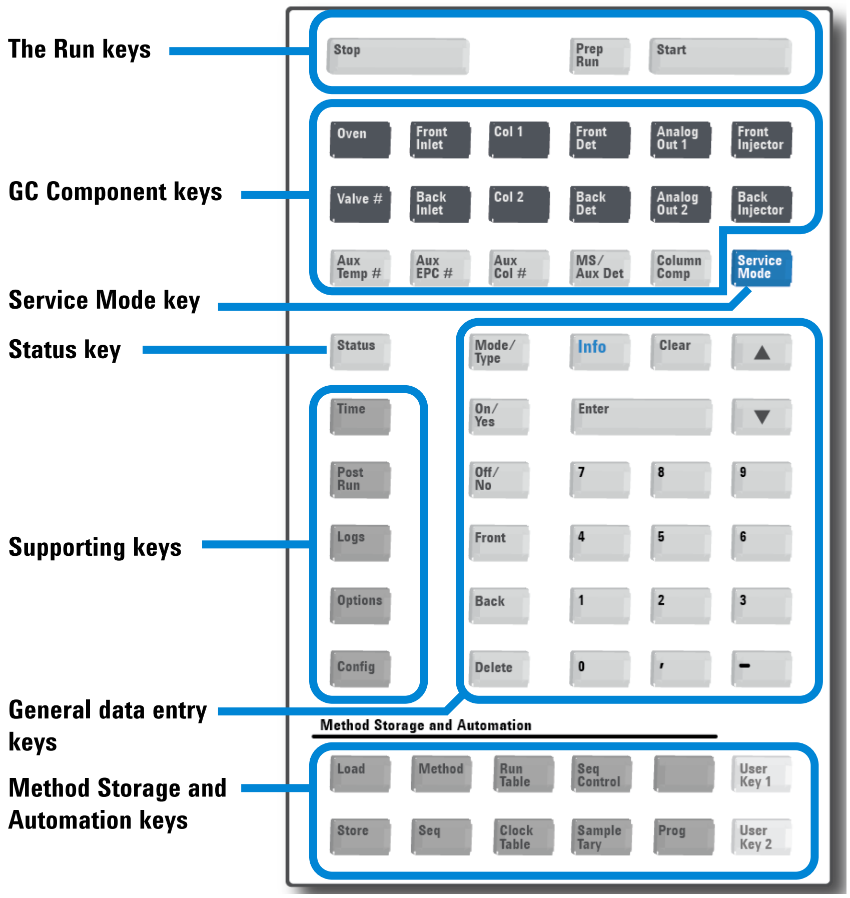
Blinking setpoint

If a gas flow, multiposition valve, or the oven is shut down by the system, **Off** or **On/Off** will blink on the appropriate line of the components parameter listing.

The keypad

All of the parameters required to operate the Agilent 7890B GC can be entered through the GC's keypad. Normally, however, most of these parameters are controlled using an attached data system, such as Agilent's OpenLAB CDS or MassHunter software.

When an Agilent data system is controlling your 7890B GC, it is possible for the data system to disable editing of the GC's current method from the keypad.



2
Operating Basics

This section describes a few basic tasks that an operator performs when using the Agilent 7890B GC.

Overview

Operating the GC involves the following tasks:

- Setting up the GC hardware for an analytical method.
- Starting up the GC. See "To Start Up the GC".
- Preparing the automatic liquid sampler. Install the method-defined syringe; configure solvent and waste bottle usage and syringe size; and prepare and load solvent, waste, and sample vials.
  - For the 7693A ALS, see its Installation, Operation, and Maintenance manual.
  - For the 7683 ALS, see manual Operating the 7683B ALS on a 7890 Series GC.
- Loading the analytical method or sequence into the GC control system.
  - See the Agilent data system documentation.
  - For standalone GC operation see "To load a method" and "To load a stored sequence".
- Running the method or sequence.
  - See the Agilent data system documentation.
  - For standalone GC operation, see "To manually inject a sample with a syringe and start a run", "To run a method to process a single ALS sample", and "To start running a sequence".
- Monitoring sample runs from the GC control panel or the Agilent data system program. See "About GC Status" or the Agilent data system documentation.
- Shutting down the GC. See "To Shut Down the GC for Less Than a Week" or "To Shut Down the GC for More Than a Week".

Instrument Control

The Agilent 7890B GC is typically controlled by an attached data system such as Agilent OpenLAB CDS. Alternately, the GC can be controlled entirely from its keypad, with output data being sent to an attached integrator for report generation.

Agilent data system users – Please refer to the online help included in the Agilent data system for details on how to load, run, or create methods and sequences using the data system.

Standalone GC users – If you are running your GC without an attached data system, see the following for details on loading methods and sequences from the keypad:

- “To load a method”
- “To load a stored sequence”

For details on running methods and sequences from the keypad see:

- “To manually inject a sample with a syringe and start a run”
- “To run a method to process a single ALS sample”
- “To start running a sequence”

For details on how to create methods and sequences using the GC keypad, see “Methods and Sequences”.

To Start Up the GC

Successful operation begins with a properly installed and maintained GC. The utility requirements for gases, power supply, venting of hazardous chemicals, and required operational clearances around the GC are detailed in the Agilent GC, GC/MS, and ALS Site Preparation Guide.

1 Check gas source pressures. For required pressures, see the Agilent GC, GC/MS, and ALS Site Preparation Guide.
2 Turn on the carrier and detector gases at their sources and open the local shutoff valves.
3 Turn on the cryo coolant at its source, if used.
4 Turn on the GC power. Wait for **Power on successful** to display.
5 Install the column.
6 Check that the column fittings are leak free. See the Troubleshooting manual.
7 Load the analytical method. See "To load a method".
8 Wait for the detector(s) to stabilize before acquiring data. The time required for the detector to reach a stable condition depends on whether the detector was turned off or its temperature was reduced while the detector remained powered.

Table 1 Detector stabilization times

Detector type	Stabilization time starting from a reduced temperature (hours)	Stabilization time starting from detector off (hours)
FID	2	4
TCD	2	4
uECD	4	18 to 24
FPD	2	12
NPD	4	18 to 24

To Shut Down the GC for Less Than a Week

1 Wait for the current run to finish.

2 If the active method has been modified, save the changes.

WARNING **Never leave flammable gas flows on if the GC will be unmonitored. If a leak develops, the gas could create a fire or explosion hazard.**

3 Turn off all gases, except the carrier gas, at their sources. (Leave the carrier gas on to protect the column from atmospheric contamination.)

4 If you are using cryogenic cooling, turn off the cryo coolant at the gas source.

5 Reduce detector, inlet, and column temperatures to between 150 and 200 °C. If desired, the detector can be turned off. See the following table to determine if it is advantageous to shut down the detector for a short time period. The time required to return the detector to a stable condition is a factor. See Table 1.

To Shut Down the GC for More Than a Week

See Maintaining Your GC manual for procedures for installing columns, consumables, and so on.

1. Load a GC maintenance method and wait for the GC to become ready. For more information about creating maintenance methods, see the Maintaining Your GC manual. (If a maintenance method is not available, set all heated zones to 40 °C.)
2. Turn off the main power switch.
3. Shut off all gas valves at the gas source.
4. If you are using cryogenic cooling, shut off the cryo coolant valve at the source.

WARNING **Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If they are hot, wear heat-resistant gloves to protect your hands.**

5. When the GC is cool, remove the column from the oven and cap both ends to keep out contaminants.
6. Cap the inlet and detector column fittings and all GC external fittings.

Correcting Problems

If the GC stops operation because of a fault, check the display for any messages. Press [**Status**] and scroll to view any additional messages.

1 Use the keyboard or data system to stop the alert tone. Press **[Off/No]** on the keyboard or turn off the offending component in the data system.

2 Resolve the problem, for example, by changing gas cylinders or fixing the leak. See the Troubleshooting Guide for details.

3 Once the problem is fixed, you may need to either power cycle the instrument, or use the software keyboard or data system to turn the problem component off, then on again. For shutdown errors, you will need to do both.

3
Keypad Operation

This section describes the basic operation of the Agilent 7890B GC keypad. For additional information on keypad functionality, see the Advanced Operation Manual.

The Run Keys

These keys are used to start, stop, and prepare the GC to run a sample.

[**Prep Run**] Activates processes required to bring the GC to the starting condition dictated by the method (such as turning off the inlet purge flow for a splitless injection or restoring normal flow from gas saver mode). See the Advanced Operation Manual for details.

[**Start**] Starts a run after manually injecting a sample. (When you are using an automatic liquid sampler or gas sampling valve, the run is automatically activated at the appropriate time.)

[**Stop**] Immediately terminates the run. If the GC is in the middle of a run, the data from that run may be lost. Also see "To resume an aborted sequence" on page 52.

The GC Component Keys

These keys are used to set the temperature, pressure, flow, velocity, and other method operating parameters.

To display the current settings, press any one of these keys. More than three lines of information may be available. Use the scroll keys to view additional lines, if necessary.

To change settings, scroll to the line of interest, enter the change, and press **[Enter]**.

For context-sensitive help, press **[Info]**. For example, if you press **[Info]** on a setpoint entry, the help provided would be similar to: *Enter a value between 0 and 350.*

[**Oven**]	Sets oven temperatures, both isothermal and temperature programmed.
[**Front Inlet**] [**Back Inlet**]	Controls inlet operating parameters.
[**Col 1**] [**Col 2**] [**Aux Col #**]	Controls column pressure, flow, or velocity. Can set pressure or flow ramps.
[**Front Det**] [**Back Det**] [**MS/Aux Det**]	Controls detector operating parameters. If configured with an MS, control GC-MS communications and special functions.
[**Analog Out 1**] [**Analog Out 2**]	Assigns a signal to the analog output. The analog output is located on the back of the GC.
[**Front Injector**] [**Back Injector**]	Edits injector control parameters such as injection volumes and sample and solvent washes. If configured with an HS, control GC-HS communications and special functions.
[**Valve #**]	Allows control of a sampling valve and/or switching valves 1 to 8 (on or off). Sets multiposition valve position.
[**Aux Temp #**]	Controls extra temperature zones such as a heated valve box, a mass selective detector (or other) transfer line, or an “unknown” device. Can be used for temperature programming.
[**Aux EPC #**]	Provides auxiliary pneumatics to an inlet, detector, capillary flow technology (CFT) device, or other device. Can be used for pressure programming.
[**Column Comp**]	Creates a column compensation profile.

The Status Key

[**Status**] Displays "ready," "not ready," and "fault" information.

When the **Not Ready** status light is *blinking*, a fault has occurred. Press [**Status**] to see which parameters are not ready and what fault has occurred.

The order in which items appear in the scrolling display window for [**Status**] can be modified. You may, for example, want to display the things you most frequently check in the top three lines so that you do not need to scroll to see them. To change the order of the **Status** display:

1 Press [**Config**] [**Status**].

2 Scroll to the setpoint you want to appear first and press [**Enter**]. This setpoint will now appear at the top of the list.

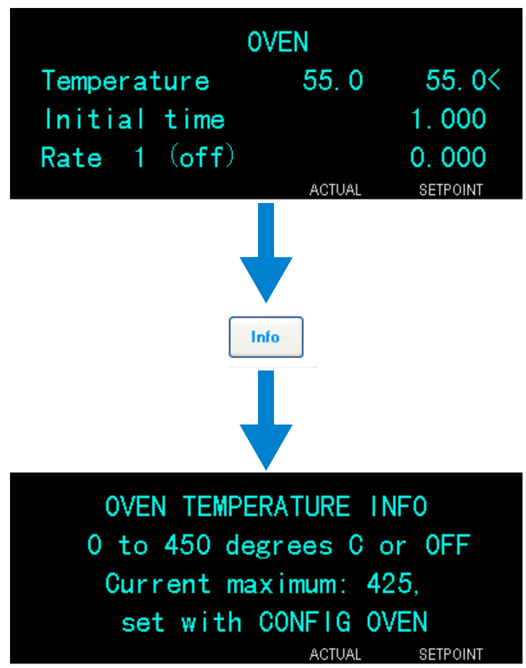
3 Scroll to the setpoint you want to appear second and press [**Enter**]. This setpoint will now be the second item on the list.

4 Continue as above until the list is in the order you require.

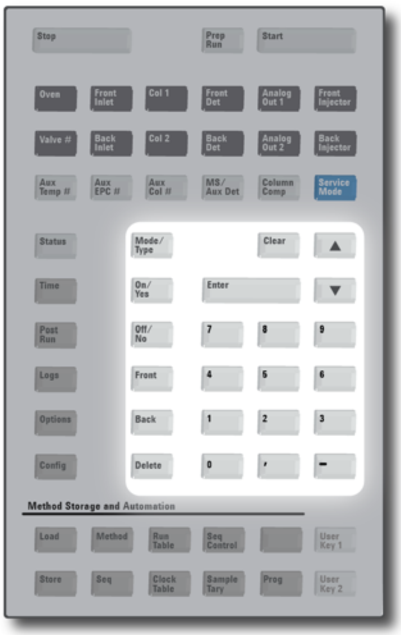
The Info Key

[Info]

Provides help for the currently shown parameter. For example, if **Oven Temp** is the active line in the display (has a **<** next to it), [**Info**] will display the valid range of oven temperatures. In other cases, [**Info**] will display definitions or actions that need to be performed.



The General Data Entry Keys



[**Mode/Type**] Accesses a list of possible parameters associated with a component's nonnumeric settings. For example, if the GC is configured with a split/splitless inlet and the [**Mode/Type**] key is pressed, the options listed will be split, splitless, pulsed split, or pulsed splitless.

[**Clear**] Removes a misentered setpoint before pressing **[Enter]**. It can also be used to return to the top line of a multiline display, return to a previous display, cancel a function during a sequence or method, or cancel loading or storing sequences and methods.

[**Enter**] Accepts changes you enter or selects an alternate mode.

 Scrolls up and down through the display one line at a time. The **<** in the display indicates the active line.

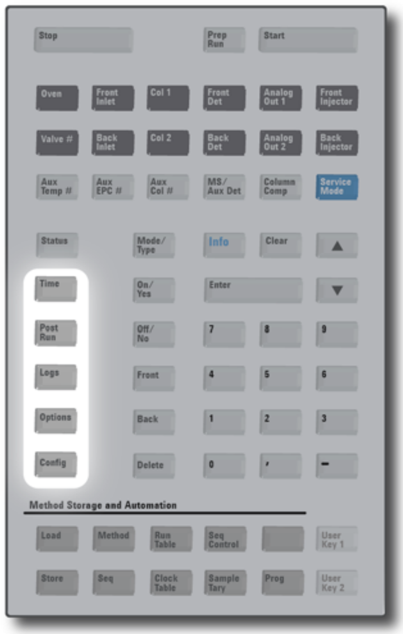
Numeric Keys Are used to enter settings for the method parameters. (Press [**Enter**] when you are finished to accept the changes.)

[**On/Yes**]
[**Off/No**] Are used when you are setting up parameters, such as the warning beep, method modification beep, and key click or for turning on or off a device like a detector.

[Front] [Back] Are mostly used during configuration operations. For example, when configuring a column, use these keys to identify the inlet and detector to which the column is attached.

[**Delete**] Removes methods, sequences, run table entries, and clock table entries. [**Delete**] also aborts the adjust offset process for nitrogen-phosphorus detectors (NPD) without interrupting other detector parameters. See the Advanced Operation Manual for more details.

The Supporting Keys



[**Time**] Displays the current date and time on the first line.

The two middle lines show the time between runs, the elapsed time and time remaining during a run, and the last run time and post-time during a post-run.

The last line always displays a stopwatch. While on the stopwatch line, press [**Clear**] to set the clock to zero and [**Enter**] to start or stop the stopwatch.

[**Post Run**] Is used to program the GC to do something after a run, such as bakeout or backflush a column. See the Advanced Operation Manual for details.

[**Logs**] Access three logs: the Run Log, the Maintenance Log, and the System Event Log. The information in these logs can be used to support Good Laboratory Practices (GLP) standards.

[**Options**] Accesses the instrument parameters setup options for calibration, communications, and the keyboard and display. Scroll to the desired line and press **[Enter]** to access the associated entries. See “Options” on page 189.

[**Config**] Is used to set up components that are not automatically detectable by the GC but are essential to running a method, such as column dimensions, carrier and detector gas types, makeup gas configurations, sample tray settings, and column plumbing to inlets and detectors. These settings are part of, and are stored with, the method.

To view the current configuration for a component (such as the inlet or detector), press **[Config]**, then the component key of interest. For example, **[Config][Front Det]** opens front detector configuration parameters.

Method Storage and Automation Keys

These keys are for loading and storing methods and sequences locally on your GC. They cannot be used to access methods and sequences stored by your Agilent data system.

[**Load**]
[**Method**]
[**Store**]
[**Seq**]

Are used together to load and store methods and sequences on your GC.

For example, to load a method, press [**Load**] [**Method**] and select one from the list of methods stored in the GC. See "To load a method" on page 41.

[**Run Table**] Is used to program special events you require during a run. A special event could be switching a valve, for example. See the Advanced Operation Manual for details.

[**Clock Table**] Is used to program events to occur at a time of day, as opposed to during a run, and to access the Instrument Schedule. The clock table events could, for example, be used to start a shutdown run at 5:00 p.m. every day. See the Advanced Operation Manual and "Resource Conservation" on page 106.

[**Seq Control**] Starts, stops, pauses, or resumes a sequence, or views the status of a sequence. See "Running Sequences from the Keypad" on page 51.

[**Sample Tray**] Displays whether the tray and/or bar code reader/mixer is enabled.

[**Prog**]
[**User Key 1**]
[**User Key 2**]

Allows you to program a series of keystrokes commonly used for specific operations. Press **User Key 1** or **User Key 2** to record up to 31 keystrokes as a macro. See the Advanced Operation Manual.

Keypad Functionality When the GC Is Controlled by an Agilent Data System

When an Agilent data system controls the GC, the data system defines the setpoints and runs the samples. If configured to lock the keypad, the data system can prevent the changing of setpoints. The **Remote** LED is lit when a data system is controlling the GC. Lit LEDs on the status board show the current progress of a run.

When an Agilent data system controls the GC, the keypad can be used:

- To view run status by selecting [**Status**]
- To view the method settings by selecting the GC component key
- To display the last and next run times, the run time remaining, and the post-run time remaining by repeatedly selecting [**Time**]
- To abort a run by selecting [**Stop**]
- To find which computer is controlling the GC by pressing **[Options] > Communication**, then scrolling. The name of the computer controlling the GC is listed after the **Enable DHCP** setting, along with the number of hosts connected to the GC.

Pressing [**Stop**] during a GC run immediately ends the run. The data system may retain the data already collected, but no further data is collected for that sample. Agilent data systems may allow the next run to begin, depending on the data system and its settings for handling errors.

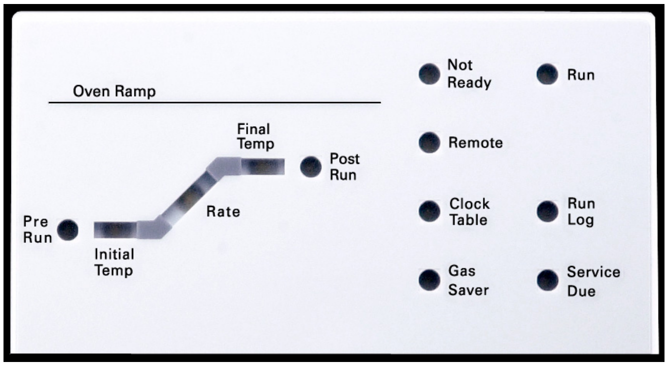
The Service Mode Key

[**Service Mode**] Is used to set up Early Maintenance Feedback and to access inlet leak checks for selected inlet types. See “Early Maintenance Feedback (EMF)” on page 118 and the Troubleshooting manual. This key also accesses settings intended for service personnel. Because these advanced settings can cause problems if misused, avoid the service settings unless specifically directed to use them.

About GC Status

When the GC is ready to begin a run, the display screen shows **STATUS Ready for Injection**. Alternately, when a component of the GC is not ready to begin a run, the **Not Ready** LED is lit on the status board. Press [**Status**] to see a message explaining why the GC is not ready.

Status board



A lit LED on the status board indicates:

- The current progress of a run (**Pre Run**, **Post Run**, and **Run**).
- Items that may require attention (**Rate**, **Not Ready**, **Service Due**, and **Run Log**).
- The GC is controlled by an Agilent data system (**Remote**).
- The GC is programmed for events to occur at specified times (**Clock Table**).
- The GC is in gas saver mode (**Gas Saver**).

Alert tones

A series of warning beeps sounds before a shutdown occurs. The GC starts with one beep. The longer the problem persists, the more the GC beeps. After a short time the component with the problem shuts down, the GC emits one beep, and a brief message is displayed. For example, a series of beeps sounds if the front inlet gas flow cannot reach setpoint. The message **Front inlet flow shutdown** is briefly displayed. The flow shuts down after 2 minutes. Press [**Off/No**] to stop the beep.

A continuous tone sounds if a hydrogen flow is shut down or a thermal shutdown occurs.

WARNING **Before resuming GC operations, investigate and resolve the cause of the hydrogen shutdown. See Hydrogen Shutdown in the Troubleshooting manual for details.**

One beep sounds when a problem exists, but the problem will not prevent the GC from executing the run. The GC will emit one beep and display a message. The GC can start the run and the warning will disappear when a run starts.

Fault messages indicate hardware problems that require user intervention. Depending on the type of error, the GC emits no beep or a single beep.

Error conditions

If a problem occurs, a status message appears. If the message indicates broken hardware, more information may be available. Press the applicable component key (for example, **Front Det**, **Oven**, or **Front Inlet**).

When configured for enhanced GC-MS or GC-HS communications, the GC will also display error messages from the connected instruments. In this case, check the connected MS or HS for more information.

Blinking setpoint

If the system shuts down a gas flow, multiposition valve, or the oven, **Off** will blink on the appropriate line of the component's parameter listing.

If there is a detector pneumatics shutdown or failure in another part of the detector, the detector **On/Off** line of the detector's parameter list blinks.

For any flow or pressure parameter, and for oven temperature, go to the blinking parameter, then press [**Off/No**] to clear the fault. Resolve the problem if possible, then press [**On/Yes**] on the parameter to use it again. If the problem is not fixed, the fault will recur.

If the shutdown includes safety concerns, for example a shutdown for hydrogen carrier gas flow, you must power cycle the GC. See the Troubleshooting manual for more information.

About Logs

Three logs are accessible from the keypad: the run log, the maintenance log, and the system event log. To access the logs, press **[Logs]** then scroll to the desired log and press [**Enter**]. The display will indicate the number of entries the log contains. Scroll through the list.

Run log

The run log is cleared at the start of each new run. During the run, any deviations from the planned method (including keypad intervention) are listed in the run log table. When the run log contains entries, the **Run Log** LED lights.

Maintenance log

The maintenance log contains entries made by the system when any of the user-defined component counters reach a monitored limit. The log entry contains a description of the counter, its current value, the monitored limits, and which of its limits has been reached. In addition, each user task related to the counter is recorded in the log, including resetting, enabling or disabling monitoring, and changing limits or units (cycles or duration).

System event log

The system event log records significant events during the GC's operation. Some of the events also appear in the run log if they are in effect during a run.

4
Methods and Sequences

What Is a Method?

A method is the group of settings required to analyze a specific sample.

Since every type of sample reacts differently in the GC—some samples require a higher oven temperature, others require a lower gas pressure or a different detector—a unique method must be created for each specific type of analysis.

What Is Saved in a Method?

Some of the settings saved in a method define how the sample will be processed when the method is used. Examples of method settings include:

- The oven temperature program
- The type of carrier gas and flows
- The type of detector and flows
- The type of inlet and flows
- The type of column
- The length of time to process a sample

Data analysis and reporting parameters are also stored in a method when it is created on an Agilent data system, for example OpenLAB CDS or MassHunter software. These parameters describe how to interpret the chromatogram generated by the sample and what type of report to print.

See the Advanced Operation Manual for more details on what can be included in a method.

What Happens When You Load a Method?

There are two kinds of methods:

- **The active method**–This is sometimes referred to as the current method. The settings defined in this method are the settings the GC is currently maintaining.
- **Stored methods**–Up to 9 user-created methods can be stored in the GC, along with one SLEEP method, one WAKE method, one CONDITION method, an MS VENT method, and a default method.

When a method is loaded from the GC or Agilent data system, the setpoints of the active method are immediately replaced with the setpoints of the method loaded.

- The method loaded becomes the active (current) method.
- The **Not Ready** light will stay lit until the GC reaches all of the settings specified by the method that was just loaded.

Refer to “Running a Method or a Sequence from the Keypad for details on using the keypad to load, modify, and save methods.

Creating Methods

A method is the group of setpoints needed to run a single sample on the GC, such as oven temperature programs, pressure programs, inlet temperatures, sampler parameters, and so forth. A method is created by saving a group of setpoints as a numbered method using the **[Store]** key.

The GC also can store several specialized methods. The GC stores three methods used for resource conservation, called **SLEEP**, **CONDITION**, and **WAKE**. When configured for use with an attached MS, the GC also provides a method called **MS VENT**, used to change GC setpoints to values appropriate for a safe MS venting process. See "Early Maintenance Feedback" on page 117 and "Intelligent Instrument Features" on page 129 for more information about these specialized methods.

Components for which setpoint parameters can be stored are shown in Table 2.

Table 2 Setpoint parameter components

Component	Component
Oven	Aux temp
Valve 1–8	Aux EPC
Front and back inlet	Aux column
Columns 1 to 6	Aux detector 1 and 2
Front and back detector	Post run
Analog 1 and 2	Run table
Front and back injector	Sample tray

The GC also saves ALS setpoints.

- See the 7693A Installation, Operation, and Maintenance manual for details on its setpoints.
- See 7650 Installation, Operation, and Maintenance manual for details on its setpoints.
- Operating the 7683B ALS on a 7890 Series GC manual for details on its setpoints.

Current setpoint parameters are saved when the GC is turned off, and loaded when you turn the instrument back on.

To program a method

1 Individually select each component for which setpoint parameters are appropriate for your method. (See Table 2.)
2 Examine the current setpoints and modify as desired. Repeat for each component as appropriate.
3 Examine the current setpoints for the ALS, if appropriate, and modify as desired.
4 Save the setpoints as a stored method. (See “To store a method” on page 41.)

To load a method

1 Press **[Load]**.
2 Press **[Method]**.
3 Enter the number of the method to be loaded (1 through 9).
4 Press **[On/Yes]** to load the method and replace the active method. Alternatively, press **[Off/No]** to return to the stored methods list without loading the method.

To store a method

1 Ensure that the proper parameters are set.
2 Press [**Method**].
3 Scroll to the method to store, then press [**Enter**].
4 Press [**On/Yes**] to store the method and replace the active method. Alternatively, press **[Off/No]** to return to the stored methods list without storing the method.

Method mismatch

This section applies *only* to a standalone (not connected to a data system) GC. When a data system, such as OpenLAB CDS or MassHunter, controls the GC, methods are stored in the data system and can be edited there. See your data system documentation for more information.

Suppose your standalone GC is equipped with a single FID. You have created and saved methods that use this detector. Now you remove the FID and install a TCD in its place. When you try to load one of your stored methods, you observe an error message saying that the method and the hardware do not match.

The problem is that the actual hardware is no longer the same as the hardware configuration saved in the method. The method cannot run because it does not know how to operate the recently-added TCD.

On inspecting the method, you find that the detector-related parameters have all been reset to the default values.

Method mismatch occurs only for electronic devices in the GC, such as inlets, detectors, and EPC modules. The GC does generate a mismatch for consumables such as columns, liners, and syringes.

Correcting a method mismatch on a standalone GC

This problem can be avoided if you follow this procedure for any hardware change, even including the simple replacement of a defective detector board.

1 Before changing any hardware, press **[Config][hardware module]**, where **[hardware module]** is the device you intend to replace, for example, [**Config**][**Front Detector**].

2 Press **[Mode/Type]**. Select **Remove module** and press **[Enter]**. The module is now **Unconfigured**.

3 Turn the GC off.

4 Make the hardware change that you intended (in this example, remove the FID and its flow module and replace them with the TCD and its module).

5 Turn the GC on. Press **[Config][hardware module]**, for example, [**Config**][**Front Detector**]

6 Press **[Mode/Type]**. Select **Install module** and press **[Enter]**. The GC will install the new hardware module, which corrects the active method (but not the stored one!).

7 Save the corrected method using the same number (which overwrites the stored method) or a new number (which leave the original method unchanged).

What Is a Sequence?

A sequence is a list of samples to be analyzed along with the method to be used for each analysis.

Refer to "Running a Method or a Sequence from the Keypad" and "Creating Sequences" for details on how to create, load, modify, and save sequences using the keypad.

Creating Sequences

A sequence specifies the samples to be run and the stored method to be used for each. The sequence is divided into a priority sequence (ALS only), subsequences (each of which uses a single method), and post-sequence events

- **Priority sequence** — allows you to interrupt a running ALS or valve sequence to analyze urgent samples. (See "About the priority sequence" on page 44.)
- **Subsequences** — contain the stored method number and information that defines a set of vials (or valve positions) to be analyzed using a particular method. Sampler and/or valve subsequences can be used in the same sequence.
- **Post sequence** — names a method to be loaded and run after the last run in the last subsequence. Specifies whether the sequence is to be repeated indefinitely or halted after the last subsequence.

Samples in each subsequence are specified as either ALS tray locations or sampling valve positions (gas or liquid sampling valves, often with a stream selection valve).

Five sequences with up to five subsequences each can be stored.

About the priority sequence

The priority sequence consists of a single sampler or valve subsequence and a special **Use priority** parameter, which can be activated at any time, even when a sequence is running. This feature allows you to interrupt a running sequence without having to edit it.

If **Use priority** is **On**, then:

1. The GC and ALS complete the current run, then the sequence pauses.
2. The GC runs the priority sequence.
3. The GC resets the **Use priority** parameter to **Off**.
4. The main sequence resumes where it paused.

To program a sequence

1. Press **[Seq]**. (Press again, if necessary, to display subsequence information.)
2. Create a priority sequence, if desired. (See “To program a priority sequence” on page 45.) If you might want to use a priority sequence, you must program it now. (Once the sequence starts, you cannot edit it without stopping it.)
3. Scroll to the **Method #** line of **Subseq 1** and enter a method number. Use **1** to **9** for the stored methods, **0** for the currently active method, or **[Off/No]** to end the sequence.
4. Press **[Mode/Type]** to select a valve or injector type. (See “To program a valve subsequence” on page 46 or “To program an ALS subsequence” on page 45.)
5. Create the next subsequence or scroll to **Post Sequence**. (See “To program post sequence events” on page 46.)
6. Save the completed sequence. (See “To store a sequence” on page 46.)

To program a priority sequence

1 Press **[Seq]**. (Press again, if necessary, to display subsequence information.)

2 Scroll to **Priority Method #** and enter a method number. Use **1** to **9** for the stored methods, **0** for the currently active method, or **[Off/No]** to end the sequence. Press **[Enter]**.

   The active method, 0, will change during the sequence if the subsequences use stored methods. Therefore, method 0 should be chosen for the priority sequence only if all subsequences use method 0.

3 Press **[Mode/Type]** and select the injector type.

4 Program the ALS subsequence. (See “To program an ALS subsequence” on page 45.)

5 Store the completed sequence. (See “To store a sequence” on page 46.)

Once a priority subsequence exists in a sequence, you can activate it when the urgent samples are ready to be processed by:

1 Press **[Seq]**. (Press again, if necessary, to display subsequence information.)

2 Scroll to **Use Priority** and press **[On/Yes]**.

When the priority samples are completed, the normal sequence resumes.

To program an ALS subsequence

1 See step 1 through step 3 of “To program a sequence” on page 44.

2 Press **[Mode/Type]** and select the injector type.

3 Enter injector sequence parameters (if using both injectors, there will be two sets of parameters):

   - **Number of Injections/vial**—the number of repeat runs from each vial. Enter **0** if no samples are to be injected. For example, you could enter **0** to perform a blank (no injection) run to clean the system after running a dirty sample.

   - **Samples**—the range (first–last) of sample vials to be analyzed.

4 Proceed with step 5 of “To program a sequence” on page 44.

To program a valve subsequence

1 See step 1 through step 3 of “To program a sequence” on page 44.

2 Press **[Mode/Type]** and select **Valve**.

3 Enter the valve sequence parameters (the first three appear only if a multiposition valve is configured):

- **#inj/position**—number of injections at each position (0–99)
- **Position rng**—first–last valve positions to sample (1–32)
- **Times thru range**—number of times to repeat the range (1–99)
- **# injections**—number of injections for each sample

4 Proceed with step 5 of “To program a sequence” on page 44.

To program post sequence events

1 See step 1 through step 4 of “To program a sequence” on page 44.

2 Scroll to the **Method #** line of **Post Sequence** and enter a method number. Use **1** to **9** for the stored methods, or **0** if there is no method to be loaded (keep the active method loaded).

3 Press **[On/Yes]** at **Repeat sequence** to keep repeating the sequence (useful for valve sequences). Otherwise, press **[Off/No]** to halt the sequence when all subsequences are finished.

To store a sequence

1 Press **[Store][Seq]**.

2 Enter an identifying number for the sequence (1–9).

3 Press **[On/Yes]** to store the sequence. Alternatively, press **[Off/No]** to cancel.

   A message is displayed if a sequence with the number you selected already exists.

   - Press **[On/Yes]** to replace the existing sequence or **[Off/No]** to cancel.

Sequences can also be stored from within the stored sequence list (**[Seq]**) by scrolling to the appropriate sequence number and pressing the **[Store]** key.

To load a stored sequence

1 Press **[Load][Seq]**.
2 Enter the number of the sequence to be loaded (1–9).
3 Press **[On/Yes]** to load the sequence or **[Off/No]** to cancel the load.

   An error message is displayed if the specified sequence number has not been stored.

To determine sequence status

Press **[Seq Control]** to display the current status of the active sequence. There are six possible sequence status modes:

- Start/running
- Ready wait
- Paused/resume
- Stopped
- Aborted
- No sequence

Automating Data Analysis, Method Development, and Sequence Development

The output of the detectors is digitized and can be sent to an automated data analysis system (such as Agilent OpenLAB CDS), where it is analyzed and the results summarized in reports.

The Agilent data system also can be used to create and store methods and sequences that are sent to the GC through a network.

Recoverable Errors

Some types of errors, such as an ALS missing vial error or a headspace sampler vial size mismatch, may not always justify stopping an entire sequence. These errors are called *recoverable errors*, since you may be able to recover from them and continue running a sequence, if desired. Agilent data systems now provide features to allow you to control how the system will react to these types of errors. When using an Agilent data system, the data system will now control whether or not the sequence pauses, aborts completely, continues with the next sample, and so on, for each type of recoverable error.

Note that the data system only controls what happens to the *next* run in the sequence, not the *current* run, except when set to immediately abort. (In that case, the data system typically aborts the current run and the sequence.)

For example, pressing [**Stop**] on the GC always halts the current run. However, the data systems can allow you to choose whether to continue with the next run or to pause or to abort the whole sequence.

For details on how this feature works in your data system, refer to its help and documentation.

5
Running a Method or a Sequence from the Keypad

This section explains how to load, store, and run a method or sequence using the GC keypad, without the use of an Agilent data system. The keypad can be used to select and run a method or automated sequence stored in the GC and run it. In this case, the data generated from the run is normally sent to an integrator for the data analysis report.

For information on creating a method or sequence using keypad entry, see Chapter 4, “Methods and Sequences."

Running Methods from the Keypad

To manually inject a sample with a syringe and start a run

1. Prepare the sample syringe for injection.
2. Load the desired method. (See "To load a method".)
3. Press **[Prep Run]**.
4. Wait for **STATUS Ready for Injection** to be displayed.
5. Insert the syringe needle through the septum and all the way into the inlet.
6. Simultaneously depress the syringe plunger to inject the sample and press **[Start]**.

To run a method to process a single ALS sample

1. Prepare the sample for injection.
2. Load the sample vial into the assigned location in the ALS tray or turret.
3. Load the desired method. (See "To load a method".)
4. Press **[Start]** on the GC keypad to initiate the ALS syringe cleaning, sample loading, and sample injection method. After the sample is loaded into the syringe, the sample is automatically injected when the GC reaches the ready state.

To abort a method

1. Press **[Stop]**.
2. When you are ready to resume running analyses, load the appropriate sequence or method. (See "To load a method" or "To load a stored sequence".)

Running Sequences from the Keypad

A sequence can specify up to five subsequences to be run, as well as priority (ALS only) and post-run sequences, if defined. Each sequence is stored as a number (from 1 to 9).

To start running a sequence

1. Load the sequence. (See "To load a stored sequence".)
2. Press **[Seq Control]**.
3. Verify the status of the sequence:
   - **Running**—the sequence is running
   - **Ready/wait**—the instrument is not ready (due to oven temperature, equilibration times, and so forth.)
   - **Paused**—the sequence is paused
   - **Stopped**—proceed to step 4
   - **Aborted**—the sequence stopped without waiting for the run to finish (See "Aborting a sequence".)
   - **No sequence**—the sequence is off or not defined
4. Scroll to the **Start sequence** line and press **[Enter]** to change the status to **Running**.

   The **Run** LED will light and stay lit until the sequence is completed. The sequence continues to run until all subsequences are executed or until the sequence is aborted.

Ready wait

If a sequence is started but the instrument is not ready (due to oven temperature, equilibration times, and so forth), the sequence will not start until all instrument setpoints are ready.

To pause a running sequence

1. Press **[Seq Control]**.
2. Scroll to **Pause sequence** and press **[Enter]**.

   The sequence stops when the current sample run is complete. The sequence status changes to **paused**, and you are given the option to resume or stop the paused sequence.

To resume a paused sequence

1 Press **[Seq Control]**.

2 Scroll to **Resume sequence** and press **[Enter]**.

The sequence resumes with the next sample.

To stop a running sequence

1 Press **[Seq Control]**.

2 Scroll to **Stop sequence** and press **[Enter]**.

The sequence stops at the end of the currently running subsequence unless **[Seq] > Repeat sequence** is **On**. The sampler tray halts immediately. A stopped sequence can only be restarted from the beginning.

To resume a stopped sequence

1 Press **[Seq Control]**.

2 Scroll to **Resume sequence** and press **[Enter]**.

The sequence restarts from the beginning of the sequence.

Aborting a sequence

When a sequence is aborted, it stops immediately without waiting for the current run to finish.

The following will cause a sequence to abort:

- The **[Stop]** key is pressed.
- A sampler error occurs, producing an error message.
- The GC detects a configuration mismatch during a method load.
- A running sequence tries to load a method that doesn't exist.
- The sampler is turned off. You can correct the problem and then resume the sequence. The aborted sample run will be repeated.

To resume an aborted sequence

1 Correct the problem. (See "Aborting a sequence".)

2 Press **[Seq Control]**.

3 Scroll to **Resume sequence** and press **[Enter]**.

The aborted sample run will be repeated.

6
Chromatographic Checkout

This section described the general procedure for verifying performance against the original factory standards. The checkout procedures described here assume a GC that has been in use for some period of time. Therefore the procedures ask that you perform bakeouts, replace consumable hardware, install the checkout column, and so forth. For a new GC installation, refer to Installation and First Startup manual for the steps you can skip in this case.

About Chromatographic Checkout

The tests described in this section provide basic confirmation that the GC and detector can perform comparably to factory condition. However, as detectors and the other parts of the GC age, detector performance can change. The results presented here represent typical outputs for typical operating conditions and are not specifications.

The tests assume the following:

- Use of an automatic liquid sampler. If not available, use a suitable manual syringe instead of the syringe listed.
- Use of a 10-µL syringe in most cases. However, a 5-µL syringe is an acceptable substitute.
- Use of the septa and other hardware (liners, jets, adapters, and so forth) described. If you substitute other hardware, performance can vary.

To Prepare for Chromatographic Checkout

Because of the differences in chromatographic performance associated with different consumables, Agilent strongly recommends using the parts listed here for all checkout tests. Agilent also recommends installing new consumable parts whenever the quality of the installed ones is not known. For example, installing a new liner and septum ensures that they will not contribute any contamination to the results.

When the GC is delivered from the factory, these consumable parts are new and do not need replacement.

NOTE For a new GC, check the installed inlet liner. The liner shipped in the inlet may not be the liner recommended for checkout.

1 Check the indicators/dates on any gas supply traps. Replace/recondition expended traps.
2 Install new consumable parts for the inlet and prepare the correct injector syringe (and needle, as needed).

Table 3 Recommended parts for checkout by inlet type

Recommended part for checkout	Part number
Split splitless inlet	
Syringe, 10-µL	5181-1267
O-ring	5188-5365
Septum	5183-4757
Liner	5062-3587 or 5181-3316
Multimode inlet	
Syringe, 10-µL	5181-1267
O-ring	5188-6405
Septum	5183-4757
Liner	5188-6568
Packed column inlet	
Syringe, 10-µL	5181-1267
O-ring	5080-8898

Table 3 Recommended parts for checkout by inlet type (continued)

Recommended part for checkout	Part number
Septum	5183-4757
Cool on-column inlet	
Septum	5183-4758
Septum nut	19245-80521
Syringe, 5-µL on-column	5182-0836
0.32-mm needle for 5-µL syringe	5182-0831
7693A ALS: Needle support insert, COC	G4513-40529
7683B ALS: Needle support assembly for 0.25/0.32 mm injections	G2913-60977
Insert, fused silica, 0.32-mm id	19245-20525
PTV inlet	
Syringe, 10-µL—for septum head Syringe, 10-µL, 23/42/HP—for septumless head	5181-1267 5181-8809
Inlet adapter, Graphpak-2M	5182-9761
Silver seal for Graphpak-2M	5182-9763
Glass liner, multibaffle	5183-2037
PTFE ferrule (septumless head)	5182-9748
Microseal replacement (if installed)	5182-3444
Ferrule, Graphpak-3D	5182-9749

To Check FID Performance

1 Gather the following:
   - Evaluation column, HP-5 30 m × 0.32 mm × 0.25 µm (19091J-413)
   - FID performance evaluation (checkout) sample (5188-5372)
   - Chromatographic-grade isooctane
   - 4-mL solvent and waste bottles or equivalent for autoinjector
   - 2-mL sample vials or equivalent for sample
   - Inlet and injector hardware (See "To Prepare for Chromatographic Checkout.")
2 Verify the following:
   - Capillary column jet installed. If not, select and install a capillary column jet.
   - Capillary column adapter installed (adaptable FID only). If not, install it.
   - Chromatographic-grade gases plumbed and configured: helium as carrier gas, nitrogen, hydrogen, and air.
   - Empty waste vials loaded in sample turret.
   - 4-mL solvent vial with diffusion cap filled with isooctane and inserted in Solvent A injector position.
3 Replace consumable parts (liner, septum, traps, syringe, and so forth) as needed for the checkout. See "To Prepare for Chromatographic Checkout."
4 Install the evaluation column. (See the procedure for the SS, PP, COC, MMI, or PTV in the Maintenance manual.)(See the procedure for the SS, PP, or COC in the Maintenance manual.)
   - Bake out the evaluation column for at least 30 min at 180 °C. (See the procedure for the SS, PP, COC, MMI, or PTV in the Maintenance manual.)(See the procedure for the SS, PP, or COC in the Maintenance manual.)
   - Be sure to configure the column.
5 Check the FID baseline output. The output should be between 5 pA and 20 pA and relatively stable. (If using a gas generator or ultra pure gas, the signal may stabilize below 5 pA.) If the output is outside this range or unstable, resolve this problem before continuing.

6 If the output is too low:

- Check that the electrometer is on.
- Check that the flame is lit.
- Check that the signal is set to the correct detector.

7 Create or load a method with the parameter values listed in Table 4.

Table 4 FID Checkout Conditions

Column and sample	
Type	HP-5, 30 m × 0.32 mm × 0.25 µm (19091J-413)
Sample	FID checkout 5188-5372
Column flow	6.5 mL/min
Column mode	Constant flow
Split/splitless inlet	
Temperature	250 °C
Mode	Splitless
Purge flow	40 mL/min
Purge time	0.5 min
Septum purge	3 mL/min
Gas saver	Off
Multimode inlet	
Mode	Splitless
Inlet temperature	75 °C
Initial time	0.1 min
Rate 1	720 °C/min
Final temp 1	250 °C
Final time 1	5.0 min
Purge time	1.0 min
Purge flow	40 mL/min
Septum purge	3 mL/min
Packed column inlet	
Temperature	250 °C
Septum purge	3 mL/min

Table 4 FID Checkout Conditions (continued)

Cool on-column inlet	
Temperature	Oven Track
Septum purge	15 mL/min
PTV inlet	
Mode	Splitless
Inlet temperature	75 °C
Initial time	0.1 min
Rate 1	720 °C/min
Final temp 1	350 °C
Final time 1	2 min
Rate 2	100 °C/min
Final temp 2	250 °C
Final time 2	0 min
Purge time	0.5 min
Purge flow	40 mL/min
Septum purge	3 mL/min
Detector	
Temperature	300 °C
H2 flow	30 mL/min
Air flow	400 mL/min
Makeup flow (N2)	25 mL/min
Lit offset	Typically 2 pA
Oven	
Initial temp	75 °C
Initial time	0.5 min
Rate 1	20 °C/min
Final temp	190 °C
Final time	0 min
ALS settings (if installed)	
Sample washes	2
Sample pumps	6
Sample wash volume	8 (maximum)

Table 4 FID Checkout Conditions (continued)

Injection volume	1 μL
Syringe size	10 μL
Solvent A pre washes	2
Solvent A post washes	2
Solvent A wash volume	8
Solvent B pre washes	0
Solvent B post washes	0
Solvent B wash volume	0
Injection mode (7693A)	Normal
Airgap Volume (7693A)	0.20
Viscosity delay	0
Inject Dispense Speed (7693A)	6000
Plunger speed (7683)	Fast, for all inlets except COC.
PreInjection dwell	0
PostInjection dwell	0
Manual injection	
Injection volume	1 μL
Data system	
Data rate	5 Hz

8 If using a data system, prepare the data system to perform one run using the loaded checkout method. Make sure that the data system will output a chromatogram.

If not using a data system, create a one sample sequence using the GC keypad.

9 Start the run.

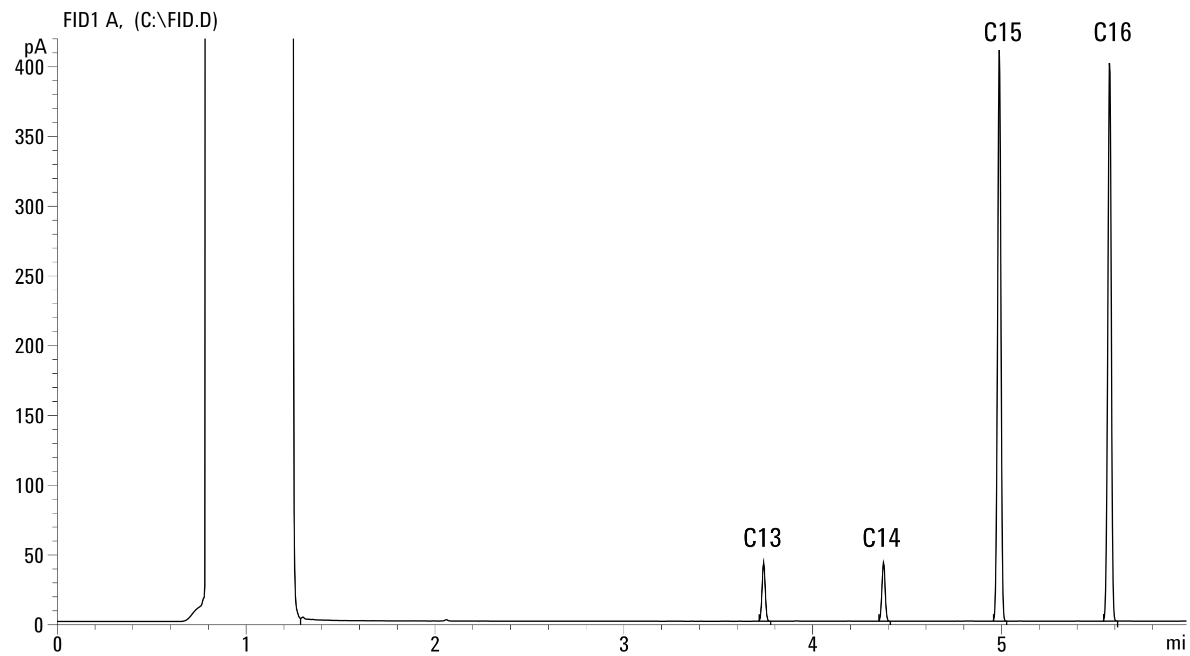
If performing an injection using an autosampler, start the run using the data system or press **[Start]** on the GC.

If performing a manual injection (with or without a data system):

a Press **[Prep Run]** to prepare the inlet for splitless injection.

b When the GC becomes ready, inject 1 µL of the checkout sample and press **[Start]** on the GC.

c The following chromatogram shows typical results for a new detector with new consumable parts installed and nitrogen makeup gas.



To Check TCD Performance

1 Gather the following:
   - Evaluation column, HP-5 30 m × 0.32 mm × 0.25 µm (19091J-413)
   - FID/TCD performance evaluation (checkout) sample (18710-60170)
   - 4-mL solvent and waste bottles or equivalent for autoinjector
   - Chromatographic-grade hexane
   - 2-mL sample vials or equivalent for sample
   - Chromatographic-grade helium as carrier, makeup, and reference gas
   - Inlet and injector hardware (See "To Prepare for Chromatographic Checkout.")
2 Verify the following:
   - Chromatographic-grade gases plumbed and configured: helium as carrier gas and reference gas.
   - Empty waste vials loaded in sample turret.
   - 4-mL solvent vial with diffusion cap filled with hexane and inserted in Solvent A injector position.
3 Replace consumable parts (liner, septum, traps, syringe, and so forth) as needed for the checkout. See "To Prepare for Chromatographic Checkout."
4 Install the evaluation column. (See the procedure for the SS, PP, COC, MMI, or PTV in the Maintenance manual.)(See the procedure for the SS, PP, or COC in the Maintenance manual.)
   - Bake out the evaluation column for at least 30 min at 180 °C. (See the procedure for the SS, PP, COC, MMI, or PTV in the Maintenance manual.)(See the procedure for the SS, PP, or COC in the Maintenance manual.)
   - Configure the column
5 Create or load a method with the parameter values listed in Table 5.

Table 5 TCD Checkout Conditions

Column and sample

Table 5 TCD Checkout Conditions (continued)

Type	HP-5, 30 m × 0.32 mm × 0.25 µm (19091J-413)
Sample	FID/TCD checkout 18710-60170
Column flow	6.5 mL/min
Column mode	Constant flow
Split/splitless inlet	
Temperature	250 °C
Mode	Splitless
Purge flow	60 mL/min
Purge time	0.75 min
Septum purge	3 mL/min
Multimode inlet	
Mode	Splitless
Inlet temperature	40 °C
Initial time	0.1 min
Rate 1	720 °C/min
Final temp 1	350 °C
Final time 1	2 min
Purge time	1.0 min
Purge flow	40 mL/min
Septum purge	3 mL/min
Packed column inlet	
Temperature	250 °C
Septum purge	3 mL/min
Cool on-column inlet	
Temperature	Oven track
Septum purge	15 mL/min
PTV inlet	
Mode	Splitless
Inlet temperature	40 °C
Initial time	0.1 min
Rate 1	720 °C/min

Table 5 TCD Checkout Conditions (continued)

Final temp 1	350 °C
Final time 1	2 min
Rate 2	100 °C/min
Final temp 2	250 °C
Final time 2	0 min
Purge time	0.5 min
Purge flow	40 mL/min
Septum purge	3 mL/min
Detector	
Temperature	300 °C
Reference flow (He)	20 mL/min
Makeup flow (He)	2 mL/min
Baseline output	< 30 display counts on Agilent OpenLAB CDS ChemStation Edition (< 750 µV)
Oven	
Initial temp	40 °C
Initial time	0 min
Rate 1	20 °C/min
Final temp	90 °C
Final time	0 min
Rate 2	15 °C/min
Final temp	170 °C
Final time	0 min
ALS settings (if installed)	
Sample washes	2
Sample pumps	6
Sample wash volume	8 (maximum)
Injection volume	1 µL
Syringe size	10 µL
Solvent A pre washes	2
Solvent A post washes	2

Table 5 TCD Checkout Conditions (continued)

Solvent A wash volume	8
Solvent B pre washes	0
Solvent B post washes	0
Solvent B wash volume	0
Injection mode (7693A)	Normal
Airgap Volume (7693A)	0.20
Viscosity delay	0
Inject Dispense Speed (7693A)	6000
Plunger speed (7683)	Fast, for all inlets except COC.
PreInjection dwell	0
PostInjection dwell	0
Manual injection	
Injection volume	1 µL
Data system	
Data rate	5 Hz

6 Display the signal output. A stable output at any value between 12.5 and 750 µV (inclusive) is acceptable.

- If the baseline output is < 0.5 display units (< 12.5 µV), verify that the detector filament is on. If the offset is still < 0.5 display units (< 12.5 µV), your detector requires service.
- If baseline output is > 30 display units (> 750 µV), there may be chemical contamination contributing to the signal. Bakeout the TCD. If repeated cleanings do not give an acceptable signal, check gas purity. Use higher purity gases and/or install traps.

7 If using a data system, prepare the data system to perform one run using the loaded checkout method. Make sure that the data system will output a chromatogram.

8 Start the run.

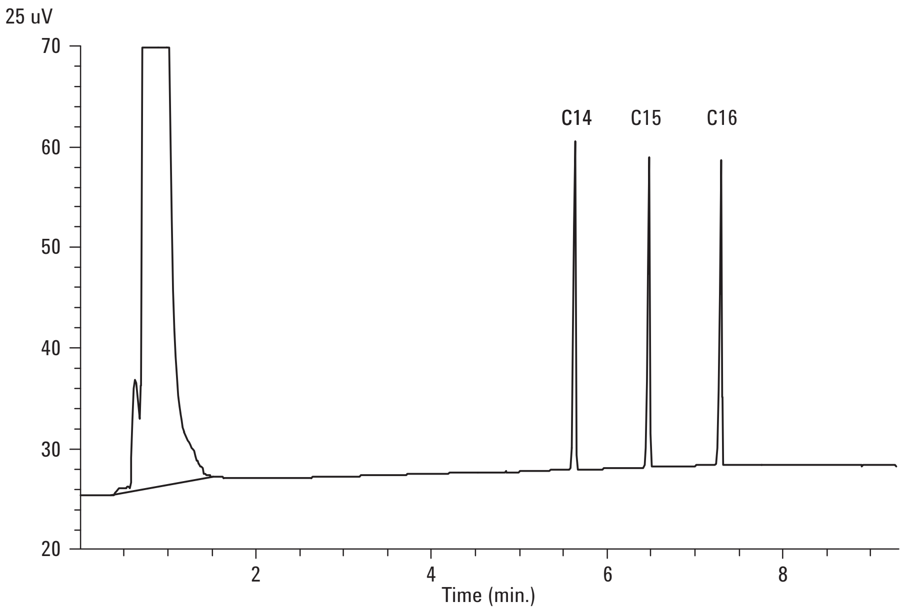
If performing an injection using an autosampler, start the run using the data system or press **[Start]** on the GC.

If performing a manual injection (with or without a data system):

a Press **[Prep Run]** to prepare the inlet for splitless injection.

b When the GC becomes ready, inject 1 µL of the checkout sample and press **[Start]** on the GC.

c The following chromatogram shows typical results for a new detector with new consumable parts installed.



To Check NPD Performance

1 Gather the following:
   - Evaluation column, HP-5 30 m × 0.32 mm × 0.25 µm (19091J-413)
   - NPD performance evaluation (checkout) sample (18789-60060)
   - 4-mL solvent and waste bottles or equivalent for autoinjector.
   - Chromatographic-grade isooctane
   - 2-mL sample vials or equivalent for sample.
   - Inlet and injector hardware (See "To Prepare for Chromatographic Checkout.")
2 Verify the following:
   - Capillary column jet installed. If not, select and install a capillary column jet.
   - Capillary column adapter installed. If not, install it.
   - Chromatographic-grade gases plumbed and configured: helium as carrier gas, nitrogen, hydrogen, and air.
   - Empty waste vials loaded in sample turret.
   - 4-mL vial with diffusion cap filled with isooctane and inserted in Solvent A injector position.
3 Replace consumable parts (liner, septum, traps, syringe, and so forth) as needed for the checkout. See "To Prepare for Chromatographic Checkout."
4 If present, remove any protective caps from the inlet manifold vents.
5 Install the evaluation column. (See the procedure for the SS, PP, COC, MMI, or PTV in the Maintenance manual.)(See the procedure for the SS, PP, or COC in the Maintenance manual.)
   - Bake out the evaluation column for at least 30 min at 180 °C. (See the procedure for the SS, PP, COC, MMI, or PTV in the Maintenance manual.)(See the procedure for the SS, PP, or COC in the Maintenance manual.)
   - Be sure to configure the column
6 Create or load a method with the parameter values listed in Table 6.

Table 6 NPD Checkout Conditions

Column and sample	
Type	HP-5, 30 m × 0.32 mm × 0.25 µm (19091J-413)
Sample	NPD checkout 18789-60060
Column mode	Constant flow
Column flow	6.5 mL/min (helium)
Split/splitless inlet	
Temperature	200 °C
Mode	Splitless
Purge flow	60 mL/min
Purge time	0.75 min
Septum purge	3 mL/min
Multimode inlet	
Mode	Splitless
Inlet temperature	60 °C
Initial time	0.1 min
Rate 1	720 °C/min
Final temp 1	350 °C
Final time 1	2 min
Purge time	1.0 min
Purge flow	60 mL/min
Septum purge	3 mL/min
Packed column inlet	
Temperature	200 °C
Septum purge	3 mL/min
Cool on-column inlet	
Temperature	Oven track
Septum purge	15 mL/min
PTV inlet	
Mode	Splitless
Inlet temperature	60 °C

Table 6 NPD Checkout Conditions (continued)

Initial time	0.1 min
Rate 1	720 °C/min
Final temp 1	350 °C
Final time 1	2 min
Rate 2	100 °C/min
Final temp 2	250 °C
Final time 2	0 min
Purge time	0.75 min
Purge flow	60 mL/min
Septum purge	3 mL/min
Detector	
Temperature	300 °C
H2 flow	3 mL/min
Air flow	60 mL/min
Makeup flow (N2)	Makeup + column = 10 mL/min
Output	30 display units (30 pA)
Oven	
Initial temp	60 °C
Initial time	0 min
Rate 1	20 °C/min
Final temp	200 °C
Final time	3 min
ALS settings (if installed)	
Sample washes	2
Sample pumps	6
Sample wash volume	8 (maximum)
Injection volume	1 µL
Syringe size	10 µL
Solvent A pre washes	2
Solvent A post washes	2
Solvent A wash volume	8
Solvent B pre washes	0

Table 6 NPD Checkout Conditions (continued)

Solvent B post washes	0
Solvent B wash volume	0
Injection mode (7693A)	Normal
Airgap Volume (7693A)	0.20
Viscosity delay	0
Inject Dispense Speed (7693A)	6000
Plunger speed (7683)	Fast, for all inlets except COC.
PreInjection dwell	0
PostInjection dwell	0
Manual injection	
Injection volume	1 µL
Data system	
Data rate	5 Hz

7 If using a data system, prepare the data system to perform one run using the loaded checkout method. Make sure that the data system will output a chromatogram.

8 Start the run.

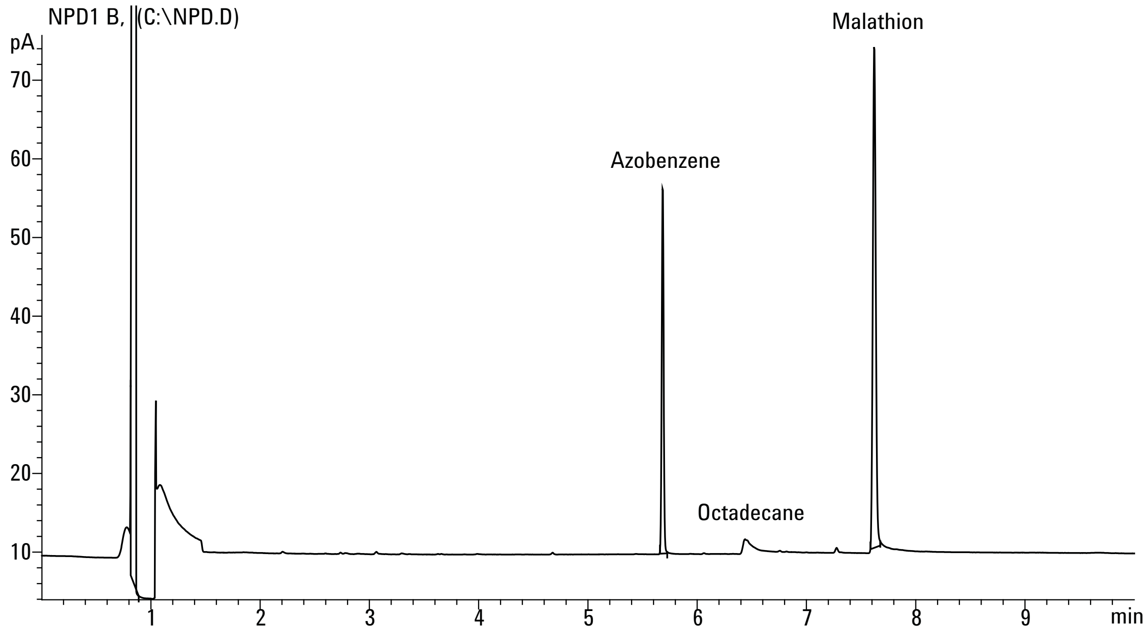
   If performing an injection using an autosampler, start the run using the data system, or creating a one sample sequence and pressing **[Start]** on the GC.

   If performing a manual injection (with or without a data system):

   a Press **[Prep Run]** to prepare the inlet for splitless injection.

   b When the GC becomes ready, inject 1 µL of the checkout sample and press **[Start]** on the GC.

   c The following chromatogram shows typical results for a new detector with new consumable parts installed.


NPD1 B, (C:\NPD.D)
pA
70
60
50
40
30
20
10
1
2
3
4
5
6
7
8
9
min
Azobenzene
Octadecane
Malathion

To Check uECD Performance

1 Gather the following:
   - Evaluation column, HP-5 30 m × 0.32 mm × 0.25 µm (19091J-413)
   - uECD performance evaluation (checkout) sample (18713–60040, Japan: 5183-0379)
   - 4-mL solvent and waste bottles or equivalent for autoinjector.
   - Chromatographic-grade isooctane
   - 2-mL sample vials or equivalent for sample.
   - Inlet and injector hardware (See "To Prepare for Chromatographic Checkout.")
2 Verify the following:
   - Clean fused silica indented mixing liner installed. If not, install it.
   - Chromatographic-grade gases plumbed and configured: helium for carrier gas, nitrogen for makeup.
   - Empty waste vials loaded in sample turret.
   - 4-mL vial with diffusion cap filled with hexane and inserted in Solvent A injector position.
3 Replace consumable parts (liner, septum, traps, syringe, and so forth) as needed for the checkout. See "To Prepare for Chromatographic Checkout."
4 Install the evaluation column. (See the procedure for the SS, PP, COC, MMI, or PTV in the Maintenance manual.)(See the procedure for the SS, PP, or COC in the Maintenance manual.)
   - Bake out the evaluation column for at least 30 minutes at 180 °C. (See the procedure for the SS, PP, COC, MMI, or PTV in the Maintenance manual.)(See the procedure for the SS, PP, or COC in the Maintenance manual.)
   - Be sure to configure the column.
5 Display the signal output to determine baseline output. A stable baseline output at any value between 0.5 and 1000 Hz (OpenLAB CDS ChemStation Edition display units) (inclusive) is acceptable.
   - If the baseline output is < 0.5 Hz, verify that the electrometer is on. If the offset is still < 0.5 Hz, your detector requires service.

- If the baseline output is > 1000 Hz, there may be chemical contamination contributing to the signal. Bakeout the uECD. If repeated cleanings do not give an acceptable signal, check gas purity. Use higher purity gases and/or install traps.

6 Create or load a method with the parameter values listed in Table 7.

Table 7 uECD Checkout Conditions

Column and sample	
Type	HP-5, 30 m × 0.32 mm × 0.25 µm (19091J-413
Sample	µECD checkout (18713-60040 or Japan: 5183-0379)
Column mode	Constant flow
Column flow	6.5 mL/min (helium)
Split/splitless inlet	
Temperature	200 °C
Mode	Splitless
Purge flow	60 mL/min
Purge time	0.75 min
Septum purge	3 mL/min
Multimode inlet	
Mode	Splitless
Inlet temperature	80 °C
Initial time	0.1 min
Rate 1	720 °C/min
Final temp 1	250 °C
Final time 1	5 min
Purge time	1.0 min
Purge flow	60 mL/min
Septum purge	3 mL/min
Packed column inlet	
Temperature	200 °C
Septum purge	3 mL/min

Table 7 uECD Checkout Conditions (continued)

Cool on-column inlet	
Temperature	Oven track
Septum purge	15 mL/min
PTV inlet	
Mode	Splitless
Inlet temperature	80 °C
Initial time	0.1 min
Rate 1	720 °C/min
Final temp 1	350 °C
Final time 1	2 min
Rate 2	100 °C/min
Final temp 2	250 °C
Final time 2	0 min
Purge time	0.75 min
Purge flow	60 mL/min
Septum purge	3 mL/min
Detector	
Temperature	300 °C
Makeup flow (N2)	30 mL/min (constant + makeup)
Baseline output	Should be < 1000 display counts. In Agilent OpenLAB CDS ChemStation Edition (< 1000 Hz)
Oven	
Initial temp	80 °C
Initial time	0 min
Rate 1	15 °C/min
Final temp	180 °C
Final time	10 min
ALS settings (if installed)	
Sample washes	2
Sample pumps	6
Sample wash volume	8 (maximum)

Table 7 uECD Checkout Conditions (continued)

Injection volume	1 µL
Syringe size	10 µL
Solvent A pre washes	2
Solvent A post washes	2
Solvent A wash volume	8
Solvent B pre washes	0
Solvent B post washes	0
Solvent B wash volume	0
Injection mode (7693A)	Normal
Airgap Volume (7693A)	0.20
Viscosity delay	0
Inject Dispense Speed (7693A)	6000
Plunger speed (7683)	Fast, for all inlets except COC.
PreInjection dwell	0
PostInjection dwell	0
Manual injection	
Injection volume	1 µL
Data system	
Data rate	5 Hz

7 If using a data system, prepare the data system to perform one run using the loaded checkout method. Make sure that the data system will output a chromatogram.

8 Start the run.

If performing an injection using an autosampler, start the run using the data system or press **[Start]** on the GC.

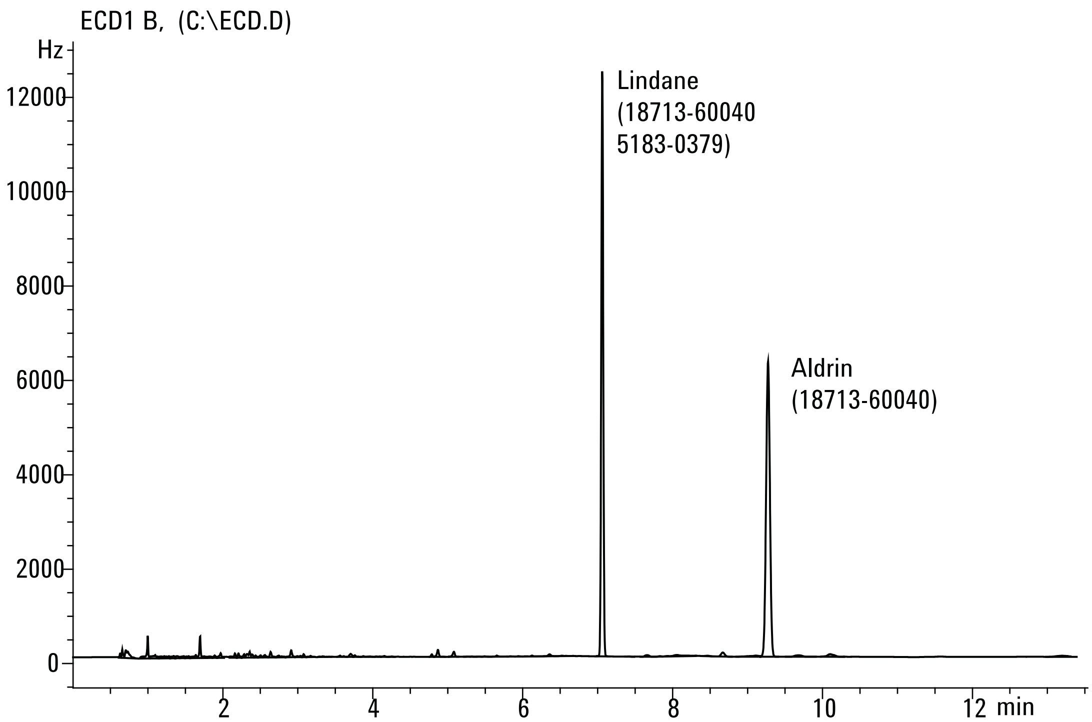
If performing a manual injection (with or without a data system):

a Press **[Prep Run]** to prepare the inlet for splitless injection.

b When the GC becomes ready, inject 1 µL of the checkout sample and press **[Start]** on the GC.

9 The following chromatogram shows typical results for a new detector with new consumable parts installed. The Aldrin

peak will be missing when using the Japanese sample 5183-0379.



To Check FPD$^+$ Performance (Sample 5188-5953)

To check FPD$^+$ performance, first check the phosphorus performance, then the sulfur performance.

Preparation

1 Gather the following:
   - Evaluation column, HP-5 30 m × 0.32 mm × 0.25 µm (19091J-413)
   - FPD performance evaluation (checkout) sample (5188-5953), 2.5 mg/L (± 0.5%) methylparathion in isooctane
   - Phosphorus filter
   - Sulfur filter and filter spacer
   - 4-mL solvent and waste bottles or equivalent for autoinjector.
   - 2-mL sample vials or equivalent for sample.
   - Chromatographic-grade isooctane for syringe wash solvent.
   - Inlet and injector hardware (See “To Prepare for Chromatographic Checkout.”)

2 Verify the following:
   - Capillary column adapter installed. If not, install it.
   - Chromatographic-grade gases plumbed and configured: helium as carrier gas, nitrogen, hydrogen, and air.
   - Empty waste vials loaded in sample turret.
   - 4-mL vial with diffusion cap filled with isooctane and inserted in Solvent A injector position.

3 Replace consumable parts (liner, septum, traps, syringe, and so forth) as needed for the checkout. See “To Prepare for Chromatographic Checkout.”

4 Verify that the **Lit Offset** is set appropriately. Typically, it should be about 2.0 pA for the checkout method.

5 Install the evaluation column. (See the procedure for the SS, PP, COC, MMI, or PTV in the Maintenance manual.)(See the procedure for the SS, PP, or COC in the Maintenance manual.)

- Set the oven, inlet, and detector to 250 °C and bake out for at least 15 minutes. (See the procedure for the SS, PP, COC, MMI, or PTV in the Maintenance manual.)(See the procedure for the SS, PP, or COC in the Maintenance manual.) Be sure to configure the column.

Phosphorus performance

1 If it is not already installed, install the phosphorus filter.

2 Create or load a method with the parameter values listed in Table 8.

Table 8 FPD+ Checkout Conditions (P)

Column and sample	
Type	HP-5, 30 m × 0.32 mm × 0.25 μm (19091J-413)
Sample	FPD checkout (5188-5953)
Column mode	Constant pressure
Column pressure	25 psi
Split/splitless inlet	
Temperature	200 °C Split/splitless
Mode	Splitless
Purge flow	60 mL/min
Purge time	0.75 min
Septum purge	3 mL/min
Multimode inlet	
Mode	Splitless
Inlet temperature	75 °C
Initial time	0.1 min
Rate 1	720 °C/min
Final temp 1	250 °C
Final time 1	5.0 min
Purge time	1.0 min
Purge flow	60 mL/min
Septum purge	3 mL/min
Packed column inlet	

Table 8 FPD$^+$ Checkout Conditions (continued)(P)

Temperature	200 °C
Septum purge	3 mL/min
Cool on-column inlet	
Temperature	Oven track
Septum purge	15 mL/min
PTV inlet	
Mode	Splitless
Inlet temperature	75 °C
Initial time	0.1 min
Rate 1	720 °C/min
Final temp 1	350 °C
Final time 1	2 min
Rate 2	100 °C/min
Final temp 2	250 °C
Final time 2	0 min
Purge time	0.75 min
Purge flow	60 mL/min
Septum purge	3 mL/min
Detector	
Temperature	200 °C (On)
Hydrogen flow	60 mL/min (On)
Air (Oxidizer) flow	60 mL/min (On)
Mode	Constant makeup flow OFF
Makeup flow	60 mL/min (On)
Makeup gas type	Nitrogen
Flame	On
Lit offset	Typically 2 pA
PMT voltage	On
Emission Block	125 °C
Oven	
Initial temp	70 °C
Initial time	0 min

Table 8 FPD$^+$ Checkout Conditions (continued)(P)

Rate 1	25 °C/min
Final temp 1	150 °C
Final time 1	0 min
Rate 2	5 °C/min
Final temp 2	190 °C
Final time 2	4 min
ALS settings (if installed)	
Sample washes	2
Sample pumps	6
Sample wash volume	8 (maximum)
Injection volume	1 µL
Syringe size	10 µL
Solvent A pre washes	2
Solvent A post washes	2
Solvent A wash volume	8
Solvent B pre washes	0
Solvent B post washes	0
Solvent B wash volume	0
Injection mode (7693A)	Normal
Airgap Volume (7693A)	0.20
Viscosity delay	0
Inject Dispense Speed (7693A)	6000
Plunger speed (7683)	Fast, for all inlets except COC.
PreInjection dwell	0
PostInjection dwell	0
Manual injection	
Injection volume	1 µL
Data system	
Data rate	5 Hz

3 Ignite the FPD flame, if not lit.

4 Display the signal output and monitor. This output typically runs between 40 and 55 but can be as high as 70. Wait for the output to stabilize. This takes approximately 1 hour.

   If the baseline output is too high:

   - Check column installation. If installed too high, the stationary phase burns in the flame and increases measured output.
   - Check for leaks.
   - Bake out the detector and column at 250 °C.
   - Wrong flows set for installed filter.

   If the baseline output is zero, verify the electrometer is on and the flame is lit.

5 If using a data system, prepare the data system to perform one run using the loaded checkout method. Make sure that the data system will output a chromatogram.

6 Start the run.

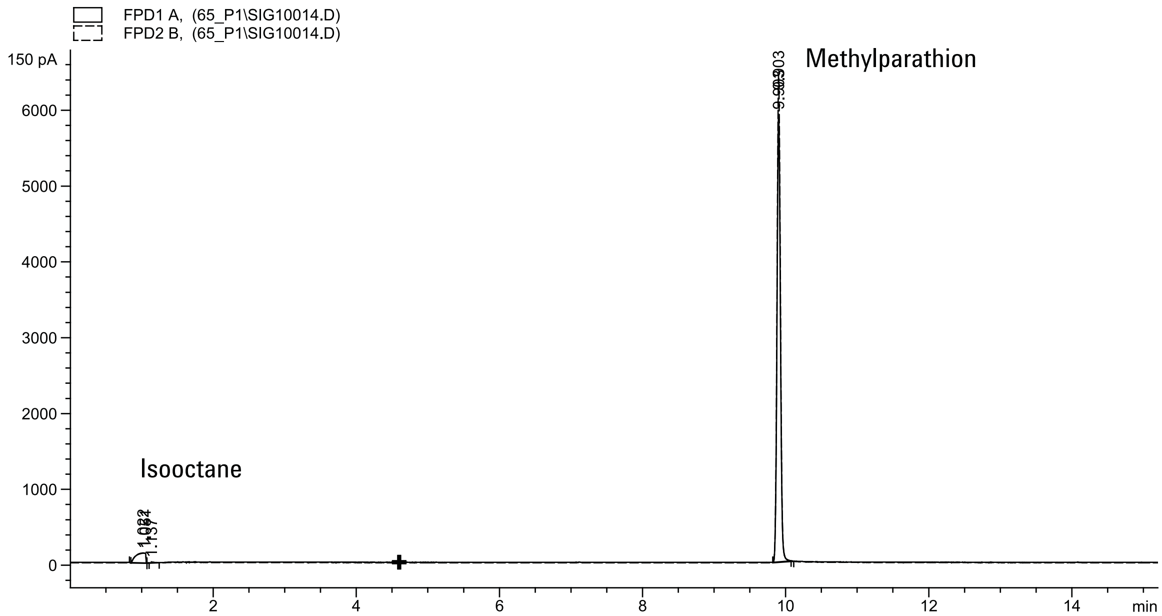
   If performing an injection using an autosampler, start the run using the data system or press **[Start]** on the GC.

   If performing a manual injection (with or without a data system):

   a Press **[Prep Run]** to prepare the inlet for splitless injection.

   b When the GC becomes ready, inject 1 µL of the checkout sample and press **[Start]** on the GC.

   c The following chromatogram shows typical results for a new detector with new consumable parts installed.



Sulfur performance

1 Install the sulfur filter and filter spacer.
2 Ignite the FPD flame if not lit.
3 Display the signal output and monitor. This output typically runs between 50 and 60 but can be as high as 70. Wait for the output to stabilize. This takes approximately 1 hour.

   If the baseline output is too high:

   - Check column installation. If installed too high, the stationery phase burns in the flame and increases measured output.
   - Check for leaks.
   - Bake out the detector and column at 250 °C.
   - Wrong flows set for installed filter.

   If the baseline output is zero, verify the electrometer is on and the flame is lit.
4 If using a data system, prepare the data system to perform one run using the loaded checkout method. Make sure that the data system will output a chromatogram.
5 Start the run.

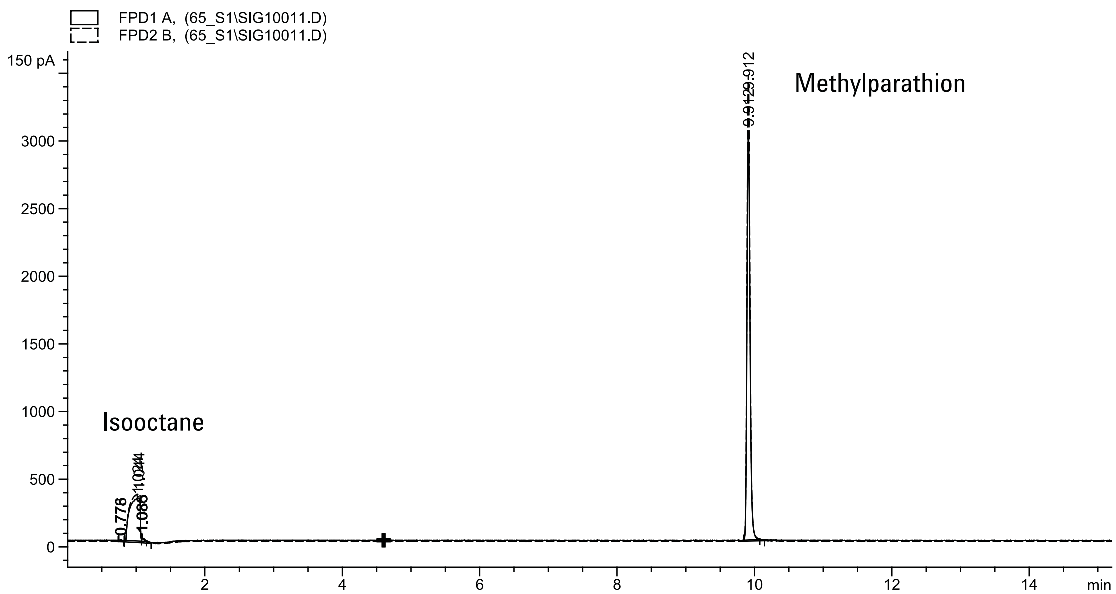
If performing an injection using an autosampler, start the run using the data system or press **[Start]** on the GC.

If performing a manual injection (with or without a data system):

a Press **[Prep Run]** to prepare the inlet for splitless injection.

b When the GC becomes ready, inject 1 µL of the checkout sample and press **[Start]** on the GC.

6 The following chromatogram shows typical results for a new detector with new consumable parts installed.



To Check FPD$^+$ Performance (Sample 5188-5245, Japan)

To verify FPD$^+$ performance, first check the phosphorus performance, then the sulfur performance.

Preparation

1 Gather the following:
   - Evaluation column, DB5 15 m × 0.32 mm × 1.0 µm (123-5513)
   - FPD performance evaluation (checkout) sample (5188-5245, Japan), composition: n-Dodecane 7499 mg/L (± 5%), Dodecanethiol 2.0 mg/L (± 5%), Tributyl Phosphate 2.0 mg/L (± 5%), tert-Butyldisulfide 1.0 mg/L (± 5%), in isooctane as solvent
   - Phosphorus filter
   - Sulfur filter and filter spacer
   - 4-mL solvent and waste bottles or equivalent for autoinjector.
   - 2-mL sample vials or equivalent for sample.
   - Chromatographic-grade isooctane for syringe wash solvent.
   - Inlet and injector hardware (See "To Prepare for Chromatographic Checkout.")
2 Verify the following:
   - Capillary column adapter installed. If not, install it.
   - Chromatographic-grade gases plumbed and configured: helium as carrier gas, nitrogen, hydrogen, and air.
   - Empty waste vials loaded in sample turret.
   - 4-mL vial with diffusion cap filled with isooctane and inserted in Solvent A injector position.
3 Replace consumable parts (liner, septum, traps, syringe, and so forth) as needed for the checkout. See "To Prepare for Chromatographic Checkout."
4 Verify the lit offset is set appropriately. Typically, it should be about 2.0 pA for the checkout method.
5 Install the evaluation column. (See the procedure for the SS, PP, COC, MMI, or PTV in the Maintenance manual.)(See the procedure for the SS, PP, or COC in the Maintenance manual.)

- Set the oven, inlet, and detector to 250 °C and bake out for at least 15 minutes. (See the procedure for the SS, PP, COC, MMI, or PTV in the Maintenance manual.)(See the procedure for the SS, PP, or COC in the Maintenance manual.)
- Configure the column.

Phosphorus performance

1 If it is not already installed, install the phosphorus filter.
2 Create or load a method with the parameter values listed in Table 9.

Table 9 FPD+ Phosphorus Checkout Conditions

Column and sample	
Type	DB-5MS, 15 m × 0.32 mm × 1.0 µm (123-5513)
Sample	FPD checkout (5188-5245)
Column mode	Constant flow
Column flow	7.5 mL/min
Split/splitless inlet	
Temperature	250 °C
Mode	Splitless
Total purge flow	69.5 mL/min
Purge flow	60 mL/min
Purge time	0.75 min
Septum purge	3 mL/min
Multimode inlet	
Mode	Splitless
Inlet temperature	80 °C
Initial time	0.1 min
Rate 1	720 °C/min
Final temp 1	250 °C
Final time 1	5.0 min
Purge time	1.0 min
Purge flow	60 mL/min

Table 9 FPD$^+$ Phosphorus Checkout Conditions (continued)

Septum purge	3 mL/min
Packed column inlet	
Temperature	250 °C
Septum purge	3 mL/min
Cool on-column inlet	
Temperature	Oven track
Septum purge	15 mL/min
PTV inlet	
Mode	Splitless
Inlet temperature	80 °C
Initial time	0.1 min
Rate 1	720 °C/min
Final temp 1	350 °C
Final time 1	2 min
Rate 2	100 °C/min
Final temp 2	250 °C
Final time 2	0 min
Purge time	0.75 min
Purge flow	60 mL/min
Septum purge	3 mL/min
Detector	
Temperature	200 °C (On)
Hydrogen flow	60.0 mL/min (On)
Air (oxidizer) flow	60.0 mL/min (On)
Mode	Constant makeup flow Off
Makeup flow	60.0 mL/min (On)
Makeup gas type	Nitrogen
Flame	On
Lit offset	Typically 2 pA
PMT voltage	On
Emission Block	125 °C
Oven	

Table 9 FPD$^+$ Phosphorus Checkout Conditions (continued)

Initial temp	70 °C
Initial time	0 min
Rate 1	10 °C/min
Final temp	105 °C
Final time	0 min
Rate 2	20 °C/min
Final temp 2	190 °C
Final time 2	7.25 min for sulfur 12.25 min for phosphorus
ALS settings (if installed)	
Sample washes	2
Sample pumps	6
Sample wash volume	8 (maximum)
Injection volume	1 µL
Syringe size	10 µL
Solvent A pre washes	2
Solvent A post washes	2
Solvent A wash volume	8
Solvent B pre washes	0
Solvent B post washes	0
Solvent B wash volume	0
Injection mode (7693A)	Normal
Airgap Volume (7693A)	0.20
Viscosity delay	0
Inject Dispense Speed (7693A)	6000
Plunger speed (7683)	Fast, for all inlets except COC.
PreInjection dwell	0
PostInjection dwell	0
Manual injection	
Injection volume	1 µL
Data System	
Data rate	5 Hz

3 Ignite the FPD flame, if not lit.

4 Display the signal output and monitor. This output typically runs between 40 and 55 but can be as high as 70. Wait for the output to stabilize. This takes approximately 1 hour.

   If the baseline output is too high:

   - Check column installation. If installed too high, the stationery phase burns in the flame and increases measured output.
   - Check for leaks.
   - Bake out the detector and column at 250 °C.
   - Wrong flows set for installed filter

   If the baseline output is zero, verify the electrometer is on and the flame is lit.

5 If using a data system, prepare the data system to perform one run using the loaded checkout method. Make sure that the data system will output a chromatogram.

6 Start the run.

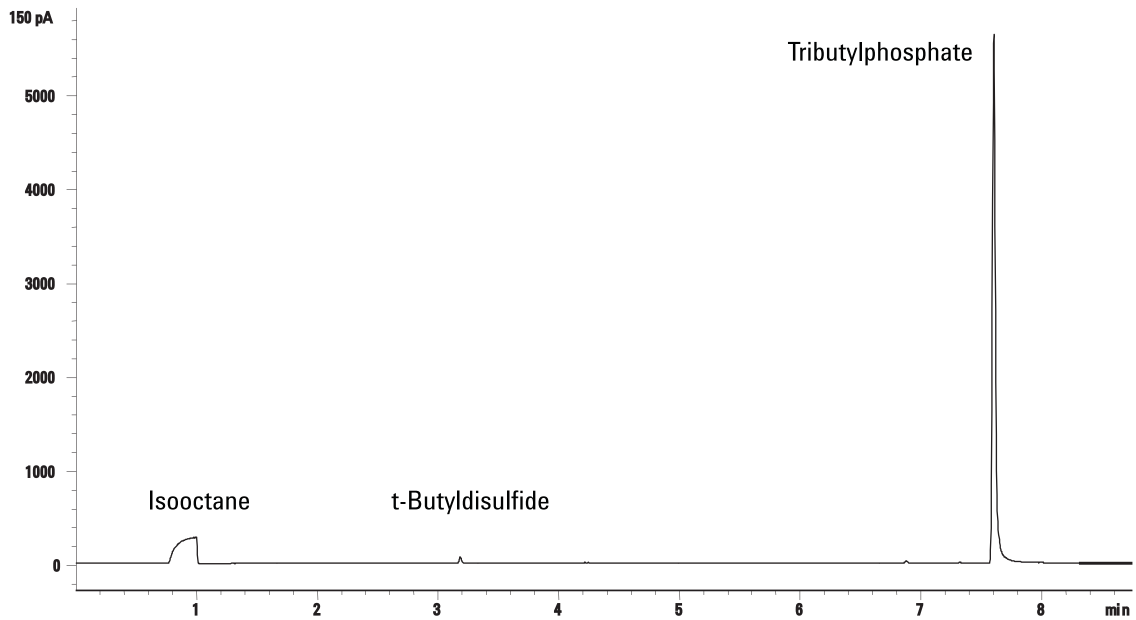
   If performing an injection using an autosampler, start the run using the data system or press **[Start]** on the GC.

   If performing a manual injection (with or without a data system):

   a Press **[Prep Run]** to prepare the inlet for splitless injection.

   b When the GC becomes ready, inject 1 µL of the checkout sample and press **[Start]** on the GC.

7 The following chromatogram shows typical results for a new detector with new consumable parts installed.



Sulfur performance

1 Install the sulfur filter.

2 Ignite the FPD flame, if not lit.

3 Display the signal output and monitor. This output typically runs between 50 and 60 but can be as high as 70. Wait for the output to stabilize. This takes approximately 2 hours.

   If the baseline output is too high:

   - Check column installation. If installed too high, the stationery phase burns in the flame and increases measured output.
   - Check for leaks.
   - Bake out the detector and column at 250 °C.
   - Wrong flows set for installed filter

   If the baseline output is zero, verify the electrometer is on and the flame is lit.

4 If using a data system, prepare the data system to perform one run using the loaded checkout method. Make sure the data system will output a chromatogram.

5 Start the run.

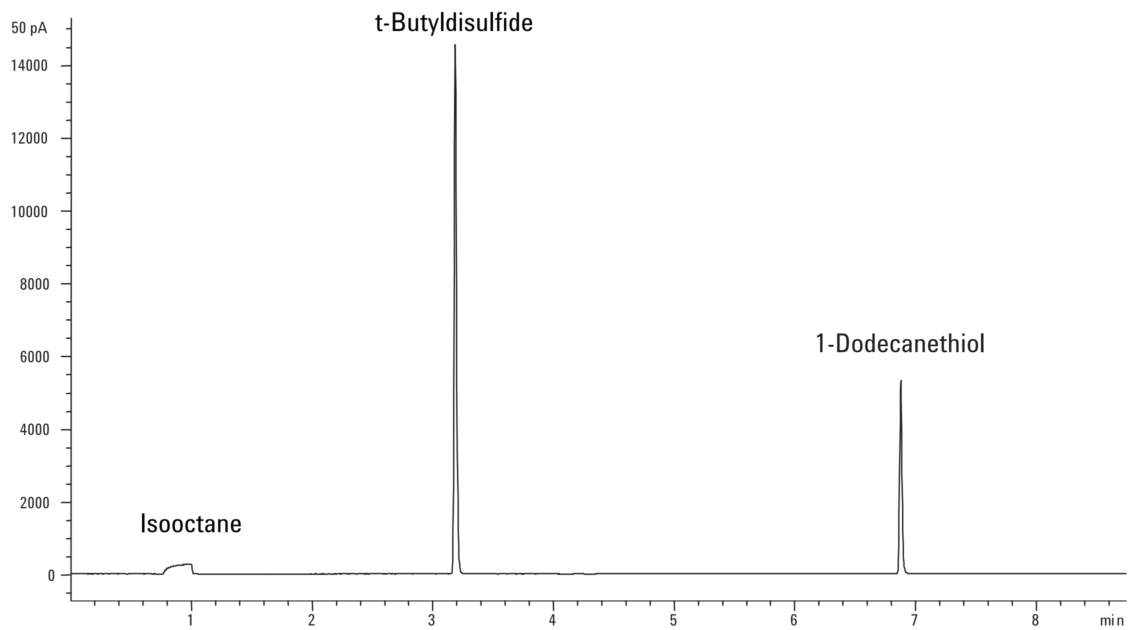
If performing an injection using an autosampler, start the run using the data system or press **[Start]** on the GC.

If performing a manual injection (with or without a data system):

a Press **[Prep Run]** to prepare the inlet for splitless injection.

b When the GC becomes ready, inject 1 µL of the checkout sample and press **[Start]** on the GC.

6 The following chromatogram shows typical results for a new detector with new consumable parts installed.



To Check FPD Performance (Sample 5188-5953)

To check FPD performance, first check the phosphorus performance, then the sulfur performance.

Preparation

1. Gather the following:
   - Evaluation column, HP-5 30 m × 0.32 mm × 0.25 µm (19091J-413)
   - FPD performance evaluation (checkout) sample (5188-5953), 2.5 mg/L (± 0.5%) methylparathion in isooctane
   - Phosphorus filter
   - Sulfur filter and filter spacer
   - 4-mL solvent and waste bottles or equivalent for autoinjector.
   - 2-mL sample vials or equivalent for sample.
   - Chromatographic-grade isooctane for syringe wash solvent.
   - Inlet and injector hardware (See "To Prepare for Chromatographic Checkout.")
2. Verify the following:
   - Capillary column adapter installed. If not, install it.
   - Chromatographic-grade gases plumbed and configured: helium as carrier gas, nitrogen, hydrogen, and air.
   - Empty waste vials loaded in sample turret.
   - 4-mL vial with diffusion cap filled with isooctane and inserted in Solvent A injector position.
3. Replace consumable parts (liner, septum, traps, syringe, and so forth) as needed for the checkout. See "To Prepare for Chromatographic Checkout."
4. Verify that the **Lit Offset** is set appropriately. Typically, it should be about 2.0 pA for the checkout method.
5. Install the evaluation column. (See the procedure for the SS, PP, COC, MMI, or PTV in the Maintenance manual.)(See the procedure for the SS, PP, or COC in the Maintenance manual.)

- Set the oven, inlet, and detector to 250 °C and bake out for at least 15 minutes. (See the procedure for the SS, PP, COC, MMI, or PTV in the Maintenance manual.)(See the procedure for the SS, PP, or COC in the Maintenance manual.)
- Be sure to configure the column.

Phosphorus performance

1 If it is not already installed, install the phosphorus filter.

2 Create or load a method with the parameter values listed in Table 10.

Table 10 FPD Checkout Conditions (P)

Column and sample	
Type	HP-5, 30 m × 0.32 mm × 0.25 µm (19091J-413)
Sample	FPD checkout (5188-5953)
Column mode	Constant pressure
Column pressure	25 psi
Split/splitless inlet	
Temperature	200 °C Split/splitless
Mode	Splitless
Purge flow	60 mL/min
Purge time	0.75 min
Septum purge	3 mL/min
Multimode inlet	
Mode	Splitless
Inlet temperature	75 °C
Initial time	0.1 min
Rate 1	720 °C/min
Final temp 1	250 °C
Final time 1	5.0 min
Purge time	1.0 min
Purge flow	60 mL/min
Septum purge	3 mL/min

Table 10 FPD Checkout Conditions (continued)(P)

Packed column inlet	
Temperature	200 °C
Septum purge	3 mL/min
Cool on-column inlet	
Temperature	Oven track
Septum purge	15 mL/min
PTV inlet	
Mode	Splitless
Inlet temperature	75 °C
Initial time	0.1 min
Rate 1	720 °C/min
Final temp 1	350 °C
Final time 1	2 min
Rate 2	100 °C/min
Final temp 2	250 °C
Final time 2	0 min
Purge time	0.75 min
Purge flow	60 mL/min
Septum purge	3 mL/min
Detector	
Temperature	200 °C (On)
Hydrogen flow	75 mL/min (On)
Air (Oxidizer) flow	100 mL/min (On)
Mode	Constant makeup flow OFF
Makeup flow	60 mL/min (On)
Makeup gas type	Nitrogen
Flame	On
Lit offset	Typically 2 pA
PMT voltage	On
Oven	
Initial temp	70 °C
Initial time	0 min

Table 10 FPD Checkout Conditions (continued)(P)

Rate 1	25 °C/min
Final temp 1	150 °C
Final time 1	0 min
Rate 2	5 °C/min
Final temp 2	190 °C
Final time 2	4 min
ALS settings (if installed)	
Sample washes	2
Sample pumps	6
Sample wash volume	8 (maximum)
Injection volume	1 µL
Syringe size	10 µL
Solvent A pre washes	2
Solvent A post washes	2
Solvent A wash volume	8
Solvent B pre washes	0
Solvent B post washes	0
Solvent B wash volume	0
Injection mode (7693A)	Normal
Airgap Volume (7693A)	0.20
Viscosity delay	0
Inject Dispense Speed (7693A)	6000
Plunger speed (7683)	Fast, for all inlets except COC.
PreInjection dwell	0
PostInjection dwell	0
Manual injection	
Injection volume	1 µL
Data system	
Data rate	5 Hz

3 Ignite the FPD flame, if not lit.

4 Display the signal output and monitor. This output typically runs between 40 and 55 but can be as high as 70. Wait for the output to stabilize. This takes approximately 1 hour.

   If the baseline output is too high:

   - Check column installation. If installed too high, the stationery phase burns in the flame and increases measured output.
   - Check for leaks.
   - Bake out the detector and column at 250 °C.
   - Wrong flows set for installed filter.

   If the baseline output is zero, verify the electrometer is on and the flame is lit.

5 If using a data system, prepare the data system to perform one run using the loaded checkout method. Make sure that the data system will output a chromatogram.

6 Start the run.

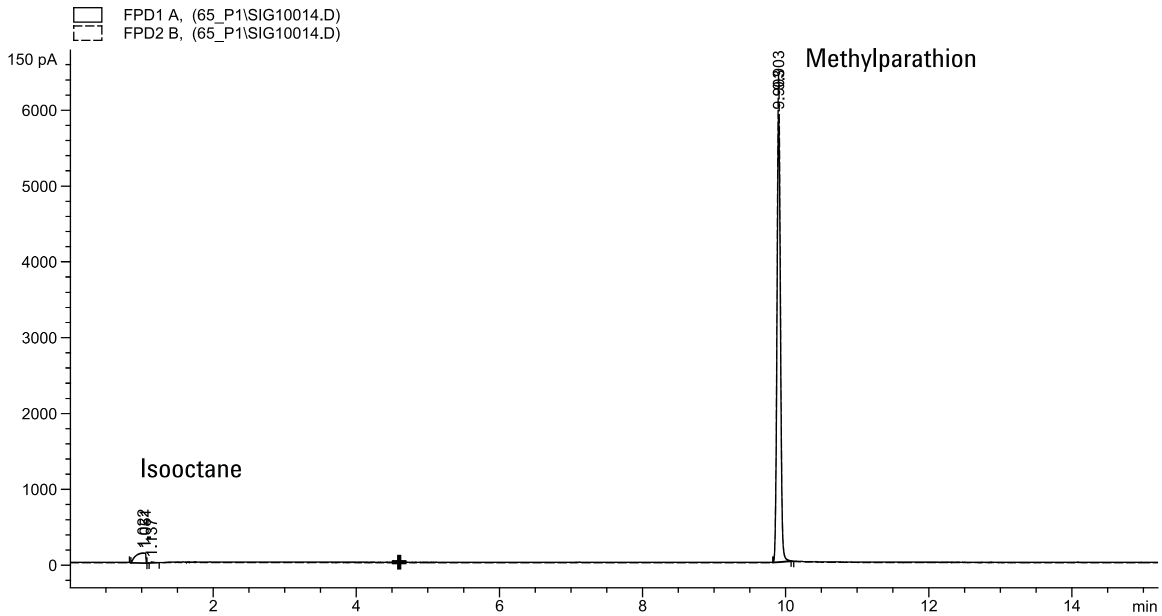
   If performing an injection using an autosampler, start the run using the data system or press **[Start]** on the GC.

   If performing a manual injection (with or without a data system):

   a Press **[Prep Run]** to prepare the inlet for splitless injection.

   b When the GC becomes ready, inject 1 µL of the checkout sample and press **[Start]** on the GC.

   c The following chromatogram shows typical results for a new detector with new consumable parts installed.



Sulfur performance

1 Install the sulfur filter and filter spacer.

2 Make the following method parameter changes.

Table 11 Sulfur method parameters (S)

Parameter	Value (mL/min)
H2 flow	50
Air flow	60

3 Ignite the FPD flame if not lit.

4 Display the signal output and monitor. This output typically runs between 50 and 60 but can be as high as 70. Wait for the output to stabilize. This takes approximately 1 hour.

If the baseline output is too high:

- Check column installation. If installed too high, the stationery phase burns in the flame and increases measured output.
- Check for leaks.
- Bake out the detector and column at 250 °C.

- Wrong flows set for installed filter.

If the baseline output is zero, verify the electrometer is on and the flame is lit.

5 If using a data system, prepare the data system to perform one run using the loaded checkout method. Make sure that the data system will output a chromatogram.

6 Start the run.

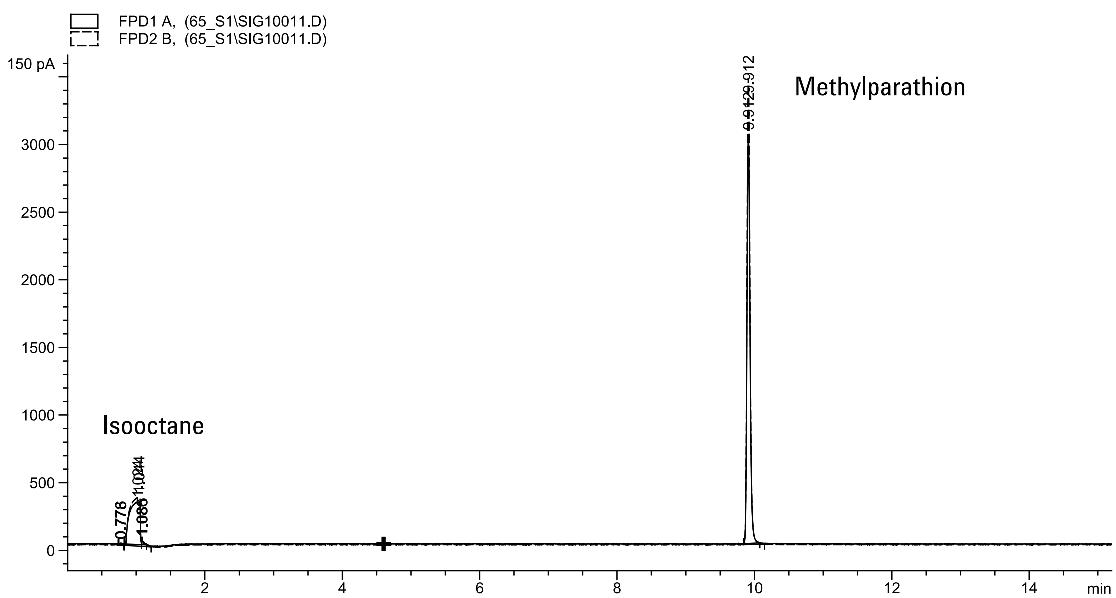
If performing an injection using an autosampler, start the run using the data system or press **[Start]** on the GC.

If performing a manual injection (with or without a data system):

a Press **[Prep Run]** to prepare the inlet for splitless injection.

b When the GC becomes ready, inject 1 µL of the checkout sample and press **[Start]** on the GC.

7 The following chromatogram shows typical results for a new detector with new consumable parts installed.



To Check FPD Performance (Sample 5188-5245, Japan)

To verify FPD performance, first check the phosphorus performance, then the sulfur performance.

Preparation

1 Gather the following:
   - Evaluation column, DB5 15 m × 0.32 mm × 1.0 µm (123-5513)
   - FPD performance evaluation (checkout) sample (5188-5245, Japan), composition: n-Dodecane 7499 mg/L (± 5%), Dodecanethiol 2.0 mg/L (± 5%), Tributyl Phosphate 2.0 mg/L (± 5%), tert-Butyldisulfide 1.0 mg/L (± 5%), in isooctane as solvent
   - Phosphorus filter
   - Sulfur filter and filter spacer
   - 4-mL solvent and waste bottles or equivalent for autoinjector.
   - 2-mL sample vials or equivalent for sample.
   - Chromatographic-grade isooctane for syringe wash solvent.
   - Inlet and injector hardware (See “To Prepare for Chromatographic Checkout.”)
2 Verify the following:
   - Capillary column adapter installed. If not, install it.
   - Chromatographic-grade gases plumbed and configured: helium as carrier gas, nitrogen, hydrogen, and air.
   - Empty waste vials loaded in sample turret.
   - 4-mL vial with diffusion cap filled with isooctane and inserted in Solvent A injector position.
3 Replace consumable parts (liner, septum, traps, syringe, and so forth) as needed for the checkout. See “To Prepare for Chromatographic Checkout.”
4 Verify the lit offset is set appropriately. Typically, it should be about 2.0 pA for the checkout method.

5 Install the evaluation column. (See the procedure for the SS, PP, COC, MMI, or PTV in the Maintenance manual.)(See the procedure for the SS, PP, or COC in the Maintenance manual.)
   - Set the oven, inlet, and detector to 250 °C and bake out for at least 15 minutes. (See the procedure for the SS, PP, COC, MMI, or PTV in the Maintenance manual.)(See the procedure for the SS, PP, or COC in the Maintenance manual.)
   - Configure the column.

Phosphorus performance

1 If it is not already installed, install the phosphorus filter.

2 Create or load a method with the parameter values listed in Table 12.

Table 12 FPD Phosphorus Checkout Conditions

Column and sample	
Type	DB-5MS, 15 m × 0.32 mm × 1.0 µm (123-5513)
Sample	FPD checkout (5188-5245)
Column mode	Constant flow
Column flow	7.5 mL/min
Split/splitless inlet	
Temperature	250 °C
Mode	Splitless
Total purge flow	69.5 mL/min
Purge flow	60 mL/min
Purge time	0.75 min
Septum purge	3 mL/min
Multimode inlet	
Mode	Splitless
Inlet temperature	80 °C
Initial time	0.1 min
Rate 1	720 °C/min
Final temp 1	250 °C

Table 12 FPD Phosphorus Checkout Conditions (continued)

Final time 1	5.0 min
Purge time	1.0 min
Purge flow	60 mL/min
Septum purge	3 mL/min
Packed column inlet	
Temperature	250 °C
Septum purge	3 mL/min
Cool on-column inlet	
Temperature	Oven track
Septum purge	15 mL/min
PTV inlet	
Mode	Splitless
Inlet temperature	80 °C
Initial time	0.1 min
Rate 1	720 °C/min
Final temp 1	350 °C
Final time 1	2 min
Rate 2	100 °C/min
Final temp 2	250 °C
Final time 2	0 min
Purge time	0.75 min
Purge flow	60 mL/min
Septum purge	3 mL/min
Detector	
Temperature	200 °C (On)
Hydrogen flow	75.0 mL/min (On)
Air (oxidizer) flow	100.0 mL/min (On)
Mode	Constant makeup flow Off
Makeup flow	60.0 mL/min (On)
Makeup gas type	Nitrogen
Flame	On
Lit offset	Typically 2 pA

Table 12 FPD Phosphorus Checkout Conditions (continued)

PMT voltage	On
Emission Block	125 °C
Oven	
Initial temp	70 °C
Initial time	0 min
Rate 1	10 °C/min
Final temp	105 °C
Final time	0 min
Rate 2	20 °C/min
Final temp 2	190 °C
Final time 2	7.25 min for sulfur 12.25 min for phosphorus
ALS settings (if installed)	
Sample washes	2
Sample pumps	6
Sample wash volume	8 (maximum)
Injection volume	1 µL
Syringe size	10 µL
Solvent A pre washes	2
Solvent A post washes	2
Solvent A wash volume	8
Solvent B pre washes	0
Solvent B post washes	0
Solvent B wash volume	0
Injection mode (7693A)	Normal
Airgap Volume (7693A)	0.20
Viscosity delay	0
Inject Dispense Speed (7693A)	6000
Plunger speed (7683)	Fast, for all inlets except COC.
PreInjection dwell	0
PostInjection dwell	0
Manual injection	

Table 12 FPD Phosphorus Checkout Conditions (continued)

Injection volume	1 µL
Data System	
Data rate	5 Hz

3 Ignite the FPD flame, if not lit.

4 Display the signal output and monitor. This output typically runs between 40 and 55 but can be as high as 70. Wait for the output to stabilize. This takes approximately 1 hour.

   If the baseline output is too high:

   - Check column installation. If installed too high, the stationery phase burns in the flame and increases measured output.
   - Check for leaks.
   - Bake out the detector and column at 250 °C.
   - Wrong flows set for installed filter

   If the baseline output is zero, verify the electrometer is on and the flame is lit.

5 If using a data system, prepare the data system to perform one run using the loaded checkout method. Make sure that the data system will output a chromatogram.

6 Start the run.

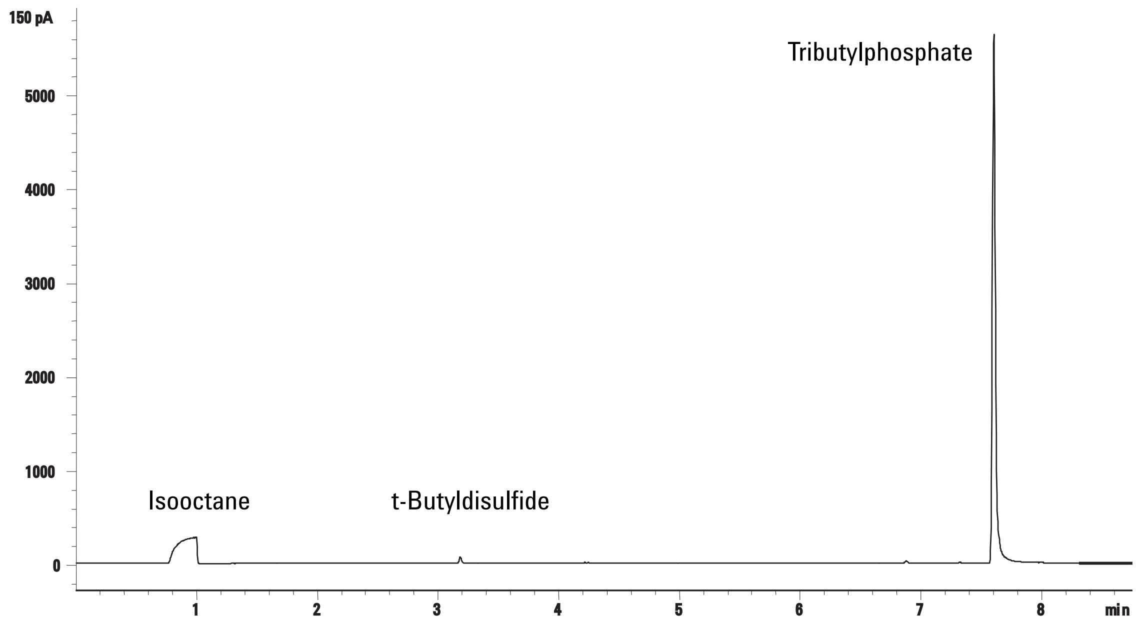
   If performing an injection using an autosampler, start the run using the data system or press **[Start]** on the GC.

   If performing a manual injection (with or without a data system):

   a Press **[Prep Run]** to prepare the inlet for splitless injection.

   b When the GC becomes ready, inject 1 µL of the checkout sample and press **[Start]** on the GC.

7 The following chromatogram shows typical results for a new detector with new consumable parts installed.



Sulfur performance

1 Install the sulfur filter.

2 Make the following method parameter changes.

Table 13 Sulfur method parameters

Parameter	Value (mL/min)
H2 flow	50
Air flow	60

3 Ignite the FPD flame, if not lit.

4 Display the signal output and monitor. This output typically runs between 50 and 60 but can be as high as 70. Wait for the output to stabilize. This takes approximately 2 hours.

If the baseline output is too high:

- Check column installation. If installed too high, the stationery phase burns in the flame and increases measured output.
- Check for leaks.
- Bake out the detector and column at 250 °C.

- Wrong flows set for installed filter

If the baseline output is zero, verify the electrometer is on and the flame is lit.

5 If using a data system, prepare the data system to perform one run using the loaded checkout method. Make sure the data system will output a chromatogram.

6 Start the run.

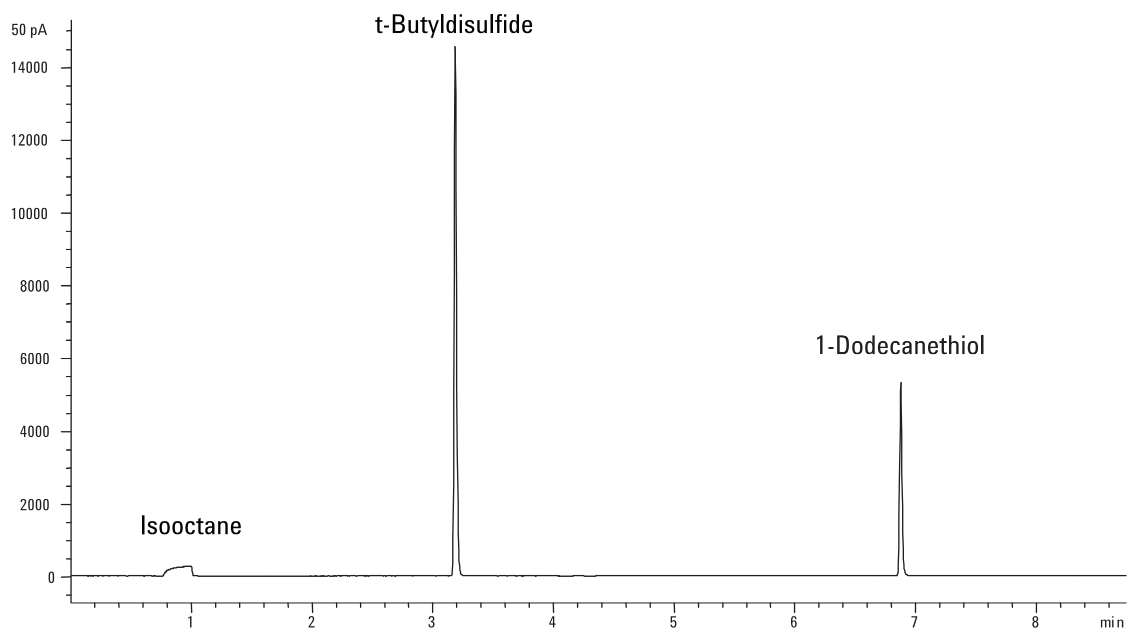
If performing an injection using an autosampler, start the run using the data system or press **[Start]** on the GC.

If performing a manual injection (with or without a data system):

a Press **[Prep Run]** to prepare the inlet for splitless injection.

b When the GC becomes ready, inject 1 µL of the checkout sample and press **[Start]** on the GC.

7 The following chromatogram shows typical results for a new detector with new consumable parts installed.



7
Resource Conservation

This section describes the resource-saving features of the GC. When used with other instruments configured for enhanced communications, additional features become available for the GC-MS, GC-HS, or HS-GC-MS system. See "Intelligent Instrument Features" on page 129.

Resource Conservation

The 7890B GC provides an instrument schedule to conserve resources such as electricity and gases. Using the instrument schedule, you can create sleep, wake, and conditioning methods that allow you to program resource usage. A **SLEEP** method sets low flows and temperatures. A **WAKE** method sets new flows and temperatures, typically to restore operating conditions. A **CONDITION** method sets flows and temperatures for a specific run time, typically high enough to clean out contamination if present.

Load the sleep method at a specified time during the day to reduce flows and temperatures. Load the wake or condition method to restore analytical settings before operating the GC again. For example, load the sleep method at the end of each day or work week, then load the wake or condition method an hour or so before arriving to work the next day.

Sleep Methods

Create a sleep method to reduce gas and power usage during times of reduced activity.

When creating a sleep method, consider the following:

- **The detector.** While you can reduce temperatures and gas usage, consider the stabilization time required to prepare the detector for use. See Table 1, “Detector stabilization times,” on page 18. The power savings is minimal.
- **Connected devices.** If connected to an external device such as a mass spectrometer, set compatible flows and temperatures.
- **The columns and oven.** Be sure to maintain sufficient flow to protect the columns at the temperature set for the oven. You may need to experiment to find the best reduced flow rate and temperature. Also consider whether the additional thermal cycling might loosen fittings, especially for MS transfer line connections. In this case, consider keeping the oven temperature > 110 °C.
- **The inlets.** Maintain sufficient flow to prevent contamination.
- **Cryo cooling.** Devices which use cryo cooling may start immediately using cryogen if the wake method requires it.

See Table 14 below for general recommendations.

Table 14 Sleep method recommendations

GC Component	Comment
Columns and oven	• Reduce temperature to save power. • Turn off to save the most power. • Maintain some carrier gas flow to protect the columns.
Inlets	For all inlets: • Reduce temperatures. Reduce temperatures to 40 °C or Off to save the most power.
Split/splitless	• Use split mode to prevent diffusion of contamination from the vent line. Use reduced split ratio. • Reduce pressure. Consider using current Gas Saver levels, if used.
Cool on-column	• Reduce pressure. • Consider reducing septum purge flow.
Multimode	• Use split mode to prevent diffusion of contamination from the vent line. Use reduced split ratio. • Reduce pressure. Consider using current Gas Saver levels, if used.
Purged packed	• Reduce pressure. • Consider reducing septum purge flow.
Volatiles interface	• Reduce pressure. • Consider reducing septum purge flow.
Detectors	
FID	• Turn off the flame. (This turns off hydrogen and air flows.) • Reduce temperatures. (Keep at or above 100 °C to reduce contamination and condensation.) • Turn off makeup flow.
FPD^{+}	• Turn off the flame. (This turns off hydrogen and air flows.) • Reduce temperatures. (Keep at or above 100 °C to reduce contamination and condensation.) • Turn off makeup flow.
μECD	• Reduce makeup flow. Try using 15–20 mL/min and test results. • Maintain temperature to avoid long recovery/stabilization times.
NPD	• Maintain flows and temperatures. Sleep not recommended due to recovery times and also thermal cycling can reduce bead life.
TCD	• Leave filament on. • Leave block temperature on. • Reduce reference and makeup flows.
FPD	• Maintain flows and temperatures. Sleep not recommended.

Table 14 Sleep method recommendations (continued)

GC Component	Comment
Other devices	
Valve box	• Reduce temperature. (Keep valve box temperature high enough to prevent sample condensation, if applicable.)
Aux thermal zones	• Reduce or turn off. Also refer to connected device manuals, for example for a connected MSD.
Aux pressures or flows	• Reduce or turn off as appropriate for connected columns, transfer lines, and so forth. Always refer to connected device or instrument manuals, for example for a connected MSD, to maintain at least the minimum recommended flows or pressures.

See also "To Create or Edit a Sleep, Wake, or Condition Method" on page 114.

Wake and Condition Methods

The GC can be programmed to wake in one of several ways:

- By loading the last active method used before going to sleep
- By loading the **WAKE** method
- By running a method called **CONDITION**, then loading the last active method
- By running a method called **CONDITION**, then loading the **WAKE** method

These choices provide flexibility in how you prepare the GC after a sleep cycle.

A WAKE method sets a temperatures and flows. The oven temperature program is isothermal since the GC does not start a run. When the GC loads a **WAKE** method, it remains at those settings until you load another method using the keypad, data system, or by starting a sequence.

A **WAKE** method can include any settings, however it typically will do the following:

- Restore inlet, detector, column, and transfer line flows.
- Restore temperatures.
- Ignite the FID, FPD$^+$, or FPD flame.
- Restore inlet modes.

A CONDITION method sets flows and temperatures for the duration of the method's oven program. When the program ends, the GC loads either the **WAKE** method or the last active method before sleep, as specified in the instrument schedule (or when manually exiting the sleep state).

One possible use for a condition method is to set higher than normal temperatures and flows to bake out any possible contamination that may have collected in the GC during sleep.

To Set the GC to Conserve Resources

Set the GC to conserve resources by creating and using an **Instrument Schedule**.

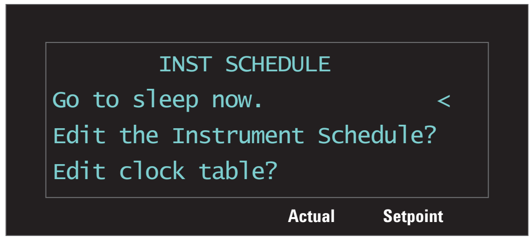
1 Decide how to restore flows. The choices are:
   - **Wake current**: At the specified time, the GC will restore the last active method used before it went to sleep.
   - **Wake with WAKE file**: At the specified time, the GC will load the wake method, and remain at those settings.
   - **Condition, Wake current**: At the specified time, the GC will load the condition method. This method runs once, then the GC will load the last method active before it went to sleep. During this conditioning run, the GC does not produce or collect data.
   - **Condition, Wake w WAKE file**: At the specified time, the GC will load the condition method. This method runs once, then the GC will load the wake method. During the conditioning run, the GC does not produce or collect data.
   - **Adjust front (or back) detector offset**: If the GC includes an NPD, you can set the GC to run its automatic **Adjust offset** bead voltage adjustment.

2 Create a **SLEEP** method. This method should reduce flows and temperatures. See “Sleep Methods”.

3 Program the **WAKE** or **CONDITION** methods, as needed. See “Wake and Condition Methods”. (While it is good practice to create these methods, you do not need them if you only wake the GC to the last active method.)

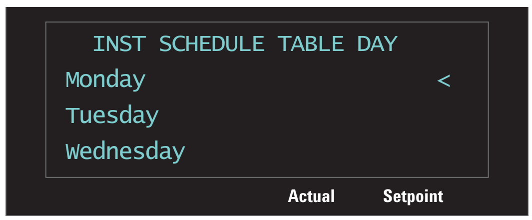
4 Create the **Instrument Schedule**.

a Press [**Clock Table**], scroll to **Instrument Schedule**, then press [**Enter**].



b Press [**Mode/Type**] to create a new schedule item.

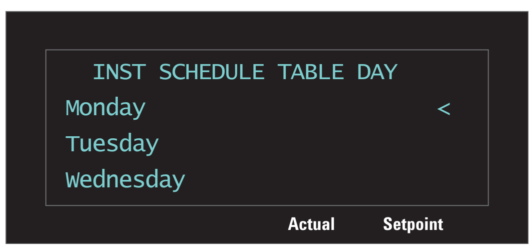
c When prompted, scroll to the desired day of the week and press [**Enter**].



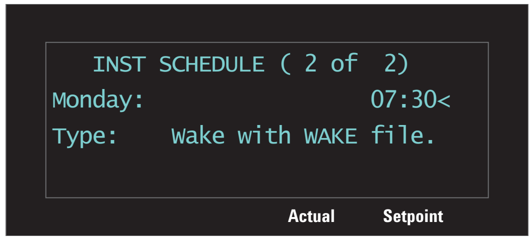
d When prompted, select the **Go to Sleep** function, press [**Enter**], then input the event time. Press [**Enter**].

e Next set the wake function. While still viewing the schedule, press [**Mode/Type**] to create a new schedule item.

f When prompted, scroll to the desired day of the week and press [**Enter**].



g When prompted, select the desired wake function, press [**Enter**], then input the event time. Press [**Enter**]. (See step 2 for descriptions of the wake functions.)



h Repeat steps b through g as needed for any other days of the week.

You do not have to program events for every day. For example, you can program the GC to sleep on Friday evening, then wake on Monday morning, keeping it continuously at operating conditions during weekdays.

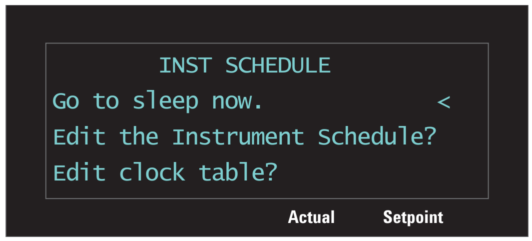
You can also use the **Instrument Schedule** to program an Adjust Offset function for an NPD, if installed. This function is useful for automatically preparing the NPD for use each day.

See also “To Create or Edit a Sleep, Wake, or Condition Method” on page 114.

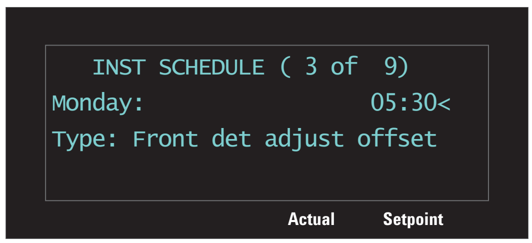
To Edit an Instrument Schedule

To edit an existing schedule, delete unwanted items, then add new items as desired.

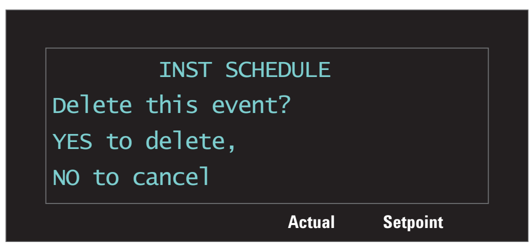
1 Press [**Clock Table**], scroll to **Instrument Schedule**, then press [**Enter**].



2 Scroll to the schedule item to delete.



3 Press [**Delete**]. When prompted press [**On/Yes**] to confirm, or [**Off/No**] to cancel and keep the item.



Add new items as described in “To Set the GC to Conserve Resources” on page 110.

To Create or Edit a Sleep, Wake, or Condition Method

To create or edit a **SLEEP**, **WAKE**, or **CONDITION** method:

1 If desired, load a method with similar setpoints.

2 Edit the method setpoints. The GC allows for setting only relevant parameters:

- For a **SLEEP** method, the GC sets the initial oven temperature, inlet and detector temperatures, inlet (column) and detector flow rates, auxiliary temperatures, and so forth. The GC ignores any ramps in a **SLEEP** method, as well as signal output, or other run-related or time-related settings. The **SLEEP** method cannot be run.
- For a **WAKE** method, the GC can set the same parameters as for the sleep method. The GC ignores any ramps in a **WAKE** method, as well as signal output or other run-related or time-related settings. The **WAKE** method cannot be run.
- For a **CONDITION** method, the method can also include ramps, for example an oven ramp. The oven run time sets the length of time the **CONDITION** method setpoints apply to the GC before the GC loads the wake method or last active method. While the GC runs the **CONDITION** method to apply any ramps and hold times, the GC does not collect data or produce a signal. The **CONDITION** run is a blank run—there is no injection.

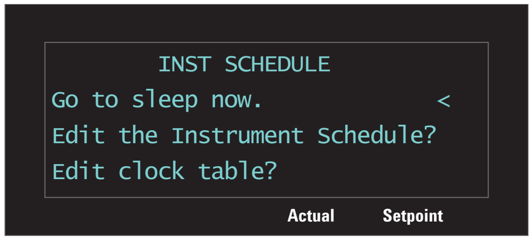
3 Press [**Method**], scroll to the method to store (**SLEEP**, **WAKE**, or **CONDITION**), and press [**Store**].

4 If prompted to overwrite, press [**On/Yes**] to overwrite the existing method or [**Off/No**] to cancel.

To Put the GC to Sleep Now

1 Press [**Clock Table**], select **Instrument Schedule**, then press [**Enter**].

2 Select **Go to sleep now**, then press [**Enter**].



To Wake the GC Now

If the GC is asleep, you can wake it up as follows:

1 Press [**Clock Table**], select to **Instrument Schedule**, then press [**Enter**].

2 Select the desired wake choice, then press [**Enter**].

- **Wake up now (restore method).** Exit sleep mode by loading the last active method used before going to sleep.
- **Wake up now (WAKE method).** Exit sleep mode by loading the **WAKE** method.
- **Run Condition, Wake (current).** Exit sleep mode by running the condition method. When the **CONDITION** method ends, the GC loads the last active method used before going to sleep.
- **Run Condition, Wake up (WAKE).** Exit sleep mode by running the condition method. When the **CONDITION** method ends, the GC loads the wake method.

8
Early Maintenance Feedback

This section describes the Early Maintenance Feedback feature available on the Agilent 7890B GC.

Early Maintenance Feedback (EMF)

The 7890B provides injection- and time-based counters for various consumable and maintenance parts. Use these counters to track usage and replace or recondition these items before potential degradation impacts the chromatographic results.

If using an Agilent data system, these counters can be set and reset from within the data system.

Counter types

Injection counters increment whenever an injection occurs on the GC via an ALS injector, headspace sampler, or sampling valve. Manual injections do not increment counters. The GC differentiates between front and back injections, and only increments counters associated with the configured injection flow path.

For example, consider the following GC:

Configured front flow path	Configured back flow path
Front injector	Back injector
Front inlet	Back inlet
Column 1 (GC oven)	Column 2 (GC oven)
Purged Union / Aux EPC 1	Back detector
Column 3 (GC oven)	
Front detector	

In this example, for a front ALS injection, the GC will increment counters for the front injector, front inlet, and the front detector, but it would not increment the back injector, back inlet, or back detector counters. For the columns, the GC would increment the injection counters for columns 1 and 3, and the oven cycles counter for all 3 columns.

Time counters increment against the GC clock. Changing the GC clock changes the age of tracked consumables.

Thresholds

The EMF feature provides two warning thresholds: **Service due** and **Service warning**.

- **Service Due**: When the counter exceeds this number of injections or days, the **Service Due** indicator lights and an entry is made in the **Maintenance Log**. The **Service Due** limit must be larger than the **Service warning** limit.
- **Service warning**: When the counter exceeds this number of injections or days, the instrument status shows a reminder that the component may need maintenance soon.

Both thresholds are set independently for each counter. You can enabled one or both, as desired.

Default Thresholds

Selected counters have default thresholds to use as a starting point. To view any available information for a counter:

1 Navigate to the desired counter and press [**Enter**]. See “To Enable or Change a Limit for an EMF Counter”.

2 Scroll to the counter’s **Service Due** entry and press [**Mode/Type**]. If available, the default threshold for the counter displays. Press [**Clear**] to return to the counter.

If a default limit is not suggested, enter a conservative limit based on your experience. Use the warning feature to alert you when service is approaching, then track performance to determine if the **Service Due** threshold is too high or too low.

For any EMF counter, you may need to adjust the threshold values based on the demands of your applications.

Available Counters

Table 15 lists the most common counters available. The available counters will vary based on the installed GC options, consumables, and future updates.

Table 15 Common EMF counters

GC Component	Parts with a counter	Type	Default value
Detectors			
FID	Collector	Number of injections	
	Jet	Number of injections	
	Ignitor	Number of ignition attempts	
TCD	Switching solenoid	On time	
	Filament on time	On time	
µECD	Insert liner	Number of injections	
	Time since wipe test	On time	6 months
NPD	Bead	Number of injections	
	Ceramics	Number of injections	
	Collector	Number of injections	
	Bead baseline offset	pA Value	
	Bead baseline voltage	Voltage value	Ceramic bead: 3.895 Blos bead: 1.045
	Bead current integral	pA-sec Value	
	Bead on time	On time	Ceramic bead: 1200 h Blos bead: 2400 h
FPD^{+}/FPD	Ignitor	Number of ignition attempts	
	PMT	Number of injections	
	PMT	On time	6 months
Inlets			
SSL	Gold seal	Number of injections	5000
	Gold seal	Time	90 days
	Liner	Number of injections	200
	Liner	Time	30 days
	Liner O-ring	Number of injections	1000

Table 15 Common EMF counters (continued)

GC Component	Parts with a counter	Type	Default value
	Liner O-ring	Time	60 days
	Septum	Number of injections	200
	Split vent trap	Number of injections	10,000
	Split vent trap	Time	6 months
MMI	Liner	Number of injections	200
	Liner	Time	30 days
	Liner O-ring	Number of injections	1000
	Liner O-ring	Time	60 days
	Septum	Number of injections	200
	Split vent trap	Number of injections	10,000
	Split vent trap	Time	6 months
	Cooling cycles	Number of injections	
	Clean bottom seal	Number of injections	1000
PP	Liner	Number of injections	200
	Liner	Time	30 days
	Septum	Number of injections	200
	Top weldment O-ring	Number of injections	10,000
	Top weldment O-ring	Time	1 year
COC	Septum	Number of injections	200
PTV	Column adapter silver seal	Number of injections	5000
	Liner	Number of injections	200
	Liner	Time	30 days
	Split vent trap	Number of injections	10,000
	Split vent trap	Time	6 months
	PTFE ferrule	Number of injections	
	PTFE ferrule	Time	60 days
VI	Split vent trap	Number of injections	10,000
	Split vent trap	Time	6 months
Columns			
Column	Injections onto column	Number of injections	
	Oven cycles	Number of injections	

Table 15 Common EMF counters (continued)

GC Component	Parts with a counter	Type	Default value
	Length	Value	
Valves			
Valve	Rotor	Activations (number of injections)	
	Maximum temperature	Value	
Instrument			
Instrument	On time	Time	
	Run count	Number of injections	
	Filters	Time	
ALS Injectors			
ALS	Syringe	Number of injections	800
	Syringe	Time	2 months
	Needle	Number of injections	800
	Plunger moves	Value	6000
Mass spectrometers			
Mass spectrometer	Pump	Time (days)	1 year
	Filament 1	Time (days)	1 year
	Filament 2	Time (days)	1 year
	Source (time since last cleaning)	Time (days)	1 year
	EMV at last tune	V	2600

To Enable or Change a Limit for an EMF Counter

When using the GC without a data system, enable or change the limit for a counter as follows:

1. Press [**Service Mode**].
2. Scroll to **Maintenance** and press [**Enter**].
3. Scroll to the desired GC component (front or back inlet, front or back detector, valves, instrument, and so forth) and press [**Enter**] to select it. The GC displays the list of counters for this component.
4. Scroll to the desired counter.
5. Press [**Enter**] to select the current counter. The display will show the **Service Due** and **Service warning** entries.
   - If the **Service Due** or **Service warning** line reads a number or time (number of days, for example), the counter is enabled.
   - If the **Service Due** or **Service warning** line reads **Off**, press [**On/Yes**] to enable the counter.
   - The display also shows the date and time when the counter was last modified.
6. Scroll to each threshold line and enter the desired limit.

To Disable an EMF Counter

When using the GC without a data system, disable a counter as follows:

1 Press [**Service Mode**].
2 Scroll to **Maintenance** and press [**Enter**].
3 Scroll to the desired GC component (front or back inlet, front or back detector, valves, instrument, and so forth) and press [**Enter**] to select it. The GC displays the list of counters for this component.
4 Scroll to the desired counter.
5 Press [**Enter**] to select the current counter. The display will show the **Service Due** and **Service warning** entries.
    - If the **Service Due** or **Service warning** line reads a number or time (number of days, for example), the counter is enabled.
    - If the **Service Due** or **Service warning** line reads **Off**, that counter is currently disabled.
    - The display also shows the date and time when the counter was last modified.
6 Scroll to each threshold line and press [**Off/No**] to disable.

To Reset an EMF Counter

When a **Service Due** counter passes its threshold, the GC **Service Due** indicator lights.

1 Press [**Service Mode**].
2 Scroll to **Maintenance** and press [**Enter**].
3 Each EMF component with a counter that passed its threshold will be marked with an asterisk. Scroll to the desired GC component (front or back inlet, front or back detector, valve, instrument, and so forth) and press [**Enter**] to select it. The list of counters for this component display. Each component that passed its threshold will be marked with an asterisk.
4 Scroll to the desired counter.
5 Press [**Off/No**] to reset the counter to 0.

EMF Counters for Autosamplers

The GC provides access to the counters for the autosampler. The functionality for ALS counters depends on the ALS model and firmware version. In all cases, the 7890B GC shows EMF counter status and allows you to enable, disable, and clear the counters using the GC keyboard.

Counters for 7693A and 7650 ALS with EMF-enabled firmware

If using an Agilent 7693 injector with firmware version G4513A.10.8 (or higher), or a 7650 injector with firmware version G4567A.10.2 (or higher), each injector independently tracks its EMF counters.

- The injector counters will increment as long as the injector is used on any 7890 Series GC. You can change positions on the same GC or install the injector on a different GC without losing the current ALS counter data.
- The ALS will report an exceeded limit only when mounted on a 7890B GC.

Counters for ALS with earlier firmware

If using a 7693 or 7650 injector with earlier firmware, or if using another injector model (for example 7683B), the GC tracks the counters for that injector. The GC uses the injector serial number to distinguish between installed injectors, but only maintains up to two sets of counters–one for the front injector, and one for the back injector.

- The GC will track injector counters regardless of installed position (front or back inlet). Because the GC tracks the injector serial number, you can change the injector position without losing the counters as long as the injector remains installed on the GC.
- Each time the GC detects a new injector (different model or different serial number), the GC resets the ALS counters in the new injector's position.

EMF Counters for MS Instruments

When configured to an Agilent MS that supports enhanced communications (such as a 5977 Series MSD or 7000C Triple Quadrupole MS), the GC reports the EMF counters as tracked by the MS. The MS provides its own EMF tracking.

When connected to an earlier model MS (for example, a 5975 Series MSD or 7000B MS), the GC tracks the MS counters, not the MS.

9
Intelligent Instrument Features

The 7890B GC supports Agilent's Intelligent Instrument features. When multiple instruments that support this technology are configured as a system, the enhanced communications and data sharing between them provide features and capabilities that are not available in earlier systems that communicate only through a remote start/stop signal.

This section describes the additional features of a 7890B GC when properly configured as part of a system with other Intelligent Instruments, such as an MS or headspace sampler (HS).

System-Level Communications

When the 7890B GC and other Agilent instruments that support enhanced communications, such as an MS or HS, are configured together, they communicate with and react to each other. The instruments share events and data to provide interaction and efficiency. As the state of one instrument changes, the other instruments react accordingly. For example if you start to vent an MS, the GC automatically changes flows and temperatures. If the GC enters its "sleep" state to conserve resources, so do the MS and HS. When programming the HS, the HS automatically incorporates the current GC method setpoints to calculate timing and throughput.

One of the primary advantages of enhanced communications is that instruments can protect themselves and each other from damage. Events that cause this type of interaction include:

- GC shutdowns
- MS venting
- MS shutdowns

Another advantage of enhanced communications is the convenience provided at a system level:

- Consolidated EMF tracking
- Synchronized instrument clocks (requires Agilent data system)
- Synchronized instrument schedules (sleep/wake)
- Pass-through display of connected instrument errors to the GC display

See the Installation and First Startup manual for configuration details.

GC/MS Systems

This section describes GC behaviors and features that require an MS or MSD that supports enhanced GC-MS communications. (See the MS documentation.)

Venting the MS

When you use the MS keypad to initiate fast venting, or when you use the Agilent data system to start venting, the MS alerts the GC. The GC loads the special MS Vent method. The GC keeps the MS Vent method loaded until:

- The MS becomes ready again.
- You manually clear the MS Vent state.

During the venting process the MS will notify the GC that venting is complete. The GC will then set very low flows at each flow- or pressure-controlled device leading back through the column configuration chain to the inlet. For example, for a configuration that uses a purged union at the transfer line, the GC will set the pressure at the purged union to 1.0 psi, and the pressure at the inlet to 1.25 psi.

If using hydrogen carrier gas, the GC will simply turn the gas off to prevent hydrogen accumulation in the MS.

Note that while in the MS Vent state, the GC will not go into MS Shutdown after losing communications with the MS.

MS Shutdown events

When configured with an MS or MSD that supports enhanced GC-MS communications, the following events will cause an MS Shutdown in the GC:

- Loss of communications with the MS, when not venting the MS. (Requires no communications for a length of time.)
- MS reports a high vacuum pump failure.

When the GC enters an MS shutdown:

- The GC aborts any current run.
- The oven is set to 50 °C. When it reaches that setpoint, it turns off.
- The MS transfer line temperature is turned off.
- If using a flammable carrier gas, the gas is turned off after the oven cools (for the MS column flow path only).

- If not using a flammable carrier gas, the GC will set very low flows at each flow- or pressure-controlled device leading back through the column configuration chain to the inlet. For example, for a configuration that uses a purged union at the transfer line, the GC will set the pressure at the purged union to 1.0 psi, and the pressure at the inlet to 1.25 psi.
- The GC displays the error state and notes the events in the logs.

The GC will not be usable until the error state is cleared or until the MS is unconfigured from the GC. See "To Use the GC When the MS is Shut Down".

If the MS is repaired or clears its error, or if communications are restored, the GC will automatically clear this error state.

Note that for MS instruments without enhanced GC-MS communications, such as a 5975 Series MSD, you can manually set an MS Shutdown state in the GC, if desired, by pressing [**MS/Aux Det**], scrolling to **MS Shutdown**, and then pressing [**Enter**].

GC Pressure Shutdown events

If the GC goes into a pressure shutdown for the carrier gas going to the MS transfer line, the MS will log this event. As part of the shutdown steps, the GC will also turn off the MS transfer line. (See the GC *Troubleshooting* manual for more information about GC shutdown behaviors.)

To Set Up a Vent Method

A good MS Vent method does the following:

- Turns off the MS transfer line heater.
- Turns off the inlet heater.
- Sets the oven to a low temperature, < 50 °C, for fast cool down.
- Sets the column flow rate into the MS to as high a flow as you feel is appropriate and safe. For turbo pumps, set the flow to 15 mL/min or to the maximum flow rate possible for the column configuration (note that rates above 15 mL/min may not provide additional benefits). For diffusion pumps, typically set the flow to 2 mL/min (never exceed 4 mL/min).

When you first configure a GC-MS system on an Agilent data system, you will be prompted to create this method if it does not exist.

You must create this method to use the MS's fast venting feature.

To create and store the method:

1 Create the method by making the settings on the GC.

2 When the settings are entered, press [**Method**].

3 Scroll to **MS Vent**, then press [**Store**]. If prompted to overwrite an existing MS Vent method, press [**On/Yes**] to confirm.

To Manually Prepare the GC for Venting the MS

If using an MS that does not communicate events to the GC (beyond a simple start/stop), you can still prepare the GC for venting by loading the MS Vent method. To manually load the MS Vent method:

1 Press [**Method**], scroll to **MS Vent**, and press [**Load**].

2 When prompted, press [**On/Yes**] to confirm.

To Manually Exit the MS Vent State

CAUTION Manually exiting the MS Vent state when the GC and MS are still connected and the MS is venting or off can damage the MS if you set inappropriate flows.

Normally, exit the MS Vent state when venting is complete and the MS is ready. When configured with an MS that supports enhanced GC-MS communications, the GC will automatically exit the MS Vent state when the MS becomes ready again.

1 Press [**MS/Aux Det**].

2 Scroll to **Clear MS Vent**, then press [**Enter**].

To Use the GC When the MS is Shut Down

To use the GC while an MS is being repaired or maintained, do the following:

1 Disable MS communications.

   5977A, 7000C, 7010: Press [**MS/Aux Det**], scroll to **MS Communication**, then press [**Off/No**].

   5977B: Press [**Config**][**MS/Aux Det**], scroll to **Lvds communication**, then press [**Off/No**].

2 Scroll to **Clear MS Shutdown**, then press [**Enter**].

Be careful to avoid settings that send carrier gas into the MS, or which raise the temperature of parts which might cause burns when working on the MS.

If needed, completely uninstall the MS from the GC.

To Enable or Disable MS or HS Communications

To temporarily disable GC-MS communications:

5977A, 7000C, 7010:

1. Press [**MS/Aux Det**].
2. Scroll to **MS Communication**. The entry will read **On** if enabled, or **Disabled** if disabled.
3. Press [**Off/No**] to disable. The line will read **MS Communication Disabled**.

   Press [**On/Yes**] to enable communications.

5977B:

1. Press [**Config**][**MS/Aux Det**].
2. Scroll to **Lvds communication**. The entry will read **On** if enabled.
3. Press [**Off/No**] to disable.

   Press [**On/Yes**] to enable communications.

To temporarily disable GC-HS communications:

1. At the GC keyboard, press [**Front Injector**] or [**Back Injector**] as applicable.
2. Scroll to **Connected time** and press [**Off/No**].

   Press [**On/Yes**] to enable communications.

System EMF Counters

For GC-MS, GC-HS, and GC-MS-HS systems, all EMF counters are available at the GC display. In addition, most counters can be reset at the GC. Some counter types, for example a counter which requires a calibration to be performed on a headspace sampler, cannot be reset at the GC, but can still be viewed.

Instrument Schedule for an Intelligent Instrument System

A system that consists of intelligent instruments will follow the GC's Instrument Schedule. When the GC is scheduled to "sleep," the other instruments will also sleep. When the GC is scheduled to "wake up," the other instruments will wake up.

- The GC will not go to sleep until it has been idle for 15 minutes. After it has been idle, it will notify connected instruments so they can also go to sleep.
- The MS will not go to sleep unless idle and not in a fault state.
- An action that awakens the GC will awaken the other instruments.
- To awaken a connected MS or HS set to follow the GC instrument schedule, awaken the GC.

  If you want to awaken a connected MS or HS set to follow the GC instrument schedule, but do not want to awaken the GC, first disable enhanced communications between the instruments.

10
Configuration

About Configuration

Configuration is a two-part process for most GC accessory devices that require power and/or communication resources from the GC. In the first part of the configuration process, a power and/or communication resource is assigned to the device. The second part of the configuration process allows setting of any configuration properties associated with the device.

Assigning GC resources to a device

A hardware device requiring but not assigned GC resources is given a mode of **Unconfigured** by the GC. Once you assign GC resources to a device, the GC gives the device a mode of **Configured,** allowing you to access other property settings (if any) for the device.

To assign GC resources to a device with an **Unconfigured** mode:

1 Unlock the GC configuration. Press **[Options]**, select **Keyboard & Display** and press **[Enter]**. Scroll down to **Hard Configuration Lock** and press **[Off/No]**.

2 Press **[Config]** on the GC keypad and select a device from the list, then press **[Enter]**.

The **[Config]** key opens a menu similar to this:

Oven
Front inlet
Back Inlet
Column #
Front detector
Back detector
Aux detector
Aux detector 2
Mass Selective Detector
Analog out 1
Analog out 2
Valve Box
Thermal Aux 1
Thermal Aux 2
Thermal Aux 3
PCM A
PCM B
PCM C
Aux EPC 1,2,3
Aux EPC 4,5,6

Aux EPC 7,8,9
Status
Time
Valve #
2 Dimensional GC Valve
Front injector
Back injector
Sample tray
Instrument
Hydrogen sensor

In many cases you can move directly to the item of interest by pressing **[Config]**[*device*].

3 When the Configure Device Display opens, the cursor should be on the **Unconfigured** field. Press **[Mode/Type]** and follow the GC prompts to assign resources to the device.

4 After assigning resources, the GC prompts for you to power cycle the GC. Turn the GC power switch off and then on.

When the GC starts, select the device just assigned the GC resources for further configuration if needed. When accessed, its mode should indicate **Configured** and the other configuration properties are displayed.

Setting configuration properties

A device's configuration properties are constant for an instrument hardware setup unlike method settings which can change from sample run to sample run. Two example configuration settings are the gas type flowing through a pneumatic device and the operation temperate limit of a device.

To change the setting configuration properties for a **Configured** device:

1 Press **[Config]** on the GC keypad and select a device from the list, then press **[Enter]**.

   In many cases you can move directly to the item of interest by pressing **[Config]**[*device*].

2 Scroll to the device setting and change the property. This can involve making a selection from a list using **[Mode/Type]**, using **[On/Yes]** or **[Off/No]**, or entering a numeric value. Press **[Info]** for help on changing numeric settings, or see the section of this document describing the specific configuration of the device.

General Topics

To Unlock the GC Configuration

Accessory devices including inlets, detectors, pressure controllers (AUX EPC and PCM), and temperature control loops (Thermal AUX) have electrical connections to a power source and/or the communication bus in the GC. These devices must be assigned GC resources before they can be used. Before assigning resources to a device, you must first unlock the GC configuration. If you try to configure an **Unconfigured** device without unlocking the GC configuration, the GC displays the message **CONFIGURATION IS LOCKED Go to Keyboard options to unlock**.

It is also necessary to unlock the GC configuration if you are removing the GC resources from a **Configured** device. This action returns the device state to **Unconfigured**.

To unlock the GC configuration:

1 Press **[Options]**, select **Keyboard & Display** and press **[Enter]**.

2 Scroll down to **Hard Configuration Lock** and press **[Off/No]**.

The GC configuration remains unlocked until the GC is power cycled off and on.

Ignore Ready =

The states of the various hardware elements are among the factors that determine whether the GC is Ready for analysis.

Under some circumstances, you may not wish to have a specific element readiness considered in the GC readiness determination. This parameter lets you make that choice. The following elements allow readiness to be ignored: inlets, detectors, the oven, PCM, and auxiliary EPC modules.

For example, suppose an inlet heater is defective but you don’t plan to use that inlet today. By setting **Ignore Ready = TRUE** for that inlet, you can use the rest of the GC. After the heater is repaired, set **Ignore Ready = FALSE** or the run could start before that inlet’s conditions are ready.

To ignore an element's readiness, press **[Config]**, then select the element. Scroll to **Ignore Ready** and press **[On/Yes]** to set it to **True**.

To consider an element's readiness, press **[Config]**, then select the element. Scroll to **Ignore Ready** and press **[Off/No]** to set it to **False**.

Information displays

Below are some examples of configuration displays:

[EPC1] = (INLET) (SS) EPC #1 is used for an inlet of type split/splitless. It is not available for other uses.

[EPC3] = (DET-EPC) (FID) EPC #3 is controlling detector gases to an FID.

[EPC6] = (AUX_EPC) (PCM) EPC #6 is controlling a two-channel pressure control module.

FINLET (OK) 68 watts 21.7 This heater is connected to the front inlet. Status = OK, meaning that it is ready for use. At the time that the GC was turned on, the heater was drawing 68 watts and the inlet temperature was 21.7 °C.

[F-DET] = (SIGNAL) (FID) The signal board for the front detector is type FID.

AUX 2 1 watts (No sensor) The AUX 2 heater is either not installed or is not working properly.

Unconfigured:

Accessory devices requiring GC power or communication must be assigned these GC resources before they can be used. To make this hardware element usable, first "To Unlock the GC Configuration" on page 142 then go to the **Unconfigured** parameter and press **[Mode/Type]** to install it. If the hardware element you are configuring requires selection of additional parameters, the GC asks for that selection. If no parameters are required, press [**Enter**] at the GC prompt to install that element. You are required to power the GC off and then power the GC on to complete this configuration.

After restarting the GC, a message reminding you of this change and its effect on the default method is displayed. If needed, change your methods to accommodate the new hardware.

Oven

See “Unconfigured:” on page 143 and “Ignore Ready =” on page 142.

Maximum temperature Sets an upper limit to the oven temperature. Used to prevent accidental damage to columns. The range is 70 to 450 °C. See the column manufacturer’s recommendations.

Equilibration time The time after the oven approaches its setpoint before the oven is declared **Ready**. The range is 0 to 999.99 minutes. Used to ensure that the oven contents have stabilized before starting another run.

Cryo These setpoints control liquid carbon dioxide (CO_2 or liquid nitrogen (N_2) cooling of the oven.

The cryogenic valve lets you operate the oven below ambient temperature. Minimum attainable oven temperature depends on the type of valve installed.

The GC senses the presence and type of cryogenic valve and disallows setpoints if no valve is installed. When cryogenic cooling is not needed or cryogenic coolant is not available, the cryogenic operation should be turned off. If this is not done, proper oven temperature control may not be possible, particularly at temperatures near ambient.

External oven mode Isothermal internal oven and programmed external oven used to calculate column flow.

Slow oven cool down mode **On** reduces the oven fan speed during the cool down cycle.

Limit ballistic power Reduce oven power when heating at maximum rate to limit the current drawn from the power line.

To configure the oven

1 Press **[Config][Oven]**.
2 Scroll to **Maximum temperature**. Enter a value and press **[Enter]**.
3 Scroll to **Equilibration time**. Enter a value and press **[Enter]**.

4 Scroll to **Cryo**. Press **[On/Yes]** or **[Off/No]**. If **On**, enter the setpoints described in "To configure the oven for cryogenic cooling" on page 145.

5 Scroll to **External oven mode**. Press **[On/Yes]** or **[Off/No]**.

6 Scroll to **Slow oven cool down mode**. Press **[On/Yes]** to run the oven fan at reduced speed during cool down, or **[Off/No]** to run it at normal speed. Note that enabling this feature means the GC will cool more slowly than noted in the GC's published specifications.

To configure the oven for cryogenic cooling

All cryogenic setpoints are in the **[Config][Oven]** parameter list.

Cryo **[ON]** enables cryogenic cooling, **[OFF]** disables it.

Quick cryo cool This feature is separate from **Cryo**. Quick cryo cool makes the oven cool faster after a run than it would without assistance. This feature is useful when maximum sample throughput is necessary, however it does use more coolant. Quick cryo cool turns off soon after the oven reaches its setpoint and Cryo takes over, if needed.

Ambient temp The temperature in the laboratory. This setpoint determines the temperature at which cryogenic cooling is enabled:

- Ambient temp + 25°C, for regular cryo operation
- Ambient temp + 45°C, for Quick Cryo Cool.

Cryo timeout Cryo timeout occurs, and the oven shuts off, when a run does not start within a specified time (10 to 120 minutes) after the oven equilibrates. Turning cryo timeout off disables this feature. We recommend that it be turned on because cryo timeout conserves coolant at the end of a sequence or if automation fails. A Post Sequence method could also be used.

Cryo fault Shuts the oven down if it does not reach setpoint temperature after 16 minutes of continuous cryo operation. Note that this is the time to *reach* the setpoint, not the time to stabilize and become ready at the setpoint. For example, with a cool on-column inlet and cryo control in the oven track mode, it may take the oven 20 to 30 minutes to achieve readiness.

If the temperature goes below the minimum allowed temperature (–90°C for liquid nitrogen, –70°C for liquid CO_2), the oven will shut down.

The COC and PTV inlets must use the same cryo type as configured for the oven.

Front Inlet/Back Inlet

See "Unconfigured:" on page 143 and "Ignore Ready =" on page 142.

To configure the Gas type

The GC needs to know what carrier gas is being used.

1 Press **[Config][Front Inlet]** or **[Config][Back Inlet]**.

2 Scroll to **Gas type** and press **[Mode/Type]**.

3 Scroll to the gas you will use. Press **[Enter]**.

This completes carrier gas configuration.

To configure the PTV or COC coolant

Press **[Config][Front Inlet]** or **[Config][Back Inlet]**. If the inlet has not been configured previously, a list of available coolants is displayed. Scroll to the desired coolant and press **[Enter]**. If oven cooling is installed, your choices are restricted to the coolant used by the oven or **None**.

Cryo type **[Mode/Type]** displays a list of available coolants. Scroll to the desired coolant and press **[Enter]**.

If the Cryo type selection is anything other than **None**, several other parameters appear.

Cryo **[On/Yes]** enables cryogenic cooling of the inlet at the specified **Use cryo temperature** setpoint, **[Off/No]** disables cooling.

Use cryo temperature This setpoint determines the temperature at which cryogenic cooling is used continuously. The inlet uses cryogen to achieve the initial setpoint. If the initial setpoint is below the **Use cryo temperature**, cryogen is used continuously to achieve and maintain the setpoint. Once the inlet temperature program starts, the cryogen will be turned off when the inlet exceeds the **Use cryo temperature**. If the initial setpoint is above the **Use cryo temperature**, cryogen is used to cool the inlet until it reaches the setpoint and then it is turned off. At the end of a run, the inlet waits until the oven becomes ready before it uses cryogen.

If the inlet is to be cooled during a run, cryogen will be used to achieve the setpoint. This may have a negative impact on the chromatographic performance of the oven and cause distorted peaks.

Cryo timeout Use this setting to conserve cryogenic fluid. If selected, the instrument shuts down the inlet and cryogenic (subambient) cooling (if installed) when no run starts in the number of minutes specified. The setpoint range is 2 to 120 minutes (default 30 minutes). Turning cryo timeout off disables this feature. We recommend cryo timeout enabling to conserve coolant at the end of a sequence or if automation fails. A Post Sequence method could also be used.

Cryo fault Shuts down the inlet temperature if it does not reach setpoint in 16 minutes of continuous cryo operation. Note that this is the time to *reach* the setpoint, not the time to stabilize and become ready at the setpoint.

Shutdown behavior

Both Cryo timeout and Cryo fault can cause cryo shutdown. If this happens, the inlet heater is turned off and the cryo valve closes. The GC beeps and displays a message.

The inlet heater is monitored to avoid overheating. If the heater remains on at full power for more than 2 minutes, the heater is shut down. The GC beeps and displays a message.

To recover from either condition, turn the GC off, then on, or enter a new setpoint.

To configure the MMI coolant

Press **[Config][Front Inlet]** or **[Config][Back Inlet]**. If the inlet has not been configured previously, a list of available coolants is displayed. Scroll to the desired coolant and press **[Enter]**.

Cryo type/Cooling type **[Mode/Type]** displays a list of available coolants. Scroll to the desired coolant and press **[Enter]**. Normally, select the coolant type that matches the installed hardware.

- **N2 cryo** Select if the N_2 option is installed and you are using LN_2 or compressed air.
- **CO2 cryo** Select if the CO_2 option is installed and you are using LCO_2 or compressed air.
- **Compressed air** Select if the N_2 or CO_2 option is installed and you are only using compressed air. If **Compressed air** is selected as the Cooling type, air coolant is used to cool the inlet regardless of the **Use cryo temperature** setpoint during the cooling cycle. If the inlet reaches setpoint, the air coolant is turned off and stays off for the duration of the cooling cycle. See the Advanced Operation manual for details.

If the Cryo type selection is anything other than **None**, several other parameters appear.

Cryo **[On/Yes]** enables cryogenic cooling of the inlet at the specified **Use cryo temperature** setpoint, **[Off/No]** disables cooling.

Use cryo temperature If **N2 cryo** or **CO2 cryo** is selected as the Cryo type, this setpoint determines the temperature below which cryogenic cooling is used continuously to hold the inlet at setpoint. Set the **Use cryo temperature** equal to or higher than the inlet setpoint to cool the inlet and hold the setpoint until the inlet temperature program exceeds the **Use cryo temperature**. If the **Use cryo temperature** is less than the inlet setpoint, cryogen will cool the inlet to the initial setpoint and turn off.

Cryo timeout This parameter is available with **N2 cryo** and **CO2 cryo** Cryo types. Use this setting to conserve cryogenic fluid. If selected, the instrument shuts down the inlet and cryogenic cooling when no run starts in the number of minutes specified. The setpoint range is 2 to 120 minutes (default 30 minutes). Turning cryo timeout off disables this feature. We recommend cryo timeout enabling to conserve coolant at the end of a sequence or if automation fails. A Post Sequence method could also be used.

Cryo fault This parameter is available with **N2 cryo** and **CO2 cryo** Cryo types. Shuts down the inlet temperature if it does not reach setpoint in 16 minutes of continuous cryo operation. Note that this is the time to *reach* the setpoint, not the time to stabilize and become ready at the setpoint.

Shutdown behavior

Both Cryo timeout and Cryo fault can cause cryo shutdown. If this happens, the inlet heater is turned off and the cryo valve closes. The GC beeps and displays a message.

The inlet heater is monitored to avoid overheating. If the heater remains on at full power for more than 2 minutes, the heater is shut down. The GC beeps and displays a message.

To recover from either condition, turn the GC off, then on, or enter a new setpoint.

Column

Length The length, in meters, of a capillary column. Enter **0** for a packed column or if the length is not known.

Diameter The inside diameter, in millimeters, of a capillary column. Enter **0** for a packed column.

Film thickness The thickness, in microns, of the stationary phase for capillary columns.

Inlet Identifies the source of gas for the column.

Outlet Identifies the device into which the column effluent flows.

Thermal zone Identifies the device that controls the temperature of the column.

In_Segment Length The length, in meters, of the In Segment of a composite column. Enter **0** to disable. See "Composite Columns" on page 160.

Out_Segment Length The length, in meters, of the Out Segment of a composite column. Enter **0** to disable. See "Composite Columns" on page 160.

Segment 2 Length The length, in meters, of the Segment 2 of a composite column. Enter **0** to disable. See "Composite Columns" on page 160.

Column ID lock Set whether the column dimensions can be set using the keyboard or only through an optional barcode scanner accessory. When locked, the keyboard cannot change column dimensions, and an Agilent data system will not overwrite column configuration data. When locked, a method will use the scanned column configuration.

Scan column barcodes If using an optional barcode scanner accessory, select to input column configuration data by scanning it. See "To scan configuration data using the G3494A USB barcode reader" on page 186".

To configure a single column

You define a capillary column by entering its length, diameter, and film thickness. You then enter the device controlling the pressure at the Inlet (end of the column), the device controlling the pressure at the column Outlet, and the Thermal zone that controls its temperature.

With this information, the instrument can calculate the flow through the column. This has great advantages when using capillary columns because it becomes possible to:

- Enter split ratios directly and have the instrument calculate and set the appropriate flow rates.
- Enter flow rate or head pressure or average linear velocity. The instrument calculates the pressure needed to achieve the flow rate or velocity, sets that, and reports all three values.
- Perform splitless injections with no need to measure gas flows.
- Choose any column mode. If the column is not defined, your choices are limited and vary depending on the inlet.

Except for the simplest configurations, such as a column connected to a specific inlet and detector, we recommend that you begin by making a sketch of how the column will be connected.

If using an optional barcode scanner accessory, see "To scan configuration data using the G3494B RS-232 barcode reader" on page 185. Using the scanner will automatically configure the column dimensions and temperature limits. You will still need to set the inlet, outlet, and thermal zone as described below.

To configure a column:

1. Press **[Config][Col 1]** or **[Config][Col 2]**, or press **[Config][Aux Col #]** and enter the number of the column to be configured.
2. Scroll to the **Length** line, type the column length, in meters, followed by **[Enter]**.
3. Scroll to **Diameter**, type the column inside diameter in microns, followed by **[Enter].**
4. Scroll to **Film thickness**, type the film thickness in microns, followed by **[Enter].** The column is now *defined*.

   If you do not know the column dimensions–they are usually supplied with the column–or if you do not wish to use the GC calculating features, enter **0** for either **Length** or **Diameter**. The column will be *not defined*.

5 Scroll to **Inlet**. Press **[Mode/Type]** to select a gas pressure control device for this end of the column. Selections include the installed GC inlets, and installed Aux and PCM channels.

   Select the appropriate gas pressure control device and press **[Enter]**.

6 Scroll to **Outlet**. Press **[Mode/Type]** to select a gas pressure control device for this end of the column.

   Select the appropriate gas pressure control device and press **[Enter]**.

   - Available choices include the installed Aux and PCM channels, front and back detectors, and MSD.
   - When a detector is selected, the outlet end of the column is controlled at 0 psig for the FID, TCD, FPD, NPD, and uECD or vacuum for the MSD.
   - Selecting **Other** enables the **Outlet pressure** setpoint. If the column exhausts into a nonstandard detector or environment (neither ambient pressure nor complete vacuum), select **Other** and enter the outlet pressure.

7 Scroll to **Thermal zone**. Press **[Mode/Type]** to see the available choices. In most cases this will be **GC oven,** but you may have an MSD transfer line heated by an auxiliary zone, valves in a separately-heated valve box or other configurations.

   Select the appropriate **Thermal zone** and press **[Enter]**.

8 Scroll to **Column ID lock**. If using an optional barcode scanner, this will be set to **On** by the data system. Normally, set to **Off** when not using a barcode scanner.

9 Set **In_Segment Length**, **Out_Segment Length**, and **Segment 2 Length** to **0** to disable composite column configuration.

   See “Composite Columns” on page 160 for information.

This completes configuration for a single capillary column.

Additional notes on column configuration

Packed columns should be configured as column not defined. To do this, enter **0** for either column length or column diameter.

You should check configurations for all columns to verify that they specify the correct pressure control device at each end. The GC uses this information to determine the flow path of the carrier gas. Only configure columns that are in current use in your GC’s carrier gas flow path. Unused columns configured with the same pressure control device as a column in the current flow path cause incorrect flow results.

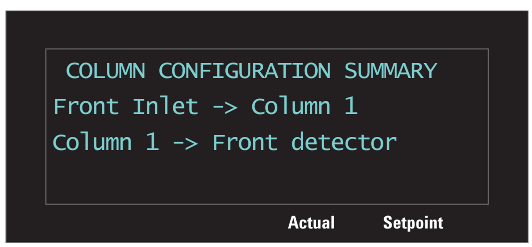
It is possible, and sometimes appropriate, to configure both installed columns to the same inlet.

When splitters or unions exist in the carrier gas flow path, without a GC’s pressure control device monitoring the common junction point, the individual column flows cannot be controlled directly by the GC. The GC can only control the inlet pressure of the upstream column whose inlet end is attached to a GC’s pressure control device. A column flow calculator available from Agilent, and provided with Agilent capillary flow devices, is used for determining pressures and flows at this type of junction.

Some pneumatic setpoints change with oven temperature because of changes in column resistance and in gas viscosity. This may confuse users who observe pneumatics setpoints changing when their oven temperature changes. However, the flow condition in the column remains as specified by the column mode (constant flow or pressure, ramped flow or pressure) and the initial setpoint values.

To view a summary of column connections

To view a summary of column connections, press [**Config**][**Aux Col #**], then press [**Enter**]. The GC lists the column connections, for example:



To configure multiple columns

To configure multiple columns, repeat the procedure above for each column.

These are the available choices for **Inlet**, **Outlet**, and **Thermal zone**. Some will not appear on your GC if the specific hardware is not installed.

Table 16 Choices for column configuration

Inlet	Outlet	Thermal zone
Front inlet	Front detector	GC oven
Back inlet	Back detector	Auxiliary oven
Aux# 1 through 9	MSD	Aux thermal zone 1
PCM A, B, and C	Aux detector	Aux thermal zone 2
Aux PCM A, B, and C	Aux 1 through 9	Aux thermal zone 3
Unspecified	PCM A, B, and C	
	Aux PCM A, B, and C	
	Front inlet	
	Back inlet	
	Other	

Inlets and outlets

The pressure control devices at the inlet and outlet ends of a column, or series of columns in a flow path, control its gas flow. The pressure control device is physically attached to the column through a connection to a GC inlet, a valve, a splitter, a union, or other device.

Table 17 Column inlet end

If the column gas flow source is:	Choose:
An inlet (SS, PP, COC, MMI, PTV, VI, or other) with electronic pressure control	The inlet.
A valve, such as gas sampling	The auxiliary (Aux PCM) or pneumatics (PCM) control module channel that provides gas flow during the inject cycle.
A splitter with an EPC makeup gas supply	The Aux PCM or EPC channel that provides the makeup gas
A device with a manual pressure controller	**Unknown**

Similar considerations apply for the column outlet end. When a column exits to a splitter, select the GC's pressure control source attached to the same splitter.

Table 18 Column outlet end

If the column exhausts into	Choose:
A detector	The detector.
A splitter with a makeup gas supply	The Aux PCM or EPC channel that provides makeup gas flow to the splitter.
A device with a manual pressure controller	**Unknown**

A simple example

An analytical column is attached at its inlet end to a split/splitless inlet located at the front of the GC and the column outlet is attached to an FID located at the front detector position.

Table 19 Analytical column

Column	Inlet	Outlet	Thermal zone
Analytical column	Front split/splitless	Front FID	GC oven

Since only a single column is configured, the GC determines that it controls the inlet pressure to the column by setting the front inlet pressure and the outlet pressure is always atmospheric. The GC can calculate a pressure for the front inlet that can exactly overcome the resistance to flow presented by this column at any point during a run.

Slightly more complex example

A precolumn is followed by a AUX 1 pressure controlled splitter and two analytical columns. This requires three column descriptions.

Table 20 Precolumn split to two analytical columns

Column	Inlet	Outlet	Thermal zone
1 - Precolumn	Front inlet	AUX 1	GC oven
2 - Analytical column	AUX 1	Front detector	GC oven
3 - Analytical column	AUX 1	Back detector	GC oven

The GC can calculate the flow through the precolumn using the precolumns physical properties to calculate the column’s resistance to flow, along with the front inlet pressure and the AUX 1 pressure. Your analytical method can set this flow directly for the precolumn.

For the flow in the two parallel analytical columns 1 and 2, the GC can use the column’s physical properties to calculate the split flow through each individual column, at a given AUX 1 pressure, with both columns exiting to atmospheric pressure. Your analytical method can only set the flow for the lowest numbered column in a split, analytical column 2. If you try to set the flow for column #3, it will be ignored and the flow for column #2 will be used.

If other columns are currently defined, they may not use AUX 1, Front inlet, Front detector, or Back detector in their configuration.

Complicated example

The inlet feeds the analytical column which ends at a three-way splitter. The splitter has the column effluent and makeup gas coming in, and transfer lines (non-coated columns) to three different detectors. This is a case where a sketch is necessary.

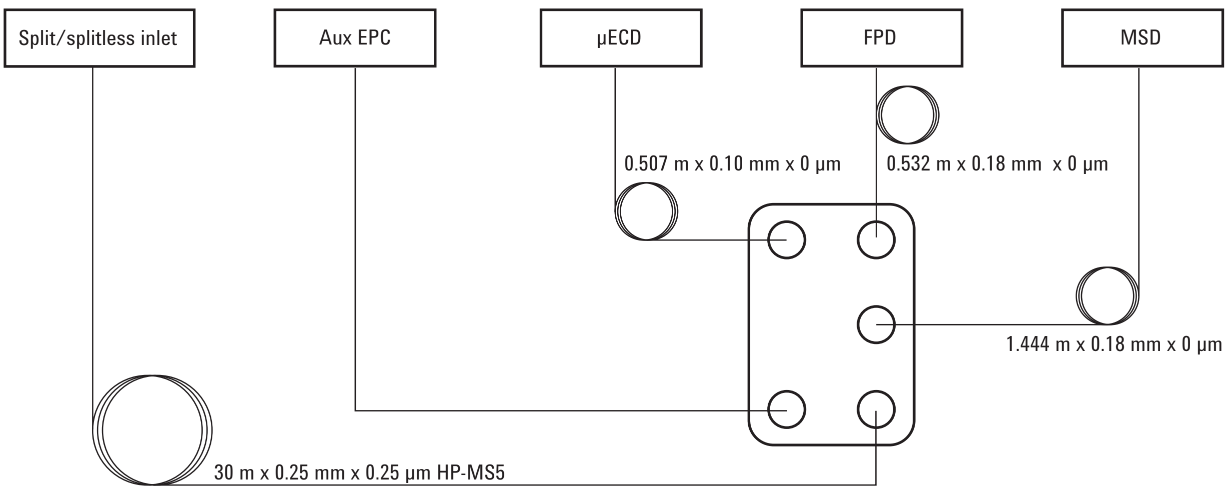


Table 21 Splitter with makeup and multiple detectors

Column	Inlet	Outlet	Thermal zone
1 - 30 m × 0.25 mm × 0.25 μm	Front inlet	Aux EPC 1	GC oven
2 - 1.444 m × 0.18 mm × 0 μm	Aux EPC 1	MSD	GC oven
3 - 0.507 m × 0.10 mm × 0 μm	Aux EPC 1	Front detector	GC oven
4 - 0.532 m × 0.18 mm × 0 μm	Aux EPC 1	Back detector	GC oven

The oven was chosen for the MSD line since most of it is in the oven.

As in the previous examples, your analytical method can control the flow of column # 1 which has a GC pressure controlled inlet and outlet.

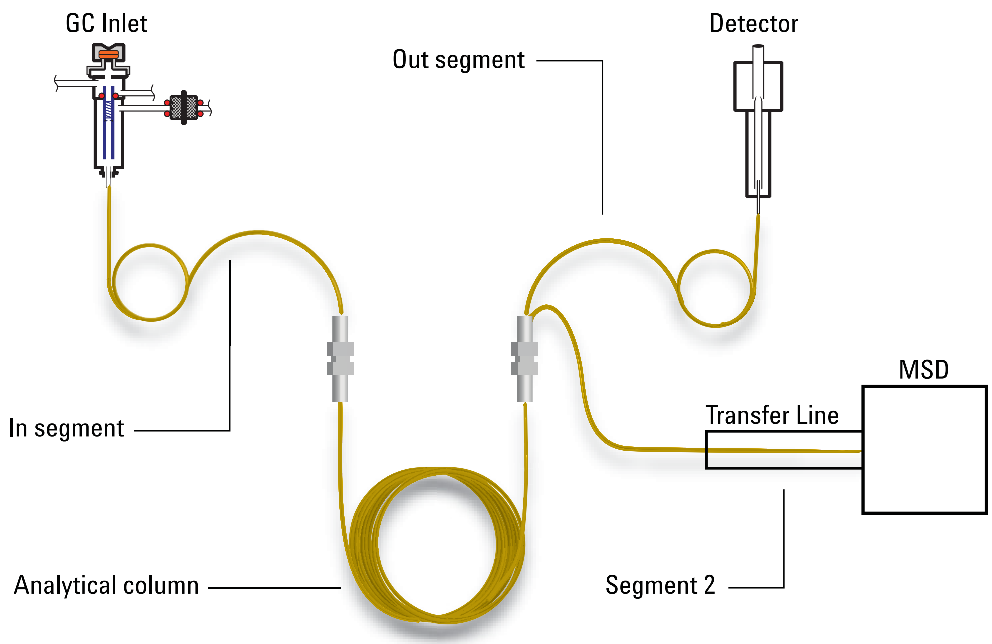
The flows to the three detectors are based on the pressure drops through the capillaries and their resistance to flow. An Agilent flow calculator provided with the capillary flow splitter device is used to size the length and diameter of these capillary sections to obtain the desired split ratios.

Your analytical method can set the flow or pressure for column # 2, the lowest numbered column in the split. Use the value obtained from the Agilent flow calculator for this setpoint in your method.

Composite Columns

A composite column is a capillary column that passes through multiple heating zones. A composite column consists of a main segment and one or more additional segments. There may be one segment on the input side of the main segment (**In Segment**) and up to two segments on its output side (**Out Segment**, **Segment 2**). Each of the four segments' lengths, diameters, and film thicknesses can be specified separately. Also, the zones that determine the temperatures of each of the four segments are specified separately. The three additional segments are often uncoated (zero film thickness) and, serving as connectors, are of shorter length than the main segment. It is necessary to specify these additional segments so that the flow-pressure relationship for the composite column can be determined.

Composite columns differ from multiple columns because for composite columns, 100% of the column flow continues through a single column or through multiple column segments without additional makeup gas.



To configure composite columns

1. Follow steps 1-7 on page 153.
2. If using an In Segment, scroll to **In_Segment Length** and enter the length, in meters. If not using an In Segment, enter **0** to disable.
3. If using an Out Segment, scroll to **Out_Segment Length** and enter the length, in meters. If not using an Out Segment, enter **0** to disable.
4. If using a Segment 2, scroll to **Segment 2 Length** and enter the length, in meters. If not using a Segment 2, enter **0** to disable.

LTM Columns

See "Unconfigured:" on page 143 and "Ignore Ready =" on page 142.

Low Thermal Mass (LTM) controllers and columns mount on the front door of the GC and connect to LVDS connectors [A-DET 1], [A-DET 2], or [EPC 6].

Press **[Config][Aux Col #]**, enter the desired LTM column number **[1-4]**, and configure as a composite column. See "Composite Columns" on page 160.

LTM Series II column modules

If using a LTM Series II column module, the GC obtains the following parameters from the column module itself during startup: primary column dimensions (length, id, film thickness, and basket size), and column maximum and absolute maximum temperatures.

Configure the column type, the In and Out segment dimensions, and so forth as needed.

Note that LTM columns can be edited only for certain parameters: column length (within a small percentage, for calibration purposes) and id (within a small percentage). Since the LTM Series II column module contains its column information, and since the column type is not changeable, changing other dimensions (for example, film thickness) does not apply.

See "Composite Columns" on page 160.

Cryo Trap

This discussion assumes that the trap is mounted in position B, that you use liquid nitrogen coolant and control the trap with Thermal Aux 1.

Configuration is in several parts:

- Configure the trap to the GC
- Configure a heater to the cryo trap.
- Configure the coolant.
- Configure the user-configurable heater.
- Reboot the GC.

Configure the cryo trap to the GC

1. Press **[Config]**, then **[Aux Temp #]** and select **Thermal Aux 1**. Press **[Enter]**.
2. Press **[Mode/Type]**. Scroll to **Install BINLET with BV Cryo** and press **[Enter]**.
3. Press **[Options]**, select **Communications**, and press **[Enter]**. Select **Reboot GC** and press **[On/Yes]** twice.

This informs the GC that a cryo trap is installed at position B.

Configure a heater to the cryo trap

1. Press **[Config]**, then **[Aux Temp #]**, select **Thermal Aux 1** and press **[Enter]**. Select **Auxiliary Type: Unknown** and press **[Mode/Type]**. Select **User Configurable Heater** and press **[Enter]**.
2. Press **[Options]**, select **Communications**, and press **[Enter]**. Select **Reboot GC** and press **[On/Yes]** twice.

This informs the GC that the heater parameters will be supplied by the user.

Configure the coolant

The GC can handle only one type of coolant. If the coolant has already been specified for some other device, then that same coolant must be specified here.

1. Press **[Config]**, then **[Aux Temp #]**.
2. Select **Thermal Aux 1** and press **[Enter]**.
3. Scroll to **Cryo Type (Valve BV)**.

If the value is *not* **N2**, press **[Mode/Type]**, select **N2 Cryo**, press **[Enter]** and then **[Clear]**.

This tells the GC what coolant will be used.

Configure the user-configurable heater

Many of the following steps tell you to reboot the GC. Ignore these requests by pressing **[Clear]**. Do *not* reboot until specifically told to do so in these instructions.

1 Press **[Config]** and select **Aux 1**. Press **[Enter]**.

2 Enter the following control values. Press **[Enter]**, then **[Clear]** after each one.

   a Proportional Gain—5.30

   b Integral Time—10

   c Derivative Time—1.00

   d Mass (Watt-sec/deg)—18

   e Power (Watts)—To find the watts to set here, scroll to **Back Inlet Status (BINLET)**. Note the watts value and enter it for this parameter.

   f Cryo Control Mode—Press **[Mode/Type]**. The first line should already be **PTV**. Select **Cryo Trap**.

   g Zone Control mode—Press **[Mode/Type]** and select **PTV**.

   h Sensor—Press **[Mode/Type]** and select **Thermocouple**.

   i Maximum Setpoint—400

   j Maximum Programming Rate—720

Reboot the GC

Press **[Options]**, select **Communications**, and press **[Enter]**. Select **Reboot GC** and press **[On/Yes]** twice.

About Heaters

Inlets, detectors, valve boxes, and so on are heated. When configuring a device, it is sometimes necessary to know the connector used for that device's heater. Use the information in this section as needed when configuring a device.

The GC provides six heater connectors on the GC mainframe:

Table 22 Heater connector locations

Location	Label
Near front inlet	FI
Near back inlet	BI
Near top right corner of front detector board	FD
Near top right corner of back detector board	BD
Left end of valve (auxiliary) bracket	A1
Right end of valve (auxiliary) bracket	A2

All heater connectors are square, 4-conductor receptacles mounted on brackets. Note that access to the detector and valve connectors generally requires removing GC covers, and should be performed only by Agilent-trained service personnel.

The Table 23 describes the heater locations that are available for each module.

Table 23 Possible heater connections by module

Module	Possible heater connections
Front inlet	FI or None
Back inlet	BI or None
Front detector	FD or A1
Back detector	BD or A2
Aux detector 1	A1 or A2 or FI
Aux detector 2	None
Valve box	A1 or A2 or both
Aux heater 1	A1
Aux heater 2	A2

A front FPD$^+$ (or FPD) uses heater connectors FD and A1. A back FPD$^+$ (or FPD) or uses heater connectors BD and A2. Alternately, an FPD (not FPD$^+$) can be configured to use only one heater.

Front Detector/Back Detector/Aux Detector/Aux Detector 2

See Ignore Ready = and "Unconfigured:" on page 143.

To configure the makeup/reference gas

The makeup gas line of your detector parameter list changes depending on your instrument configuration.

If you have an inlet with the *column not defined,* the makeup flow is constant. If you are operating with *column defined*, you have a choice of two makeup gas modes. See the Advanced Operation manual for details.

1 Press **[Config][***device***]**, where [*device*] is one of the following:
   - **[Front Det]**
   - **[Back Det]**
   - **[Aux detector 1]**
   - **[Aux detector 2]**
2 Scroll to **Makeup gas type** (or **Makeup/reference gas type**) and press **[Mode/Type].**
3 Scroll to the correct gas and press **[Enter]**.

Lit offset

The GC monitors the difference between the detector output with the flame lit and the output when the flame is not lit. If this difference falls below the setpoint, the GC assumes that the flame has gone out and tries to reignite it. See the *Advanced Operation* manual for details on how to set the **Lit Offset**:

FID

FPD

If set too high, the lit detector baseline output can be below the **Lit Offset** setpoint, causing the GC to erroneously try to reignite the flame.

To configure the FPD heaters

The flame photometric detector (FPD) uses two heaters, one in the transfer line near the base of the detector and one near the combustion chamber. When configuring the FPD heaters, select **Install Detector 2 htr** rather than the default **Install Detector (FPD)**.

This two heater configuration controls the detector body using the detector heated zone, and the transfer line using Thermal Aux 1 for a front detector or Thermal Aux 2 for a back detector.

To ignore the FID or FPD ignitor

WARNING

In general, do not ignore the ignitor for normal operation. Ignoring the ignitor also disables the Lit Offset and autoignition features, which work together to shut down the detector if the detector flame goes out. If the flame goes out under manual ignition, GC will continue to flow hydrogen fuel gas into the detector and lab.

Use this feature only if the ignitor is defective, and only until the ignitor is repaired.

If using an FID or FPD, you can ignite the flame manually by setting the GC to ignore the ignitor.

1 Press **[Config][Front Det]** or **[Config][Back Det]**.
2 Scroll to **Ignore Ignitor.**
3 Press **[On/Yes]** to ignore the ignitor (or **[Off/No]** to enable the ignitor.

When **Ignore Ignitor** is set to **True**, the GC does not try to light the flame using the ignitor. The GC also completely ignores the **Lit Offset** setpoint and does not attempt autoignition. This means that the GC cannot determine if the flame is lit, and will not shut down the fuel gas.

Analog out 1/Analog out 2

Fast peaks

The GC allows you to output analog data at two speeds. The faster speed—to be used only with the FID, FPD, and NPD—allows minimum peak widths of 0.004 minutes (8 Hz bandwidth), while the standard speed—which can be used with all detectors— allows minimum peak widths of 0.01 minutes (3.0 Hz bandwidth).

To use fast peaks:

1 Press [**Config**][**Analog out 1**] or [**Config**][**Analog out 2**].

2 Scroll to **Fast peaks** and press [**On/Yes**].

The *fast peaks* feature does not apply to digital output.

If you are using the *fast peaks* feature, your integrator must be fast enough to process data coming from the GC. Integrator bandwidth should be at least 15 Hz.

Valve Box

See "Unconfigured:" on page 143 and "Ignore Ready =" on page 142.

The valve box mounts on top of the column oven. It may contain up to four valves mounted on heated blocks. Each block can accommodate two valves.

Valve positions on the blocks are numbered. We suggest that valves be installed in the blocks in numeric order.

All heated valves in a valve box are controlled by the same temperature setpoint.

To assign a GC power source to a valve box heater

1 Unlock the GC configuration, press **[Options]**, select **Keyboard & Display** and press **[Enter]**. Scroll down to **Hard Configuration Lock** and press **[Off/No]**.

2 Press **[Config]**, scroll to **Valve Box** and press **[Enter]**.

3 With **Unconfigured** selected, press **[Mode/type]**, select one of the following and press **[Enter]**.

   - **Install heater A1** - for a valve box containing a single heater plugged into the connector labeled A1 on the valve box bracket.
   - **Install heater A2** - for a valve box containing a single heater plugged into the connector labeled A2 on the valve box bracket.
   - **Install 2 htr A1 & A2** - for a valve box containing two heaters plugged into the connectors labeled AI and A2 on the valve box bracket.

   The valve box bracket is located inside the GC right side electrical compartment in the upper right location.

4 When prompted by the GC, turn the power off then on again.

This completes the configuration of the valve box. To set the valve box temperature for your method press the **[Valve #]** key, and scroll to **Valve Box**.

Thermal Aux

See “Unconfigured:” on page 143 and “Ignore Ready =” on page 142.

The auxiliary thermal controllers provide up to three channels of temperature control. These controllers are labeled Thermal Aux 1, Thermal Aux 2, and Thermal Aux 3.

To assign a GC power source to an Aux thermal zone

Devices such as valve boxes and transfer lines have heaters which can be plugged into one of several connectors on the GC. Before use, you must configure these devices so that the GC knows the type of device plugged into the connector (inlet heater, detector heater, transfer line heater, and so on) and how to control it.

This procedure assigns the heater power source to the Thermal Aux 1, Thermal Aux 2, or Thermal Aux 3 temperature control zone.

1. Unlock the GC configuration. Press [**Options**], select **Keyboard & Display** and press [**Enter**]. Scroll down to **Hard Configuration Lock** and press [**Off/No**].
2. Press [**Config**][**Aux Temp #**] and scroll to **Thermal Aux 1, Thermal Aux 2,** or **Thermal Aux 3** and press [**Enter**].
3. With **Unconfigured** selected, press [**Mode/Type**], and select:
   - **Install Heater A1** to configure a valve box heater plugged into the valve box bracket plug labeled A1.
   - **Install Heater A2** to configure a valve box heater plugged into the valve box bracket plug labeled A2.
   - If installing a transfer line, scroll to the line which describes the transfer line type (**MSD Transfer**, **Ion Trap**, **RIS Transfer**, and so on) and its GC connector (**F-DET**, **A1**, **BINLET**, and so on). For example, for an MSD transfer line connected to A2, select **Install MSD Transfer A2**.
4. Press **[Enter]** after making the selection.
5. For devices such as a valve box, inlet, or detector, configuration is complete. When prompted by the GC, turn the power off then on again. Skip the rest of the steps in this procedure.

   For other devices, next configure the specific device type: Press [**Clear**] to skip the reboot for now.

6 Scroll to **Auxiliary type**, press **[Mode/Type]**, scroll to and select the desired device type, and press **[Enter]**. Types may include:
   - **Cryo focus**
   - **Cryo trap**
   - **AED transfer line**
   - **Nickel catalyst**
   - **ICMPS argon preheat**
   - **ICMPS transfer line**
   - **ICPMS injector**
   - **Ion Trap GC Heated Interface**
   - **G3520 Transfer Line**
   - **MSD transfer line**
   - **User Configurable**

7 When prompted, reboot the GC to implement the changes.

To configure a MSD transfer line heater

1 Check that a power source for the MSD heater was assigned. See "To assign a GC power source to an Aux thermal zone" on page 171.

2 Press **[Config][Aux Temp #]** and scroll to **Thermal Aux 1, Thermal Aux 2,** or **Thermal Aux 3** depending on where the MSD heater was assigned, and press **[Enter]**.

3 Scroll to **Auxiliary type**, press **[Mode/Type]**, scroll to and select the **MSD transfer line**, and press **[Enter]**.

To configure a nickel catalyst heater

1 Check that a power source for the Nickel Catalyst heater was assigned. See "To assign a GC power source to an Aux thermal zone" on page 171.

2 Press **[Config][Aux Temp #]** and scroll to **Thermal Aux 1, Thermal Aux 2,** or **Thermal Aux 3** depending on where the Nickel Catalyst heater was assigned, and press **[Enter]**.

3 Scroll to **Auxiliary type**, press **[Mode/Type]**, scroll to and select **Nickel catalyst**, and press **[Enter]**.

To configure an AED transfer line heater

1 Check that a power source for the AED transfer line heater was assigned. See “To assign a GC power source to an Aux thermal zone” on page 171.

2 Press **[Config][Aux Temp #]** and scroll to **Thermal Aux 1, Thermal Aux 2,** or **Thermal Aux 3** depending on where the AED transfer line heater was assigned, and press **[Enter]**.

3 Scroll to **Auxiliary type**, press **[Mode/Type]**, scroll to and select the **AED transfer line**, and press **[Enter]**.

To configure an ion trap transfer line heater

1 Check that a power source for the ion trap transfer line heater was assigned. See “To assign a GC power source to an Aux thermal zone” on page 171.

2 Press **[Config][Aux Temp #]** and scroll to **Thermal Aux 1, Thermal Aux 2,** or **Thermal Aux 3** depending on where the ion trap transfer line heater was assigned, and press **[Enter]**.

3 Scroll to **Auxiliary type**, press **[Mode/Type]**, scroll to and select **Ion Trap GC Heated Interface**, and press **[Enter]**.

PCM A/PCM B/PCM C

See “Unconfigured:” on page 143 and “Ignore Ready =” on page 142.

A pressure control module (PCM) provides two channels of gas control.

Channel 1 is a simple forward-pressure regulator that maintains a constant pressure at its output. With a fixed downstream restrictor, it provides constant flow.

Channel 2 is more versatile. With the normal flow direction (in at the threaded connector, out via the coiled tubing), it is similar to channel 1. However with the flow direction reversed (some extra fittings will be needed), it becomes a back-pressure regulator that maintains a constant pressure at its inlet.

Thus channel 2 (reversed) behaves as a controlled leak. If the inlet pressure drops below setpoint, the regulator closes down. If inlet pressure rises above setpoint, the regulator bleeds off gas until the pressure returns to setpoint.

To assign a GC communication source to a PCM

1 Unlock the GC configuration, press **[Options]**, select **Keyboard & Display** and press **[Enter]**. Scroll down to **Hard Configuration Lock** and press **[Off/No]**.
2 Press **[Config][Aux EPC #]**, scroll to a **PCMx** and press **[Enter]**.
3 With **Unconfigured** selected, press **[Mode/Type]**, select **Install EPC**x and press **[Enter]**.
4 When prompted by the GC, turn the power off then on again.

To configure the other parameters on this PCM, see To configure a PCM.

To configure a PCM

1 Press **[Config][Aux EPC #]**, scroll to the **PCMx** and press **[Enter]**.
2 Scroll to **Gas type**, press **[Mode/Type]**, make a selection and press **[Enter]**.

This completes configuration for Channel 1. The rest of the entries refer to Channel 2.

3 Scroll to **Aux gas type**, press **[Mode/Type]**, make a selection and press **[Enter]**.

4 Scroll to **Aux Mode:,** press **[Mode/Type],** select one of the following and press **[Enter]**:

- Forward Pressure Control - Aux channel
- Back Pressure Control- Aux channel

For a definition of these terms the Advanced Operation manual.

The pressure control mode for the main channel is set by pressing **[Aux EPC #]**. Select **Mode:**, press **[Mode/Type]**, select the mode and press **[Enter]**.

Pressure aux 1,2,3/Pressure aux 4,5,6/Pressure aux 7,8,9

See Ignore Ready = and "Unconfigured:" on page 143.

An auxiliary pressure controller provides three channels of forward-pressure regulation. Three modules can be installed for a total of nine channels.

The numbering of the channels depends on where the controller is installed. See the Advanced Operation manual for details. Within a single module, channels are numbered from left to right (as seen from the back of the GC) and are labeled on the AUX EPC module.

To assign a GC communication source to an Aux EPC

1 Unlock the GC configuration, press **[Options]**, select **Keyboard & Display** and press **[Enter]**. Scroll down to **Hard Configuration Lock** and press **[Off/No]**.
2 Press **[Config][Aux EPC #],** select **Aux EPC 1,2,3** or **Aux EPC 4,5,6** or **Aux EPC 7,8,9** and press **[Enter]**.
3 With **Unconfigured** selected, press **[Mode/Type]**, select **Install EPCx** and press **[Enter]**.
4 When prompted by the GC, turn the power off then on again.

To configure the other parameters on this EPC, see To configure an auxiliary pressure channel.

To configure an auxiliary pressure channel

1 Press **[Config][Aux EPC #],** select **Aux EPC 1,2,3** or **Aux EPC 4,5,6** or **Aux EPC 7,8,9** and press **[Enter]**.
2 Select **Chan x Gas type**, press **[Mode/Type]**, select the gas that is plumbed to the channel and press **[Enter]**.
3 If necessary, repeat the above step for the other two channels on this EPC module.

Status

The **[Status]** key has two tables associated with it. You switch between them by pressing the key.

The Ready/Not Ready status table

This table lists parameters that are *Not Ready* or gives you a *Ready for Injection* display. If there are any *faults, warnings,* or *method mismatches* present, they are displayed here.

The setpoint status table

This table lists setpoints compiled from the active parameter lists on the instrument. This is a quick way to view active setpoints during a run without having to open multiple lists.

To configure the setpoint status table

You can change the order of the list. You might want the three most important setpoints to appear in the window when you open the table.

1. Press **[Config][Status]**.
2. Scroll to the setpoint that should appear first and press **[Enter]**. This setpoint will now appear at the top of the list.
3. Scroll to the setpoint that should appear second and press **[Enter]**. This setpoint will now be the second item on the list.
4. And so on, until the list is in the order you wish.

Time

Press **[Time]** to open this function. The first line always displays the current date and time, and the last line always displays a stopwatch. The two middle lines vary:

Between runs Show last and next (calculated) run times.

During a run Show time elapsed and time remaining in the run.

During Post Run Show last run time and remaining Post Run time.

To set time and date

1 Press **[Config][Time].**
2 Select **Time zone (hhmm)** and enter the local time offset from GMT using a 24 hour format.
3 Select **Time (hhmm)** and enter the local time.
4 Select **Date (ddmmyy)** and enter the date.

To use the stopwatch

1 Press **[Time]**.
2 Scroll to the **time=** line.
3 To begin the timed period press **[Enter]**.
4 To stop the timed period press **[Enter]**.
5 Press **[Clear]** to reset the stopwatch.

Valve

Up to 4 valves can be mounted in a temperature-controlled valve box and are normally wired to the valve box bracket V1 through V4 plugs, located inside the electrical compartment. Additional valves or other devices (4 through 8) can be wired using the plug labeled **EVENT** on the back of the GC.

To configure a valve

1 Press **[Config][Valve #]** and enter the number (1 to 8) of the valve you are configuring. The current valve type is displayed.

2 To change the valve type, press **[Mode/Type]**, select the new valve type, and press **[Enter]**.

Valve types

- **Sampling** Two-position (load and inject) valve. In load position, an external sample stream flows through an attached (gas sampling) or internal (liquid sampling) loop and out to waste. In inject position, the filled sampling loop is inserted into the carrier gas stream. When the valve switches from Load to Inject, a run starts if one is not already in progress. See the Advanced Operation manual for details.
- **Switching** Two-position valve with four, six, or more ports. These are general-purpose valves used for such tasks as column selection, column isolation, and many others. For an example of valve control, see the Advanced Operation manual.
- **Multiposition** Also called a stream selection valve. It selects one from a number of gas streams and feeds it to a sampling valve. The actuator may be ratchet- (advances the valve one position each time it is activated) or motor-driven. An example that combines a stream selection valve with a gas sampling valve is provided in the Advanced Operation manual.
- **Remote start** Available selection when configuring valve #7 or #8 only. Use this selection when wires controlling an external device are attached to an internal pair of contacts controlled by the GC.
- **Other** Something else.
- **Not installed** Self-explanatory.

Front injector/Back injector

The GC supports three models of samplers.

For the 7693A and 7650A samplers, the GC recognizes which injector is plugged into which connector, **INJ1** or **INJ2**. No configuration is needed. To move an injector from one inlet to another requires no settings: the GC detects the injector position.

To configure the 7693A sampler system, see the 7693A Installation, Operation, and Maintenance manual. To configure the 7650A sampler system, see the 7650A Installation, Operation, and Maintenance manual.

For the 7683 series samplers, normally the front inlet's injector is plugged into the connection on the rear of the GC labeled **INJ1.** The rear inlet's injector is plugged into the connection on the rear of the GC labeled **INJ2.**

When a GC shares a single 7683 injector between two inlets, the injector is moved from one inlet to the other and the injector's plug-in on the rear of the GC is switched.

To move the 7683 injector from one inlet on the GC to another without changing the injector's plug-in, use the **Front/Back tower** parameter. See "To move a 7683 injector between front and back positions" on page 181.

Solvent Wash Mode (7683 ALS)

This section applies to the 7683 ALS system. To configure the 7693A sampler system, see the 7693A Installation, Operation, and Maintenance manual.

Depending upon the installed injector and turret, these parameters may be available to configure multiple solvent wash bottles usage. If necessary, refer to your injector user documentation for details.

A, B—Use solvent bottle A if injector uses solvent A washes and solvent bottle B if injector uses solvent B washes.

A-A2, B-B2—Use solvent bottles A and A2 if injector uses solvent A washes and solvent bottles B and B2 if injector uses solvent B washes. The injector alternates between both bottles.

A-A3, B-B3—Use solvent bottles A, A2, and A3 if injector uses solvent A washes and solvent bottles B, B2, and B3 if injector uses solvent B washes. The injector alternates between all bottles.

To configure an injector (7683 ALS)

This section applies to the 7683 ALS system. To configure the 7693A sampler system, see the 7693A Installation, Operation, and Maintenance manual. To configure the 7650A sampler system, see the 7650A Installation, Operation, and Maintenance manual.

1 Press **[Config][Front Injector]** or **[Config][Back Injector]**.
2 Scroll to **Front/Back tower**.
3 Press **[Off/No]** to change the present tower position from INJ1 to INJ2 or from INJ2 to INJ1.
4 If the installed turret has locations for multiple solvent bottles, scroll to **Wash Mode**, press **[Mode/Type]**, and then select **1**, **2**, or **3** bottles for each solvent and press **[Enter]**.
5 Scroll to **[Syringe size]**. Enter the size of the syringe that is installed and press **[Enter].**

To move a 7683 injector between front and back positions

This section applies only to the 7683 ALS system. (The 7693A system automatically determines the current injector location.)

If only one injector is installed on the GC, move it from the front to back inlet and reconfigure the GC as described below:

1 Press **[Config][Front Injector]** or **[Config][Back Injector]**.
2 Scroll to **Front/Back tower**.
3 Press **[Off/No]** to change the present tower position from INJ1 to INJ2 or from INJ2 to INJ1.

   If you press **[Config]**, then scroll down, you will see that the only configurable injector is now in the other position.
4 Lift the injector and place it over the mounting post for the other inlet.

Sample tray (7683 ALS)

This section applies to the 7683 ALS system. To configure the 7693A sampler system, see the 7693A Installation, Operation, and Maintenance manual.

1 Press **[Config][Sample Tray]**.

2 If the vial gripper is touching vials either too high or too low for reliable pickup, scroll to **Grip offset** and press **[Mode/Type]** to select:

   - **Up** to increase the gripper arm pickup height
   - **Default**
   - **Down** to decrease the gripper arm pickup height

3 Scroll to **Bar Code Reader**.

4 Press **[On/Yes]** or **[Off/No]** to control the following bar code setpoints:

   - **Enable 3 of 9**—encodes both letters and numbers, plus a few punctuation marks, and message length can be varied to suit both the amount of data to be encoded and the space available
   - **Enable 2 of 5**—restricted to numbers but does allow variable message length
   - **Enable UPC code**—restricted to numbers-only with fixed message length
   - **Enable checksum**—verifies that the checksum in the message matches the checksum calculated from the message characters, but does not include the checksum character in the returned message

5 Enter **3** as the **BCR Position** when the reader is installed in the front of the tray. Positions 1–19 are available.

Instrument

1 Press **[Config]**. Scroll to **Instrument** and press **[Enter]**.

2 Scroll to **Serial #**. Enter a serial number and press **[Enter]**. This function can only be done by Agilent service personnel.

3 Scroll to **Auto prep run**. Press **[On/Yes]** to enable **Auto prep run**, **[Off/No]** to disable it. See the Advanced Operation manual for details.

4 Scroll to **Zero Init Data Files**.

- Press **[On/Yes]** to enable it. When it is On, the GC immediately begins to subtract the current detector output from all future values. This applies only to digital output, and is useful when a non-Agilent data system has problems with baseline data that is non-zero.
- Press **[Off/No]** to disable it. This is appropriate for all Agilent data systems.

5 Scroll to **Require Host Connection**. Set **On** to consider whether or not the remote host reports Ready as part of GC readiness.

6 Press **[Clear]** to return to the **Config** menu or any other function to end.

Using the Optional Barcode Reader

The optional G3494A USB Barcode Reader and G3494B RS-232 Barcode Reader accessories provide an easy way to input configuration information when used with an Agilent data system. The G3494B accessory uses RS-232 communication and connects to the **BCR/RA** port on the back of the GC. The G3494A accessory uses USB communications, and connects to the data system PC.

Refer to your Agilent data system help for additional usage details.

The barcode reader accessories can be used to input data directly from labels on the new consumables into the data system. The data system uses this part number information to search its consumable parts catalogs to then populate various configuration fields with the appropriate data for the part.

Scannable data includes part numbers, lot numbers, and serial numbers. Lookup data from the database includes:

- Column description, temperature limits, form factor, and nominal dimensions.
- Liner description and internal volume.
- Injector syringe description, type, and volume.

Barcode reader power

The USB version of the barcode reader gets its power from the PC’s USB port.

The RS-232 version of the barcode reader uses its own power supply. Plug the power cord into the appropriate outlet. **When power cycling the GC, turn off the RS-232 barcode reader too.**

CAUTION

To avoid damaging the barcode reader, do not connect or disconnect the RS-232 barcode reader to or from the GC when either GC power or barcode reader power is on.

Installing the barcode reader

To install the G3494B RS-232 barcode reader

1. Shut down the GC and turn it off.
2. Connect the control cable from the barcode reader to the GC the **BCR/RA** port.
3. Plug the barcode reader power cord into an appropriate outlet.
4. Turn on the GC.
5. Press [**Options**], scroll to [**Communications**], and press [**Enter**].
6. Scroll to **BCR/RA connector**, then press [**Mode/Type**].
7. Select **Barcode reader connection**, then press [**Enter**] to accept.

The barcode reader is ready for use.

To install the G3494A USB barcode reader

1. Shut down the Agilent data system.
2. Connect the USB cable from the barcode reader to an open PC USB port.

The barcode reader is ready for use.

To scan configuration data using the G3494B RS-232 barcode reader

1. If not open, launch the data system online session for the GC.
2. Press [**Config**], then scroll to the desired item to configure:
   - Select the column to configure a column.
   - Select [**Front Inlet**] or [**Back Inlet**] to scan liner data.
   - Select **Injector** to configure an ALS syringe.
3. Scroll to the appropriate line: **Scan syringe barcodes**, **Scan column barcodes**, or **Scan liner barcodes**. Press [**Enter**].
4. Scroll to the appropriate entry to scan. See Table 24.

Table 24 Scannable configuration data

Columns	Liners	Syringes
Part No.	Part Number	Part Number
Serial No.	Lot Number	Lot Number

5. Scan the barcode for the entry.

6 Scroll to the next line for the consumable item, then scan its barcode.

7 After scanning all desired items, scroll to **Enter to save, Clear to abort**.

8 Press [**Enter**] to save the scanned data, or press [**Clear**] to abort the process and discard the scanned data.

9 After pressing [**Enter**], the GC will beep once when the data system and GC successfully synchronize their data.

If the data system online session was not running, you will not see the new configuration data. Instead, you will see a scrolling message similar to: **New *part* barcode waiting for info from data system**. The next time you launch a data system online session, you will be prompted to download the last method used or upload the current instrument setpoints. To keep the scanned data, upload the current setpoints from the instrument. If you choose to download the last data system method, that method's part data will be used and you will need to re-scan the barcode as described above.

To scan configuration data using the G3494A USB barcode reader

Refer to the online help available in the data system.

To delete scanned configuration data

To delete (clear) the scanned configuration data for an item:

1 Press [**Config**], then scroll to the desired item to configure:
   - Select the column for column data.
   - Select [**Front Inlet**] or [**Back Inlet**] for liner data.
   - Select **Injector** for ALS syringe data.

2 Scroll to the appropriate line: **Scan syringe barcodes**, **Scan column barcodes**, or **Scan liner barcodes**. Press [**Enter**].

3 Scroll to the part number line and press [**Enter**].

4 Scroll to the lot number or serial number line and press [**Enter**].

5 Press [**Enter**] to save the blank data.

If the data system online session was not running, you will not see the new configuration data. Instead, you will see a scrolling message similar to: **New *part* barcode waiting for info from data system**. The next time you launch a data system online session, you will be prompted to download the last method used or upload the current instrument setpoints. To finish deleting the data, upload the current setpoints from the instrument. If you choose to download the last data system method, that method's part data will be used and you will need to re-delete the barcode as described above.

To uninstall the RS-232 barcode reader

To uninstall the barcode reader, disable it before disconnecting it.

1 Press [**Options**], scroll to [**Communications**], and press [**Enter**].

2 Scroll to **BCR/RA connector**, then press [**Mode/Type**].

3 Select **Disable BCR/RA connection**, then press [**Enter**] to accept.

4 Turn off the GC.

5 Unplug the barcode reader from the GC and disconnect it from power.

11
Options

About Options

The **[Options]** key is used for a group of functions that are usually set on installation and seldom changed afterward. It accesses this menu:

Calibration
Communication
Keyboard and Display

Calibration

Press [**Calibration**] to list the parameters that can be calibrated. These include:

- Inlets
- Detectors
- ALS
- Columns
- Oven
- Atmospheric pressure
- Hydrogen sensor (if available)

In general, you will only need to calibrate the EPC modules and capillary columns. ALS, oven, and atmospheric pressure calibration should only be performed be trained service personnel.

Maintaining EPC calibration—inlets, detectors, PCM, and AUX

The EPC gas control modules contain flow and/or pressure sensors that are calibrated at the factory. Sensitivity (slope of the curve) is quite stable, but zero offset requires periodic updating.

Flow sensors

The split/splitless and purged packed inlet modules use flow sensors. If the **Auto flow zero** feature (see page 190) is on, they are zeroed automatically after each run. This is the recommended way. They can also be zeroed manually—see "To zero a specific flow or pressure sensor."

Pressure sensors

All EPC control modules use pressure sensors. They must be zeroed individually. There is no automatic zero for pressure sensors.

Auto flow zero

A useful calibration option is **Auto flow zero**. When it is **On**, after the end of a run the GC shuts down the flow of gases to an inlet, waits for the flow to drop to zero, measures and stores the flow sensor output, and turns the gas back on. This takes about two seconds. The zero offset is used to correct future flow measurements.

To activate this, select **Calibration** on the **Options** menu, then choose either **Front inlet** or **Back inlet**, press **[Enter]**, and turn **Auto flow zero** on.

Auto zero septum purge

This is similar to **Auto flow zero**, but is for the septum purge flow.

Zero conditions

Flow sensors are zeroed with the carrier gas connected and flowing.

Pressure sensors are zeroed with the supply gas line disconnected from the gas control module.

Zero intervals

Table 25 Flow and Pressure Sensor Zero Intervals

Sensor type	Module type	Zero interval
Flow	All	Use Auto flow zero and/or Auto zero septum purge
Pressure	Inlets	
	Packed columns	Every 12 months
	Small capillary columns (id 0.32 mm or less)	Every 12 months
	Large capillary columns (id > 0.32 mm)	At 3 months, at 6 months, then every 12 months
	Auxiliary channels	Every 12 months
	Detector gases	Every 12 months

To zero a specific flow or pressure sensor

1 Press **[Options]**, scroll to **Calibration**, and press **[Enter]**.

2 Scroll to the module to be zeroed and press **[Enter]**.

3 Set the flow or pressure:

   Flow sensors. Verify that the gas is connected and flowing (turned on).

   Pressure sensors. Disconnect the gas supply line at the back of the GC. Turning it off is not adequate; the valve may leak.

4 Scroll to the desired zero line.

5 Press **[On/Yes]** to zero or **[Clear]** to cancel.

6 Reconnect any gas line disconnected in step 3 and restore operating flows

Column calibration

As you use a capillary column, you may occasionally trim off portions, changing the column length. If measuring the actual length is impractical, and if you are using EPC with a defined column, you can use an internal calibration routine to estimate the actual column length. Similarly, if you do not know the column internal diameter or believe it is inaccurate, you can estimate the diameter from related measurements.

Before you can calibrate the column, make sure that:

- You are using a capillary column
- The column is defined
- There are no oven ramps
- The column gas source (usually the inlet) is **On** and non-zero

Also note that column calibration fails if the calculated column length correction is $\geq$ 5 m, or if the calculated diameter correction is $\geq$ 20 µm.

Calibration modes

There are three ways to calibrate the column length and/or diameter:

- Calibrate using an actual measured column flow rate
- Calibrate using an unretained peak time (elution time)
- Calibrate both length and diameter using flow rate and elution time

CAUTION

When you measure the column flow rate, be sure to convert the measurement to normal temperature and pressure if your measurement device does not report data at NTP. If you enter uncorrected data, the calibration will be wrong.

To estimate the actual column length or diameter from an elution time

1. Set oven ramp 1 to 0.00, then verify that the column is defined.
2. Perform a run using an unretained compound and record the elution time.
3. Press **[Options]**, scroll to **Calibration** and press **[Enter]**.
4. From the calibration list, select the column and press **[Enter]**. The GC displays the current calibration mode for the column.
5. To recalibrate or to change calibration mode, press **[Mode/Type]** to see the column calibration mode menu.
6. Scroll to **Length** or **Diameter** and press **[Enter]**. The following choices appear:
   - **Mode**
   - **Measured flow**
   - **Unretained peak**

- **Calculated length** or **Calculated diameter**
- **Not calibrated**

7 Scroll to **Unretained peak** and enter the actual elution time from the run performed above.

8 When you press **[Enter]**, the GC will estimate the column length or diameter based on the elution time input and will now use that data for all calculations.

To estimate the actual column length or diameter from the measured flow rate

1 Set oven ramp 1 to 0.00, then verify that the column is defined.

2 Set the oven, inlet, and detectors temperatures to 35 °C and allow them to cool to room temperature.

3 Remove the column from the detector.

CAUTION

When you measure the column flow rate, be sure to convert the measurement to normal temperature and pressure if your measurement device does not report data at NTP. If you enter uncorrected data, the calibration will be wrong.

4 Measure the actual flow rate through the column using a calibrated flow meter. Record the value. Reinstall the column.

5 Press **[Options]**, scroll to **Calibration** and press **[Enter]**.

6 From the calibration list, select the column and press **[Enter]**. The GC displays the current calibration mode for the column.

7 To recalibrate or to change calibration mode, press **[Mode/Type]** to see the column calibration mode menu.

8 Scroll to **Length** or **Diameter** and press **[Enter]**. The following choices appear:

- **Mode**
- **Measured flow**
- **Unretained peak**
- **Calculated length** or **Calculated diameter**
- **Not calibrated**

9 Scroll to **Measured flow** and enter the corrected column flow rate (in mL/min) from the run performed above.

10 When you press **[Enter]**, the GC will estimate the column length or diameter based on the elution time input and will now use that data for all calculations.

To estimate the actual column length and diameter

1 Set oven ramp 1 to 0.00, then verify that the column is defined.

2 Perform a run using an unretained compound and record the elution time.

3 Set the oven, inlet, and detectors temperatures to 35 °C and allow them to cool to room temperature.

4 Remove the column from the detector.

CAUTION

When you measure the column flow rate, be sure to convert the measurement to normal temperature and pressure if your measurement device does not report data at NTP. If you enter uncorrected data, the calibration will be wrong.

5 Measure the actual flow rate through the column using a calibrated flow meter. Record the value. Reinstall the column.

6 Press **[Options]**, scroll to **Calibration** and press **[Enter]**.

7 From the calibration list, select the column and press **[Enter]**. The GC displays the current calibration mode for the column.

8 To recalibrate or to change calibration mode, press **[Mode/Type]** to see the column calibration mode menu.

9 Scroll to **Length & diameter** and press **[Enter]**. The following choices appear:

- **Mode**
- **Measured flow**
- **Unretained peak**
- **Calculated length**
- **Calculated diameter**
- **Not calibrated**

10 Scroll to **Measured flow** and enter the corrected column flow rate (in mL/min) from the run performed above.

11 Scroll to **Unretained peak** and enter the actual elution time from the run performed above.

12 When you press **[Enter]**, the GC will estimate the column length or diameter based on the elution time input and will now use that data for all calculations.

Hydrogen sensor calibration

If available, the optional hydrogen sensor requires periodic calibration. Calibration verifies that the hydrogen sensor is properly measuring the hydrogen level within the oven and takes about 5 minutes. During calibration, the hydrogen sensor is offline. The calibration gas flows across the sensor for a few minutes, and then the sensor recovers for a few minutes. You cannot start a calibration within 5 minutes after turning on the GC.

Agilent provides an automated calibration schedule. This schedule is based on the GC (and sensor) uptime (hours of use), not calendar days. It begins with calibrations on a 24-hour interval, and eventually tapers off to a monthly schedule.

To enable or disable the automated schedule:

1 Press **[Options]** then go to **Calibration > Hydrogen Sensor** and press **[Enter]**.

2 Scroll the **Auto schedule calibration** setting. Press [**On/Yes**] to enable, or [**Off/No**] to disable.

Note that the GC maintains only one schedule for the hydrogen sensor, regardless of whether or not you use the automated calibration feature. The Service Due indicator will light if a scheduled calibration is missed.

To manually calibrate the hydrogen sensor:

1 Press **[Options]** then go to **Calibration** > **Hydrogen Sensor** and press **[Enter]**.

2 Scroll to **Start Calibration cycle?** and press [**On/Yes**].

If calibration fails

If a calibration fails, the GC's Service Due indicator lights. Press [**Service Mode**] on the GC keypad. The first line will indicate that the hydrogen sensor calibration failed. Check the following:

- Check the calibration gas. Is it the correct type? Is the tank empty or low?
- Check for leaks in the calibration gas supply.
- Check for restrictions in the supply tubing.

- Check if the calibration gas is flowing at the expected rate of 30 mL/min. Adjust the pressure as needed. See manual Maintaining Your GC.

The GC records hydrogen sensor calibration events in its Event log.

Communication

Configuring the IP address for the GC

For network (LAN) operation, the GC needs an IP address. It can get this from a DHCP server, or it can be entered directly from the keyboard. In either case, see your LAN administrator.

To use a DHCP server

1. Press **[Options]**. Scroll to **Communications** and press **[Enter]**.
2. Scroll to **Enable DHCP** and press **[On/Yes]**. When prompted, turn the GC off and then on again.

To set the LAN address at the keyboard

1. Press **[Options]**. Scroll to **Communications** and press **[Enter]**.
2. Scroll to **Enable DHCP** and, if necessary, press **[Off/No]**. Scroll to **Reboot GC**. Press **[On/Yes]** and **[On/Yes]**.
3. Press **[Options]**. Scroll to **Communications** and press **[Enter]**.
4. Scroll to **IP**. Enter the numbers of the GC IP address, separated by dots, and press **[Enter]**. A message tells you to power cycle the instrument. Do *not* power cycle yet. Press **[Clear]**.
5. Scroll to **GW**. Enter the Gateway number and press **[Enter]**. A message tells you to power cycle the instrument. Do *not* power cycle yet. Press **[Clear]**.
6. Scroll to **SM** and press **[Mode/Type]**. Scroll to the appropriate subnet mask from the list given and press **[Enter]**. A message tells you to power cycle the instrument. Do *not* power cycle yet. Press **[Clear]**.
7. Scroll to **Reboot GC**. Press **[On/Yes]** and **[On/Yes]** to power cycle the instrument and apply the LAN setpoints.

Keyboard and Display

Press **[Options]** and scroll to **Keyboard and Display**. Press **[Mode/Type]**.

The following parameters are turned on and off by pressing the **[On/Yes]** or **[Off/No]** keys.

Keyboard lock These keys and functions are operational when the keyboard lock is On:

[Start], **[Stop]**, and **[Prep Run]**

[Load][Method] and **[Load][Seq]**

[Seq]—to edit existing sequences

[Seq Control]—to start or stop sequences.

When **Keyboard lock** is On, other keys and functions are not operational. Note that an Agilent data system can independently lock the GC keyboard. To edit GC setpoints using the GC keyboard, turn off both the GC keyboard lock and the data system keyboard lock.

Hard configuration lock **On** prevents keyboard configuration changes; **Off** removes lock.

Key click Click sound when keys are pressed.

Warning beep Allows you to hear warning beeps.

Warning beep mode There are 9 different warning sounds that may be selected. This allows you to give multiple GCs individual “voices”. We suggest you experiment.

Method modified beep Turn on for high pitched beep when method setpoint is modified.

Press **[Mode/Type]** to change the pressure units and radix type.

Pressure units psi—pounds per square inch, lb/in^2

bar—absolute cgs unit of pressure, $dyne/cm^2$

kPa—mks unit of pressure, $10^3\ N/m^2$

Language Select English or Chinese.

Radix type Determines the numeric separator type—1.00 or 1,00

Display saver If **On**, dims the display after a period of inactivity. If **Off**, disabled.