Tutorial

HP 5890 Series II and HP 5890 Series II Plus

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Warranty

The information contained in this document is subject to change without notice.

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Safety Information

The HP 5890 Series II and HP 5890 Series II Plus are IEC (International Electrotechnical Commission) Safety Class 1 instruments. This unit has been designed and tested in accordance with recognized safety standards. Whenever the safety protection of the HP 5890 Series II has been compromised, disconnect the unit from all power sources and secure the unit against unintended operation.

Safety Symbols

This manual contains safety information that should be followed by the user to ensure safe operation.

WARNING

A warning calls attention to a condition or possible situation that could cause injury to the user.

CAUTION

A caution calls attention to a condition or possible situation that could damage or destroy the product or the user's work.

Little Falls Site
Hewlett-Packard Company
2850 Centerville Road
Wilmington, DE 19808-1610

Contents

Part 1. Introduction

Welcome to the Hewlett•Packard5890 SERIES II Gas Chromatograph. This manual points out the major functions of this instrument by leading you through an analysis of the Performance Evaluation Sample supplied with the instrument.

Two inlets (packed column and split/splitless capillary column) and two detectors (flame ionization and thermal conductivity) are described here. For other inlets or detectors, see the Operating Manual.

The other manuals

The Operating and Reference Manuals are included with the instrument; the Service Manual can be purchased.

Operating Manual: Facts you are likely to need fairly frequently. It does not cover material that, while certainly important, is only rarely needed.

Reference Manual: All information that is not in the Operating Manual.

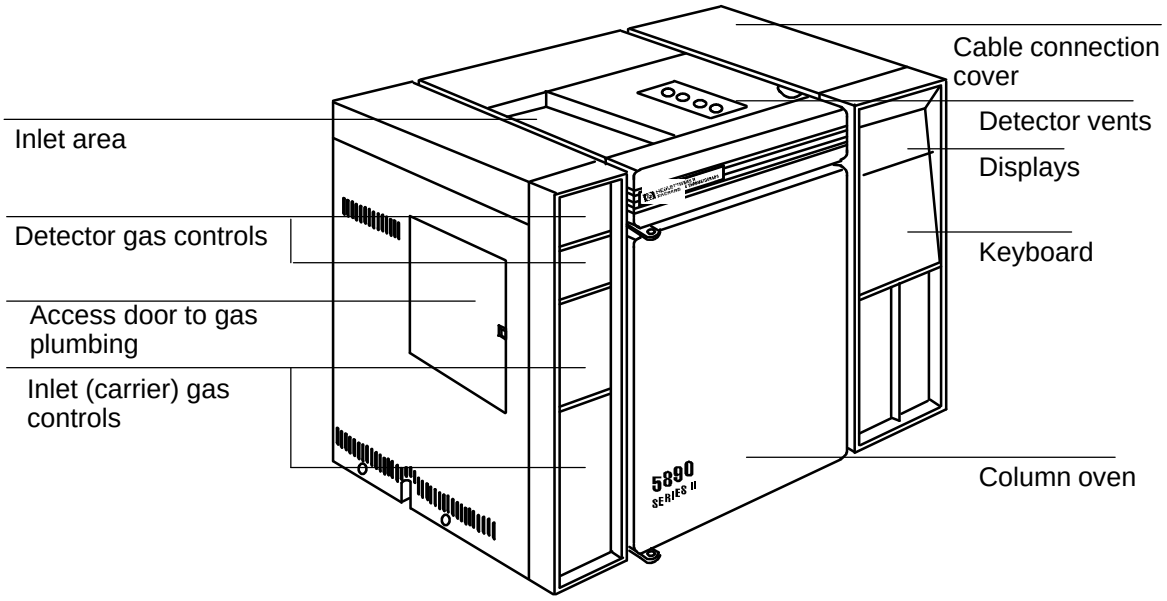
Is the instrument ready?

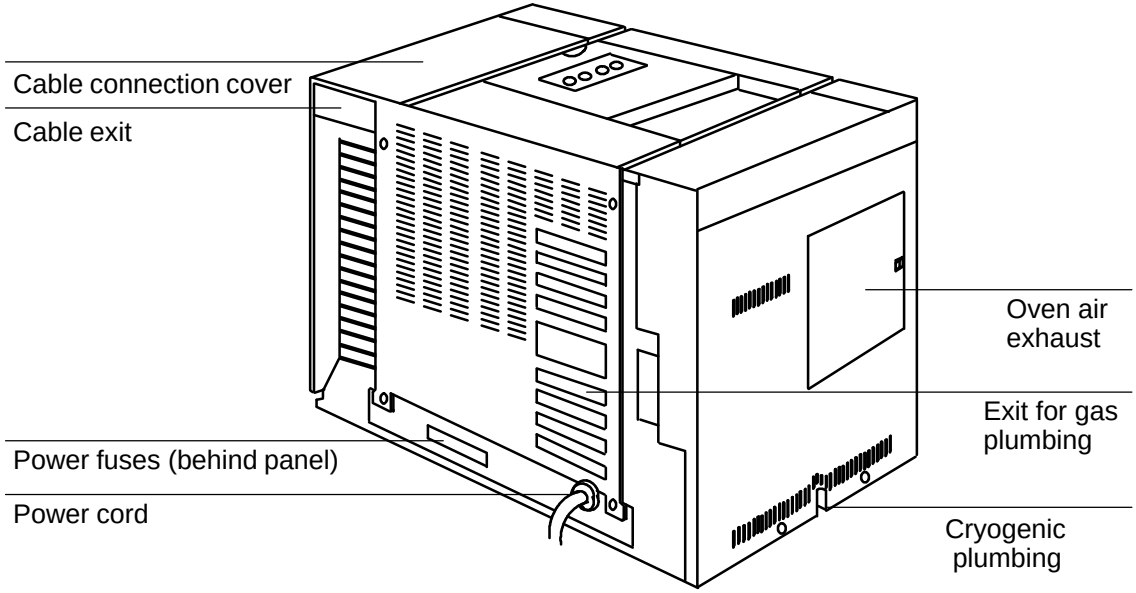
This manual assumes that:

- The instrument has been unpacked and installed on the lab workbench.
- It is connected to some kind of recording device (recorder, integrator, etc.).
- Helium is the carrier gas and has been plumbed up.
- The gas supplies for the detector have been plumbed up.

If this is not so, please see the instructions in the Installation Manual. Return to this manual when you're finished. When everything is ready:

- If the instrument is on, turn it off. The power switch is at the bottom of the right side near the rear.
- Turn all gases off at the regulators.




Cable connection cover
Cable exit
Oven air exhaust
Exit for gas plumbing
Power fuses (behind panel)
Power cord
Cryogenic plumbing

Part 2. Verify the instrument condition

Is the instrument new or existing?

In this manual, an instrument is **new** if it is fresh from the factory, has just been installed, and you're the first person to use it. If so, move ahead to Part 3. If the instrument is not **new,** then consider it **existing**. It must be restored to the as shipped" condition.

What is the as shipped condition?

It's a long list, but these are the important items:

- All gas flow controlling devices are turned off.
- All heaters (inlets, oven, detectors) are turned off.
- The packed inlet does not have an adapter liner installed.
- The capillary inlet has a column nut screwed into the fitting inside the oven.
- The flame ionization detector (FID) protective brass cap is screwed onto the fitting inside the oven and there is no adapter liner installed.
- The thermal conductivity detector (TCD) makeup gas adapter is installed on the fitting inside the oven and a capillary column nut is screwed into the adapter.

Restoring the as shipped condition

To restore an existing instrument to the "as shipped" condition:

1. Verify that the main power and all gas flows are turned off.
2. Verify that the hardware in the oven matches the preceding list. Remove any adapter liners from the inlets and detectors.
3. Turn the main power on.
4. Reset the internal setpoints to their default values by pressing these keys:

Part 3. Prepare the instrument test column

Your instrument was tested at the factory using a 530 µ id capillary column. A similar column (not the one that was used in testing) is in the Mainframe Kit shipped with the instrument. It can be used with either the split/splitless or the packed column inlet.

The column is labeled:

HP•1(Methyl Silicone Gum) Instrument Test
5m x 0.53mm x 2.65µm film thickness
U.S. Patent No. 4,293,415 Made in U.S.A.

This is an instrument test column. It is not a high resolution capillary column and is not suitable for anything other than testing the instrument. It is roughly equivalent to an 18•inchpacked column.

When you're finished with this column, store it in a safe place for use by the next new operator.

New instruments

The column is in the Mainframe Shipping Kit.

Existing instruments

The column is in the safe place where the previous user put it.

Part 4. Select an inlet and detector

The two most commonly used inlets and the two most commonly used detectors are discussed in this manual:

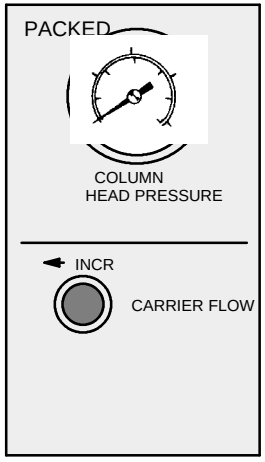
- The split/splitless capillary column inlet
- The packed column inlet
- The thermal conductivity detector
- The flame ionization detector

For other inlets or detectors, see the Operating Manual.

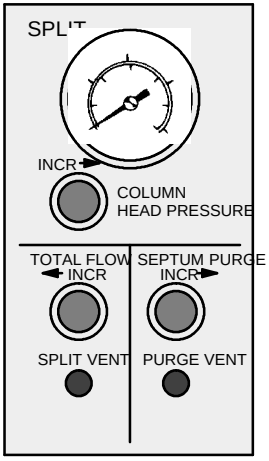
What kind of inlet do I have?

Look at the panels to the left of the oven door. The two that are covered here are the carrier gas control for packed columns (labeled **packed**) and the carrier gas control for capillary columns (labeled **split**). They look like this:

Packed column gas controls



Capillary column gas controls

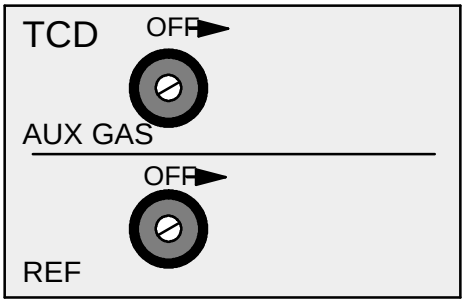


If you have a choice, the **packed** inlet is much easier to use.

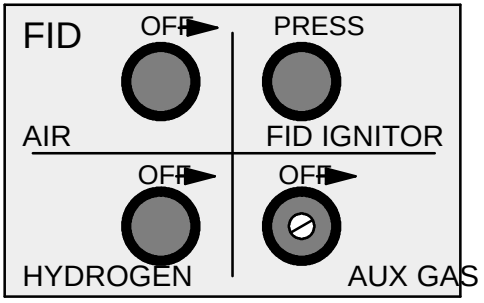
What kind of detector do I have?

Look at the small panels. The gas controls for the flame ionization detector (FID) and the thermal conductivity detector (TCD) look like this:

Thermal conductivity detector gas controls



Flame ionization detector gas controls

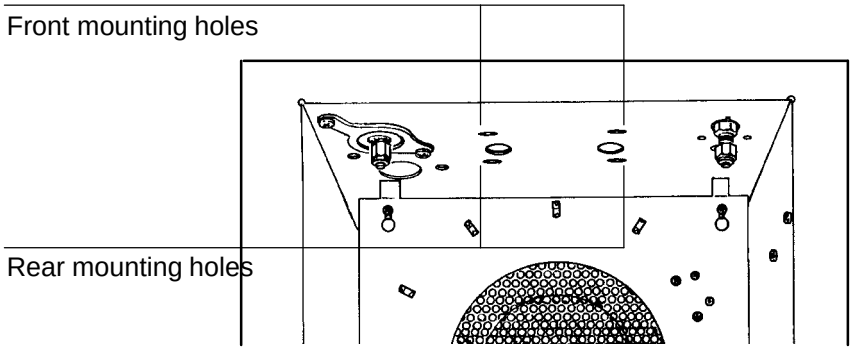


Turn off the flow control knobs for the detector you select.

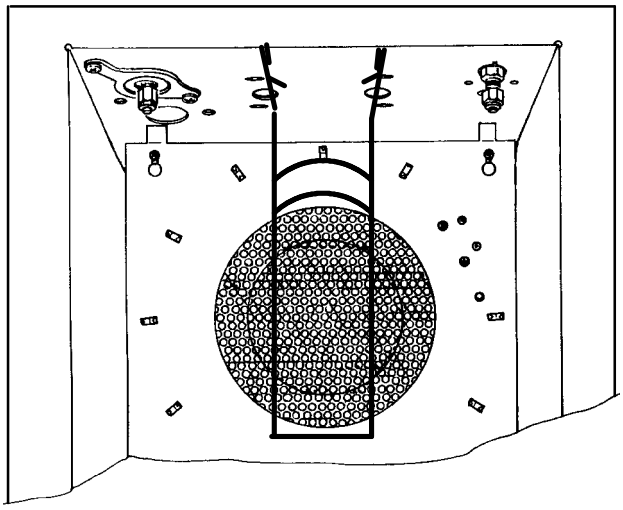
If you have a choice, the thermal conductivity detector is easier to use.

Part 5. Mount the column support bracket in the oven

The instrument test column is supported by a bracket that attaches to the top of the oven. To open the oven door, press up on the latch below the lower right corner. There are two sets of slightly oblong holes in the inside top surface, one set toward the rear and one toward the front of the oven. These are the mounting holes for the column bracket.



Hold the column bracket with the loops at the top pointing toward you. Squeeze the loops together and slip the hooks on top into the holes in the top of the oven. Use the pair of holes that best matches the positions of the injector and detector that you will be using.



Now hold the column so that the metal label is toward you. Slide the column forward on its frame so that you can hang the frame on the mounting bracket. Use the position on the bracket that best centers the column in the oven.

Release enough of the column from the frame at each end so that the column can reach the inlet and detector fittings. You want a smooth curve with as little strain on the column as possible. This may require cutting some length off the column; wait until the next Part before you do this.

Remove the column (but not the bracket!) from the oven.

Part 6. Install the column nuts and ferrules

New instruments

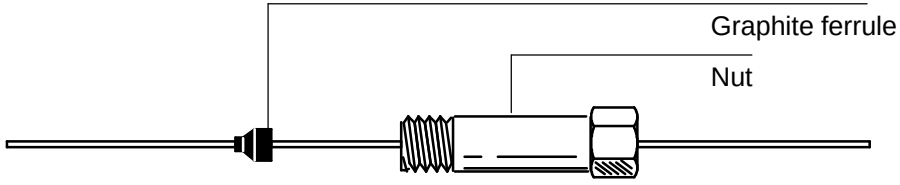
There's a tube containing graphite ferrules in the Mainframe Shipping Kit. Column nuts are screwed into the inlet and detector fittings inside the oven.

Existing instruments

Find two column nuts and two graphite ferrules among the instrument supplies. The figure below will help you identify them.

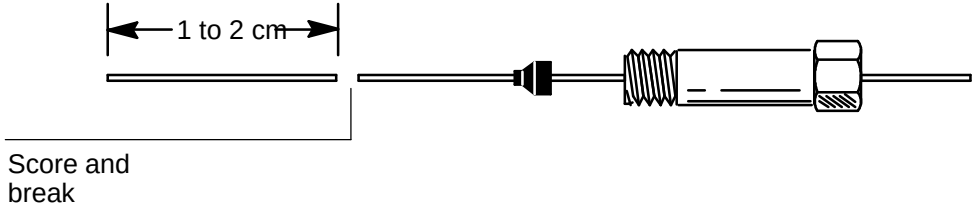
Installing nuts and ferrules

Slip a column nut over each end of the column, with the threaded end of the nut toward the end of the column. Follow it with a graphite ferrule, with the narrow end toward the column end. See the figure for the correct arrangement.



Part 6. Install the column nuts and ferrules

You probably got a few graphite fragments inside the column when you installed the ferrules. These must be removed. Push the ferrules away from the column end, score the column 1 or 2 cm from the end, and break off the end. If you need to cut off some excess length so that the column will connect smoothly to the inlet and detector, do it now.



Part 7a. The split/splitless capillary inlet

New instruments

The correct inlet insert (split mode) was installed at the factory.

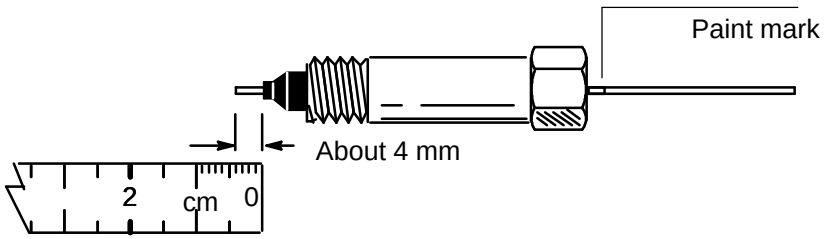
Existing instruments

Changing inlet inserts requires some care and practice. To save time, have someone in the laboratory who is familiar with the instrument verify that the split mode insert is in place or, if it is not, change the insert for you. The details are in the Operating Manual.

Connecting the column

Free enough of the inlet end of the column from the column frame so that it curves smoothly up to the inlet.

Move the nut and ferrule so that approximately 4 mm of the column extends beyond the ferrule. Mark the column behind the nut. Typewriter correction fluid works well.



Insert the column, nut, and ferrule into the bottom of the inlet. Keep the mark at the back of the column nut and tighten the nut finger•tight. Use a wrench to tighten 1/4•turnmore. Avoid overtightening or you may shatter the column end.

Part 7b. The packed inlet

New instruments

The inlet does not contain an adapter. All of the parts you will need are in the Packed Injection Port Shipping Kit.

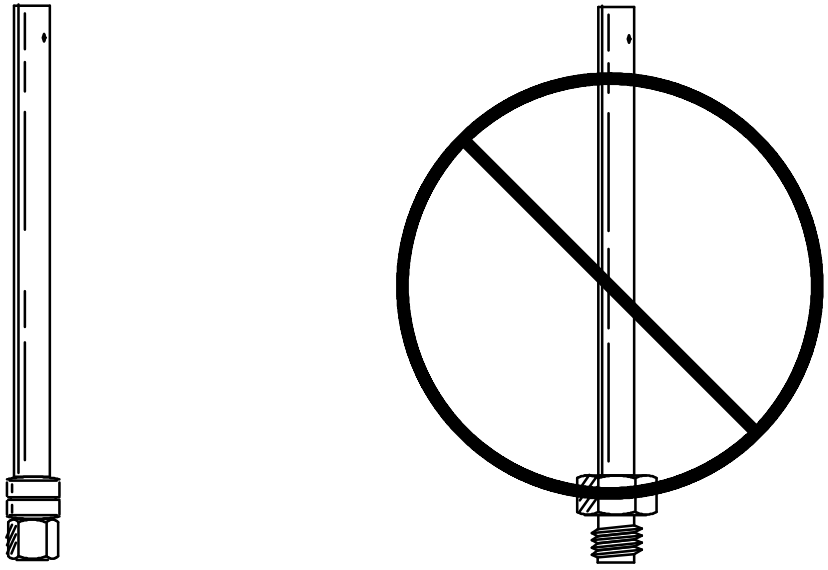
Existing instruments

The inlet probably contains an adapter, but it's impossible to say which one. It depends on how the inlet has been used. Have someone who is familiar with the instrument inspect the inlet and, if necessary, remove the adapter/insert.

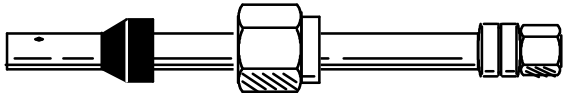
Installing the adapter

Two inlet adapters are provided in the Injection Port Shipping Kit. One has external threads at one end; this is for use with packed columns. Select the one with internal threads.

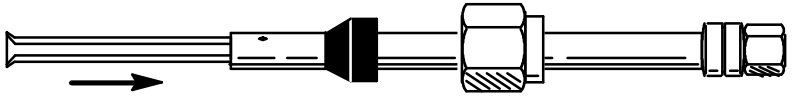
For capillary columns



Place a graphitized Vespel ferrule and a brass nut on the adapter, as shown here.



If there's a glass liner in the adapter, replace it with a new one.

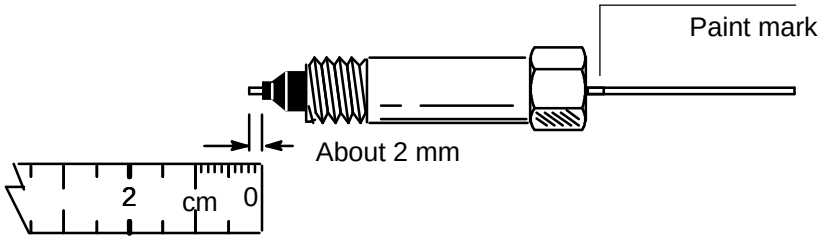


Push the adapter, with the liner, ferrule and nut, up into the inlet from inside the oven. Hold the adapter as far up as it will go and tighten the brass nut finger•tight. Use a wrench to tighten another 1/4 turn.

Connecting the column

Free enough of the inlet end of the column from the column frame so that it curves smoothly up to the inlet.

Move the nut and ferrule so that approximately 2 mm of the column extends beyond the ferrule. Mark the column behind the nut. Typewriter correction fluid works well.



Insert the column, nut, and ferrule into the bottom of the inlet adapter. Keep the mark at the back of the column nut and tighten the nut finger•tight. Use a wrench to tighten 1/4•turn more. Avoid overtightening or you may shatter the column end.

Part 8a. The thermal conductivity detector (TCD)

New instruments

The makeup gas adapter is installed at the factory. A column nut is attached to it.

Existing instruments

The makeup gas adapter is installed at the factory. Remove any other fittings that might be attached to it.

Connecting the column

Free enough of the detector end of the column from the column frame so that it curves smoothly up to the detector.

Insert the column, with its nut and ferrule, into the bottom of the adapter. **Gently** push the column up as far as it will go (about 40 mm). Do not force it.

While holding the column up, tighten the column nut finger•tight. Pull the column down about 1 mm. Use a wrench to tighten the nut another 1/4 turn. Avoid overtightening or you may shatter the column end.

Part 8b. The flame ionization detector (FID)

New instruments

The adapter and other fittings are in the FID Shipping Kit. The capillary column jet is installed in the detector at the factory.

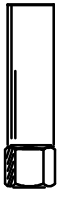
Existing instruments

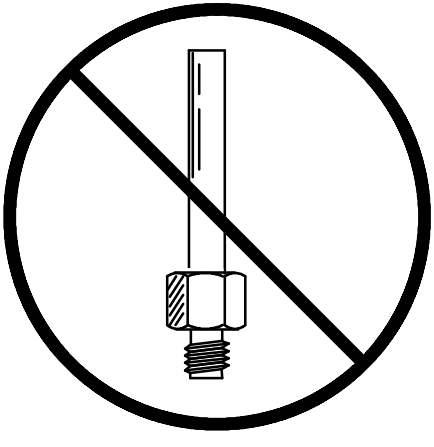
Have someone who is familiar with the instrument verify that the capillary column jet is in the detector.

Installing the adapter

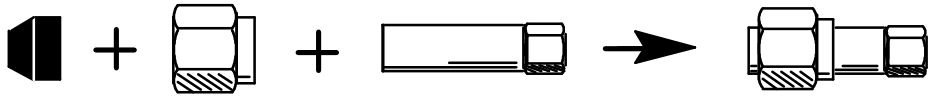
Two adapters are supplied with this detector. Use the shorter one.

For capillary columns





Remove the protective cap from the detector fitting inside the oven. Assemble a brass nut and a graphite ferrule on the adapter as shown here.



Push the adapter, with the ferrule and nut, into the detector fitting from inside the oven. Hold the adapter as far up as it will go and tighten the nut finger•tight. Use a wrench to tighten another 1/4 turn.

Connecting the column

Free enough of the detector end of the column from the column frame so that it curves smoothly up to the detector.

Insert the column, with its nut and ferrule, into the bottom of the adapter. **Gently** push the column up as far as it will go (about 40 mm). Do not force it.

While holding the column up, tighten the column nut finger•tight. Pull the column down about 1 mm. Use a wrench to tighten the nut another 1/4 turn. Avoid overtightening or you may shatter the column end.

Part 9. Set and measure gas flows

New instruments

The gas flows were turned off after final factory testing. You will have to reset them all.

Existing instruments

If the instrument has been in use, some (perhaps all) of the gas flows have already been set up. However, you should measure the flows to be sure that they are correct, especially if the instrument has been used with anything but HP Series 530 µ columns.

Setting the carrier flow rates

Begin by turning off all of the flows. This gives a known starting place for the rest of the process.

- On the **packed** panel:

  Locate the knob labeled CARRIER FLOW. Turn it **clockwise** as far as it will go. Don't force the knob; when it closes it comes to a slightly soft" stop.

- On the **split** panel:

  Locate the knob labeled TOTAL FLOW. Turn it **clockwise** as far as it will go. Don't force the knob; when it closes it comes to a slightly soft" stop.

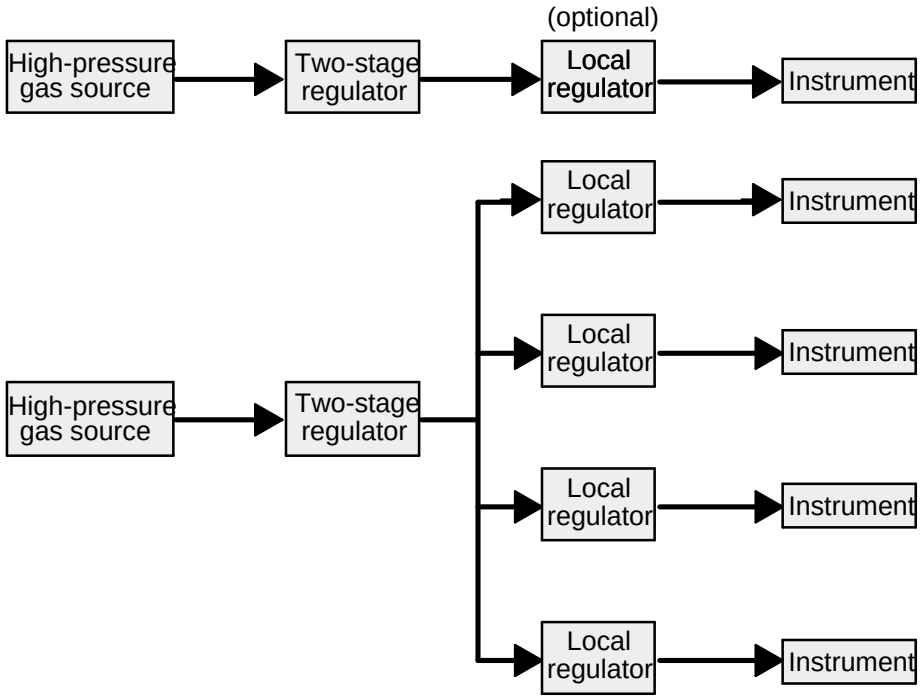
  Locate the knob marked SEPTUM PURGE. Turn it **counterclockwise** to turn the flow off. There is no definite stop position; when the knob turns freely (doesn't seem to be touching anything inside), it's off.

- On the detector gas panels:

  Turn all of the knobs **clockwise** as far as they will go.

Gas plumbing

There are two possible plumbing arrangements for each gas:



The high•pressuresource is a gas cylinder. There may be one for each instrument, or the gas from a single source may be piped around to several instrument locations.

The local regulator, usually a single stage, is optional when each instrument has its own gas supply. When a source is shared, each instrument should have a local regulator.

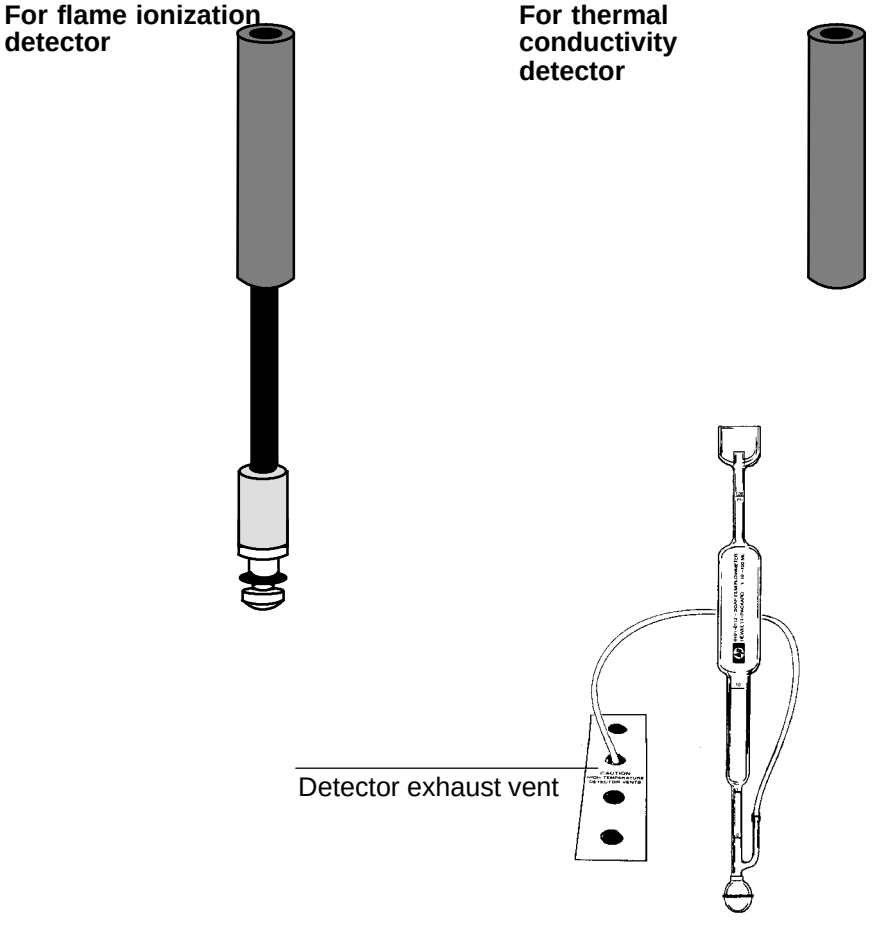
Local regulators can be wall•or bench•mounted(outside the instrument) or on an auxiliary panel inside the door on the left side panel. Trace the lines in your instrument to find out which arrangement you have for each gas.

Delivery pressure

This is the gas pressure at the exit side of the **last** regulator, regardless of where that regulator is. It is the pressure that the chromatograph has available to work with.

Measuring gas flows

You use a soap bubble flowmeter and the adapters that are supplied in the detector shipping kits. These adapters connect the detector outlet to the flowmeter.

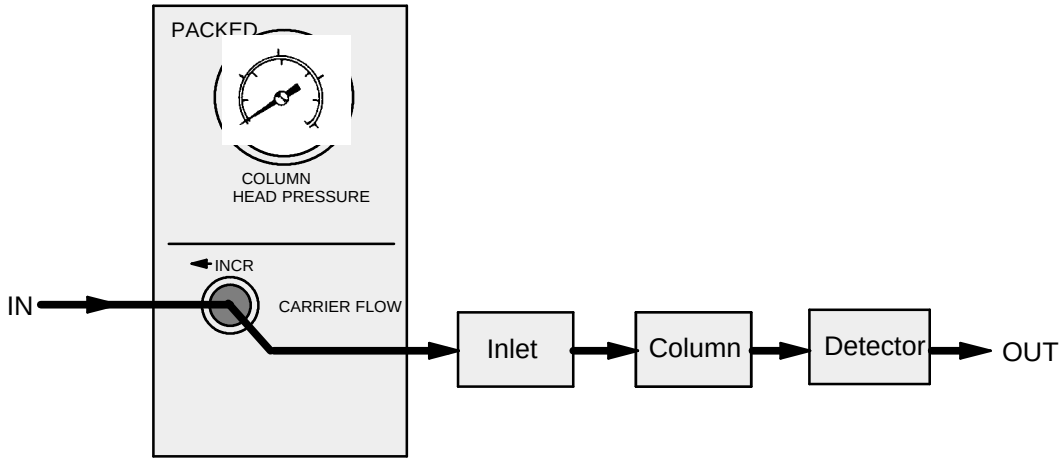


To make a flow measurement:

1. Place some soapy water or leak detection fluid in the flowmeter, enough to fill the bulb but not cover the gas entrance.
2. With the gas flowing, squeeze and release the bulb to form a soap film.
3. Time the soap film as it moves between two of the graduations on the meter.
4. From the volume and time, calculate the flow rate.
5. If necessary, adjust the flow, wait for it to stabilize, and measure again.

Part 10. Set carrier gas flows for the packed inlet

The internal flow path in the instrument is:

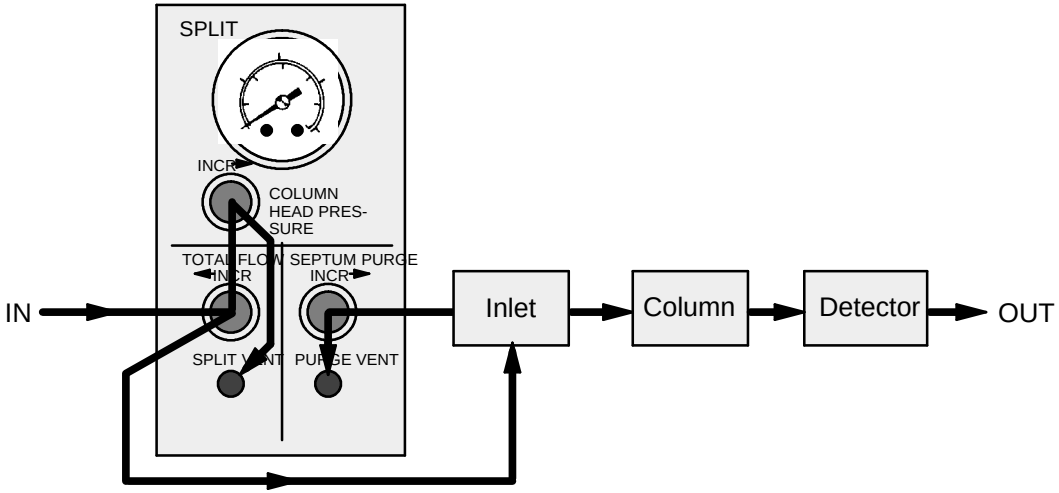


To set the carrier gas flow:

1. Open the helium cylinder valve and set the delivery pressure of the two•stageregulator to 410 kPa (60 psi). If there is a local regulator in the carrier gas line, set the cylinder regulator to 550 kPa (80 psi) and the local regulator to 410 kPa (60 psi).
2. Attach the bubble flowmeter to the detector outlet. There should be no flow at this time. If there is, check the detector gas controls to be sure that they are turned off.
3. Turn the CARRIER FLOW knob in the ◄INCR direction to turn the gas on. Adjust to achieve a flow of 20 ml/min.

Part 11. Set carrier gas flows for the split inlet

The internal flow path in the instrument is:



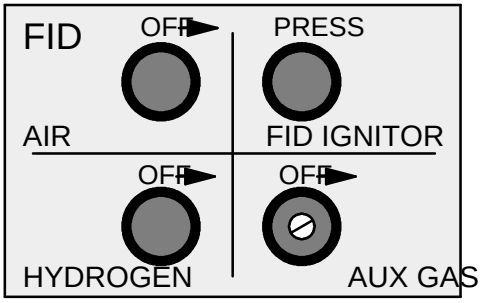
To set the gas flows:

1. Open the helium cylinder valve and set the delivery pressure of the two•stageregulator to 410 kPa (60 psi). If there is a local regulator in the carrier gas line, set the cylinder regulator to 550 kPa (80 psi) and the local regulator to 410 kPa (60 psi).
2. Attach the bubble flowmeter to the detector outlet. There should be no flow at this time. If there is, check the detector gas controls to be sure that they are turned off.
3. Turn the TOTAL FLOW knob in the ◄INCR direction to turn the flow on.
4. Turn COLUMN HEAD PRESSURE knob in the INCR► direction until the flow is 15 ml/min. If you cannot, increase TOTAL FLOW until you can. Use TOTAL FLOW for coarse and COLUMN HEAD PRESSURE for fine adjustment.

5. Move the flowmeter to the split vent. Adjust TOTAL FLOW until the flow at the **split vent** is 200 ml/min.
6. Move the flowmeter to the purge vent**.** Turn the SEPTUM PURGE knob in the INCR► direction until the flow at the **purge vent** is 5 ml/min.
7. Repeat steps 4, 5, and 6 until all flows are correct.

Part 12. Set gas flows for the FID

The flame ionization detector flows are set on this panel:



The HYDROGEN and AIR gas controls should always be either full **on** or full **off**. Intermediate settings are unstable. Adjust flow by changing the supply pressure.

The AUX GAS control is an **on/off**device combined with a needle valve (the screwdriver adjustment in the center) for flow adjustment. The needle valve is delicate and should not be forced to either end of its travel.

To set the FID gas flows:

1. Verify that the detector gas flows are turned off on this panel.
2. Attach the flowmeter to the detector exit and verify that the carrier gas flow rate is about 20 ml/min for the **packed** inlet or 15 ml/min for the **split** inlet.
3. Turn the AUX GAS on (full counterclockwise). With a small flat•blade screwdriver, turn the screw adjustment in the center of the knob until the total flow (carrier + makeup gas) is 30 ml/min for the **packed** inlet or 35 ml/min for the **split** inlet.

4. Set the delivery pressure for air to 275 kPa (40 psi). Turn the AIR knob on (full counterclockwise).
5. Adjust the delivery pressure until the total flow (carrier + makeup gas + air) is 430 ml/min for the **packed** inlet or 435 ml/min for the **split** inlet.
6. Turn the AIR knob off (full clockwise).

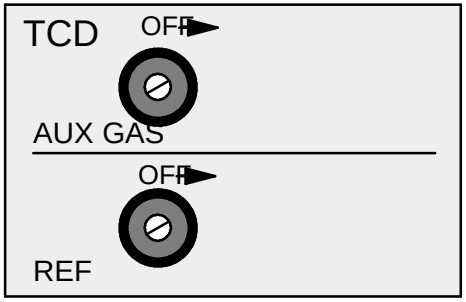
WARNING The next step is to set the hydrogen flow. Hydrogen and air form explosive mixtures and should never be measured together.

7. Verify that the AIR control is off (full clockwise).

   Set the delivery pressure for hydrogen to 100 kPa (15 psi). Turn the HYDROGEN knob on (full counterclockwise). Adjust the delivery pressure until the total flow (carrier + makeup gas + hydrogen) is 63 ml/min for the **packed** inlet or 65 ml/min for the **split** inlet.
8. Leave the carrier gas on. Turn the others off.

Part 13. Set gas flows for the TCD

The thermal conductivity detector flows are set on this panel:



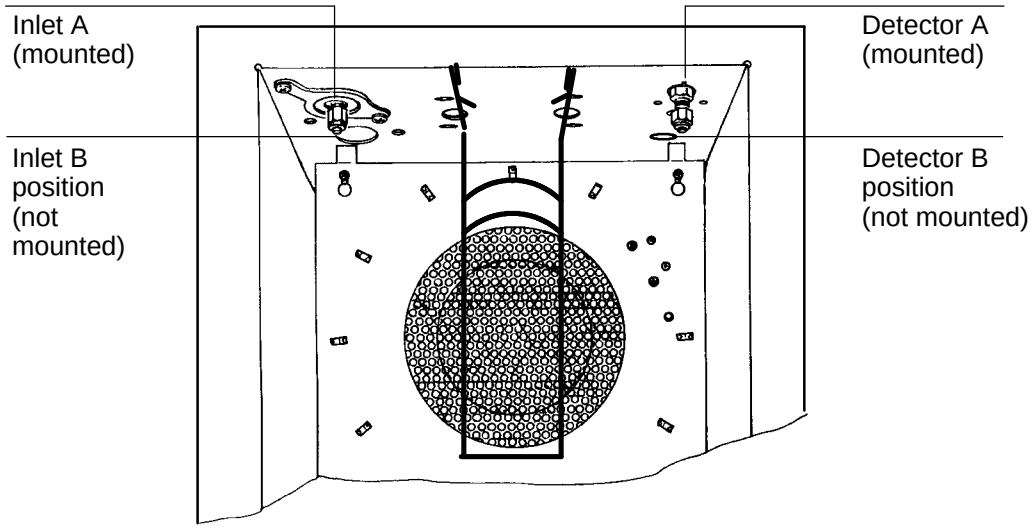
The AUX GAS and REF controls are **on/off** knobs with screwdriver adjustments in the center. The center adjustments, which control the flow rates, are delicate needle valves. Avoid forcing them to either end of their travel.

To set the TCD gas flows:

1. Verify that the detector gas flows are turned off on this panel.
2. Attach the flowmeter to the detector exit and verify that the carrier gas flow rate is about 20 ml/min for the **packed** inlet or 15 ml/min for the **split** inlet.
3. Turn the AUX GAS on (full counterclockwise). With a small flat•blade screwdriver, turn the screw adjustment in the center of the knob until the total flow (carrier + makeup gas) is 21 to 22 ml/min for the **packed** inlet or 25 ml/min for the **split** inlet.
4. Turn the REF knob on (full counterclockwise). With a small flat•blade screwdriver, turn the screw adjustment in the center of the knob until the total flow (carrier + makeup gas + reference gas) is 51 to 52 ml/min for the **packed** inlet or 62 ml/min for the **split** inlet.
5. Leave the carrier gas on. Turn the others off.

Part 14. Set the inlet and detector temperatures

Open the oven door and look at the top of the oven.



(Column omitted for clarity)

There are two mounting positions for inlets and two for detectors. They are identified by letters: A for the front ones (closest to the door) and B for the rear ones (closest to the back wall of the oven). Identify which inlet and detector positions you are using.

Before entering the setpoints

- Verify that the carrier gas flow is on, since heating a zone without carrier gas could damage it.
- Turn the instrument power on. Wait until the self•testends (about 30 seconds).

- As a precaution, clear any existing temperature settings by pressing

CLEAR . 6 ENTER

If you are using the flame ionization detector

- Set the inlet temperature to 200°C by pressing

INJ A TEMP (or INJ B TEMP if you are using the B inlet)

The display shows the present temperature (ACTUAL) and the word OFF (SETPOINT). Now press

2 0 0 ENTER

SETPOINT changes to 200 and the inlet begins to heat. ACTUAL displays the rising temperature.

- Set the detector temperature to 250°C by pressing

DET A TEMP (or DET B TEMP if you are using the B detector)

The display shows the present temperature (ACTUAL) and the word OFF (SETPOINT). Now press

2 5 0 ENTER

SETPOINT changes to 250 and the injector begins to heat. ACTUAL displays the rising temperature.

If you are using the thermal conductivity detector

- Set the inlet temperature to 250°C by pressing

  INJ A TEMP (or INJ B TEMP if you are using the B inlet)

  The display shows the present temperature (ACTUAL) and the word OFF (SETPOINT). Now press

  2 5 0 ENTER

  SETPOINT changes to 250 and the inlet begins to heat. ACTUAL displays the rising temperature.

- Set the detector temperature to 300°C by pressing

  DET A TEMP (or DET B TEMP if you are using the B detector)

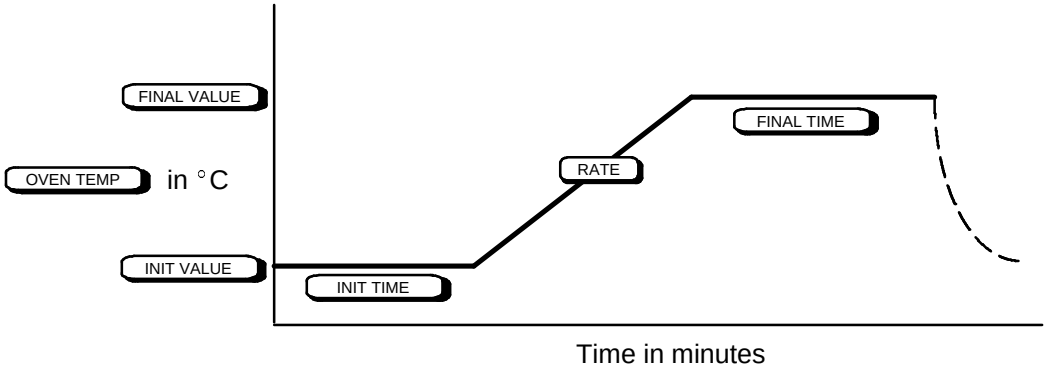
  The display shows the present temperature (ACTUAL) and the word OFF (SETPOINT). Now press

  3 0 0 ENTER

  SETPOINT changes to 300 and the injector begins to heat. ACTUAL displays the rising temperature.

Part 15. Set the oven temperature

This analysis uses temperature programming. The oven is at the INIT VALUE of OVEN TEMP when the sample is injected. It remains at that temperature for INIT TIME minutes, then heats up at the RATE specified (in °C/min) until it reaches FINAL VALUE, where it stays for FINAL TIME (if any). Then it cools down to INIT VALUE in preparation for the next analysis.



The details of the program depend on the kind of inlet and the kind of detector you're using. That's four possible sets of key commands. Find the correct one for your situation below and enter the commands.

Packed inlet and FID detector

INIT TEMP ON

OVEN TEMP INIT VALUE 1 1 0 ENTER

(The oven begins to heat to INIT VALUE.)

INIT TIME 1 ENTER

RATE 1 5 ENTER

FINAL VALUE 1 8 0 ENTER

FINAL TEMP 1 ENTER

Packed inlet and TCD detector

INIT TEMP ON

OVEN TEMP INIT VALUE 1 1 0 ENTER

(The oven begins to heat to INIT VALUE.)

INIT TIME 1 ENTER

RATE 1 5 ENTER

FINAL VALUE 1 5 0 ENTER

FINAL TIME 1 ENTER

Split inlet and FID detector

OVEN TEMP ON

OVEN TEMP INIT VALUE 1 0 0 ENTER

(The oven begins to heat to INIT VALUE.)

INIT TEMP ON

RATE 2 0 ENTER

FINAL VALUE 1 8 0 ENTER

FINAL TIME 1 ENTER

Split inlet and TCD detector

OVEN TEMP ON

OVEN TEMP INIT VALUE 1 0 0 ENTER

(The oven begins to heat to INIT VALUE.)

INIT TIME 1 ENTER

RATE 1 0 ENTER

FINAL VALUE 1 5 0 ENTER

FINAL TEMP 2 ENTER

Part 16. Send the signal to the recorder

A recorder", as used in this part, is any device that draws a chromatogram on paper. It could be a strip•chartrecorder, a digital integrator, or a data system.

To record a chromatogram:

- The signal from the detector must be sent to one of the output channel connectors in the chromatograph.
- The output channel connector must be connected to the recorder with a signal cable.

Specify the signal and detector

All HP 5890 SERIES II chromatographs have the SIG 1 output channel (some may also have a SIG 2 channel). To send the detector output to the SIGNAL 1 output connector, press

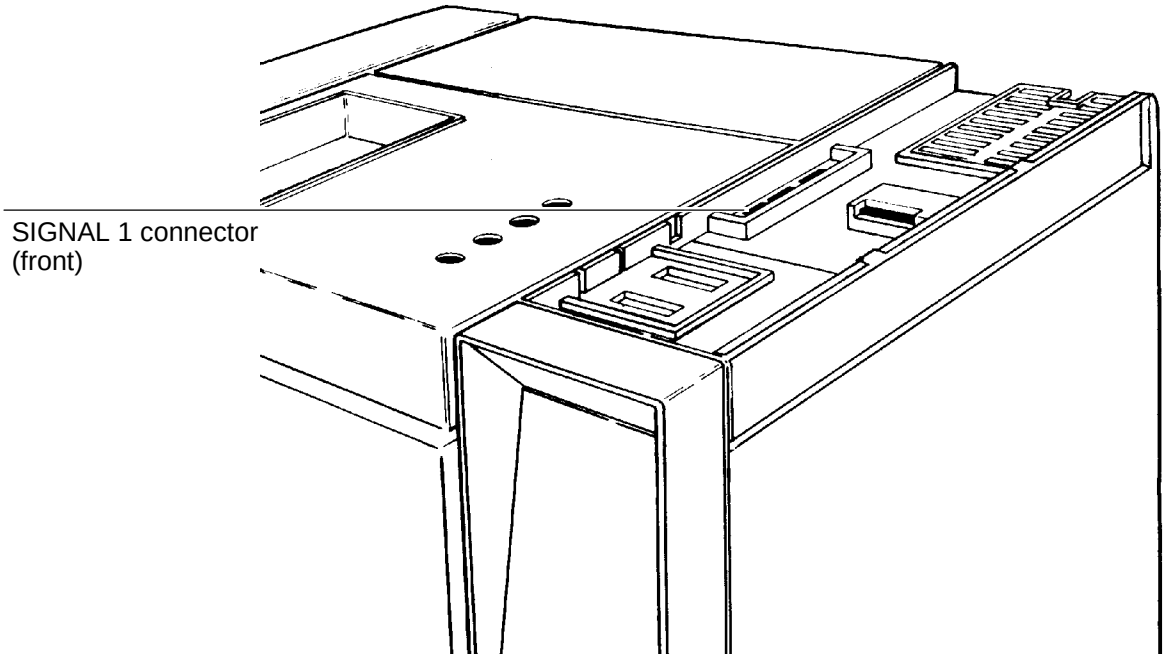
if you are using the A detector SIG 1 A ENTER

or

if you are using the B detector SIG 1 B ENTER

Check the signal cable

Remove the cover on the top right of the chromatograph by lifting the rear edge up.



Locating the Signal 1 connector

- Verify that there is a signal cable between the SIGNAL 1 connector and your recorder. If not, install one (see the Operating Manual for details).
- Replace the cover.

Part 17. Prepare to make a run

These are the steps you go through, or should go through, every time you analyze a sample.

Check gas flows

Caution If you are using an FID, do not turn on the hydrogen gas at this time.

Examine all pressure gauges and be certain that they are set correctly. If there are on/off valves in any of the lines, be sure they are open.

Prepare the thermal conductivity detector

Caution Verify that the carrier, reference, and makeup gases are **on** before continuing. Failure to do this could damage the detector.

Turn on the detector electronics, including the internal switching valve, by pressing

DET A ON if you are using the A detector

or

DET B ON if you are using the B detector.

This analysis requires the high gain setting of the detector amplifier. The key command is

gold DET A (or B) ON

The key command is the same as the previous one except for the gold pre•key The display above the keys will show the difference.

Prepare the flame ionization detector

Caution Verify that the carrier, makeup, and air flows are **on** and that the hydrogen flow is **off**.

1. Turn the detector electronics on by pressing

   if you are using the A detector DET A ON

   or

   if you are using the B detector DET B ON

2. Open the air, hydrogen, and makeup gas controls.
3. Press the FID IGNITOR button on the detector gas panel.

The flame should light within a few seconds. If it does not, turn the makeup gas down or off and try again. After ignition, restore the normal makeup gas flow.

There are two ways to verify ignition. If the detector signal is being displayed or recorded, it will increase to a steady value when the flame lights. Also, a cold, shiny surface (such as a chrome•platedwrench) will show condensation when held over the detector exit.

Check temperature readiness

When all heated zones are at their specified temperatures and under control, the NOT READY light on the front panel is off.

Turn on your recorder

A lot of good data has been lost by forgetting to do this.

Part 18. Analyze the sample

Find the sample

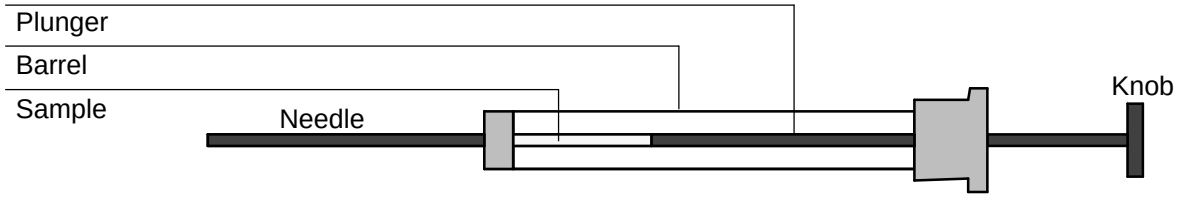
The Performance Evaluation samples are supplied in boxes containing several glass vials. The correct one to use depends on the combination of inlet and detector that you are using.

	FID Detector	TCD Detector
Split inlet	8500-4789 (in the inlet kit)	8500-4789 (in the inlet kit)
Packed inlet	18710-60170 (in the detector kit)	18710-60170 (in the detector kit)

Load the syringe

Remove one of the vials from the box of samples. The vials are scored at the narrow section. Wrap the vial with a cloth or paper towel to protect your fingers and snap the top off.

Use a 10 µl (microliter) syringe to inject the sample. Load 1 µl of sample except for the Packed/TCD combination; this needs a 3 µl sample size. Obtain help from someone else in the laboratory if you are not familiar with these syringes.

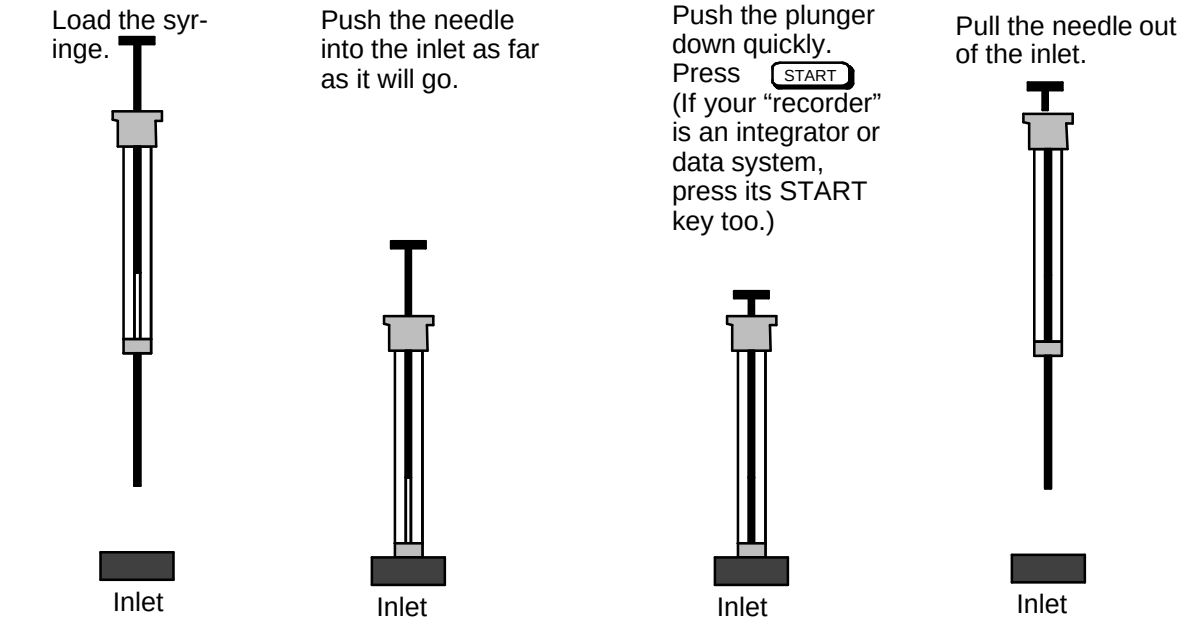


Inject the sample

Verify that the NOT READY light is **off**. Now you must do three things at the same time:

- Inject the sample into the chromatograph.
- Start the oven temperature programmer by pressing the START key.
- Start (if required) your recorder.

The purpose of the injection is to place a small amount of sample at the head of the column. The injection should be done in a single quick motion.



The whole operation should only take 3 to 4 seconds.

Now watch the chromatogram appear. You can follow the progress of the temperature program with the lights above the keyboard. When the program ends, the FINAL TIME light turns off.

- Stop your recorder and examine the chart.

Part 19. Examine the chromatogram

Compare your chromatogram with those that follow.

Don't expect exact duplication! Your chromatogram is the product of your instrument, your column, your gas flows, your injection technique, and your recorder. At least some of these variables are different from the ones used to generate these chromatograms.

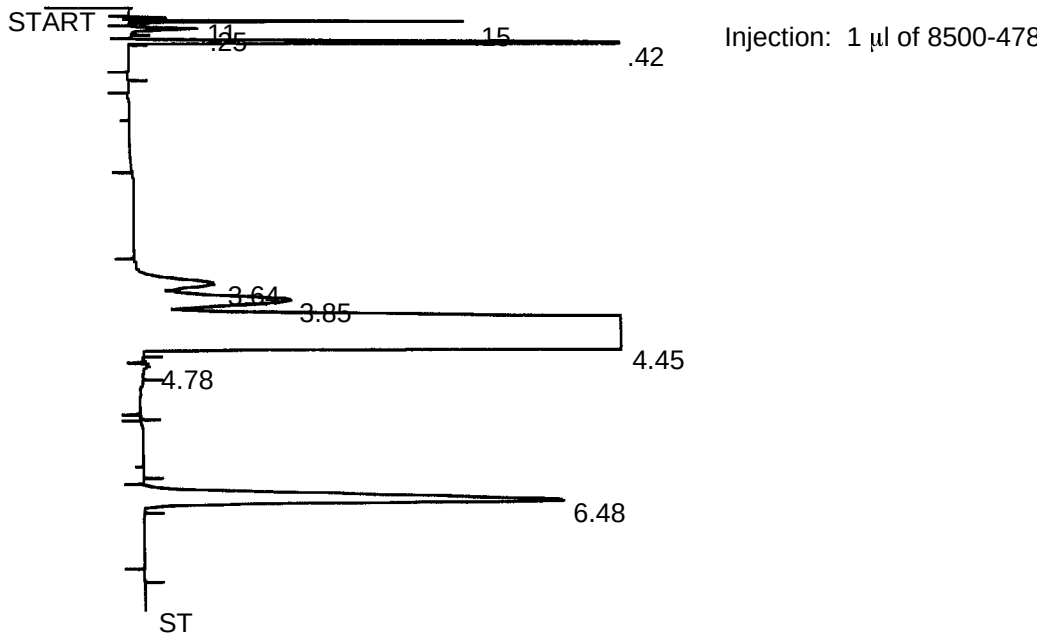
Do look for:

- The right number of peaks
- The right order of peaks
- The right relative sizes

These chromatograms were recorded by an HP 3390A integrator.

Part 19. Examine the chromatogram

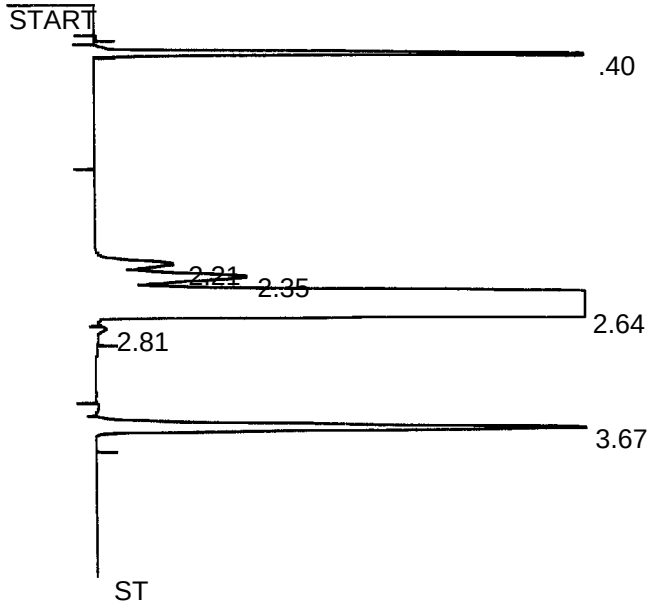
Split inlet and TCD



Split inlet and thermal conductivity detector

Part 19. Examine the chromatogram

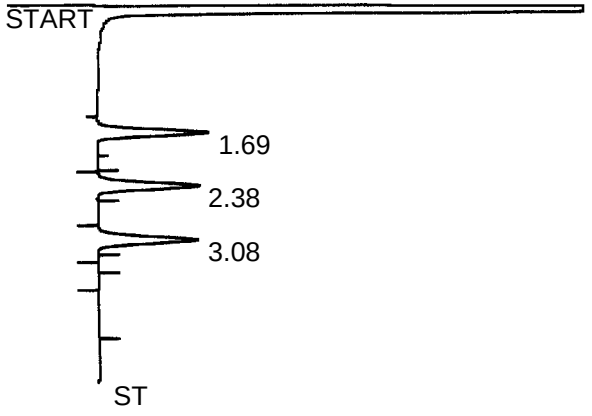
Split inlet and FID



Injection: 1 µl of 8500-4789.

Split inlet and flame ionization detector

Packed inlet and TCD

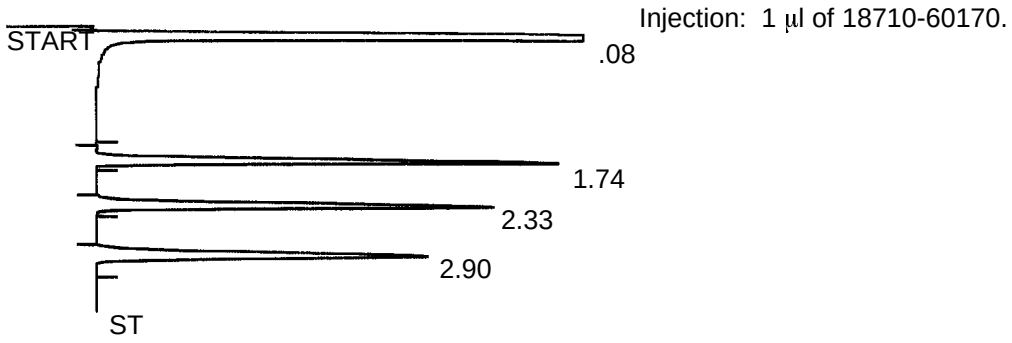


Injection: 3 µl of 18710-60170.

Packed inlet and thermal conductivity detector

Part 19. Examine the chromatogram

Packed inlet and FID



Packed inlet and flame ionization detector

Part 20. Some last words

You have now completed an entire analysis, starting with an installed instrument and finishing with a chromatogram. In the process you installed a column, set correct gas flows, zone temperatures, and an oven temperature program, and arranged for the detector signal to go to your recorder.

You may want to repeat the analysis, either for practice or because you want to try a different recorder speed, a different sensitivity, or some other change that might produce a better looking chart. If so, wait for the NOT READY light to turn off before injecting the sample.

There's much more to chromatography and to this instrument, but you have the basic information. The next step is to go to the Operating Manual to see what other functions are available.