Agilent G3440A

7890A GC

Service Manual

Agilent Technologies

Manual Part Number

G3430-90006

Edition

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Software Revision

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Safety Notices

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.

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1 Before Servicing the Instrument

Safety

Before servicing the GC, observe the safety precautions in the 7890A Safety Manual.

Hand tools

We assume you have a well- equipped toolbox, but some of the special tools listed here will be helpful.

- T-20 Torx Driver - 5182-3465
- T-20 Torx Key (for close-quarters work) - 8710-1807
- T-10 Torx Driver - 5182-3466
- T-10 Torx Key (for close-quarters work) - 8710-2140
- #1 Pozidriv Screwdriver - 8710-0899
- #2 Pozidriv Screwdriver - 8710-0900
- ¼-inch Nut Driver – 8710-1561 (FID Jets)
- 7mm Nut Driver – 8710-1217
- Diagonal Cutters
- Crimper/Wire Strippers
- Tubing Cutters
  - Restek #20193 ***http://www.restekcorp.com***
  - Agilent 8710-1709
  - Alternate for Europe:
    HICHROM Ltd - Part No: HI-196

    Description: Tubing Cutters - Price: £17.00

    1 The Markham Centre

    Station Road – Theale, Berkshire

    RG7 4PE, UK

    Telephone: +44 (0) 118 930 3660

    mailto: ***salesw@hichrom.co.uk***

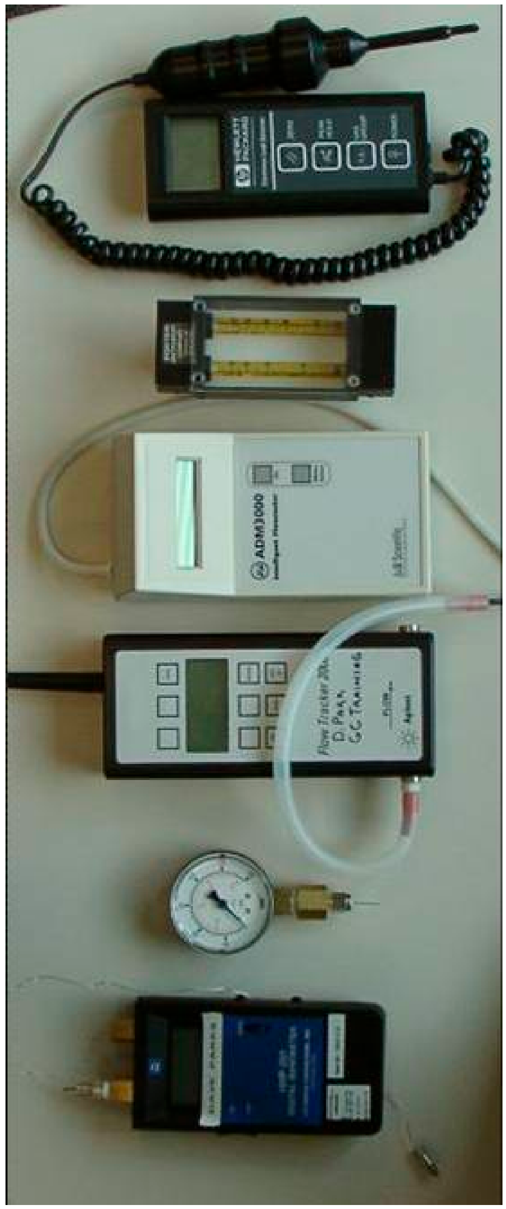
Specialized tools

- FID Flow Tool - 19301-60660
- FID Cleaning Kit - 9301-0985, (.010” Guitar String)
- Injection Port Cleaning Kit – 480-0003
- 12 Piece File Kit – RSF-1200
- (Ferrule Removal tool – not shown – 440-1000)
- Fiberglass Tape – 0460-0186
- Teflon Tape – 0460-0016
- White Gloves_8650-0030
- NPT Adapter – 0100-0118
- 5/16” by #20 Thread Chaser (Die) – to clean 1/8” swagelok threads – Other Supplier
- On/Off Valve – 1/8” Ball Valve – 0100-2144
- Exacto Knife
- Metric (8710-0641) and English Allen Wrench – Hex Keys
- Pin Vise and small drill bit
- Tweezers - 8710-0007
- Micro Probes (Sharp Object) – RMP-5005 – Qty 5
- Inspection Mirror – 707-0027

Electronic tools

- Digital Multimeter _(Fluke 110 shown)
- Power Outlet Test Tool (Radio Shack/Sears/Electrical Supply)
- Static Strap _9300- 0970
- Various jumpers and clip leads – electronic supply
- Useful Cables – not shown:_
  - Crossover LAN Cable - 5183- 4649_
  - 9 Pin RS- 232 Null Modem Cable –G1530- 60600

Pneumatic tools



- Electronic Leak Detector
  - 5182- 9646 – 120 VAC
  - 5182- 9648 – 220 VAC (Agilent)
- Rotameter – Porter Model 65 –_

  Tube 1 – 10- 70cc/min He, Tube 2 – 85–850cc/min Air

http://www.porterinst.com/indust_19.php

- Electronic Flow Meter
  - ADM 1000 – 220- 1170
  - ADM 2000 – 220- 1171- U (Mass Flow Version)
- Electronic”Mass” Flow Meter – Flow Tracker_
  - Model 1000 Flow Only - 5183- 4779
  - Model 2000 with Leak Detector – 5183- 4780_
  - Universal Power Adapter – 5183- 4781
- White Silicone Tubing:
  - 4 meters – 701- 0016
  - 7 cm – 220- 1179

For Checking Inlet Pressure

- Quality Analog Pressure Gauge (0- 100 or 0- 60 PSIG) adapted with a Headspace Probe (301- 013- HSP) – need NPT adapter – 0100- 0118 and TCD Ferrules Set – 5180- 4103, 5182- 9673, 5182- 3477
- Digital Pressure Gauge (0- 100 PSIG) – Omega – Model HHP- 201_Adapted with 1/8” NPT adapter 0100- 0111, SS Capillary 5021- 1831, Reducing Ferrule – 0100- 1342 and 530 uM Column Ferrule – 5080- 8773

NPD Flow adapter - G1534- 60640

G1530- 20610 - FID/NPD Jet Plug

“No- Hole” Column Ferrules - 5181- 7458

FID Flow adapter - 19301- 60660

5060- 9055 ECD/TCD Detector Plug

Plastic 1/8” Swagelok Cap – P/N 0100- 2414 Qty 3

Replacement Septum Purge Fitting for EPC Module – P/N G2630- 61720 (Not included in kit)

“No Hole” Column Nut (Use with any ferrule)

2 Inlets

Inlet overview

Inlets are a means of introducing a sample into the carrier gas stream and then into the analyzing column. The term "Inlets" includes:

- Injection ports, for use with a syringe
- Sampling valves, both liquid and gas, for high sample size reproducibility
- Vapor inlets, in which the sample is vaporized in an external sampler, then swept into the GC. Headspace and thermal desorbers are examples.
- Solid samplers
- and other devices.

Purged Packed Inlet

The purged packed column inlet controls column flow by means of a forward pressure/flow, electronic proportional control valve. A forward pressure regulator controls flow out the septum purge vent. The inlet can be used for packed or capillary columns. Based on the column you have configured, the inlet can be operated in either a mass flow controlled mode or a pressure controlled mode.

Replacing the Purged Packed inlet

1 Cool down the oven.
2 Turn off the GC main power switch and disconnect its power cord.

WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.**

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Turn off all gas flows at their sources.

WARNING **Inlets, detectors, and the oven are insulated with fibrous materials which may cause irritation to skin, eyes, and/or mucous membranes. Always wear gloves when working with the insulation. Additionally, if the insulation is flaky/crumbly, wear protective eyewear and a suitable breathing mask and/or respirator.**

4 Remove the nutwarmer cup and insulation from inside the oven.
5 Disconnect the column from the inlet and cap the column to minimize contamination.
6 Remove the inlet cover.
7 Observe plumbing and wiring layouts and connectivity.
8 Remove the assembly stepwise. You will need Torx T- 10 and T- 20 drivers.
9 Disconnect the heater/sensor cable.
10 Disconnect the 1/16- inch tubing pair from the EPC module.

11 Remove the three top screws retaining the inlet to the GC.

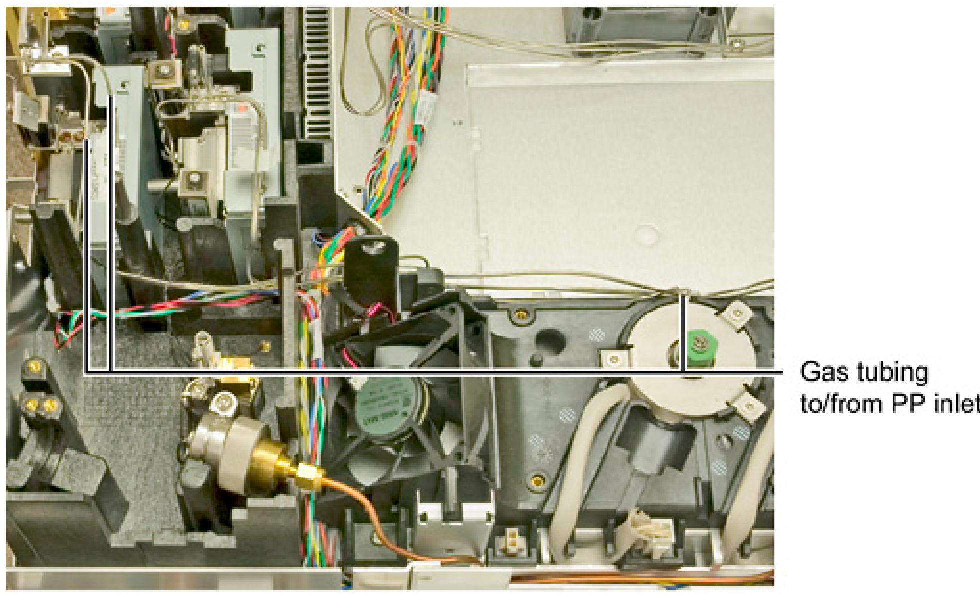
12 Gently lift the assembly up and out.

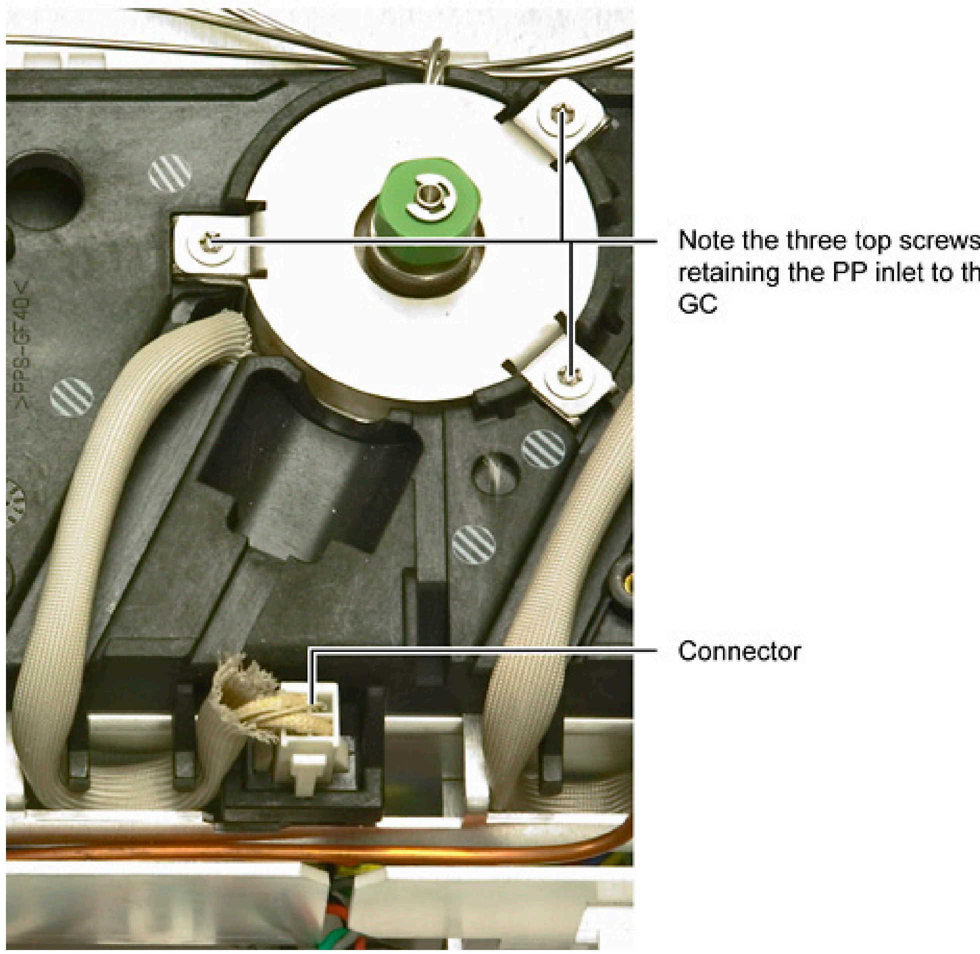
13 Insert replacement inlet.

14 Reassembly is the reverse of these steps.

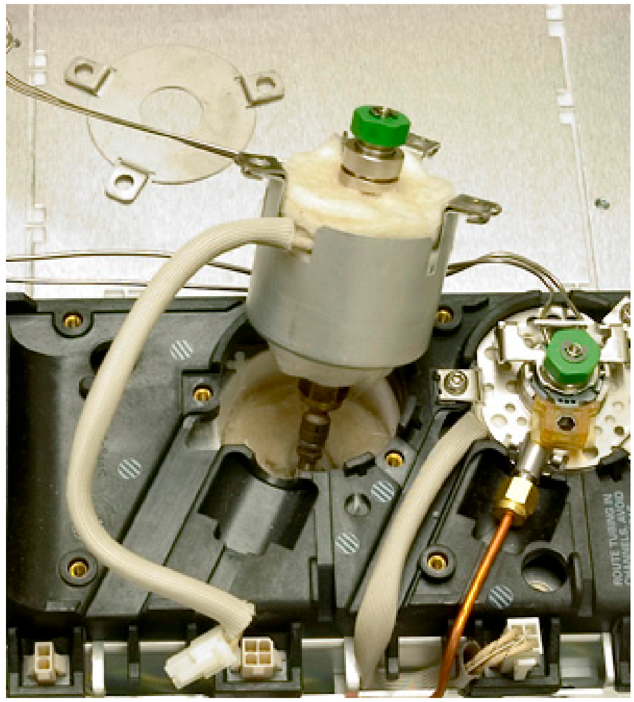
15 Use new O- rings during EPC reconnection.

16 Refer to the figures and photos in this section for guidance.



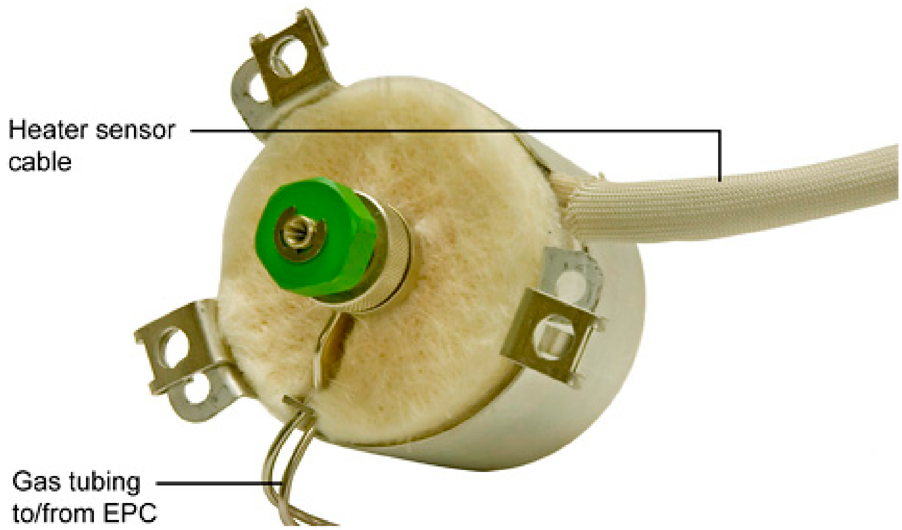


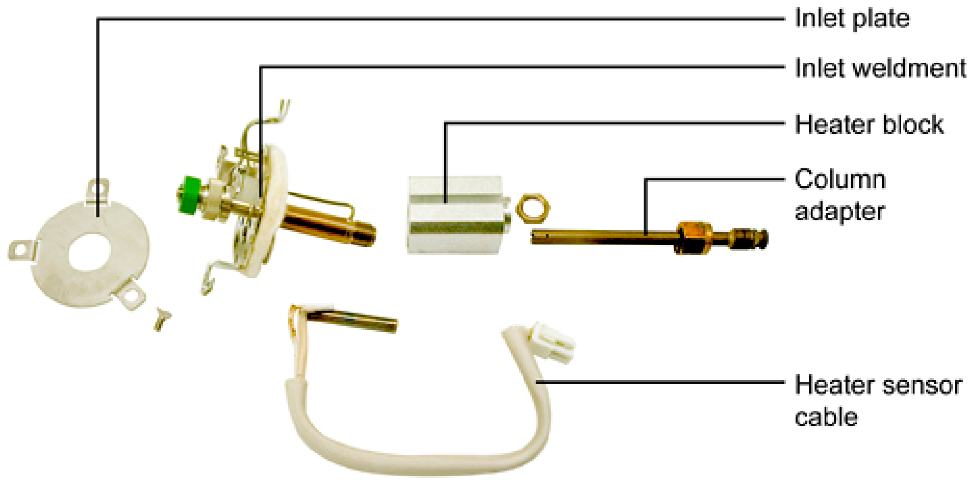
If the EPC module is disconnected, the inlet can be removed and replaced.



This housing is designed to accommodate a variety of Agilent inlets.

Note fibrous insulation within housing. See earlier warning.





Replacing the Purged Packed inlet heater

1. Cool down the oven.
2. Turn off the GC main power switch and disconnect its power cord.

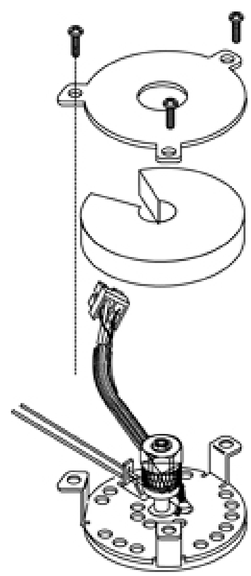
WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock**

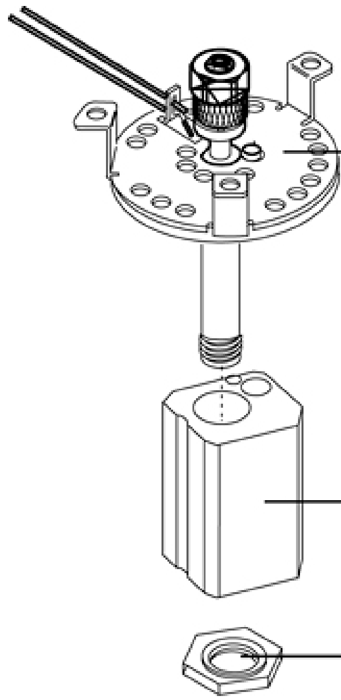
hazard by disconnecting the power cord before removing any GC panels.

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

WARNING **Inlets, detectors, and the oven are insulated with fibrous materials which may cause irritation to skin, eyes, and/or mucous membranes. Always wear gloves when working with the insulation. Additionally, if the insulation is flaky/crumbly, wear protective eyewear and a suitable breathing mask and/or respirator.**

Heater replacement requires removal of the inlet. Refer to ***Replacing the Purged Packed inlet*** (32) for removal instructions.





With the inlet removed:

1 Remove the tubing nut and column adapter.
2 Remove the bottom nut holding the thermal block.
3 Slide the thermal block off the inlet weldment.
4 Carefully remove the heater and sensor from the thermal (heater) block.
5 Replace heater/sensor cable assembly with a new unit.
6 Reassembly is the reverse of these steps.

3 Cool On-Column Inlet

Cool On- Column (COC) inlets allow the injection syringe to deposit the liquid sample directly into the capillary column. This is accomplished by the use of an insert which aligns the syringe with the capillary column and the syringe needle.

Replacing the COC inlet

1 Cool down the oven.

2 Turn off the GC main power switch and disconnect its power cord.

WARNING

Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.

CAUTION

Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 From inside the oven, remove the column from the inlet fitting.

4 From the top of the GC, remove the blue inlet carrier cover (or the tray bracket, if installed) and the left side cover.

5 Unclip the heater/sensor leads from the connector to the left of the inlet carrier.

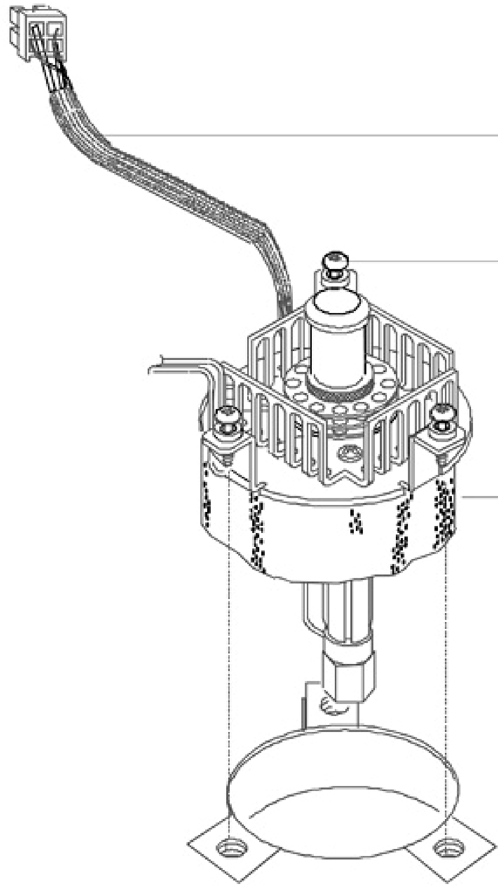
6 Disconnect the inlet plumbing and reroute the plumbing from underneath the tabs on the left side of the instrument.

The inlet plumbing terminates in a pneumatics block connected to the EPC flow module one Torx T- 10 screw.

7 Use a Torx T- 20 screwdriver to loosen the three captive screws that attach the inlet weldment to the top of the inlet carrier.

8 Slide the inlet up out of the inlet carrier. If necessary, you can also slide the insulation sleeve off the bottom of the inlet.

9 Reinstallation is the reverse of these steps.



Replacing the COC heater/sensor assembly

1 Cool down the oven.

2 Turn off the GC main power switch and disconnect its power cord.

WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.**

CAUTION **Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing**

this procedure.

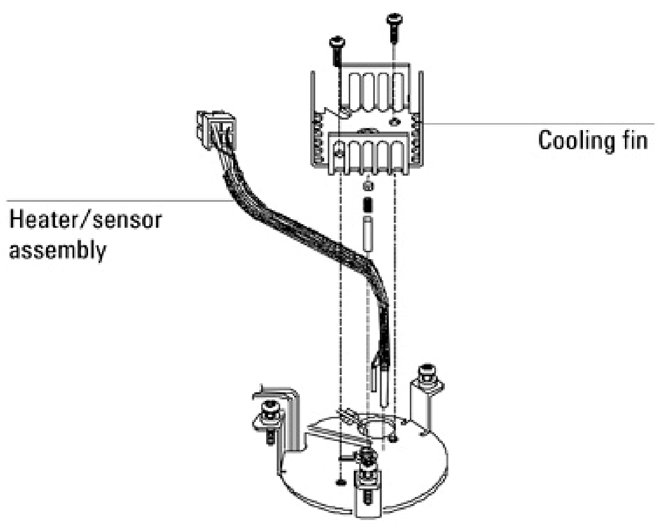
3 If necessary, remove the septum nut, cooling tower and/or needle guide to provide access to the two screws in the top of the cooling fin.

NOTE If desired, you can remove the entire inlet for better access.

4 Remove the screws securing the cooling fin to the inlet weldment and remove the fin.

5 Lift the heater/sensor leads out of the weldment channel and lift the assembly out of the inlet.

6 Install the new heater/sensor assembly and reassemble the inlet. You may need to use tweezers to seat the cable back in the channel and fully seat the heater/sensor in the weldment.



Replacing a Cryoblast tube

1 Cool down the oven.

2 Turn off the GC main power switch and disconnect its power cord.

WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC**

panels.

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

NOTE Unless otherwise noted, the installation process is the same for both LCO2 and LN2 oven cryo valves, and for front or back inlet locations.

Preparation of the inlet

1 Remove the septum retaining nut carefully: there is a small septum and very small coil spring held in place by the nut.

NOTE These parts, especially the coil spring, are easily lost. For their safety, it is recommended that the spring, septum, and septum retainer nut be kept together in a safe place for later reassembly.

2 Next, remove the heat sink by removing its two screws.

3 ***If*** the inlet is secured into the inlet chassis, release its three mounting screws and pull it straight upwards enough to expose the full length of the inlet body.

4 ***If***, as you raise the inlet body, there is a large insulation pad either on the inlet body or in the inlet's mounting hole, it must be carefully removed to preserve its integrity.

5 Carefully inspect both the inlet mounting flange and the existing end of the Cryoblast tube to be replaced:

- Note the large, round hole in the flange – this is the pass through for the nozzle end of the Cryoblast tube.
- Also note the smaller, square hole with a raised metal tab adjacent to the round hole – this is a location and alignment guide. The double right- angle bent portion of the Cryoblast tube must be routed over the square hole and against the tab when installation is complete.

6 Remove the old tube from the inlet and entirely from the GC. Use two wrenches against each other at the T- fitting to avoid twisting tube.

7 Install the new Cryoblast tube into the opening in the mounting flange, as noted in step 5.

8 Carefully work the insulation pad onto both the inlet body and Cryoblast nozzle such that you end with both the Cryoblast tube and the tube on the inlet body in the slit provided in the insulation pad (if two precut slits are present, use one for each tube). Work the pad upwards until it contacts the inlet mounting flange.

NOTE In the next step, maintain control over the Cryoblast tube as you insert and secure the inlet: the tube must not be allowed to slip deeper into the inlet cavity than as described in the inspection detail item in steps 3-8: basically, the tube's double right-angle bend must remain in its described position at all times.

9 Lower the inlet into its prepared location with its three screws aligned with the holes in the inlet chassis and its heater/sensor cable sitting in the trough in the inlet chassis. While doing so, mark where to bend the Cryoblast tube into its channel across the inlet chassis.

10 Remove the inlet and bend the cryo tube at the marked location to pass between the inlet chassis and the GC frame.

11 Reinsert the inlet while guiding the Cryoblast tube through the channel between the inlet chassis and the GC frame. Again, maintain control over the Cryoblast tube inside the inlet, as noted above.

12 Start each mounting screw one at a time to insure the inlet is aligned and screws are properly threaded. Then tighten each screw in turn evenly until snug and the inlet secured.

13 From the left side of the GC, locate the inlet's heater/sensor cable and its corresponding connector plug. Tuck the heater/sensor cable underneath the routing tabs at the side of the GC and connect it to the heater connector.

14 In the following order, replace the heat sink, coil spring, septum, and septum retaining nut on the inlet. Route the Cryoblast tube to the tee attached to the cryo valve.

15 Tighten the swage fitting where the Cryoblast tube connects to the T- fitting at the oven cryo valve. Use two wrenches against each other to avoid twisting tubing.

This completes replacement of a Cryoblast tube for a cool on- column capillary inlet.

Programmed Temperature Vaporization Inlet (PTV)

In addition to the PTV consumables (inlet adapters, columns, Teflon ferrules, and septa), the replacement parts in the PTV inlet assembly are:

- The PTV inlet
- PTV weldment and front trap assemblies
- The filter
- The head assembly (septum or septumless)
- The cryo shroud on the inlet body (CO_2 or liquid nitrogen)
- The PTV thermocouple board
- The O- rings and restrictors in the gas fitting assembly.

Replacing the PTV inlet

1 Cool down the oven.

2 Turn off the GC main power switch and disconnect its power cord.

WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.**

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

The PTV inlet system is removed and replaced as a single unit consisting of the inlet and split vent trap assemblies connected via its split vent line.

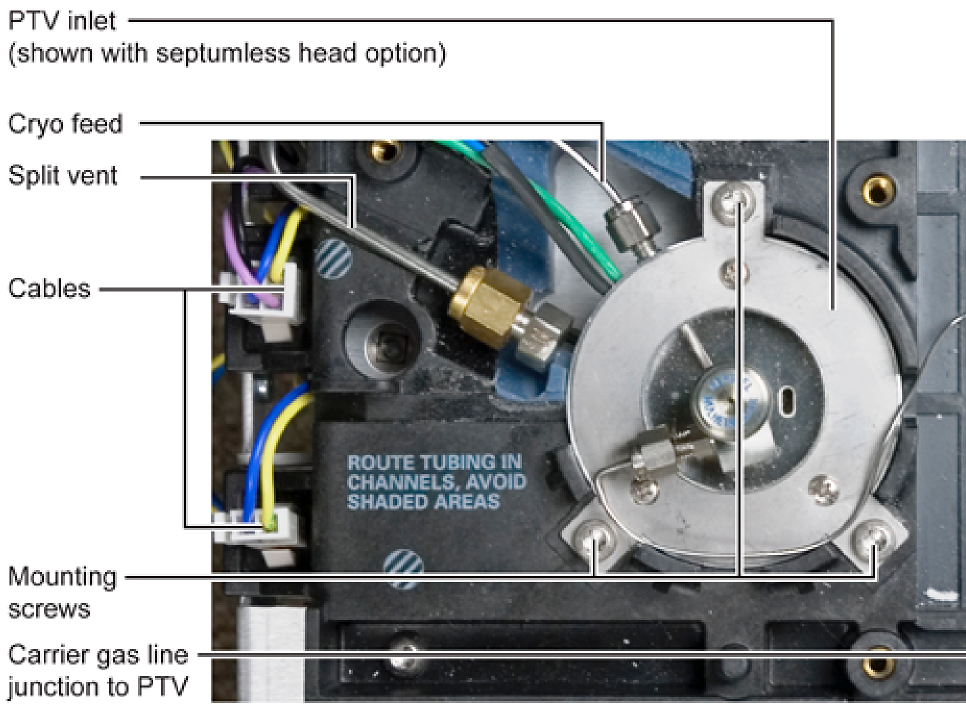
WARNING **Inlets, detectors, and the oven are insulated with fibrous materials which may cause irritation to skin, eyes, and/or mucous membranes. Always wear gloves when working with the insulation. Additionally, if the insulation is flaky/crumbly, wear protective eyewear and a suitable breathing mask and/or**

respirator.

1 Remove the top EPC module cover.

2 Remove the inlet cover and GC left side panel.

3 At the inlet, if present, disconnect the cryo line (use two wrenches against each other to prevent rotation).



CAUTION When removing/attaching the cryo line use two wrenches: one wrench to support one fitting and the other to loosen/tighten the nut. Failure to do this could damage the fitting/tubing.

4 At the inlet, also disconnect the carrier gas line. If equipped with septum purge, disconnect the purge line from the inlet.

5 At the PTV EPC module, disconnect the split vent valve cable from the lower right corner of the PC board underneath the module exposed by lifting the module.

6 Disconnect inlet thermocouple and heater/sensor cables at the PTV heater/cryo PC board and work them back through other wiring and tubing to the inlet. Disconnect any

additional cables at the inlet. Note that, if fitted, the PTV N2 cryo feed tube from the N2 cryo valve to the inlet may need to be entirely removed from the GC to provide room for cable connectors.

7 Release the inlet assembly by removing three screws and lifting the entire assembly from the GC.

8 In reassembly, pay attention to the following:

- Maintain correct orientations of insulation and the inlet body.
- Ensure that the inlet's insulation aligns properly with the tube for the cryo attachment, if present.

9 Reconnect PTV inlet cables.

10 As necessary, reconnect the split vent line, cryo line, carrier gas line, and septum purge (if present).

Replacing the PTV inlet cryo jacket

1 Cool down the oven.

2 Turn off the GC main power switch and disconnect its power cord.

WARNING

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CAUTION

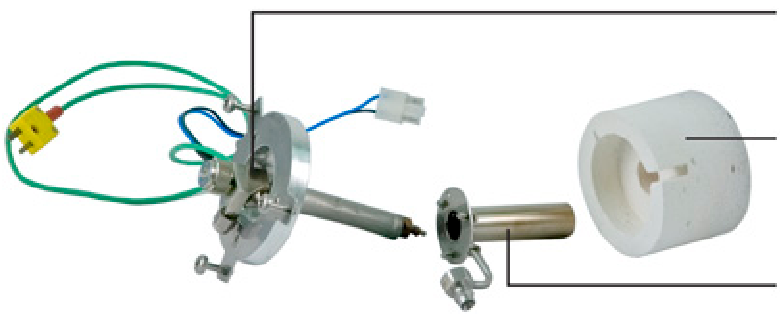
Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

WARNING

Inlets, detectors, and the oven are insulated with fibrous materials which may cause irritation to skin, eyes, and/or mucous membranes. Always wear gloves when working with the insulation. Additionally, if the insulation is flaky/crumbly, wear protective eyewear and a suitable breathing mask and/or respirator.

3 Remove the PTV inlet assembly. See ***Replacing the PTV***

Inlet (45).



4 Remove three screws from the underside of the inlet body assembly securing the cryo jacket to the inlet body.

NOTE The CO2 cryo jacket (marked "CO2" on its inlet fitting) is different from the N2 jacket (marked "N2" on its inlet fitting).

5 Reassembly is the reverse of these steps.

NOTE The inlet body with its heater and sensor are not individually replaceable parts.

Replacing the PTV CO2 or LN2 inlet cryo assembly

1 Once the PTV with cooling assembly is removed, the cryo assembly on the inlet can be replaced.

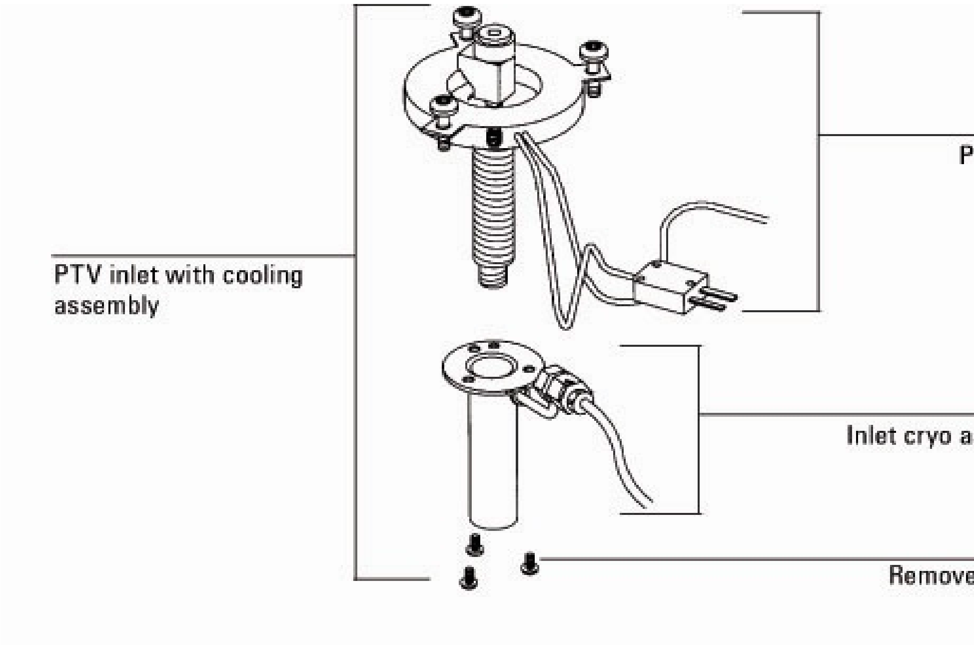
2 Remove the PTV inlet as described under ***Replacing the PTV inlet*** (45).

3 Remove the three screws on the cryo assembly from the PTV inlet, and remove the cryo assembly.

4 Install the new cryo assembly over the inlet body. Be sure to align the assembly so that the fitting is closest to the wires.

5 Reassembly is the reverse of these steps.

6 Check for leaks.



Replacing a PTV CO2 cryo valve

If changing the GC configuration, see ***Changing the GC configuration*** (222) for important information regarding GC methods. Then proceed with the steps below.

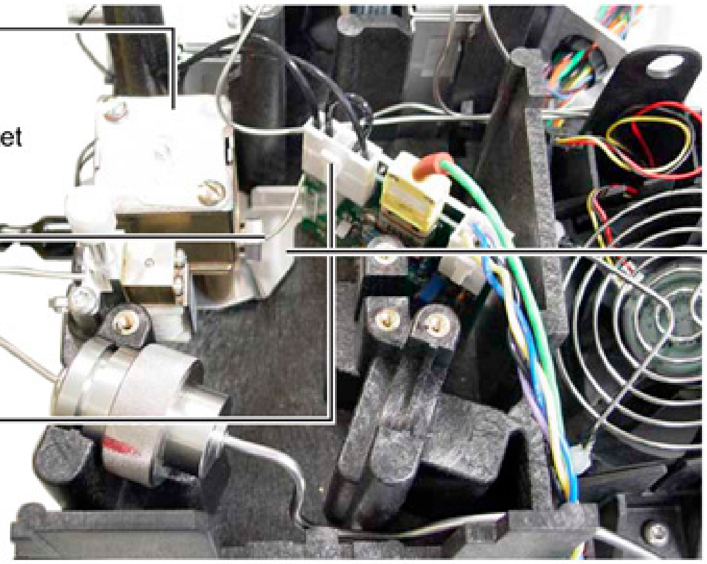
1 Cool down the oven and all heated zones.

2 Turn off all gas flows at their sources.

3 Turn off the GC main power switch and disconnect its power cord.

WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.**

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.



4 See ***Removing the PTV cryo/PC board bracket*** (53).

5 Remove the valve via its two mounting screws accessible under the removed bracket assembly.

6 In reinstallation, make sure the valve is oriented correctly on the bracket with its cryo feed input connection towards the rear of the GC and that its cable is reconnected to the nearby PC board.

Replacing the PTV N2 cryo valve

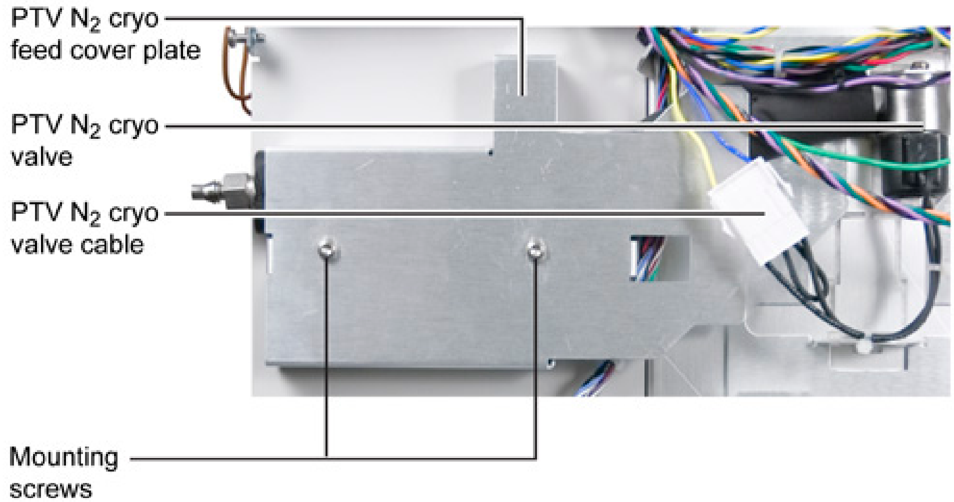
1 Cool down the oven.

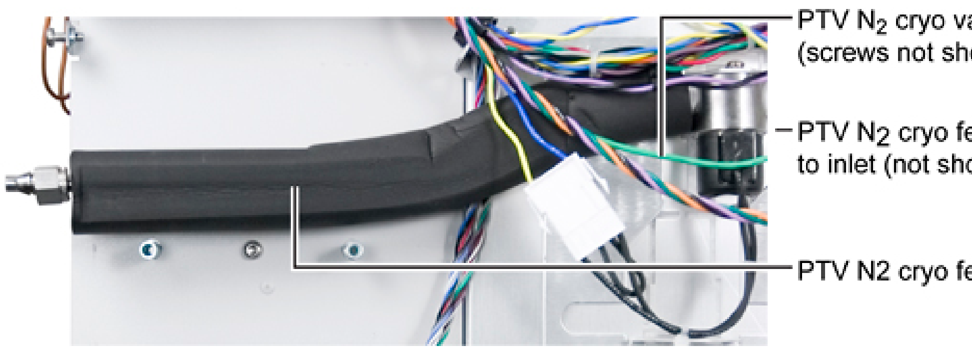
2 Turn off the GC main power switch and disconnect its power cord.

WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.**

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Remove the inlet cover and GC left side panel.





1 Remove the N2 cryo feed tube between the cryo valve and the PTV inlet.

2 Remove two screws from the PTV N2 cryo feed cover plate. Remove the cover plate.

3 Disconnect the PTV N2 cryo valve cable. If you intend to replace this cable with a new one, use the existing cable as a model while you install the new cable, then remove the old cable.
4 Remove the valve bracket and cryo valve by three screws.
5 Replace the N2 cryo valve assembly by reversing these steps.
6 Reinstall the N2 cryo tube between the valve and the inlet.

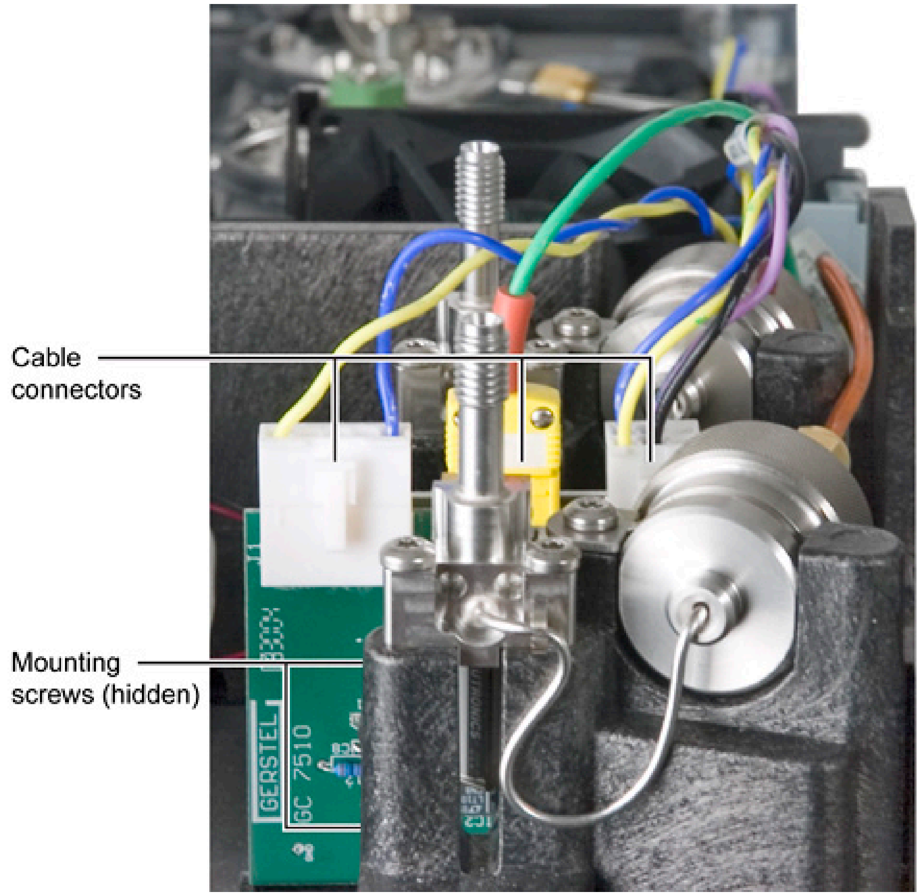
Replacing the PTV heater/cryo PC board

1 Cool down the oven.
2 Turn off the GC main power switch and disconnect its power cord.

WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.**

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Remove the top EPC module cover.



4 To remove the heater/cryo PC board, first remove its three cables: from left- to- right, respectively, the N2 cryo valve cable (if present), the thermocouple cable, and the heater/sensor cable.

5 Next, remove two T- 20 screws securing the board onto its bracket.

6 Lift the board straight up and out of the GC.

7 Installing the new board is the reverse of these steps.

Removing the PTV cryo/PC board bracket

1 Cool down the oven.

2 Turn off the GC main power switch and disconnect its power cord.

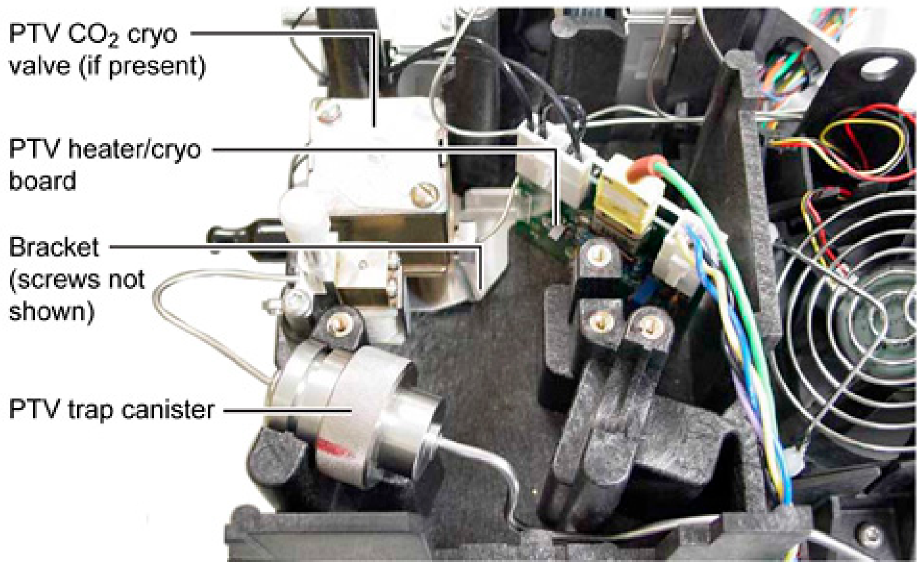
WARNING **Hazardous voltages are present in the mainframe when the GC**

power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.

CAUTION

Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Remove the top EPC module cover.



4 Disconnect cables to the PTV heater/cryo PC board. See ***Replacing the PTV heater/cryo PC board*** (52).

5 If a PTV CO2 valve is present, disconnect its cryo feed lines (CO2 in / CO2 out).

6 Remove two screws securing the bracket to the GC.

7 Lift the bracket assembly out of the GC working it around any interfering wiring and/or tubing.

NOTE

The PTV CO2 cryo valve, if present, is also mounted on this bracket.

8 Reassembly is the reverse of these steps.

Volatiles Interface

The Volatiles Interface (VI) uses a controlled stream of gas to transfer a vaporized sample from an external sampler (headspace, purge and trap, thermal desorber, etc.) to a capillary column.

Replacing or cleaning the volatiles interface

1 Turn off all gas flows at their sources.

2 Turn off the GC main power switch.

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Disconnect the transfer line. Loosen the nut with a 1/4- inch wrench and remove the line. Remove the clamping plate from the interface by loosening the captive screw with a T- 20 Torx screwdriver. Put the plate in a safe place.

4 Lift the interface out of the heater block.

5 If a column is installed, remove it.

6 Remove the split and pressure sensing lines by loosening the hex nuts with the wrench.

7 Clean or replace the interface. If cleaning the interface, sonicate it twice and then rinse.

8 Reinstall the split line and pressure sensing lines and finger tighten the hex nuts. Tighten the hex nuts an additional 1/4 turn with the wrench.

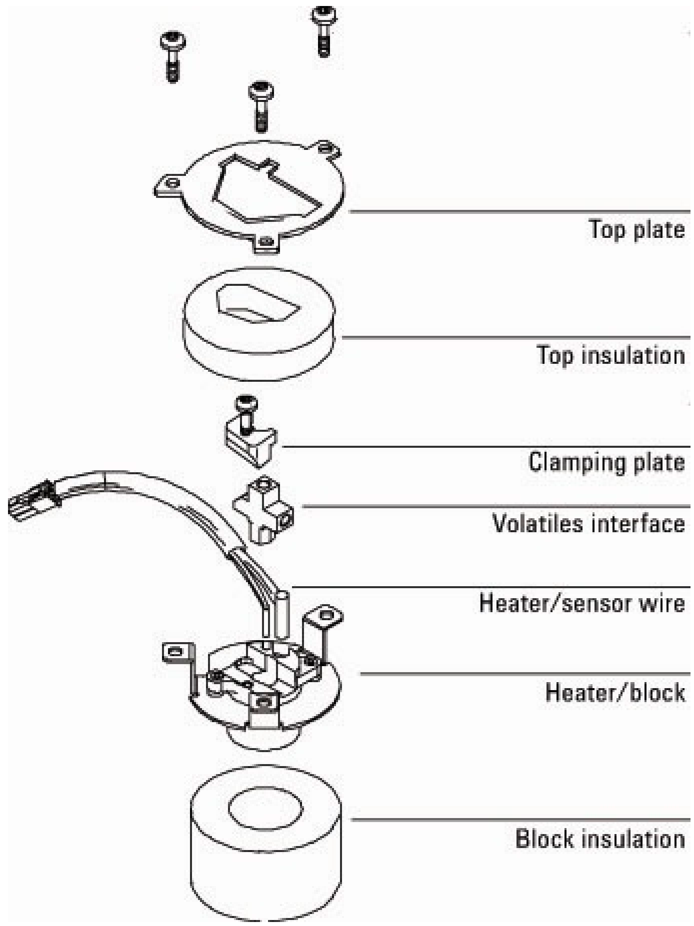
9 Reinstall the column in the interface.

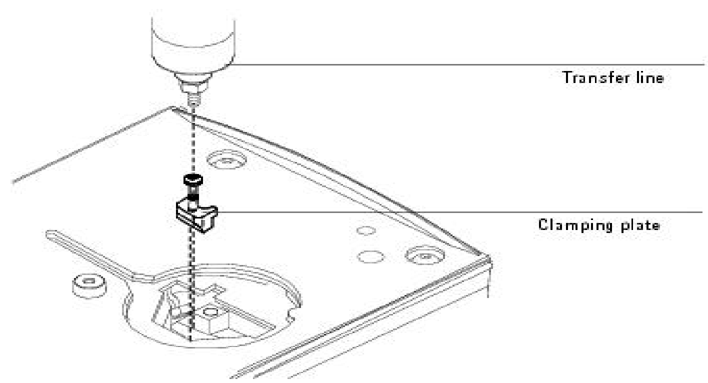
10 Place the interface in the heater block. Replace the clamping plate and tighten the screw until snug. Do not overtighten.

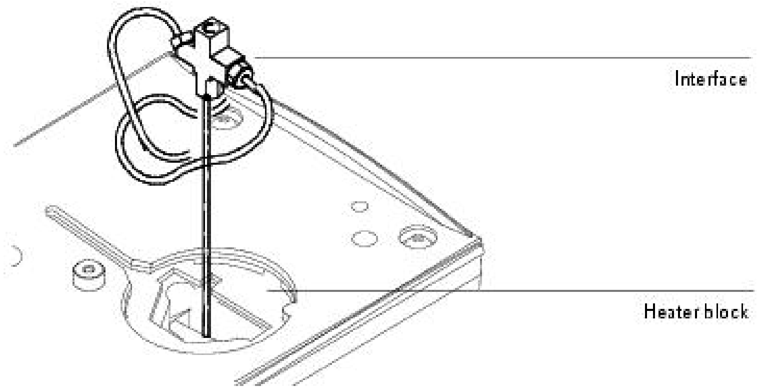
11 Reinstall the transfer line. Finger tighten the nut and then tighten an additional 1/4 turn with the wrench.

NOTE If the transfer line is from a TMR-8900 Purge and Trap, install the transfer line support nut assembly up and inside the metal sleeve of the heated line assembly to prevent damage to the fused silica line.

12 After the column is installed at both the interface and the detector, establish a flow of carrier gas through the interface and maintain it for 10 to 15 minutes. Check for leaks. Heat the interface to operating temperatures and retighten the fittings, if necessary.


Top plate
Top insulation
Clamping plate
Volatiles interface
Heater/sensor wire
Heater/block
Block insulation


Transfer line
Clamping plate



Replacing the volatiles interface heater/sensor assembly

1 Cool down the oven.

2 Turn off the GC main power switch and disconnect its power cord.

WARNING

Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.

CAUTION

Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Disconnect the transfer line. Loosen the nut with a 1/4- inch wrench and remove the line.

4 Remove the heater/sensor wire connector from the GC connection.

5 Remove the three screws in the top plate of the volatiles assembly which mount it in the GC using a T- 20 Torx screwdriver. Loosen each screw a little at a time.

6 Remove the top plate and the top insulation from the GC.

7 Remove the heater/sensor assembly and replace.

8 Reinstall the top insulation and the top plate. Align the volatiles interface with the mounting holes.

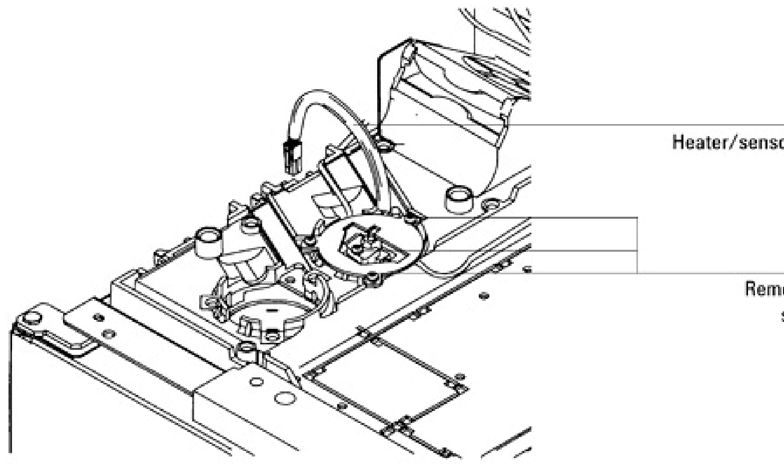
9 Reinstall the three Torx screws. Tighten each screw once with the T- 20 Torx screwdriver until the interface is

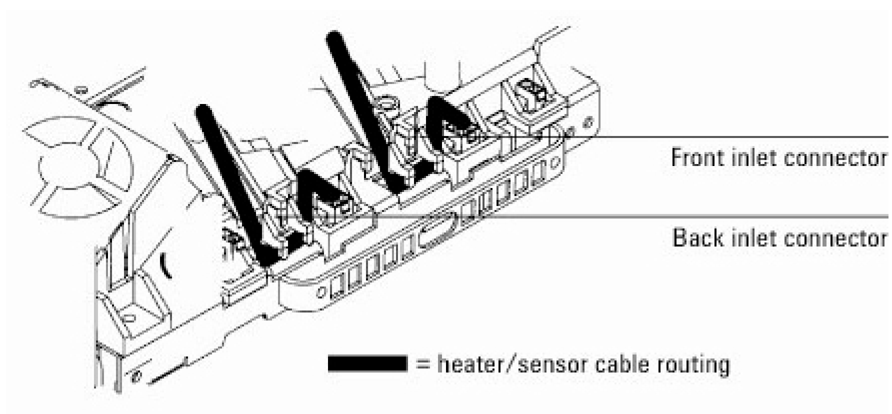
properly aligned. Tighten each screw again until snug.

10 Reinstall the heater/sensor wire connector in the GC. Route the wire as shown.

11 Reinstall the transfer line using a 1/4- inch wrench and check for leaks.

Cable routing





Calibrating your interface

The interface's flow module contains a pressure sensor that must be zeroed after it is installed on your GC. This calibration procedure ensures an accurate interface pressure display.

Do not connect the carrier gas to the flow module until you have zeroed the interface's pressure sensor.

1 Plug in the GC and turn it on, if you haven't already done so.

2 Wait 15 minutes. This allows the GC to reach thermal equilibrium.

3 Zero the interface's pressure sensor:

   a Press ***[Options]***, scroll to **Calibration** and press ***[Enter]***.

   b Scroll to the module to be zeroed and press ***[Enter]***.

   c Scroll to a zero line and press ***[Info]***. The GC will remind you of the conditions necessary for zeroing that specific sensor.

   `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.

   d Press ***[On/Yes]*** to zero or ***[Clear]*** to cancel.

4 Turn off the GC.

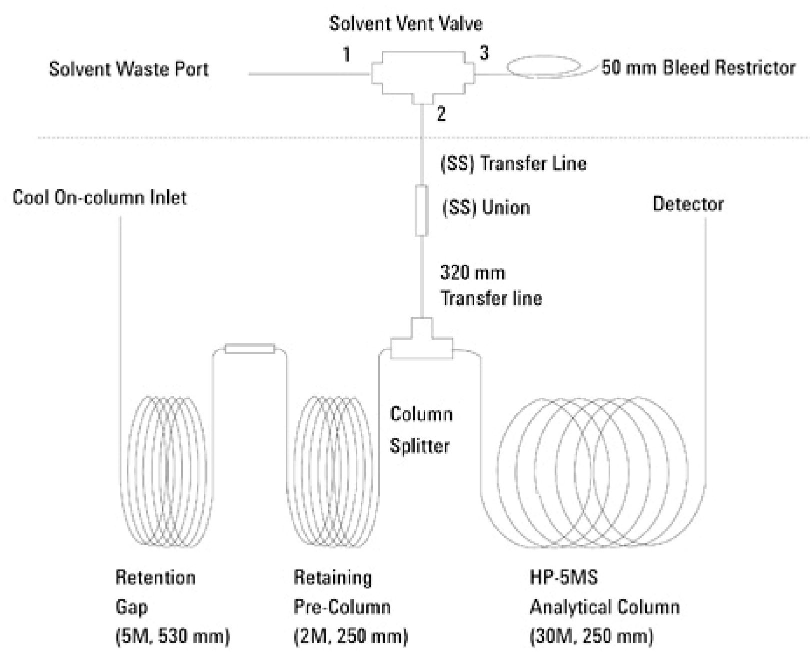
5 Plumb the carrier gas to the flow module. If you need help with this step, see the GC Site Preparation and Installation Manual/CD- ROM.

6 Turn on the GC.

7 Configure the column and carrier gas.

Solvent Vapor Exit Accessory

This accessory vents the carrier gas and solvent vapor to waste for a controlled time after injection. This greatly reduces the size of the solvent peak.



Replacing the SVE valve/fitting assembly

WARNING **Hazardous voltages are present in the mainframe when the GC power cord is plugged in. Avoid a potentially dangerous shock hazard by unplugging the power cord before removing the side panels.**

CAUTION Prevent electrostatic voltages from damaging the GC by using an ESD wriststrap.

1 Turn off the GC and unplug the power cord. Allow time for all heated zones to cool and then turn off supply gases at their sources.

2 Remove the top cover, the pneumatics cover, the electronics

carrier cover, and the right side cover.

3 Remove the bleed restrictor column and the solvent vent waste line from the valve fitting assembly.

4 Inside the oven, disconnect the transfer line from the stainless union on the 1/16- inch stainless steel tubing. Carefully remove the tubing from the oven through the cutout in the top of the oven.

5 Disconnect the valve driver cable from the valve jumper cable or valve driver assembly, as applicable.

6 Remove the mounting screw in the valve/fitting assembly and remove the assembly from the GC.

7 Install the new valve/fitting assembly and mount it to the GC oven with the screw. Cover the open end of the union to avoid contamination and route the 1/16- inch stainless steel tubing and union into the oven. Repack the insulation around the cabling. Connect the valve driver cable to the valve jumper cable or valve driver assembly, as applicable.

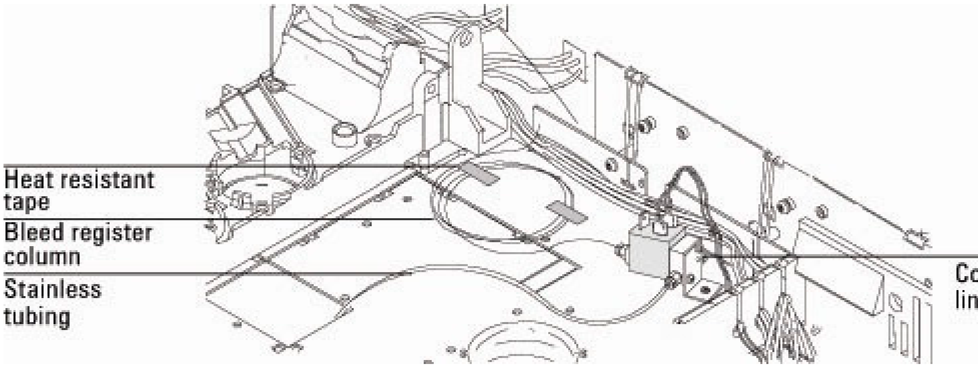
8 Use a new graphite/Vespel ferrule to reconnect the transfer line to the union.

9 Examine the bleed restrictor column. If the column is damaged, replace it with a new 0.5 m length of 0.050 mm column, installing a new fitting and ferrule. Be sure to trim 5 to 10 mm off the end of the new column after installing the new fitting and ferrule.

10 Reattach the solvent waste vent line.

WARNING **Because a significant amount of solvent is vented through the SVE valve assembly, it is important that the bleed restrictor and the solvent vent are connected to an appropriate laboratory ventilation system.**

11 Check for leaks.



Replacing the SVE bleed restrictor column

1 Turn off the GC and unplug the power cord. Allow time for all heated zones to cool and then turn off supply gases at their sources.
2 Remove the top cover and the right side cover. If necessary, also remove the pneumatics cover and the electronics carrier cover.
3 Using a wrench, remove the old bleed restrictor column.
4 Cut a 0.5 m section off of the new 50 µm bleed column for use as the restrictor.
5 Attach a male fitting and ferrule to the restrictor column, then trim 5 to 10 mm from that end of the column.
6 Connect the 0.5 m x 50 µm bleed restrictor to the SVE valve.
7 Make a loop (or loops) in the excess column protruding from the valve and move it to an unobstructive position.
    - Coil it in a loose coil (approximately 6 inch diameter).
    - Secure the coil with heat resistant tape or equivalent.

Replacing the SVE tri-column assembly

1 Turn off all gas flows at their sources.
2 Turn off the GC main power switch.

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Disconnect the Tri- column assembly from the COC inlet, detector and (SS) union and remove the column assembly from the GC oven.

4 Install the new SVE Tri- column assembly onto a column hanger and hang the assembly inside the GC oven. Position the column assembly so that the end of the retention gap (530 µm) is located under the COC inlet and the end of the analytical column (250 µm) is under the detector.

5 Connect the retention gap to the COC inlet using a graphite ferrule and a column nut.

6 If using a MSD, connect the analytical column (HP- 5MS) to the MSD using a column nut (part no. 05988- 20066) and a graphite/Vespel ferrule (part no.5062- 3508). If using any other type of detector, connect the analytical column (HP- 5MS) to the GC detector using a column nut (part no. 5181- 8830) and a graphite/Vespel ferrule (part no. 5062- 9527).

7 Remove the stainless ferrules from the union. Use a graphite/Vespel ferrule to connect the 0.5 m × 320 µm transfer line from the quartz Y- splitter of the Tri- column assembly to the unused end of the stainless union located inside the GC oven.

8 Check all of the connections for leaks using an electronic leak detector.

Replacing the SVE pre-column assembly

1 Turn off all gas flows at their sources.

2 Turn off the GC main power switch.

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Disconnect the Tri- column assembly from the COC inlet, the detector and the stainless steel union and remove the column assembly from the GC oven.

4 Using a column cutter, cut the transfer column and the analytical columns as close to the quartz Y- splitter as possible. Be sure to cut the columns straight.

5 Using the column cutter, trim the ends of the tri- column assembly ensuring that the cuts are straight. Then use a lint

free wipe and methanol to clean any dirt and finger prints from approximately three to four centimeters from each of the five column ends.

6 Being careful not to touch the ends of the columns, insert them into the quartz splitter as far as possible, making sure that the column ends are making contact with the inside walls of the splitter. Sufficient pressure should be applied to give a good seal. Too much pressure, on the other hand, can damage the polyimide layer or even the column and result in leakage. Test to see that the column has been installed correctly by trying to pull the column out of the splitter using medium force. If the column comes out easily, trim the end and insert again.

NOTE A concentric circle inside the splitter should result if the column is installed correctly.

7 After connecting the column ends into the quartz splitter, reconnect the tri- column assembly inside the GC oven and increase the column head pressure incrementally to the desired pressure. An incremental increase is better than immediately applying the total column head pressure to avoid a "shock" that can loosen the connection.

Split/Splitless Inlet

This is the general- purpose inlet for use with capillary columns. It vaporizes the sample in a heated liner, then delivers all (splitless mode) or a specified fraction (split mode) of the vapor to the column.

Replacing the split/splitless inlet

1 Cool down the oven.

2 Turn off the GC main power switch and disconnect its power cord.

WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC**

panels.

CAUTION

Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

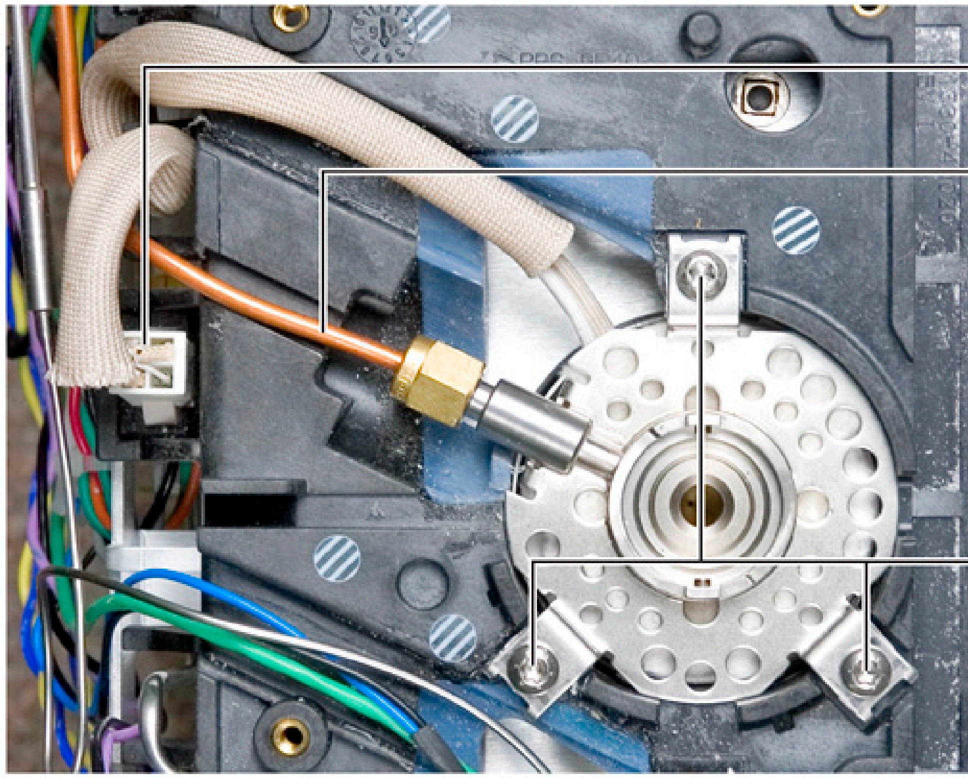
WARNING

Inlets, detectors, and the oven are insulated with fibrous materials which may cause irritation to skin, eyes, and/or mucous membranes. Always wear gloves when working with the insulation. Additionally, if the insulation is flaky/crumbly, wear protective eyewear and a suitable breathing mask and/or respirator.

3 Inside the oven, remove interferences as needed: column(s), the inlet insulating cup, and so forth.

4 Remove the split/splitless top weldment assembly. See ***Replacing the split/splitless inlet top weldment assembly*** (68).

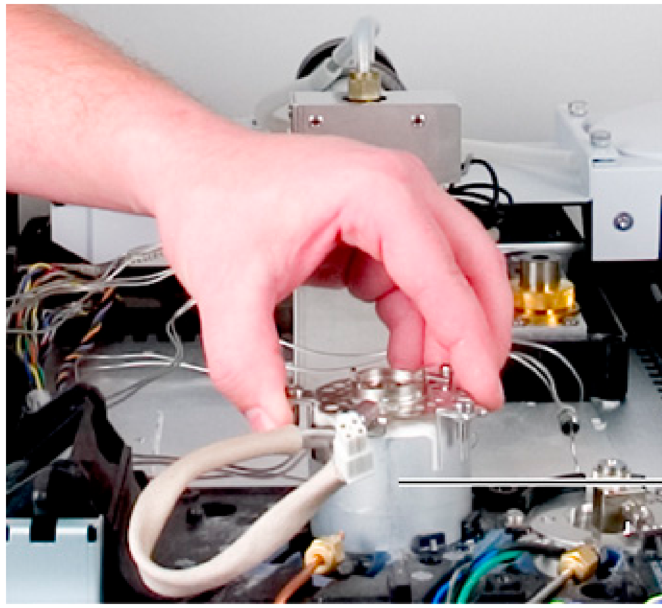
5 At the top of the GC, remove screws from the injection port top cover and remove the cover to expose the inlet assembly.



6 Disconnect the split vent line.

7 Disconnect the sensor/heater cable and work it back through any interfering wiring, tubing, and/or GC frame members.

8 Remove 3 screws to release the inlet body assembly with its insulation and cup and lift the assembly from the GC.



9 Replacing the inlet assembly is the reverse of these steps. Pay attention to rotational orientations of the inlet body, the preformed insulation and its cup, and positions of the split vent connection and the heater/sensor cable as you fit the assembly into the GC.

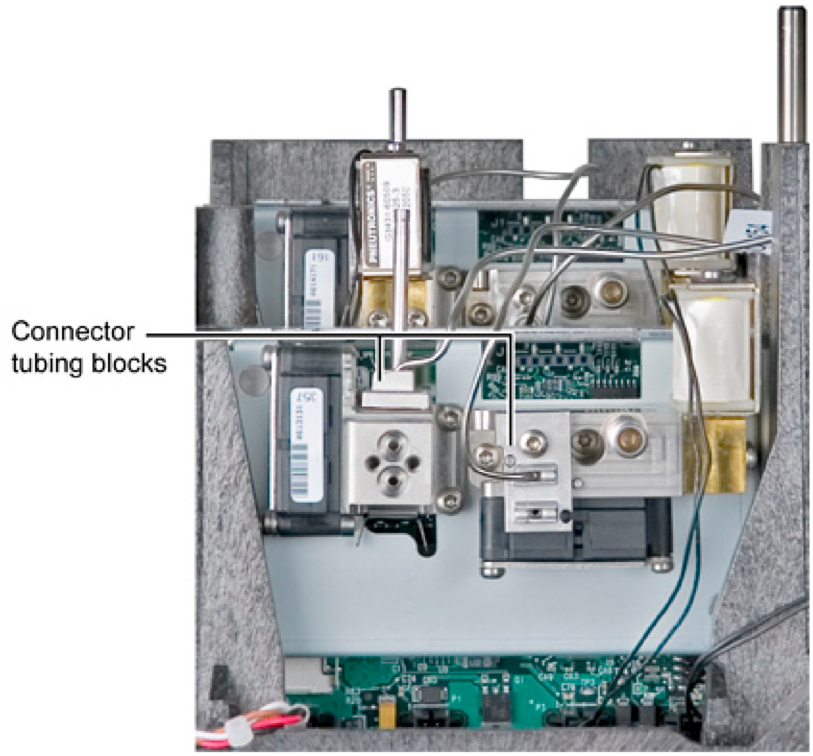
Replacing the split/splitless inlet top weldment assembly

1 Turn off all gas flows at their sources.

2 Turn off the GC main power switch.

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Rotate the locking tab to release the top weldment assembly from the split/splitless inlet.



4 Disconnect tubing connector blocks at the EPC module locations (T- 10 screwdriver). Take care to make sure sealing O- rings are not dislodged or damaged.

5 Guide the top weldment assembly carefully through any interfering wiring and/or tubing to remove it from the GC.

6 Reassembly is the reverse of these steps.

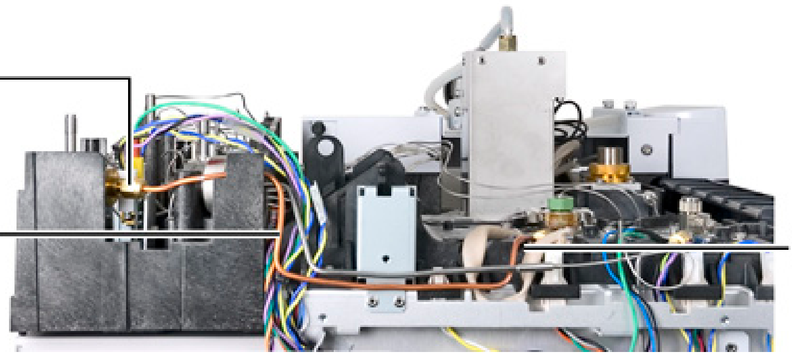
Replacing the split/splitless inlet split vent line

1 Turn off all gas flows at their sources.

2 Turn off the GC main power switch.

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Remove the top EPC module cover and the left side panel on the GC.



4 Remove the inlet cover.

5 Disconnect the split vent line at each end: from the inlet and from the trap canister. At the trap end, use two wrenches against each other to prevent the trap body from rotating.

CAUTION

When removing/attaching the split vent line at its trap canister, always use one wrench to support the canister fitting and one to tighten the nut. Failure to do this could break the seal within the canister.

6 Remove the split vent line for cleaning or replacement.

7 Replacement is the reverse of these steps.

Replacing the split/splitless inlet split vent filter canister and valve assembly

1 Cool down the oven.

2 Turn off the GC main power switch and disconnect its power cord.

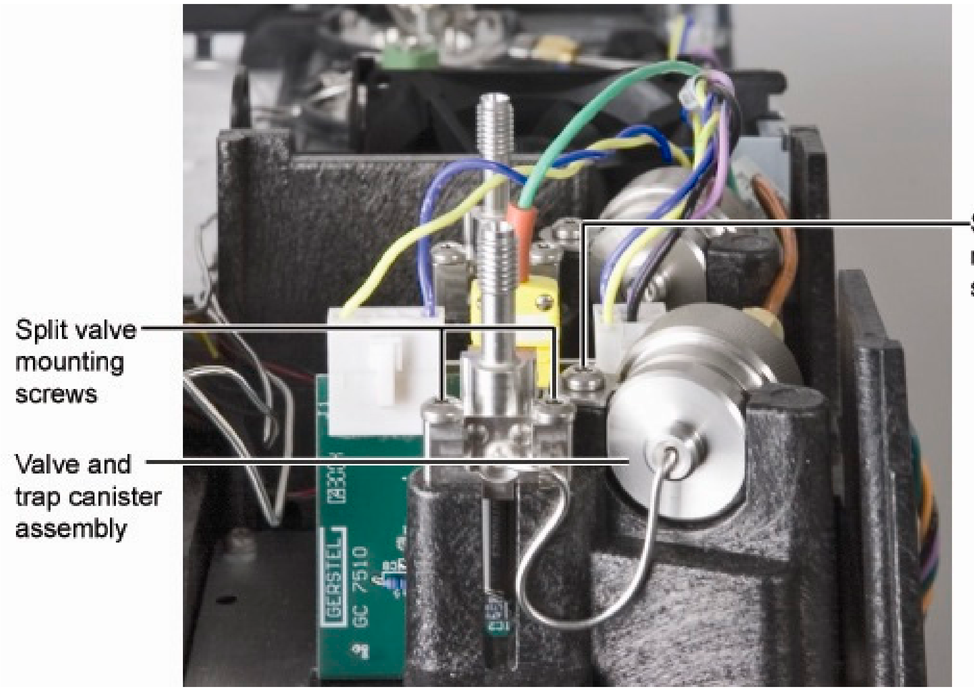
WARNING

Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.

CAUTION

Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Remove the top EPC module cover.



4 Disconnect the cable to the split valve from the inlet EPC module. See ***Replacing the split/splitless inlet split vent line*** (69).

5 Disconnect the split vent line. See ***Replacing the EPC modules*** (157).

6 Loosen the screw securing the canister retainer enough to rotate it aside. Loosen 2 screws to release the split valve assembly.

7 The canister and split valve are removed as a unit. Note that the split valve is now easily accessible for replacement if needed.

8 Reassembly is the reverse of these steps.

Reinstalling the split/splitless inlet

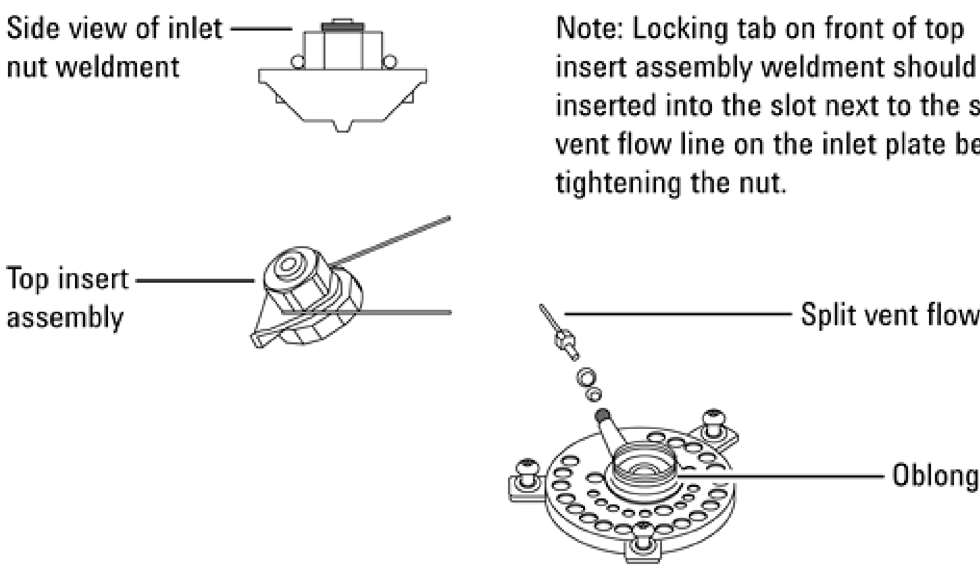
1 Make sure the heater/sensor assembly is installed and the inlet insulation sleeve is in place.

2 Install a column nut and blank ferrule on the bottom of the inlet to prevent insulation contamination, and place the inlet into the inlet carrier.

NOTE Make sure the insulation is properly seated around the inlet and that the heater/sensor wiring harness insulation sleeve is tucked under the top inlet plate.

3 Retighten the three screws (Torx T- 20) to secure the top inlet weldment plate to the inlet carrier.

4 Reconnect the split vent flow line.



1 Reinstall the top insert assembly (with septum and carrier lines attached). Make it finger tight plus a quarter turn with the inlet wrench provided in the ship kit (part number 19251- 00100).

NOTE Make sure the locking tab fits into the oblong slot on the left side of the inlet weldment plate.

2 Tuck the "service loop" of the septum purge and carrier gas lines under the tabs on the left side of the GC.

3 Seat the heater/sensor leads into the channel on the inlet carrier.

4 Reconnect the heater/sensor assembly into the provided connector (front or back) on the left side of the GC.

5 Reinstall the insulated thermal cup and insulation in the GC oven.

6 Reinstall the inlet cover.

4 Detectors

Detector overview

A detector monitors the gas stream exiting from the analyzing column. Its electrical output changes when the composition of the gas does. This section deals with the most widely used detectors:

About the detector signal boards

The 7890A can control up to 4 detector signal boards and simultaneously process their digital signals. Except for a TCD, all detector boards are mounted in the electronics carrier on the right- hand side of the GC. A TCD signal board can be mounted in the optional 3rd detector carrier.

Repairs on detector modules should be in this order:

1 Verify the signal board is receiving 24 VDC power, the green LED is ON, and the board appears configured in the GC

display.

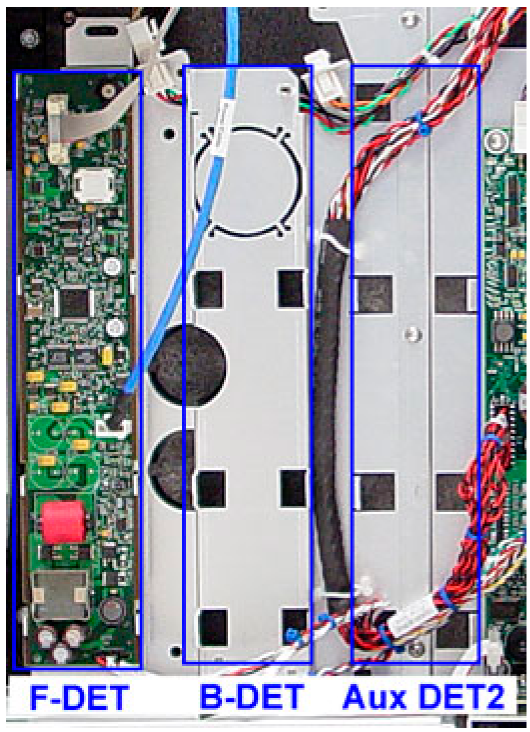
2 Check diagnostics for faults caused by components connected to the signal board, such as, ignitors, electrometers, filaments, and PMTs.

3 Replace the module only after 1 and 2.

Repairs should be verified by the following:

- Typical detector signal baseline output and noise.

There are 6 types of detector signal boards. Their part numbers and possible locations are listed in the table below.



Detector signal boards

Description	Part number	Slot
AIB	G3456-60010	Aux DET1
uECD	G3433-60020	F-DET or B-DET
FID	G3431-60020	F-DET or B-DET
FPD	G3435-60010	F-DET or B-DET or Aux DET2
NPD	G3434-60020	F-DET or B-DET
TCD	G3432-60010	F-DET or B-DET or Aux DET1

Detector signal electrical connectors

Description	P1	P2	P3	P4	Other
AIB	Communication buss			J1 Signal input	P5
uECD	Communication buss	Electrometer			
FID	Communication buss	Ignitor		Electrometer	
FPD	Communication buss	Ignitor		Signal input	P7 S11 Higl for PMT
NPD	Communication buss	Bead current		Electrometer	
TCD	Communication buss		Switching valve	J4 Filaments	

Accessing detector signal boards

The front and back detector signal boards are located under the right- hand side panel.

1 Loosen the T- 20 captured screws until they do not engage the electronics carrier.
2 Slide the panel toward the back of the GC and lift off. Place the tip of the driver in one of the top ventilation slots and push back.

The 3rd detector signal board is located in the 3rd detector carrier on the left side of the GC.

1 Remove the 2 T- 20 screws from the side panel.
2 Lift the panel (both side and top) off of the carrier.
3 Remove the screw from the detector signal board cover. Remove the cover.

Replacing detector signal boards

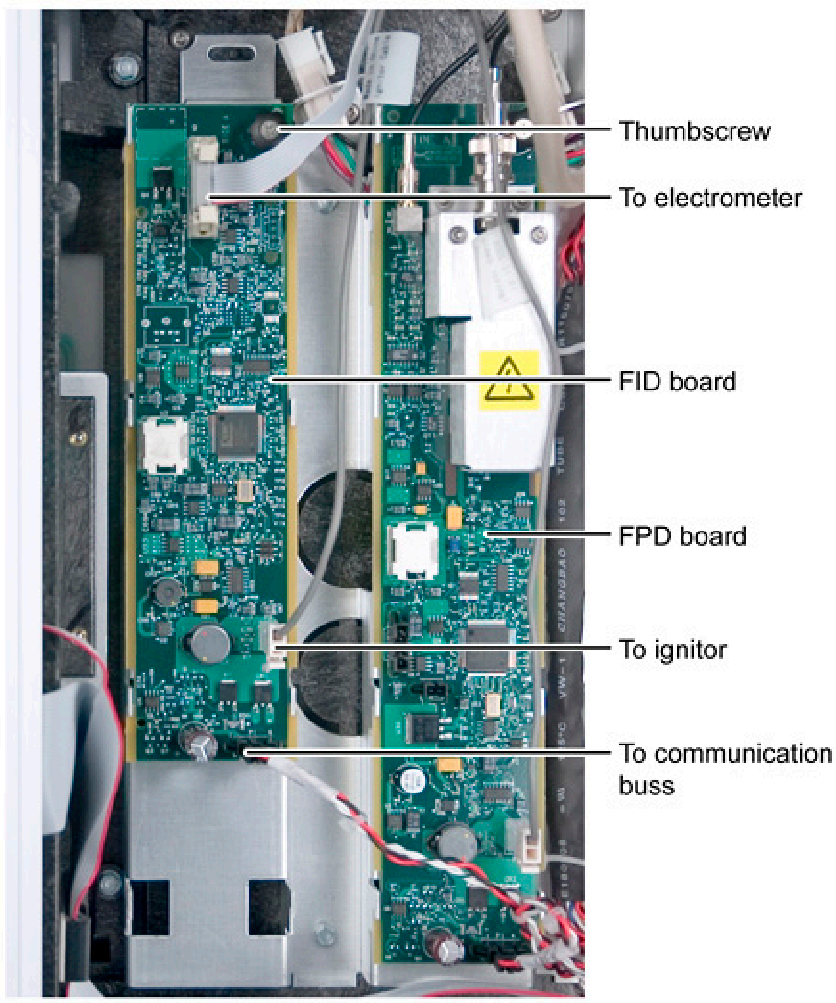
1 Cool down the oven.
2 Turn off the GC main power switch and disconnect its power cord.

WARNING **Hazardous voltages are present in the mainframe when the GC**

power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.

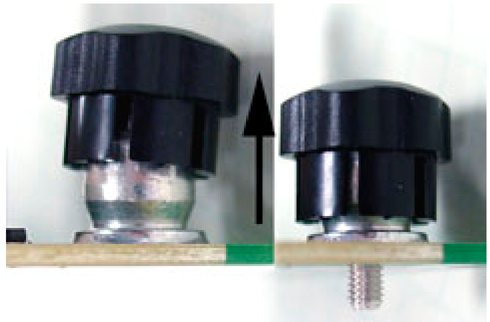
CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Remove the right- hand side panel for the electronics carrier.



4 Disconnect the electrical cables to the board.

5 Turn the thumb screw counter- clockwise and lift the screw to disengage it from the sheet metal.



6 Slide the board down and lift it out.

7 When replacing the signal board, short boards, such as the FID and uECD, slide into 3 slots. Long boards, such as NPD and FPD, slide into 4 slots.

8 Push in on the thumbscrew to engage the threads. Turn the screw clockwise until it is tight.

CAUTION

The grounding point for the signal board is the thumbscrew. If this screw is not secured, the detector signal will be noisy and may cause damage to the board.

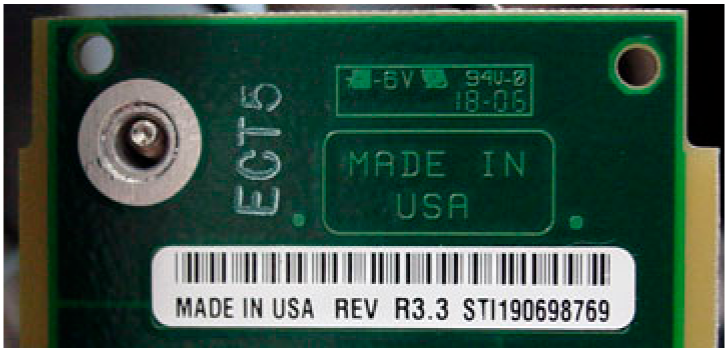
9 Connect the electrical cables to the board.

10 Turn ON the GC and reconfigure the detector signal board. See ***Replacing a GC module*** (220) for details.

Detector signal board, bad checksum error

It is very possible that you will get error messages at power on. The messages can be a fault or exception. They are often due to a checksum error with the detector signal boards. Use the following instructions to add a serial number and manufacturing date to the signal board eeprom.

Detector signal boards are programmed and labelled with a unique ID number along with a manufacturing date. The following is an example of an FPD signal board. The serial number is `STI190698769`.



In some rare occasions, the board ID number or manufacturing date is not programmed into the board's EEPROM. In these cases, the GC will post an exception or a "bad checksum error." In this state, the detector is not usable.

Before you start, you can confirm the problem by trying to view the information. Navigate to Service Mode | Diagnostics | <Front Detector> | Signal board. At the bottom of the table, you will see the manufacturing date and ID number.

You can perform the following procedure to insert the ID number and/or date into the EEPROM of the board. You will need:

- PC with a telnet program, such as, HyperTerminal.
- LAN cable or cross- over cable.
- LAN connection to the GC and IP address for this GC.
- The ID number of the board.

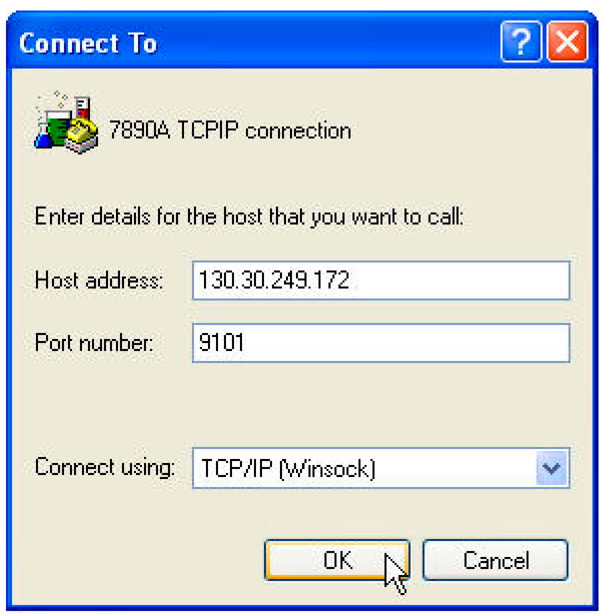
Procedure

1 Power off the GC, remove the detector signal board, and record the serial number.
2 Reinstall the detector signal board and power ON the GC.
3 If necessary, configure the GC and the PC for a LAN connection.
4 Unlock the keyboard.
5 Launch HyperTerminal or other telnet program.

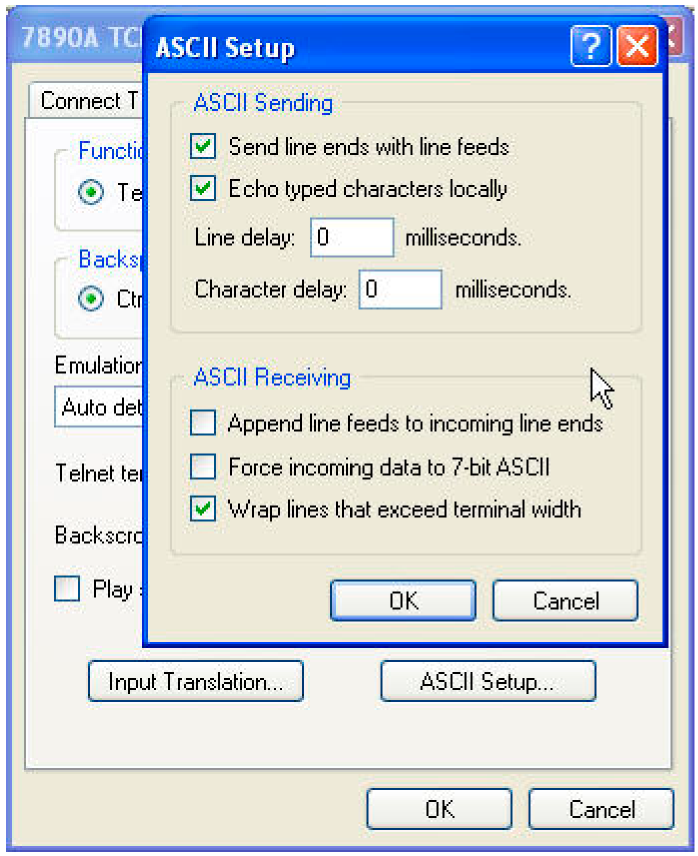
6 Name the connection and click OK.

7 Select TCP/IP (Winsock) for the connection.

8 Enter the IP address of the instrument and a Port number of `9101`.



9 Under the Connection properties select ASCII Setup. Check the items shown below.



10 The GC will automatically reply with this prompt. Enter go and press Enter.

11 Type go and press Enter.

12 For an ID number, enter the following string and press enter. The memory location is 1.

dvcLES<space>< 9 or 8 or 7or 6 ><space>1<space>(string)<serial number>

- 9 for FRONT DET
- 8 for BACK DET

- 7 for AUX DET2
- 6 for AUX DET1 or 3rd detector

13 For a manufacturing date, enter the following string and press enter. The memory location is 7.

dvcLES<space><9 or 8 or 7 or 6><space>7<space>(int)1134699051

If the process is successful, the GC will respond with a 0.

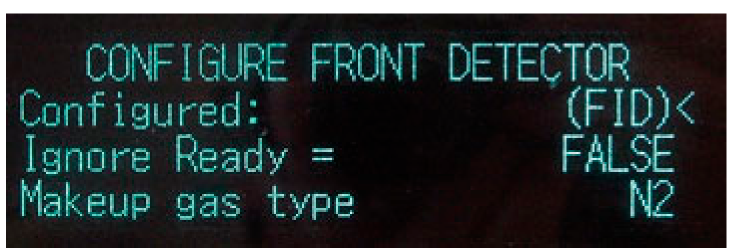
14 After writing the information to the eeprom, confirm the ID number and date by entering these strings and pressing enter.

dvcRES<space>< 9 or 8 or 6 ><space>1<space>(string) and

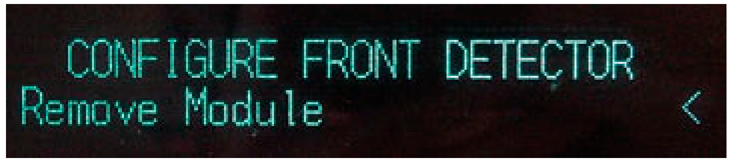
dvcRES<space><9 or 8 or 7 or 6><space>7<space>(int)

15 Next steps reconfigure the detector signal board.

16 Press Config Front or Back Det.



17 Press Mode/Type and press Enter.



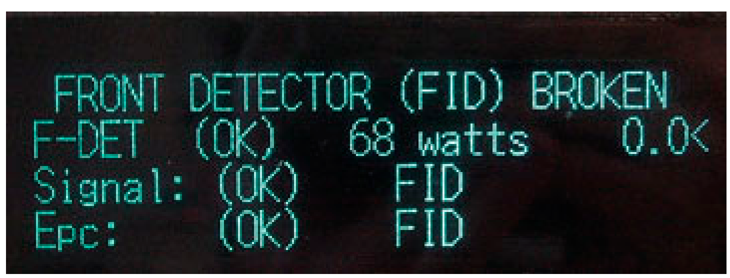
18 The GC displays a message prompting to power cycle. Do not power cycle.

19 Press Mode/Type again and press Enter.

20 Power cycle the GC. Your detector is reconfigured.

If you do not perform steps 14 through 18, the GC will display the following messages at power ON.

and

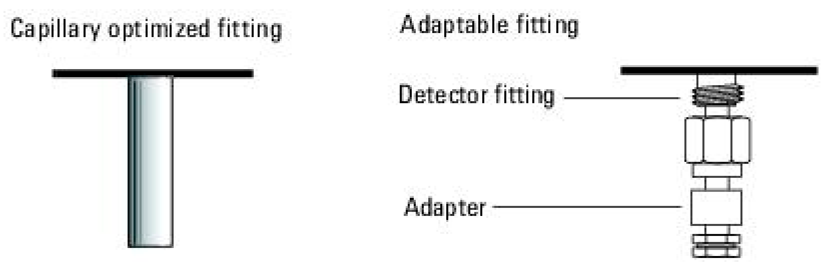


Flame Ionization Detector (FID)

The FID is the most widely used of the GC detectors. It responds to almost all organic compounds (there are a few exceptions), has good sensitivity and a wide linear range, and is easy to use.

Selecting an FID jet

Open the oven door and locate the column connection fitting at the base of the detector. It will look like either a capillary optimized fitting or an adaptable fitting.



- If you have an application that tends to clog the jet, select a jet with a wider tip id.
- When using packed columns in high column- bleed applications, the jet tends to clog with silicon dioxide.
- In simulated distillation applications, the high- boiling hydrocarbons tend to clog the jet.

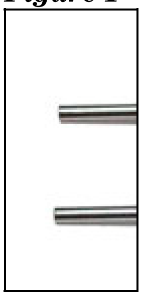
For capillary optimized fittings, select a jet from the table below, "Jets for capillary optimized fittings".

Table 25 Jets for capillary optimized fittings

Figure 1 ID	*Jet type*	*Part number*	*Jet tip id*	*Length*
1	Capillary	G1531- 80560	0.29 mm (0.011 inch)	48 mm

2	High-temperature (use with simulated distillation)	G1531-80620	0.47 mm (0.018 inch)	48 mm

Figure 1   Capillary optimized jets



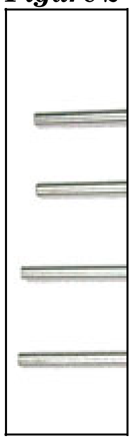
For adaptable fittings, select a jet from the table below, "Jets for capillary adaptable fittings".

Table 26   Jets for capillary adaptable fittings

Figure 2 ID	*Jet type*	*Part number*	*Jet tip id*	*Length*
1	Capillary	19244-80560	0.29 mm (0.011 inch)	61.5 mm
2	Capillary, high-temperature (use with simulated distillation)	19244-80620	0.47 mm (0.018 inch)	61.5 mm
3	Packed	18710-20119	0.46 mm (0.018 inch)	63.6 mm

4	Packed, wide- bore (use with high- bleed applications)	18789- 80070	0.76 mm (0.030 inch)	63.6 mm

Figure 2 Capillary adaptable jets



Replacing the FID interconnect assembly or spring

1 Cool down the oven.
2 Turn off the GC main power switch and disconnect its power cord.

WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.**

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Gather the following:

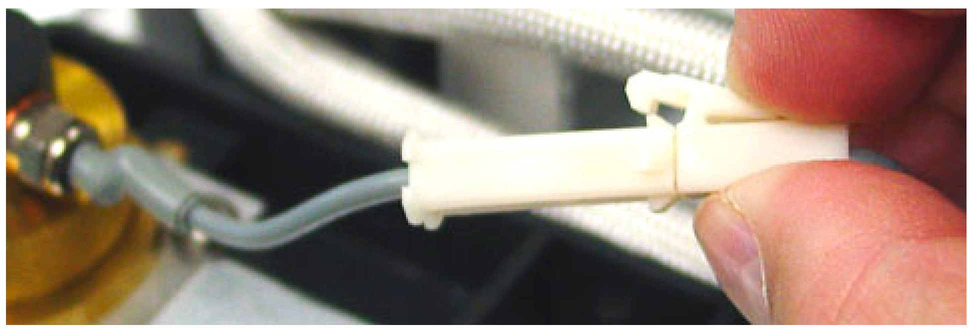
- New FID collector assembly. (See ***Consumables and Parts for the FID*** (474).)
- T- 20 Torx screwdriver
- 1/4- inch nut driver
- Tweezers
- Lint- free gloves

4 Shut off the detector and the detector gases and let the detector cool.

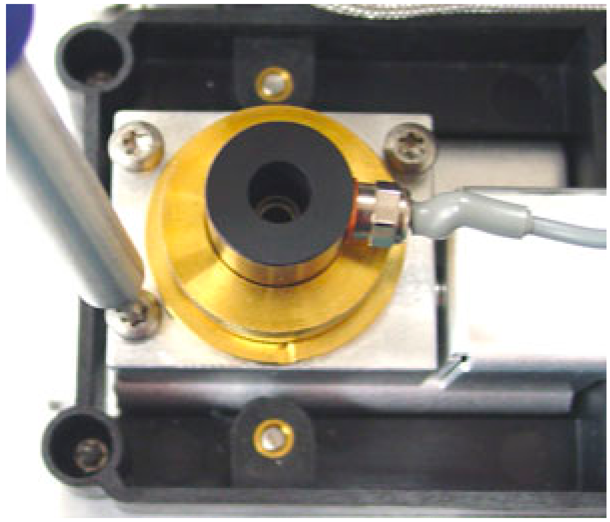
CAUTION

To avoid contaminating the FID, wear clean, lint-free gloves when handling the collector assembly.

5 Disconnect the ignitor cable assembly.



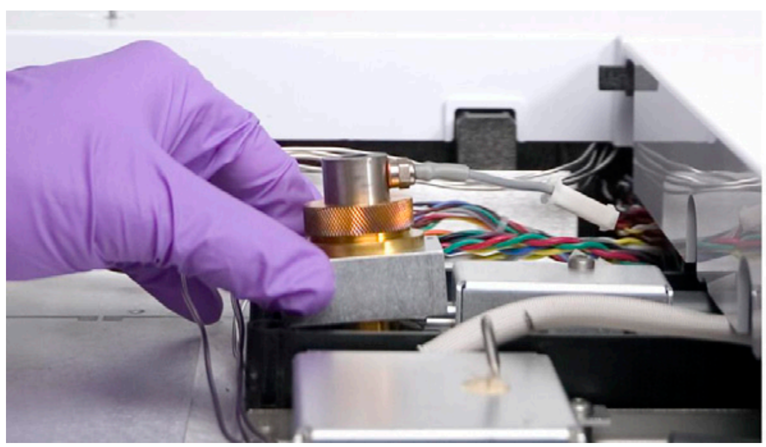
6 Remove the three screws holding the collector assembly to the mounting pallet.



CAUTION

The next step exposes the interconnect spring. Be careful not to touch or disfigure the spring while working on the FID. Any dirt or bending will reduce the sensitivity of your detector.

7 Lift and remove the assembly from the pallet.



To replace the interconnect spring only

1 Pull the spring off the end of the interconnect. Push a new spring on.

2 Reassemble the detector.

To replace the interconnect (and spring)

1 Remove the screws at each end of the electrometer body. DO NOT loosen the screw in the center of the electrometer cover.
2 The interconnect is held by a small spring clip. Remove the screw holding this clip.
3 Disconnect the ribbon cable that connects the electrometer to the signal board. Remove the electrometer.
4 There is a hex section where the interconnect enters the electrometer. Use a wrench to losen and remove the interconnect.
5 Insert a new interconnect and tighten it firmly (do not overtighten!).
6 Reassemble the detector.

7890A Replacing the heater

1 Cool down the oven.
2 Turn off the GC main power switch and disconnect its power cord.

WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.**

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Turn off all gas flows at their sources.

WARNING **Inlets, detectors, and the oven are insulated with fibrous materials which may cause irritation to skin, eyes, and/or mucous membranes. Always wear gloves when working with the insulation. Additionally, if the insulation is flaky/crumbly, wear protective eyewear and a suitable breathing mask and/or**

respirator.

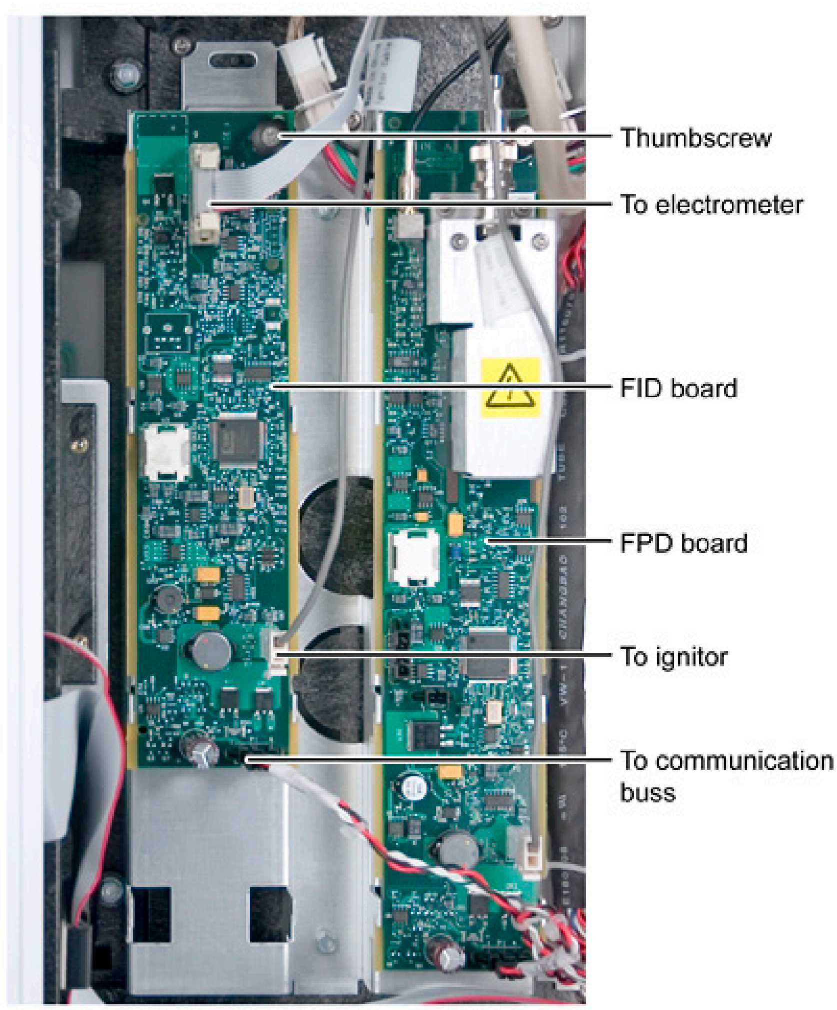
4 Disconnect the column from the bottom of the detector.

5 Remove the right side electronics panel.

6 Access the FID module by unscrewing the single T-20 screw holding the GC cover over the detector(s).

7 Raise it out of the way or remove it temporarily.

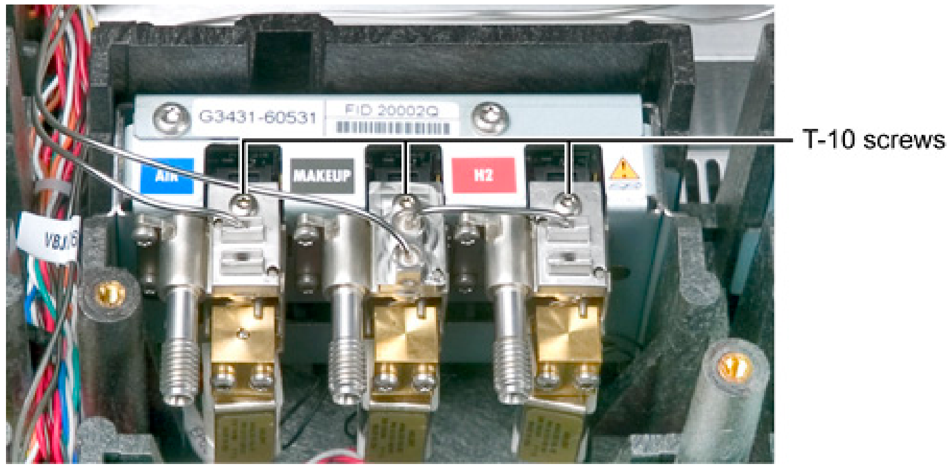
8 Disconnect the heater/sensor cable from the heater/sensor connector.



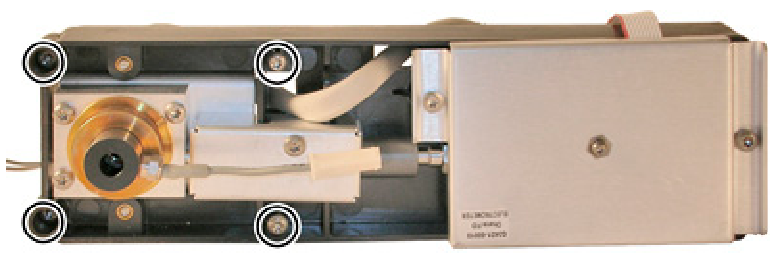
9 Disconnect the ignitor cable from the FID logic board to the ignitor castle.

10 Disconnect the electrometer cable from the FID logic board.

11 Unscrew the three captive T- 10 screws retaining the FID flow blocks to the EPC module.



12 Remove the four T- 20 screws retaining the FID assembly to the GC.



13 Lift the entire FID assembly up and off.

14 Lay the assembly down on a clean flat surface.

15 Examine the underside of the detector assembly.

16 Remove the insulated cover over the heater block.

17 Loosen the heater/sensor cable sufficiently to allow for the lifting and removal of the heater from the heater block.

18 Carefully remove the defective heater/sensor cable and replace it with a new heater/sensor cable.

19 Reassembly is the reverse of these steps.

7890A Replacing the FID logic board

1 Cool down the oven.

2 Turn off the GC main power switch and disconnect its power cord.

WARNING

Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Turn off all gas flows at their sources.

WARNING **Inlets, detectors, and the oven are insulated with fibrous materials which may cause irritation to skin, eyes, and/or mucous membranes. Always wear gloves when working with the insulation. Additionally, if the insulation is flaky/crumbly, wear protective eyewear and a suitable breathing mask and/or respirator.**

4 Remove the right side electronics panel from the GC.

5 Lift up the GC detector cover to access the FID.

6 Disconnect all electrical connections between the FID and the logic board.

7 Rotate the FID board thumbscrew counterclockwise, lift the board up and then downward to remove it from the GC.

8 Replace the defective board with a new FID board.

9 Restore the FID electrical connections.

10 Reassembly is the reverse of these steps.

11 Reconfigure the GC using the front panel keypad, supplying the requested information.

7890A Replacing the electrometer

1 Cool down the oven.

2 Turn off the GC main power switch and disconnect its power cord.

WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.**

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Turn off all gas flows at their sources.

WARNING **Inlets, detectors, and the oven are insulated with fibrous materials which may cause irritation to skin, eyes, and/or mucous membranes. Always wear gloves when working with the insulation. Additionally, if the insulation is flaky/crumbly, wear protective eyewear and a suitable breathing mask and/or respirator.**

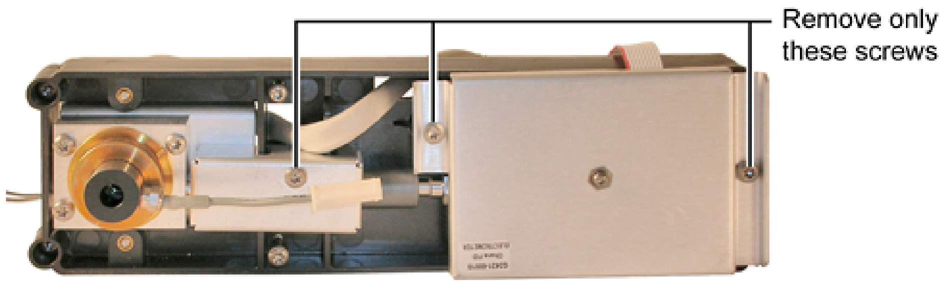
4 Remove the right side electronics cover.

5 Disconnect the electrometer ribbon cable from the FID logic board.

6 Remove the Torx T-20 screw and clamp over the interconnect tube.

7 Remove the two Torx T-20 screws from each end of the electrometer.

8 Lift the electrometer up and away.



9 Replace the defective electrometer with a new one, making sure that there is firm contact between the interconnect spring and the collector.

10 Reassembly is the reverse of these steps.

11 After reassembly, turn the GC power on and reconfigure the modified detector using the front panel keypad, supplying the requested information.

7890A Replacing the glow plug (ignitor)

1 Cool down the oven.
2 Turn off the GC main power switch and disconnect its power cord.

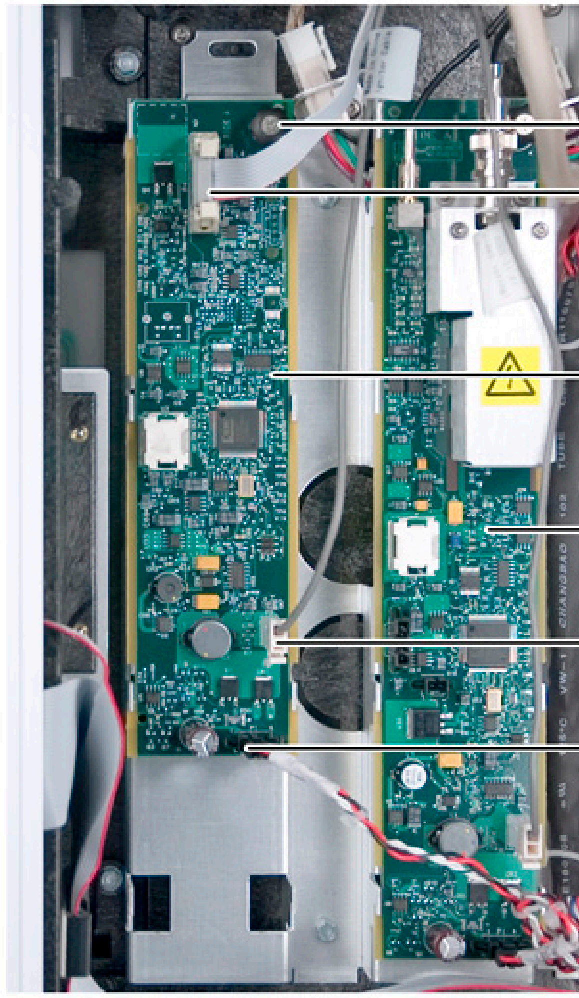
WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.**

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

WARNING **Inlets, detectors, and the oven are insulated with fibrous materials which may cause irritation to skin, eyes, and/or mucous membranes. Always wear gloves when working with the insulation. Additionally, if the insulation is flaky/crumbly, wear protective eyewear and a suitable breathing mask and/or respirator.**

3 Remove the right side electronics panel and identify the FID logic board.

4 Disconnect the ignitor cable from the FID logic board.



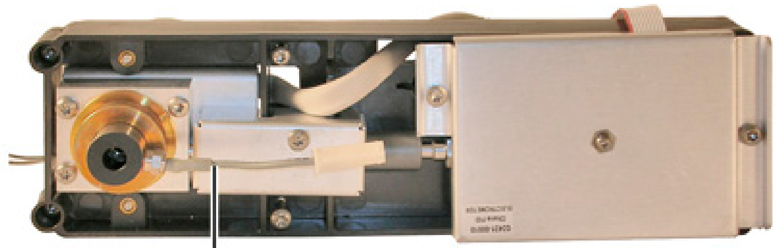
5 Lift up or remove the GC detector cover to access the FID.

6 Unclip the ignitor cable from the cable extension to the FID board.

7 From the top, unscrew the defective ignitor cable from the ignitor castle.

8 Replace the defective cable with a new ignitor cable.

9 Reassembly is the reverse of these steps.



7890A Replacing the entire FID

1 Cool down the oven.

2 Turn off the GC main power switch and disconnect its power cord.

WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.**

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Turn off all gas flows at their sources.

WARNING **Inlets, detectors, and the oven are insulated with fibrous materials which may cause irritation to skin, eyes, and/or mucous membranes. Always wear gloves when working with the insulation. Additionally, if the insulation is flaky/crumbly, wear protective eyewear and a suitable breathing mask and/or respirator.**

4 Disconnect the column from the bottom of the detector.

5 Remove the right side electronics panel.

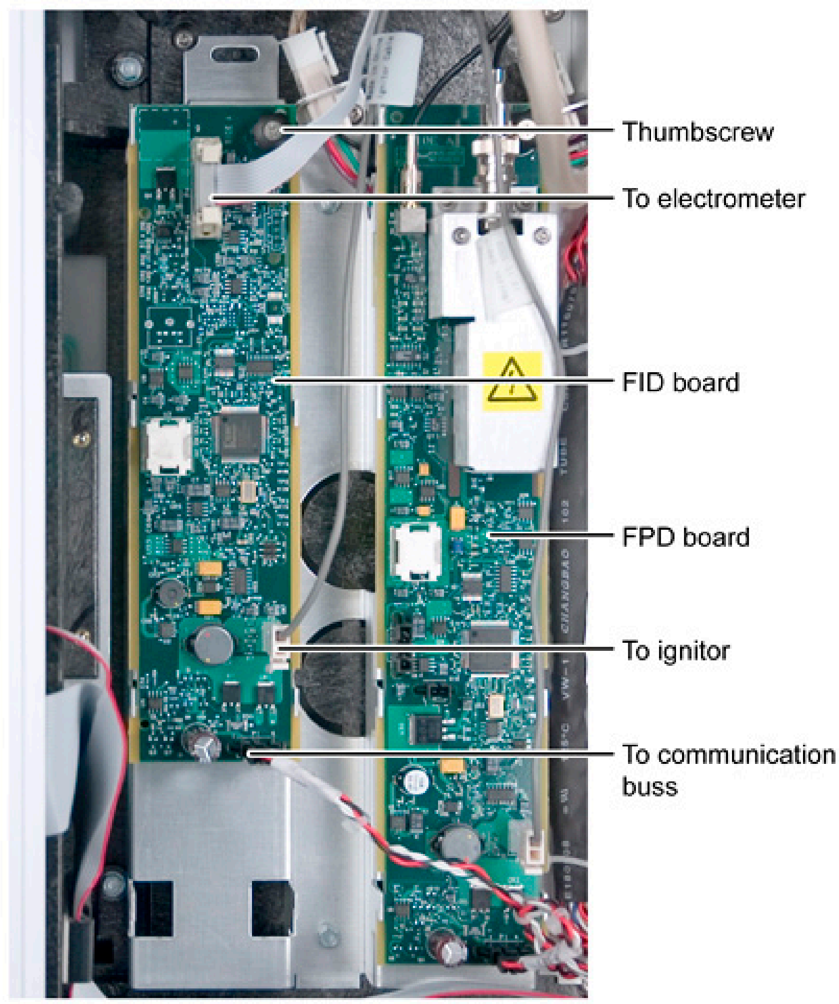
6 Access the FID module by unscrewing the single T- 20 screw holding the GC cover over the detector(s).

7 Raise the cover out of the way or remove it temporarily.

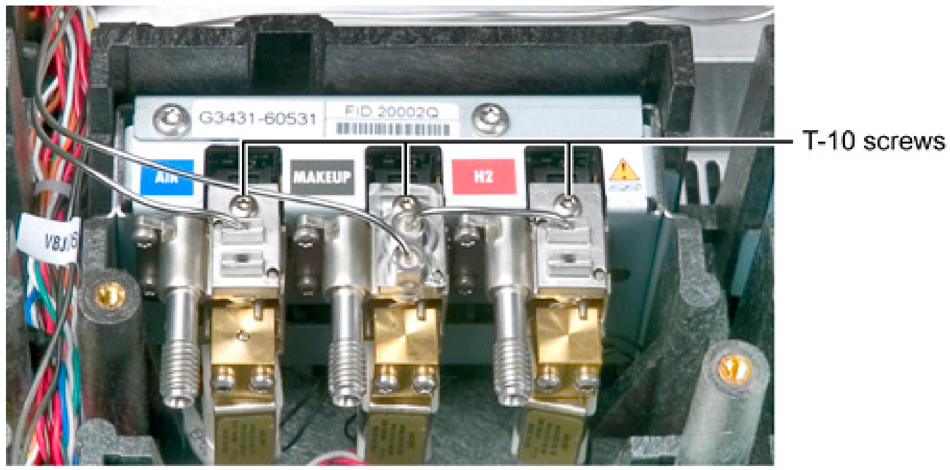
8 Disconnect the heater/sensor cable to the FID.

9 Disconnect the ignitor cable from the FID logic board.

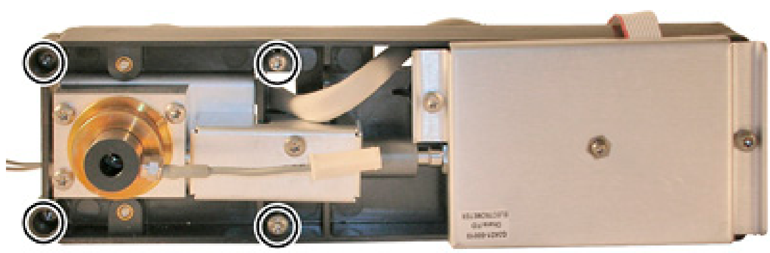
10 Disconnect the electrometer cable from the FID logic board.



11 Unscrew the three captive T- 10 screws retaining the tubing connection blocks to the EPC module.



12 Remove the four T- 20 screws retaining the FID assembly to the mounting pallet.



13 Lift the entire FID assembly up and off.

14 At this point the entire unit can be replaced with a new or repaired unit.

15 Reassembly is the reverse of these steps.

16 After completing the reassembly turn the power on and reconfigure the GC from the front panel keypad.

To clean FID parts using an ultrasonic bath

The collector requires occasional cleaning to remove deposits (usually white silica from column bleed, or black, carbonaceous soot). Deposits reduce sensitivity and cause chromatographic noise and spikes. The cleaning procedure presented here suggests you use an ultrasonic bath to clean the collector and other parts of the detector. However, if your collector is not too dirty, it may be sufficient to scrub it with a nylon brush and then use a burst of compressed air or nitrogen to blow stray particles away.

WARNING

This procedure summarizes the general steps for cleaning the parts. You need to follow the standard safety practices of your laboratory for handling chemicals. For example, wear the appropriate safety eye glasses, lab coat, and gloves.

CAUTION

Scratches on the FID jet affects its performance. If you choose to clean the jet, be sure not to scratch or bend the jet.

CAUTION

The FID castle is coated with a layer of Teflon. Ultrasonic cleaning of this part for more than 5 to 10 seconds will damage this coating.

It is often more convenient to replace dirty jets with new ones than to clean them, especially jets that have been badly contaminated.

1 Gather the following:
   - Small ultrasonic cleaning bath
   - Aqueous detergent
   - GC- grade methanol in a Teflon wash bottle. Wash bottles made of other materials usually contain plasticizer contaminants
   - Dry, filtered, compressed air or nitrogen
   - Clean cloth
2 If you are cleaning the jet, run the cleaning wire through the tip of the jet. Run it back and forth a few times until it moves smoothly. Be careful not to scratch the jet.

3 Place the parts in your glassware, cover them with the aqueous detergent, and place them in the ultrasonic bath.

4 If you are cleaning the castle, sonicate for only 5 to 10 seconds. Push the wire brush through the collector.

   For other parts, sonicate for 1 to 5 minutes.

5 Remove the parts from the bath.

6 Push the wire brush through the collector.

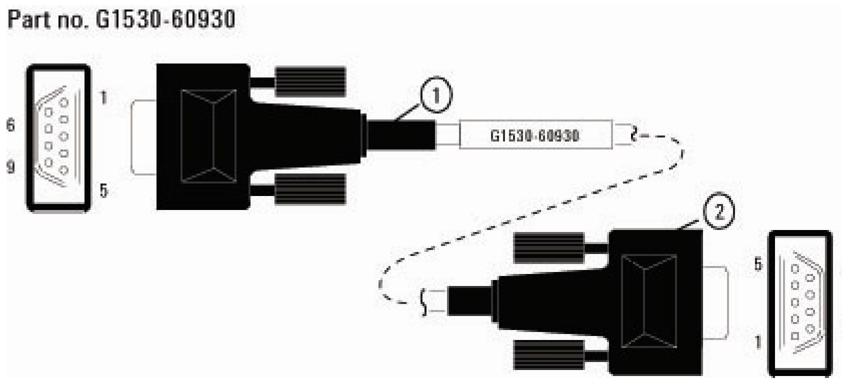
7 Rinse the parts in tap water or distilled water.

8 Rinse all surfaces of the parts in methanol; inside and outside surfaces. To insure good rinsing use either a Teflon wash bottle or a beaker.

9 From this point on, handle the parts only with forceps (or tweezers). Remove the jet from the bath and rinse it thoroughly with hot tap water and then with a small amount of methanol.

10 Blow the jet dry with a burst of compressed air or nitrogen and then place the jet on a clean cloth to air dry.

Cable pinouts, GC to 35900C, D, E/MSD/Sampler, 2 meters



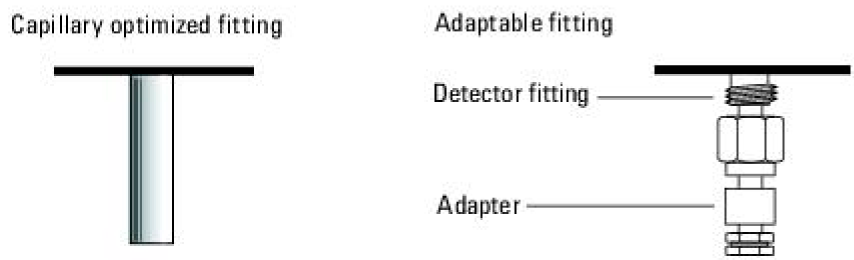
Connector 1 (male)	Signal name	Connector 2 (male)
1	GND	1
2	Prepare	2
3	Start	3
4	Start relay	4
5	Start relay	5
6	No connection	6
7	Ready	7
8	Stop	8
9	No connection	9

Nitrogen Phosphorus Detector (NPD)

The NPD is a variation on the FID, in that the sample is burned and the resulting ions are collected. However, the hydrogen/air ratio is set to suppress carbon ionization and an alkali salt enhances nitrogen and phosphorus ionization.

Selecting an NPD jet

Open the oven door and locate the column connection fitting at the base of the detector. It will look like either a capillary optimized fitting or an adaptable fitting.



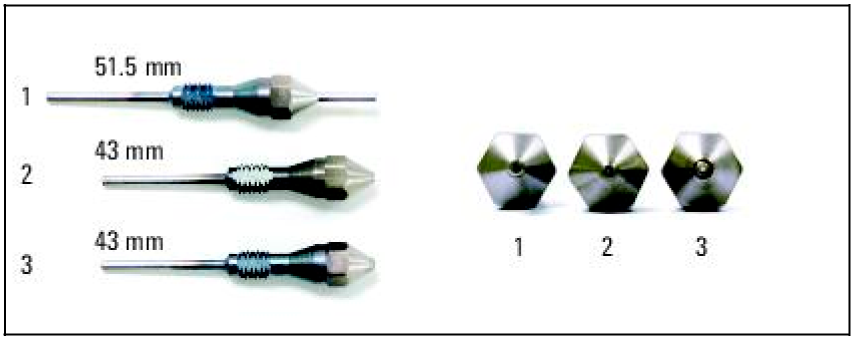
- If you have an application that tends to clog the jet, select a jet with a wider tip id.
- When using packed columns in high column- bleed applications, the jet tends to clog with silicon dioxide.

For capillary optimized fittings, select one of the following from the table below, "Jets for capillary optimized fittings".

Table 36 Jets for capillary optimized fittings

Figure 3 ID	*Jet type*	*Part number*	*Jet tip id*	*Length*
1	Capillary with extended jet (recommended)	G1534- 80580	0.29 mm (0.011 inch)	51.5 mm
2	Capillary	G1531- 80560	0.29 mm (0.011 inch)	43 mm
3	High- temperature	G1531- 80620	0.47 mm (0.018 inch)	43 mm

Figure 3 Capillary optimized NPD jets

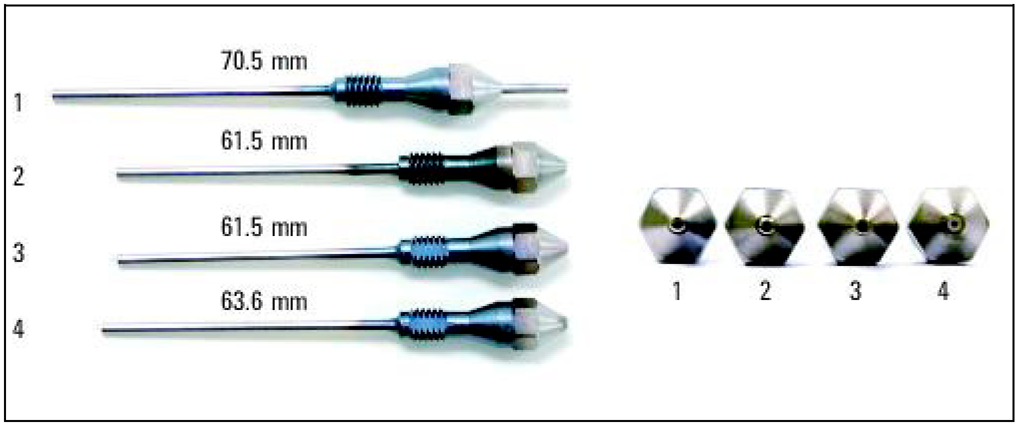


For adaptable fittings, select one of the following from the table below, "Jets for adaptable fittings".

Table 37 Jets for adaptable fittings

Figure 4 ID	*Jet type*	*Part number*	*Jet tip id*	*Length*
1	Capillary with extended jet (recommended)	G1534- 80590	0.29 mm (0.11 inch)	70.5 mm
2	Capillary	19244- 80560	0.29 mm (0.011 inch)	61.5 mm
3	Capillary, high- temperature	19244- 80620	0.47 mm (0.018 inch)	61.5 mm
4	Packed	18710- 20119	0.46 mm (0.018 inch)	63.6 mm

Figure 4 Adaptable NPD jets



Removing the NPD electrometer

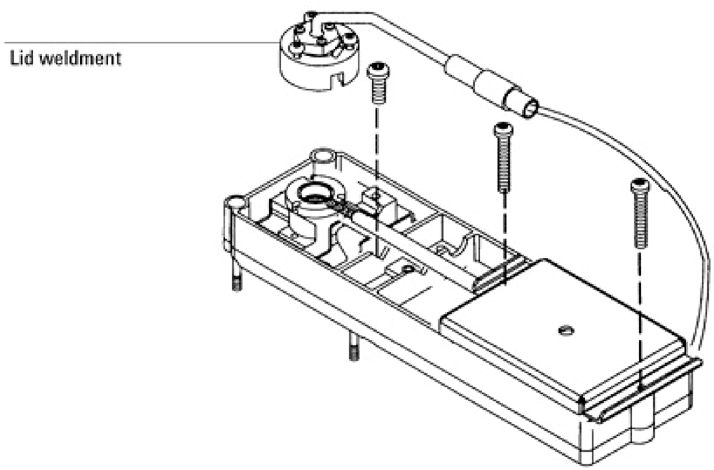
1 Cool down the oven.
2 Turn off the GC main power switch and disconnect its power cord.

WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.**

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Remove both the electronics top cover and the right side cover.

4 Lift up the hinged detector tower cover and remove the Torx T- 20 screw and the clamp on the electrical interconnect.



5 Loosen the three Torx T- 10 screws on the lid weldment and remove the lid.

6 Remove one Torx T- 20 screw from each end of the electrometer. (You do not need to remove the screw on the top of the electrometer that holds the cover on.)

7 Unlock and detach the electrometer's ribbon cable from the detector's interface board and lift the electrometer from the detector pallet.

8 Reassembly is the reverse of these steps.

Replacing the entire NPD

1 Cool down the oven.

2 Turn off the GC main power switch and disconnect its power cord.

WARNING

Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

WARNING **Inlets, detectors, and the oven are insulated with fibrous materials which may cause irritation to skin, eyes, and/or mucous membranes. Always wear gloves when working with the insulation. Additionally, if the insulation is flaky/crumbly, wear protective eyewear and a suitable breathing mask and/or respirator.**

3. Remove the right side electronics panel.
4. Disconnect the column from the bottom of the detector.
5. To access the NPD module unscrew the single T-20 screw holding the GC cover over the detector(s).
6. Raise it out of the way or remove it temporarily.
7. Disconnect the power/sensor cable to the NPD.
8. Disconnect the electrometer cable from the NPD logic board.
9. Remove the three T-10 screws fastening the NPD pneumatic tubing assembly to the EPC module.
10. Remove the four T-20 screws retaining the NPD pallet.
11. Lift the entire NPD unit up and off.
12. At this point the entire unit can be replaced.
13. Reassembly is the reverse of these steps.
14. Restore power and reconfigure the GC using the keypad, supplying the requested information.
15. Note that the replacement of some NPD components does not require the complete removal of this detector.

7890A Replacing an NPD logic board

1. Cool down the oven.
2. Turn off the GC main power switch and disconnect its power cord.

WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock**

hazard by disconnecting the power cord before removing any GC panels.

CAUTION

Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Turn off all gas flows at their sources.

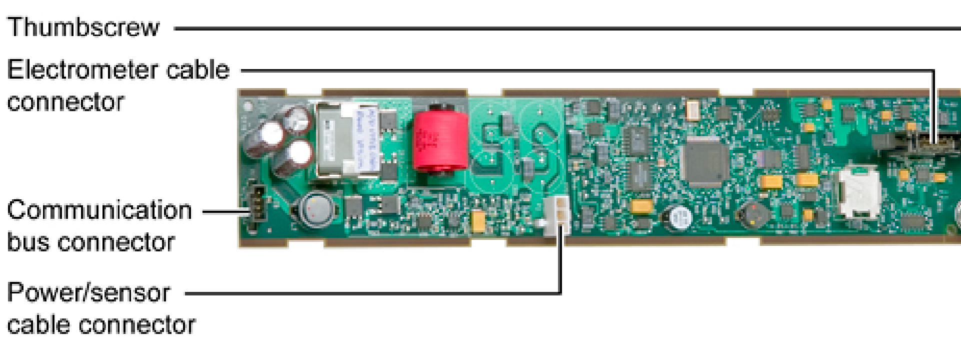
WARNING

Inlets, detectors, and the oven are insulated with fibrous materials which may cause irritation to skin, eyes, and/or mucous membranes. Always wear gloves when working with the insulation. Additionally, if the insulation is flaky/crumbly, wear protective eyewear and a suitable breathing mask and/or respirator.

CAUTION

Wear lint-free gloves to minimize source contamination when servicing the bead assembly.

4 Disconnect three electrical connections (to electrometer, to heater, and the 4- wire communication buss).
5 Turn thumb screw counterclockwise, lift screw to disengage, slide board down, and then lift out. (Note that the grounding point for the board is at the thumbscrew.)
6 Insert the replacement board.
7 Reassembly is the reverse of these steps.
8 Reconfigure the modified GC from the front panel keypad, supplying requested information.



7890A Replacing the NPD heater

1 Cool down the oven.
2 Turn off the GC main power switch and disconnect its power cord.

WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.**

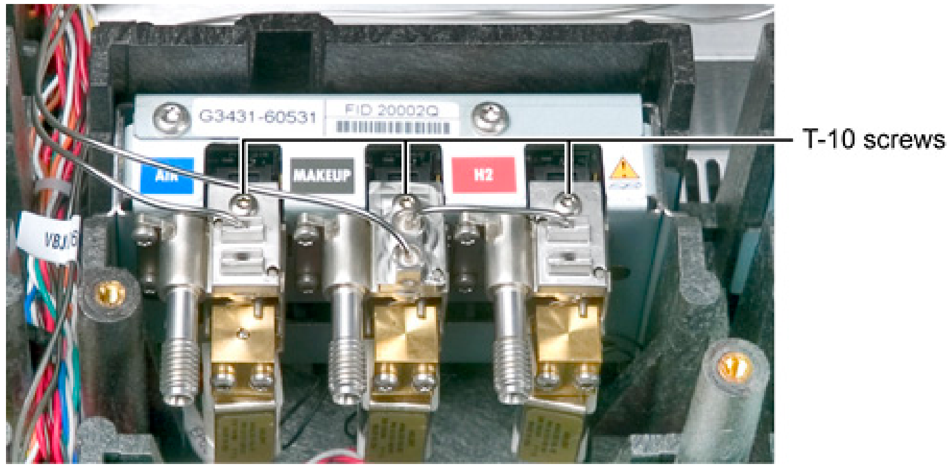
CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Turn off the oven and all heated zones and let them cool.
4 Turn off all gas flows at their sources.
5 Turn off the GC main power switch and disconnect its power cord.

WARNING **Inlets, detectors, and the oven are insulated with fibrous materials which may cause irritation to skin, eyes, and/or mucous membranes. Always wear gloves when working with the insulation. Additionally, if the insulation is flaky/crumbly, wear protective eyewear and a suitable breathing mask and/or respirator.**

6 Disconnect the column from the bottom of the detector.
7 Remove the right side mainframe panel.
8 Access the NPD module by unscrewing the single T- 20 screw holding the GC cover over the detector(s).
9 Raise it out of the way or remove it temporarily.
10 Disconnect the power/sensor cable to the NPD detector.
11 Disconnect the electrometer cable from the NPD logic board.
12 Remove the three T- 10 screws fastening the NPD pneumatic

tubing connectors to the EPC module.



13 Remove the four T- 20 screws retaining the NPD assembly to the GC.

14 Remove the NPD detector assembly from the GC.

15 Examine the underside of the detector assembly.

16 Cover or plug the sample inlet tube while servicing this unit to limit contamination.

17 Remove the insulated cover over the heater/detector block.

18 Loosen the heater cable sufficiently to allow for the lifting off and removal of the heater from the detector block.

19 Remove and replace the entire heater/cable assembly.

20 Reassembly is the reverse of these steps.

1 Cool down the oven.

2 Turn off the GC main power switch and disconnect its power cord.

WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.**

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Turn off all gas flows at their sources.

WARNING

Inlets, detectors, and the oven are insulated with fibrous materials which may cause irritation to skin, eyes, and/or mucous membranes. Always wear gloves when working with the insulation. Additionally, if the insulation is flaky/crumbly, wear protective eyewear and a suitable breathing mask and/or respirator.

CAUTION

Wear lint-free gloves to minimize source contamination when servicing the bead assembly.

4 Remove both the electronics top cover and the right side cover.

5 Lift up the hinged NPD cover and remove the T- 20 screw and J- clamp on the interconnect assembly.

6 Loosen the three Torx T- 10 screws on the lid weldment and remove the lid.

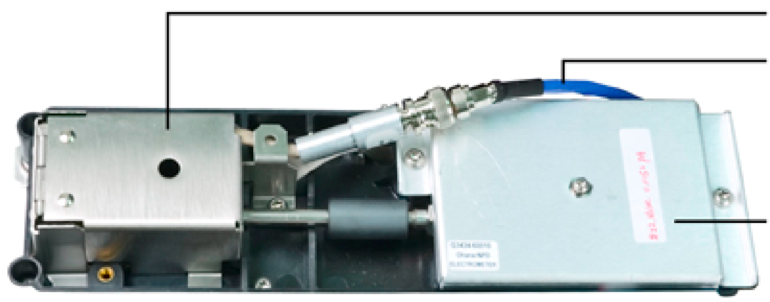
7 Remove one Torx T- 20 screw from each end of the electrometer. Do not remove the screw on the top of the electrometer that holds the cover on.

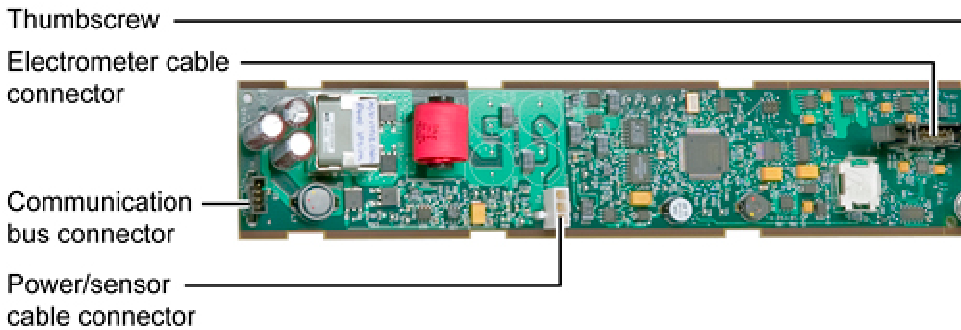
8 Disconnect the power/sensor cable from the bead assembly and from the NPD logic board.

9 Unlock and detach the electrometer's ribbon cable from the NPD logic board and lift the electrometer up from the pallet.

10 Reassembly is the reverse of these steps.

11 Reconfigure the modified GC from the front panel keypad, supplying requested information.





Cleaning the NPD jet and collector

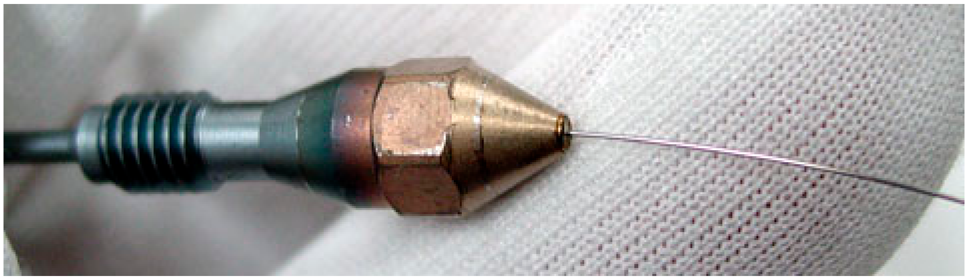
The collector requires occasional cleaning to remove deposits (usually white silica from column bleed, or black, carbonaceous soot). Deposits reduce sensitivity and cause chromatographic noise and spikes. The cleaning procedure presented here suggests you use an ultrasonic bath to clean the collector and other parts of the detector. However, if your collector is not too dirty, it may be sufficient to scrub it with a nylon brush and then use a burst of compressed air or nitrogen to blow stray particles away.

WARNING **This procedure summarizes the general steps for cleaning the parts. You need to follow the standard safety practices of your laboratory for handling chemicals. For example, wear the appropriate safety eye glasses, lab coat, and gloves.**

CAUTION Scratches on the NPD jet affects its performance. If you choose to clean the jet, be sure not to scratch or bend the jet.

It is often more convenient to replace dirty jets with new ones than to clean them, especially jets that have been badly contaminated.

1 Gather the following:
   - Small ultrasonic cleaning bath
   - Aqueous detergent
   - GC- grade methanol in a Teflon wash bottle. Wash bottles made of other materials usually contain plasticizer contaminates.
   - Dry, filtered, compressed air or nitrogen
   - Clean cloth
2 If you are cleaning the jet, run the cleaning wire through the tip of the jet. Run it back and forth a few times until it moves smoothly. Be careful not to scratch the jet.



3 Place the parts in your glassware, cover them with the aqueous detergent, and place them in the ultrasonic bath for 1 to 5 minutes.
4 Remove the parts from the bath and push the wire brush through the collector.
5 Rinse the parts in tap water or distilled water.
6 Rinse all surfaces of the parts in methanol; inside and outside surfaces. To insure good rinsing use either a Teflon wash bottle or a beaker.
7 From this point on, handle the parts only with forceps (or tweezers). Remove the jet from the bath and rinse it thoroughly with hot tap water and then with a small amount of methanol.
8 Blow the jet dry with a burst of compressed air or nitrogen

and then place the jet on a clean cloth to air dry.

7890A Cleaning the NPD

1 Turn off all gas flows at their sources.

2 Turn off the GC main power switch.

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

WARNING **Inlets, detectors, and the oven are insulated with fibrous materials which may cause irritation to skin, eyes, and/or mucous membranes. Always wear gloves when working with the insulation. Additionally, if the insulation is flaky/crumbly, wear protective eyewear and a suitable breathing mask and/or respirator.**

CAUTION Wear lint-free gloves to minimize source contamination when servicing the bead assembly.

3 Remove the right side mainframe panel.

4 To access the NPD module unscrew the single T- 20 screw holding the GC cover over the detector(s).

5 Raise it out of the way or remove it temporarily.

6 Disconnect the power/sensor cable to the NPD.

7 Disconnect the electrometer cable from the NPD logic board.

8 Remove the three T- 20 screws fastening the NPD pneumatic tubing assembly to the EPC module.

9 Remove the four T- 20 screws retaining the NPD assembly to the GC.

10 Lift entire unit up and off.

11 Place unit on a clean surface.

12 Lift up the hinged metal cover over the detector assembly.

13 Remove the three T- 10 screws retaining the bead assembly to the housing and then remove the bead assembly to prevent accidental damage.

14 Do not touch the ceramic bead.

15 Apply protective cap over the bead assembly, if available.

16 Loosen the three captive T- 20 screws retaining the lid.

17 Lift the lid up and off.

18 Using a pair of tweezers, carefully remove the three O- rings, two alumina insulators, and the collector assembly.

19 At this point one can choose to clean only the parts removed or continue the disassembly to remove, clean, or replace the jet.

20 Use a 1/4- inch deep- socket nut driver to unscrew the jet.

21 Use slight side pressure on the nut driver to drag the jet up out of the detector weldment and then use tweezers to grasp and remove the jet.

22 Reassembly is the reverse of these steps.

Thermal Conductivity Detector (TCD)

The TCD is sometimes called the "universal" detector because it responds to anything that is not the carrier gas.

Replacing the TCD detector cell

1 Cool down the oven.

2 Turn off the GC main power switch and disconnect its power cord.

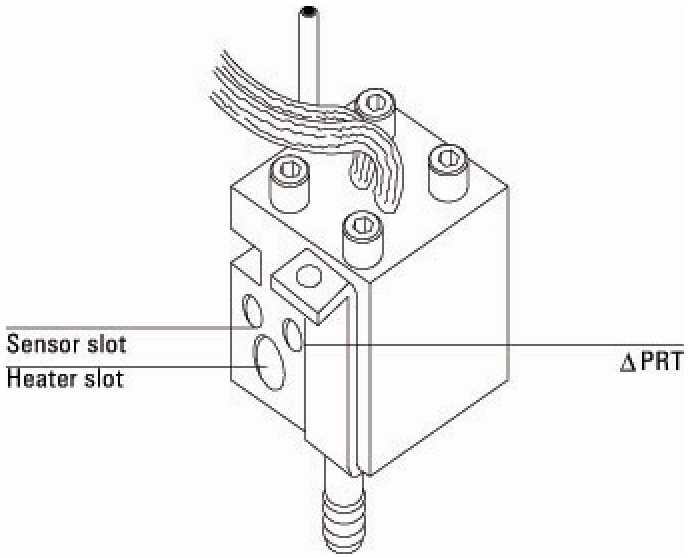
WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.**

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3. Turn off any detector gases at their supply.
4. Shut off the detector and the detector gases and let the detector cool.
5. Remove the detector cover, the electronics cover, the right side cover, the RFI shield, and the rear top panel.
6. Disconnect the TCD filament leads which run from the detector to the detector interface card. Disconnect the wires from the detector interface card using a small flat blade screwdriver to push down on the connector tabs while you pull out the wires.
7. Remove the cover and the insulation.
8. Use a T- 20 Torx screwdriver to remove the two screws securing the detector cell to the aluminum detector carrier bracket and lift the cell from the bracket.
9. Slide the heater/sensor assembly from the detector cell.
10. Slide the ΔPRT out of the detector cell.
11. Install the new cell and reassemble the detector. Reassembly is the reverse of these steps with the following additional considerations:
    - Before replacing the insulation, place the cap that came with your detector over the detector vent to prevent plugging the vent with insulation. Remove the cap once the insulation is in place.
12. When replacing the detector cover, make sure that the hole in the top of the cover is positioned over the detector vent and that the filaments, plumbing and heater/sensor leads including the ΔPRT leads are positioned under the appropriate cut- outs on the sides of the cover.
    - Make sure that only the filament wire is inserted into the connector, not the insulation sleeve. Then, check the filaments by tugging slightly on them.
    - Check the ΔPRT sensor lead connections to the detector card by tugging slightly on them.
    - Replace the heater/sensor and ΔPRT in the sensor holes as shown below.

CAUTION

Make sure the ΔPRT leads are properly installed. If the ΔPRT leads are not properly installed in the detector card, filament burnout can occur.



Replacing the TCD switching valve

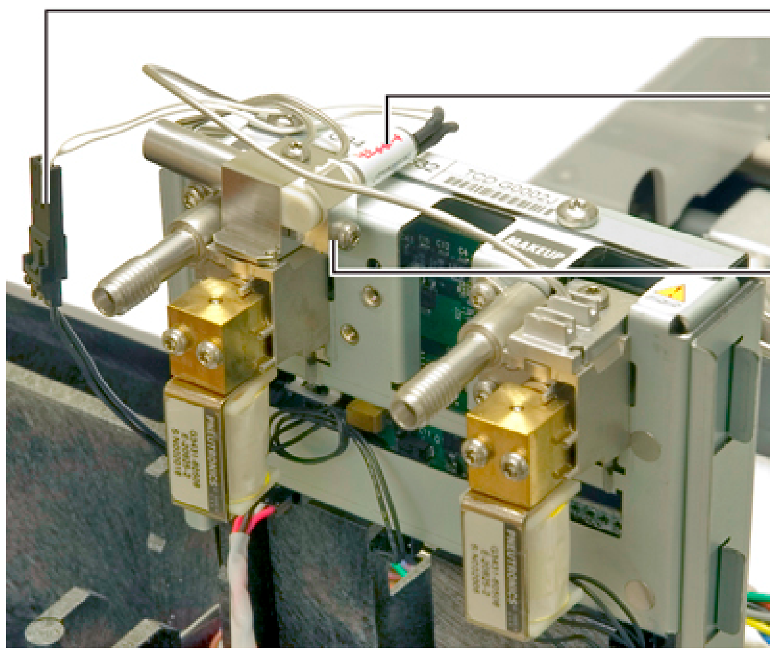
1 Turn off all gas flows at their sources.

2 Turn off the GC main power switch.

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Remove the EPC module cover and the module retainer. With a side- mounted TCD, remove the left side cover.

4 It is possible, but quite difficult, to replace the switching valve without further disassembly. We recommend raising the module for better accessibility. With a side- mounted TCD, remove the module from its bracket.



5 Trace the wires from the valve to the extension cable connector. Disconnect them.

6 Loosen the screw holding the clamp and slide the old valve out.

7 Examine the new valve. The plastic part has a flat side with 3 small O- rings. These must be placed over the 3 holes in the piece to which the screw connects.

8 Slide the new valve into position (flat side against the metal) and place the clamp over it.

9 Align the flat end of the valve with the flat metal surface next to it. Adjust the valve position until it lies flat against the adjacent metal.

10 Tighten the clamp screw. There should be no gap between the plastic and the metal. If there is, loosen the clamp screw and repeat the adjustment.

11 Reconnect the wires and remount the module.

12 Restore the covers.

Micro-cell Electron Capture Detector (uECD)

This detector simply ignores most compounds, but responds with enormous sensitivity to electron- accepting species such as the halogens.

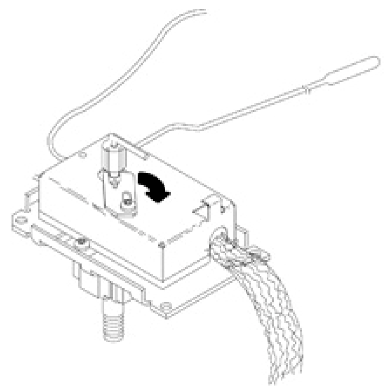
Replacing the uECD heater/sensor assembly

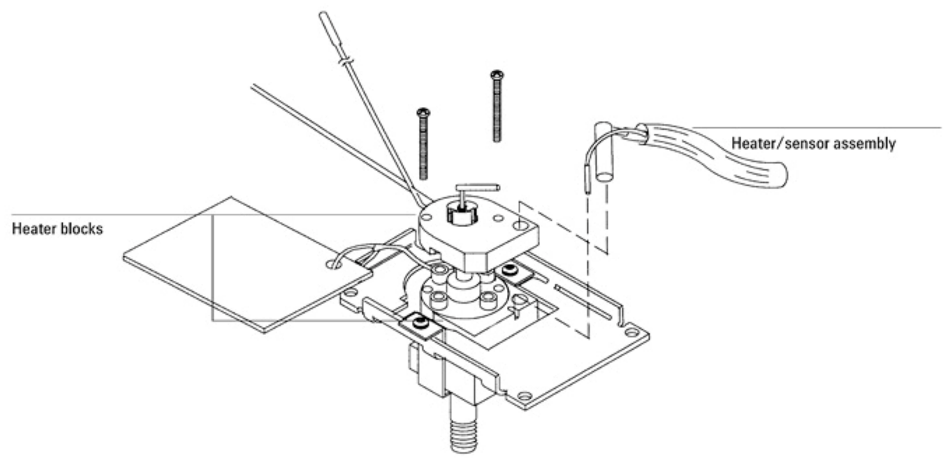
After removing the uECD detector from the GC, you can further disassemble it to replace the heater/sensor assembly.

WARNING **The ECD micro-cell contains radioactive ^{63}Ni. To reduce the risk of exposure, wear disposable gloves while handling the ECD micro-cell. When you are finished, dispose of the gloves and wash your hands with soap and water.**

1. Remove the detector.
2. Loosen the locking tab screw on top of the detector, slide the locking tab back, and pivot it out of the away.
3. Lift the thermal cover up and carefully slide it off the anode assembly.
4. Remove the two screws holding the upper heated block onto the assembly. Lift the block over the anode lead and remove.

5 Slide the heater and sensor out of the lower heated block.





Replacing the uECD makeup gas adapter

After removing the uECD detector from the GC, you can further disassemble it to replace the makeup gas adapter. The makeup gas adapter consists of a line from the detector pneumatics manifold that carries makeup gas to a weldment that screws into the bottom of the uECD detector. From there, the makeup gas sweeps past the end of the column and carries the column effluent into the uECD cell.

1 Remove the detector.

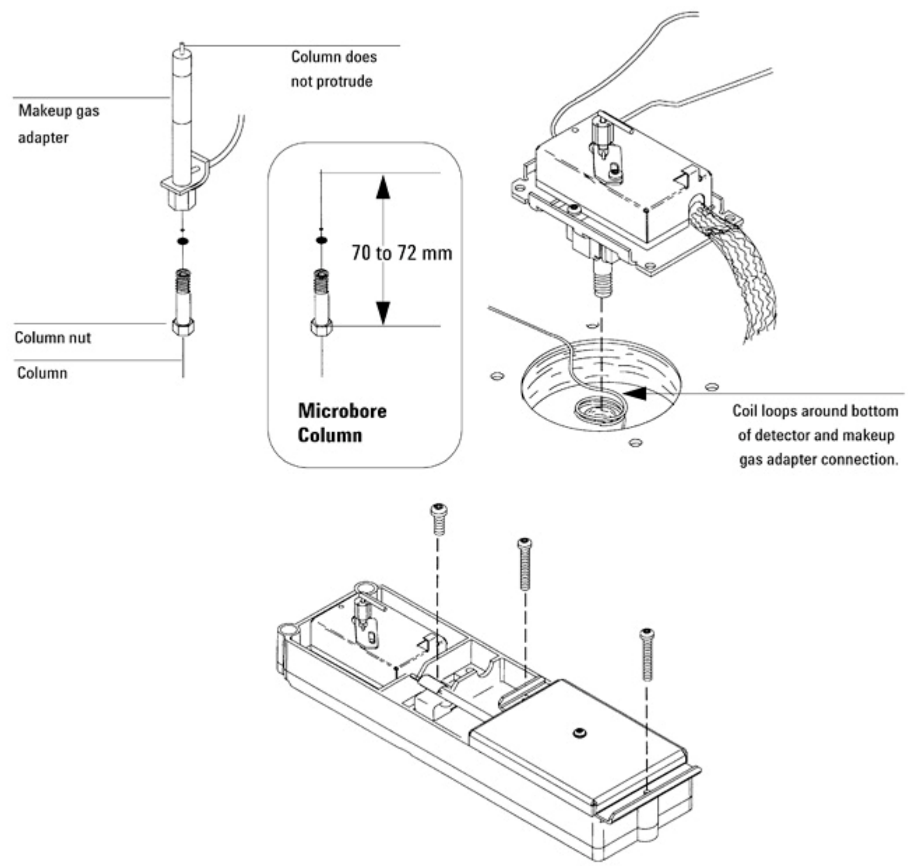
2 Remove the Torx T- 20 screw holding the pneumatics block(s) to the detector manifold.

3 Slide the makeup gas adapter up and out of the GC.

4 When re- installing the makeup gas adapter, ensure the

following:

- Approximately 6 inches of the makeup gas line resides in the oven after installation.
- The makeup gas line is bent into a coil or loop (inside the oven) that loops around the bottom of the detector weldment and makeup gas adapter.
- The end of the column does not protrude from the top of the makeup gas adapter. For most columns (outer diameter > 0.15 mm), insert the column as far as it will go into the gigabore liner. If using a microbore column that passes completely through the liner, position the column so that the total length from the back of the capillary nut to the end of the column is about 70 to 72 mm.



Frequency test

Perform this test to make sure that the base frequency for the uECD during a blank run indicates a relatively contaminant- free system.

NOTE

It may take 24 hours for the uECD baseline to completely stabilize, especially if you are starting with a cold system and want to assure high-sensitivity operation. Therefore, for the most accurate results, run the detector at normal operating conditions for as long as possible (at least 2 hours and up to 24 hours) before running the frequency test.
If you will be injecting into an unused inlet, you must use low-bleed septa. Make sure to condition new septa before use in an inlet for several hours with 1 to 5 mL/min carrier flow.

1 Make sure you are using normal operating conditions and that *at least* 2 hours have elapsed since the last run.
2 Turn on the uECD and the corresponding signal.
3 Check the displayed "Output":
   - <25 = uECD frequency is acceptable
   - ≥1000 = Contaminants in system

NOTE

Each display count equals a frequency of 1 Hertz (e.g., a display reading of 100 = 100 Hz.).

4 If the uECD frequency indicates contamination (≥1000) check for the following:
   - Contaminated carrier gas trap(s) and or supply—replace carrier gas supply tank and any traps on the carrier supply line.
   - Insufficient column conditioning—fully condition the column.
   - Contaminated detector—bake out the detector.
   - Column, inlet and/or septum bleed—clean the inlet/replace the septum with a conditioned, low bleed septum.
   - Leaks—perform leak tests on both the inlet and detector systems.
   - Anode current leakage—make sure the anode contacts are clean. Make sure the anode nut is tight.

Leak test

NOTE Once you have determined that the flow system components upstream from the detector (gas supply tubing, inlet, column fittings) are leak free, perform the following uECD detector leak test.

1 With the GC on and operating normally, set the oven, detector, and inlet temperatures to ambient.
2 Turn off the uECD and then turn off the inlet pressure.
3 Turn off the anode and makeup gas flows.
4 Cap the uECD exhaust vent with a vent plug (part no. 5060-9055).
5 Set carrier gas pressure at the inlet corresponding to the uECD to 15 psi (103 kPa).
6 Wait until the system reaches the setpoint pressure and then turn off the pressure and monitor the actual pressure value for at least 10 minutes.
7 Check for pressure drop:
   - If the pressure stays stable or drops only 0.5 psi, you can consider the uECD leakfree.
   - If the pressure drops more than 0.5 psi, you have a leak.

If you are sure none of the upstream flow system components are leaking, check for leaks at the column fitting and plugged inlet. If you find leaks, tighten the fittings and repeat the leak test.

NOTE If you can find no other leaks, the uECD itself is probably leaking. The uECD cannot be disassembled without special license from the Nuclear Regulatory Commission or Agreement State Licensing Agency (USA only). Return the leaking uECD to Agilent for disposal.

Performing a radioactivity leak test (wipe test)

Micro-cell ECDs must be tested for radioactive leakage at least every 6 months. Records of tests and results must be maintained for possible inspection by the Nuclear Regulatory Commission and/or responsible state agency. More frequent tests may be conducted when necessary.

The procedure used is the wipe test. A Wipe Test Kit (part no. 18713-60050) is supplied with each new uECD. Refer to the information card supplied in the Wipe Test Kit for instructions on performing the wipe test.

Flame Photometric Detector (FPD)

The sample is burned in a hydrogen-rich flame. Excited species rise into a cooler zone above the flame, decay, and give off characteristic radiation. This is filtered and measured by a high-gain photomultiplier.

The intense yellow carbon radiation is blocked by a shield around the flame. Filters select either sulfur or phosphorus radiation.

Preparing for maintenance

1 Turn off all gas flows at their sources.
2 Turn off the GC main power switch.

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

CAUTION To prevent damage to the column or columns, remove the columns from the GC.

Additional tasks in preparation include:

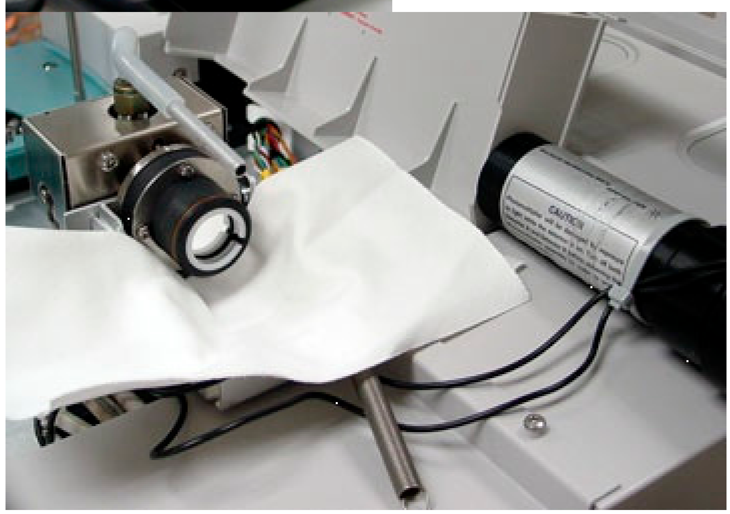
- If you are replacing the transfer line, turn off the source gases to the FPD detector.
- If you are not replacing the transfer line, plug base of transfer line with a 1/8-inch Swagelok nut to keep it clean.

Disassembling the FPD

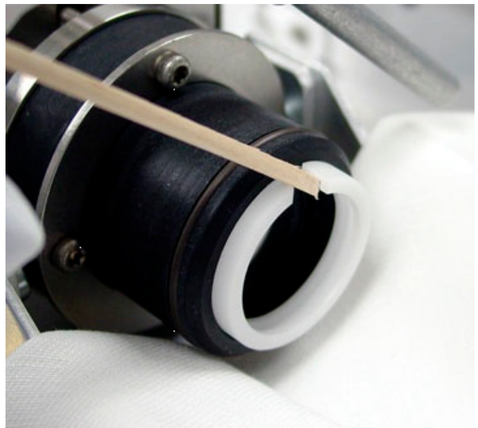
Our objective here is to disassemble the detector and prevent it from getting dirty. We recommend using lint free gloves during most of these steps.

1 Disconnect the spring and remove the photomultiplier tube

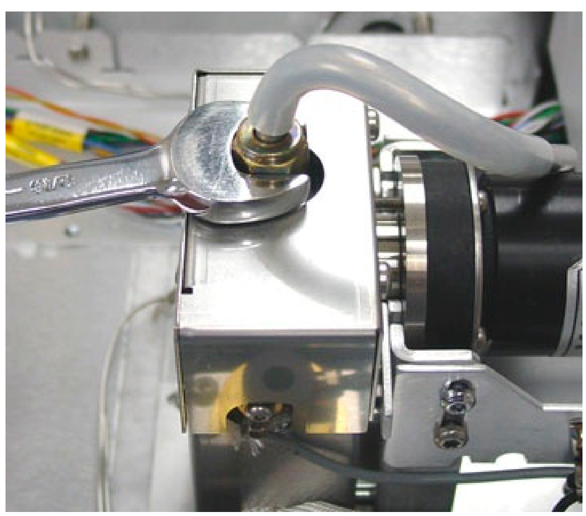
(PMT). Place it in a safe place away from the light. The dual FPD will have 2 PMTs.



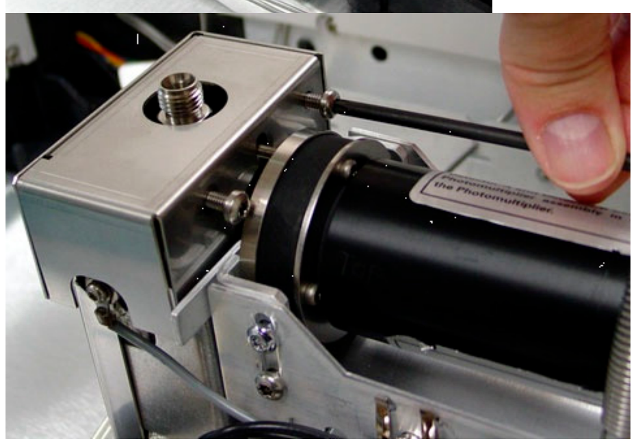
2 Remove and set aside the filter in a lint free cloth. For sulfur, remove the plastic spacer and then the filter. Try tapping the side of the detector or using the edge of a cotton swab. The phosphorus filter sits closer to the end of the housing.



3 Remove the vent or exhaust tube with a 9/16- inch wrench.

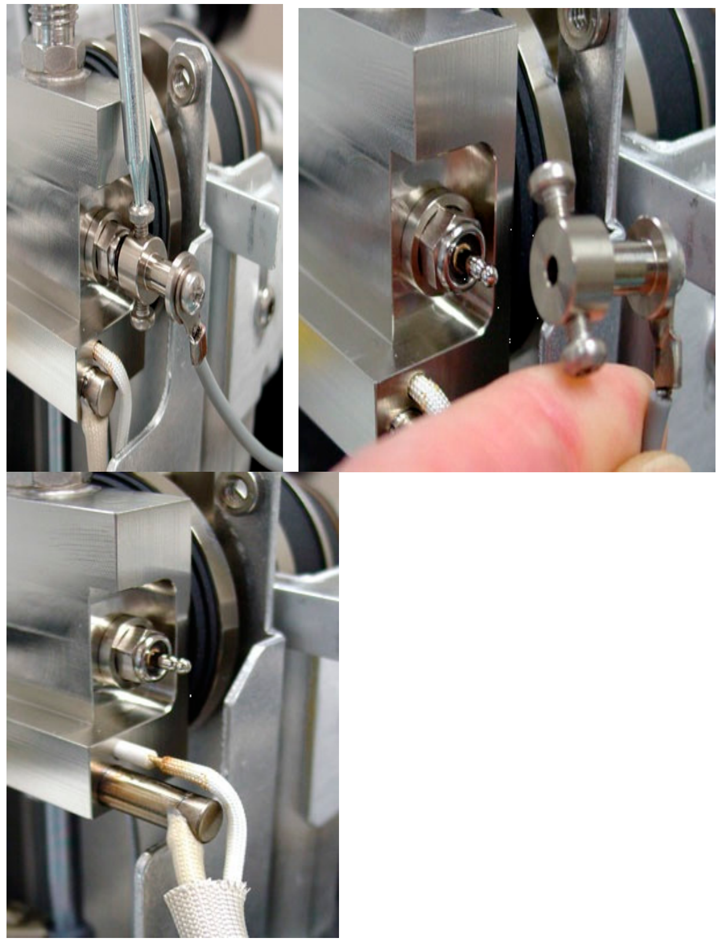


4 Remove the 4 screws and detector cover with a Torx T- 20 driver.



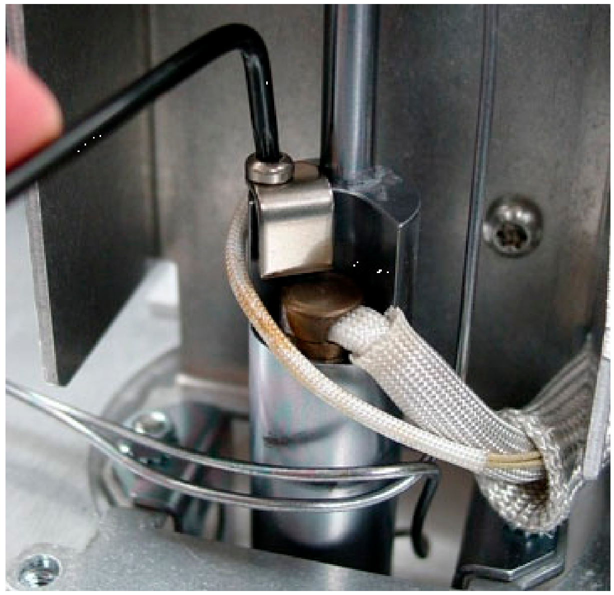
5 Loosen one screw and remove the ignitor collar with a Torx T- 10 driver. The collar of your ignitor may have 1 or 2 screws.

6 Remove the heater/sensor assembly from the emission block.



The heater/sensor assembly for the dual FPD attaches with a screw.

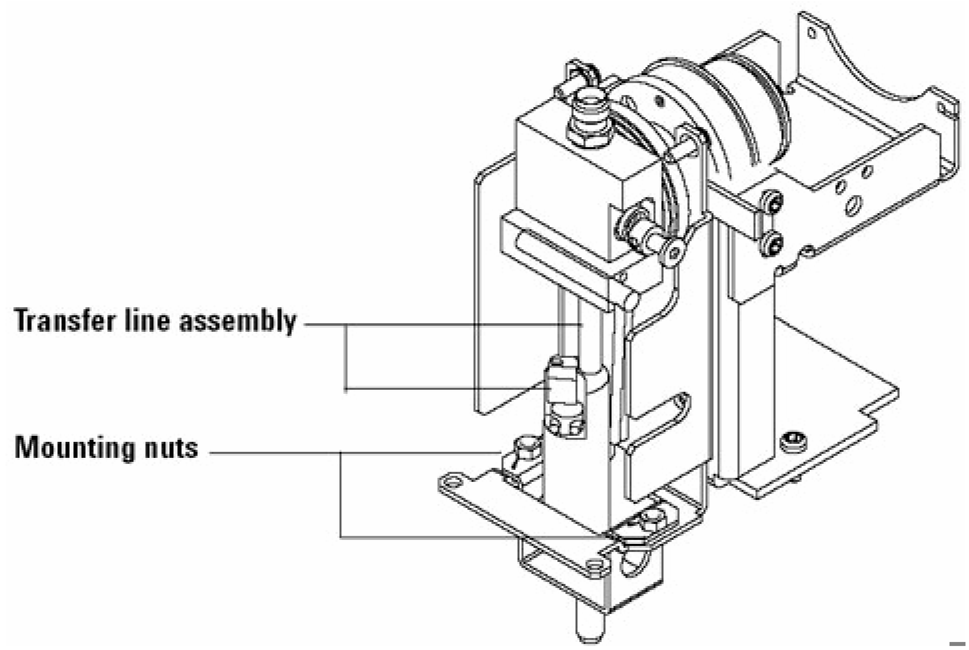
7 Remove one screw and retainer for the heater/sensor assembly in the transfer line with a Torx T- 10 Key.



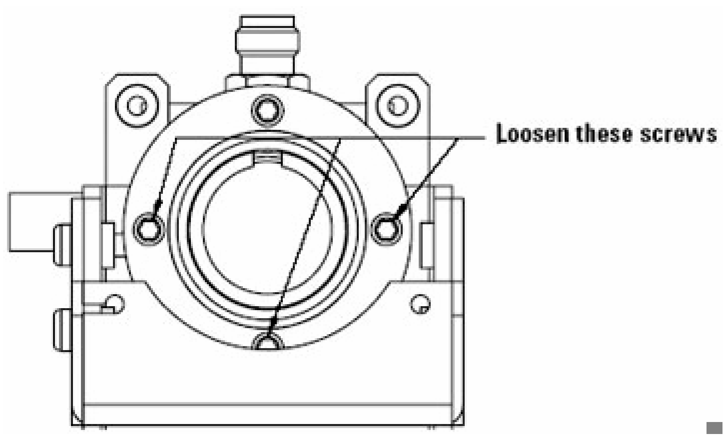
8 Remove the heater/sensor assembly.

9 Move the heater/sensor assemblies and ignitor cable to the front of the oven top.

10 Remove two 7- mm mounting nuts from the base of the transfer line.

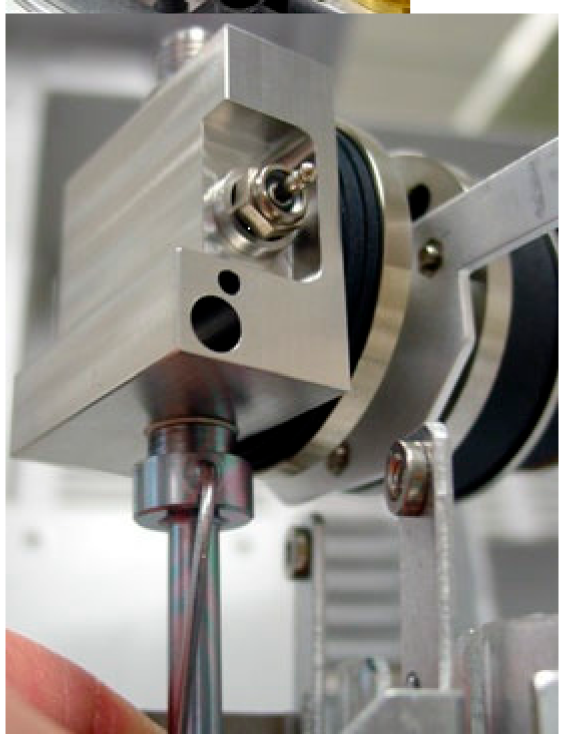


11 Loosen 3 screws that hold the optics assembly to the detector bracket with a Torx T- 10 driver.



12 The objective of this step is to separate the optics from the transfer line. Do not flex the tubing where it is brazed to the transfer line weldment.

Grasp the transfer line with your left hand and the optics assembly with your right hand. Lift them just high enough so that the 3 screws that you loosened in step 11 are above the bracket.



13 Twist and lift the optics while holding the transfer line stationary. Carefully separate the assemblies. The O- ring on the transfer jet is compressed against the inside of the

emissions chamber. This is the resistance that you feel.

14 Place the optic assembly on a lint free cloth.

15 If you are not replacing the transfer line, skip to the section ***Rebuilding the optics assembly*** (133). If you are replacing the transfer line, continue with the next section.

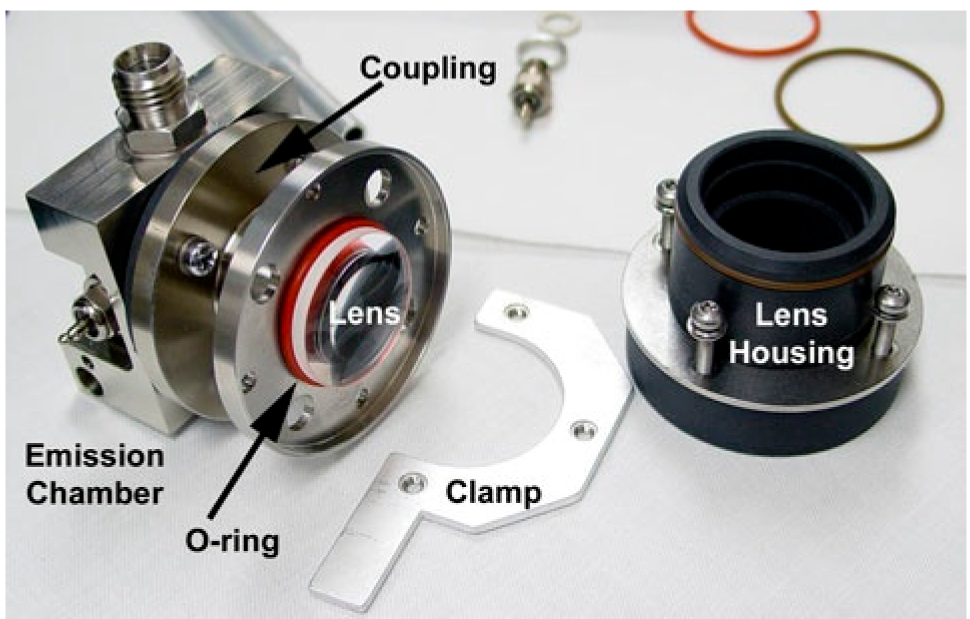
Rebuilding the FPD optics assembly

Use lint- free gloves when handling the optics assembly and O- ring seal.

1 Completely loosen the 4 T- 10 screws from the clamp and coupling.

2 Set the Y-shaped clamp to one side.

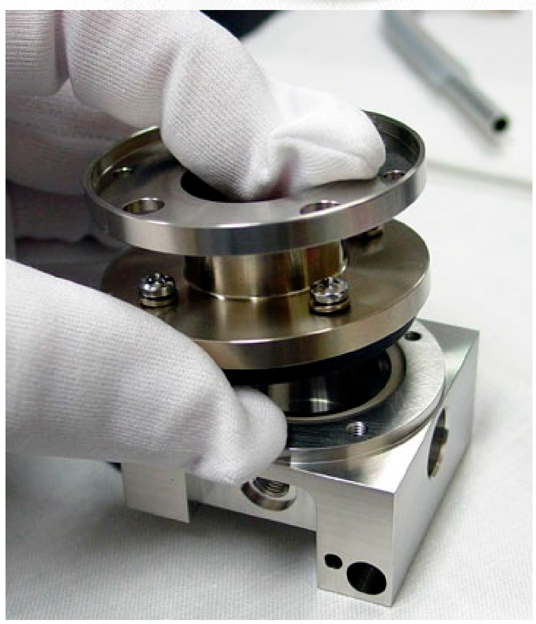
3 Carefully separate the lens housing from the stainless steel coupling. The focusing lens and O-ring usually stick to the coupling, but could stay with the lens housing. Try to keep the housing, flange ring, screws and washers in place.



4 Remove the brown O-ring on the lens housing with a small

pick. Roll the new seal over the edge of the housing until it sits in the groove.

5 Remove the coupling and heat shield disk from the old emission chamber with a No 1 Pozidrive or Philips screwdriver. Try to keep the screws, washers, and parts together.

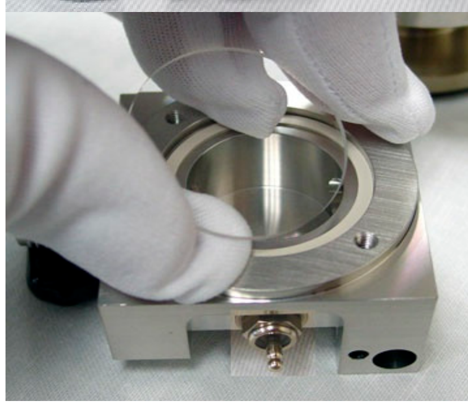


6 Assemble the ignitor parts. Slip the stainless steel spacer over the glow plug, followed by the O- ring. Do not use the

copper washer.

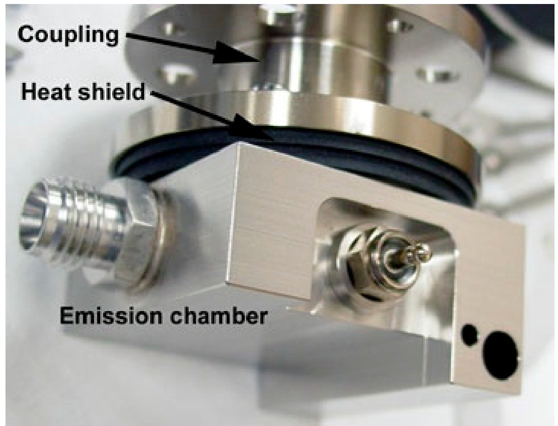
7 Screw the glow plug into the new emission chamber and tighten with a 5/16- inch wrench.

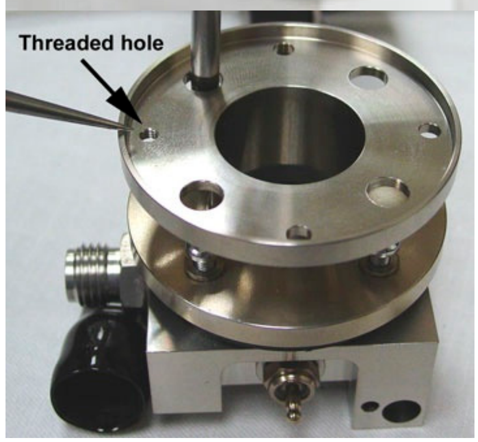
8 Assemble the new emission chamber, seal, and window.



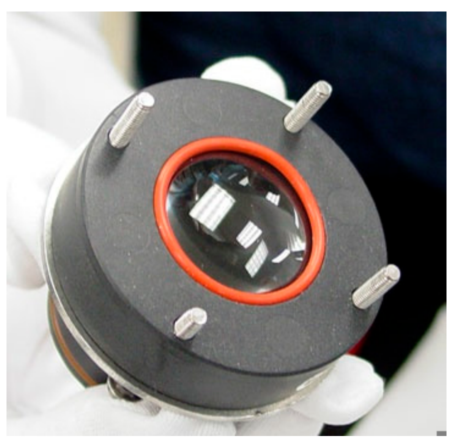
9 Position the heat shield and coupling onto the emission chamber so the threaded hole is aligned with the threaded fitting for the exhaust tube.

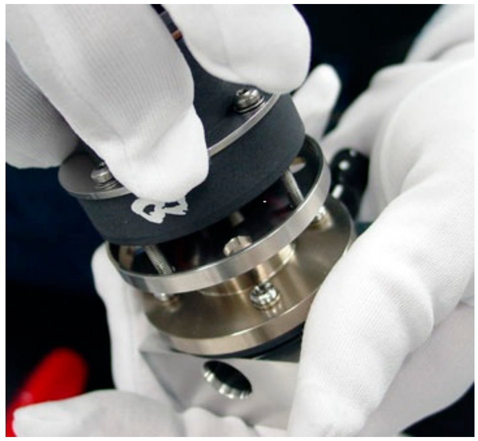
10 Reconnect the parts using the 4 screws and washers. Tighten opposite screws, similar to a wheel on an automobile, to insure a good seal.





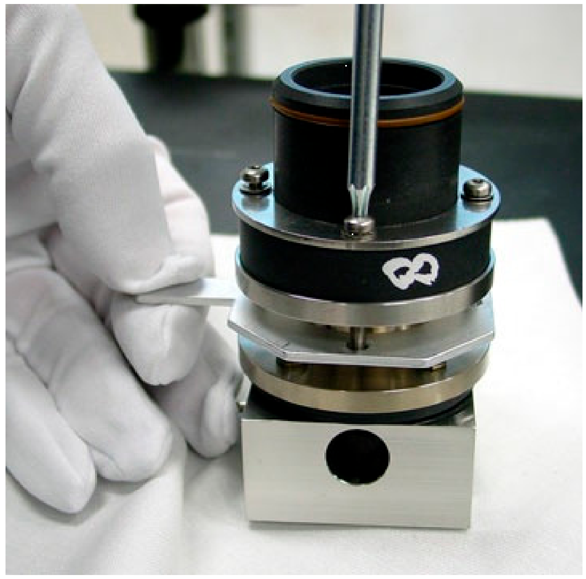
11 Turn the lens housing so that it faces the coupling. Insert the lens and rust colored O- ring.





12 Place the housing onto the coupling and fasten the top screw just tight enough to keep the parts together.

13 Hold the y- shaped clamp and start the remaining screws into the clamp. Do not tighten until step 7 of ***Reassembling the detector*** (139).



Reassembling the FPD

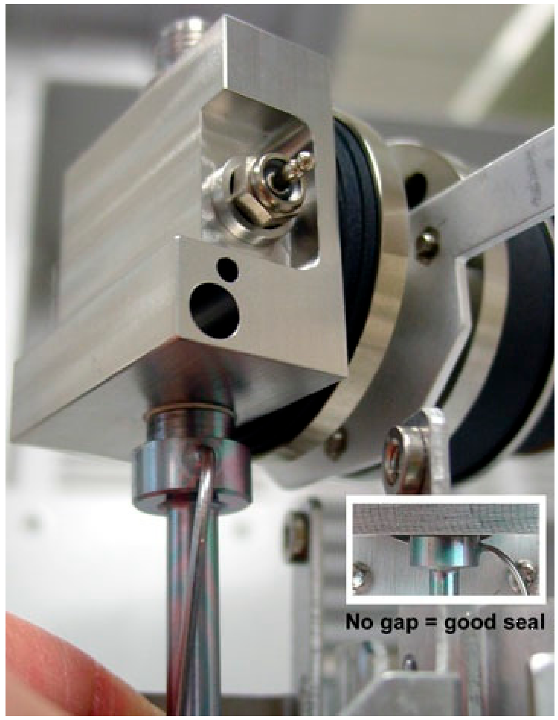
This part of the procedure reassembles the optics assembly with the transfer line, reconnects both to the detector bracket, replaces the heater/sensor and ignitor wires, replaces the covers and PMT.

1 Replace or install the O- ring on the transfer line jet. Remove the O- ring with a small pick. Place the new O- ring over the jet. Roll it into the groove below the jet.

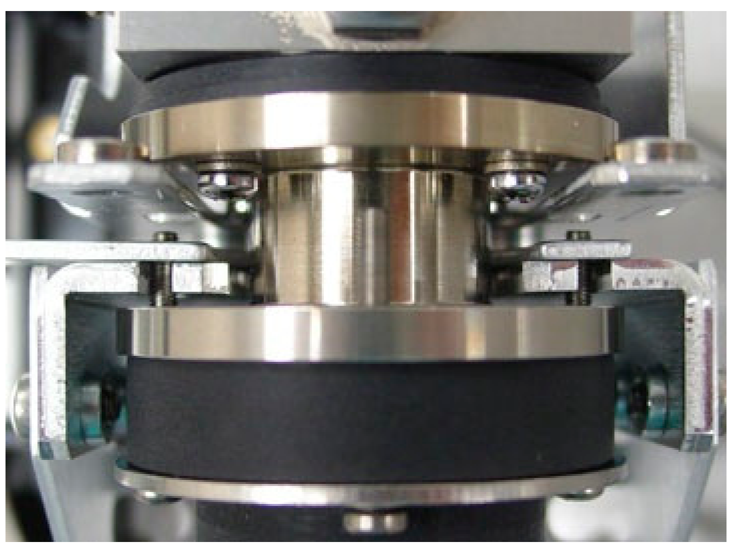
2 Reposition the detector optics above the bracket.

3 The objective of this step is to reattach the optics to the transfer line and insure a good seal between the O- ring and the emissions chamber. Grasp the transfer line with your left hand and the optics assembly with your right hand. Push them together while twisting back and forth.

4 Before lowering the assemblies into the bracket, make sure there is no gap between the transfer line and the emission chamber.



5 Lower the assemblies into the bracket. Line up the holes in the transfer line base with the threaded posts in the bracket. Line up the 3 screws and the clamp with the notches in the detector bracket.



6 Reattach the transfer line to the bracket with the 7- mm nuts.

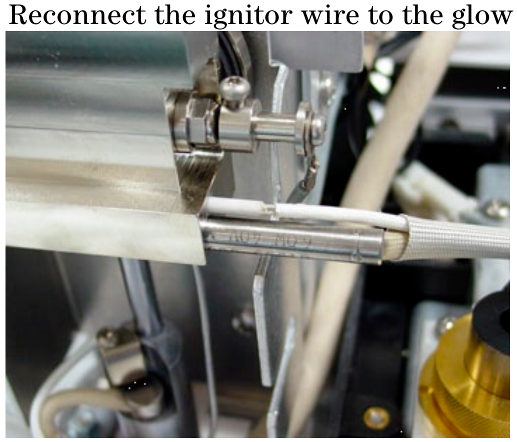
7 Tighten the clamp against the detector bracket. Tighten the 3 bottom screws on the optics assembly.

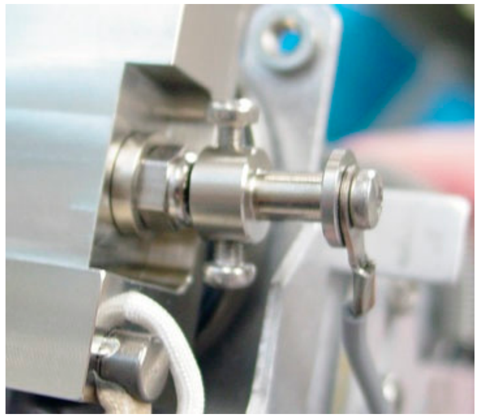
8 Insert the heater/sensor assembly into the transfer line. Make sure the sensor is at the bottom of the hole.

9 Reinstall the retainer and screw.

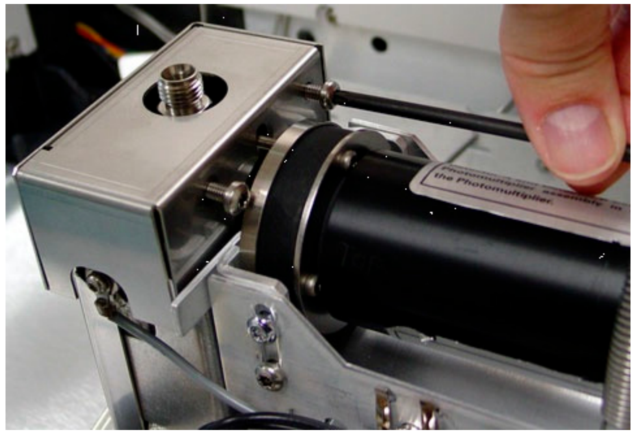
10 Insert the heater/sensor assembly into the emission chamber.

11 Reconnect the ignitor wire to the glow plug.





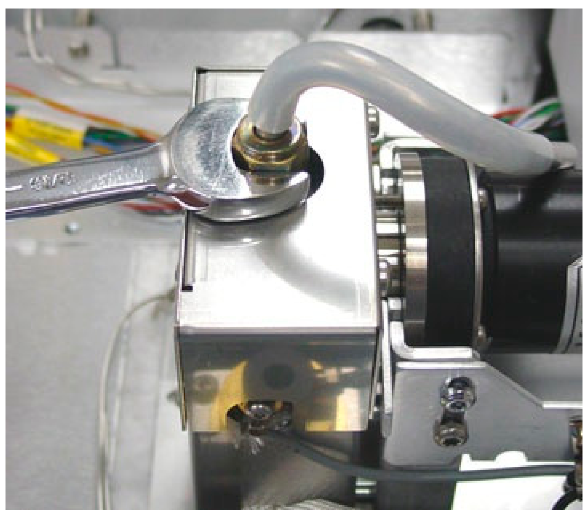
12 Replace the cover. First, start the 2 screws on the right-hand side of the cover. Second, start and tighten the screws at the base on the left-hand side. Third, tighten the screws on the right-hand side.



13 Replace the filter. If you are doing the Agilent checkout, run the phosphorus filter before the sulfur filter with spacer.

14 Replace the photomultiplier tube (PMT). Connect the spring.

15 Install the new vent tube. Make sure it is tight to prevent light leaks.



Bake out and run checkout test

This part of the procedure bakes out the detector and restores conditions. The detector output will level off in about 1 hour after you restore the conditions. The detector output will continue to drift down slowly for about 24 hours.

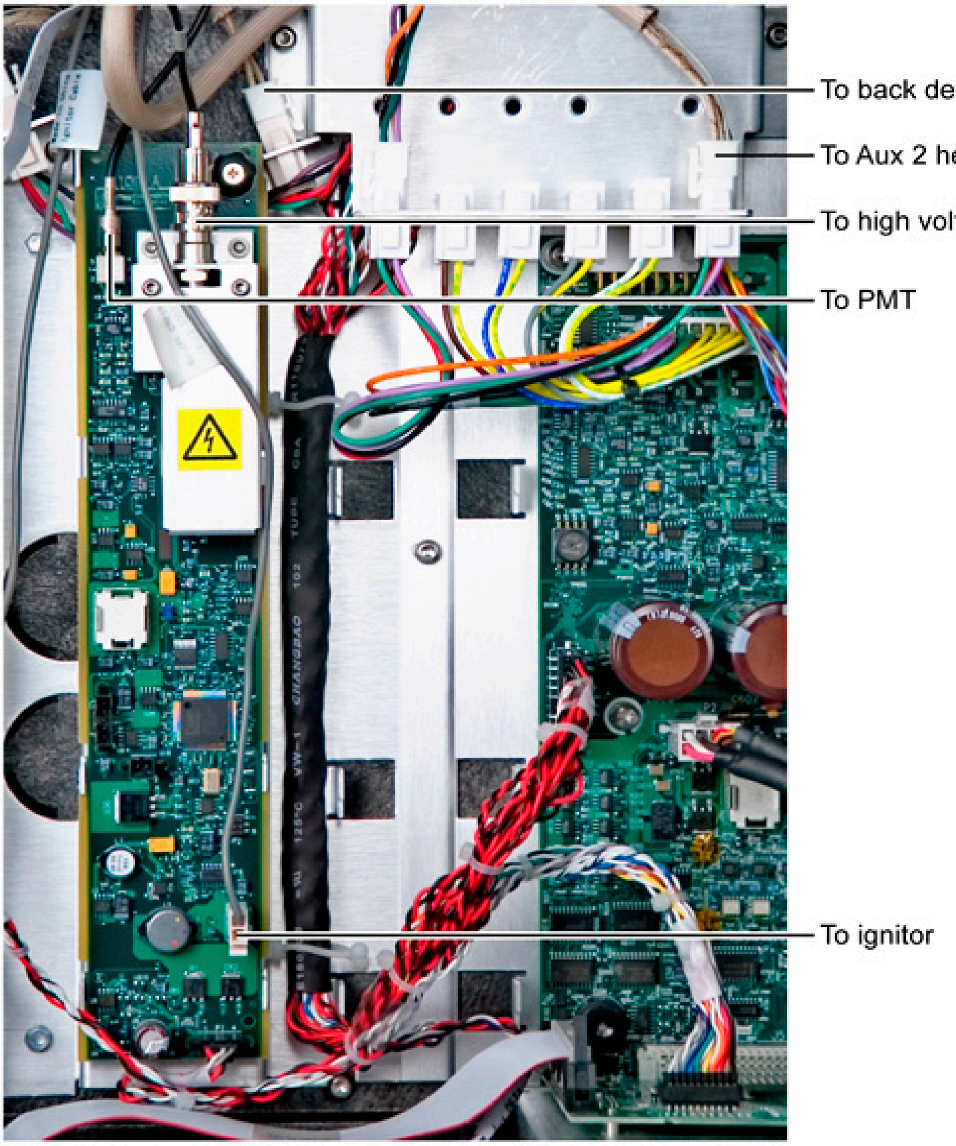
1 Reinstall the column or columns.

2 Reinstall the drain tube to the FPD exhaust tube.
3 Restore the gases to the GC.
4 Restore the power to the GC.
5 Restore the conditions to the inlets and detectors, but turn off the flame of the FPD to prevent condensation.
6 After the FPD is at temperature for about 10 minutes, light the flame.
7 Bake out the detector. Set the oven and detector temperatures to 250°C for 15 minutes. Insure there is adequate gas flows through the column.
8 After the bakeout, restore the oven and FPD conditions.
9 Allow the output to level off.
10 Run a checkout and compare the results.

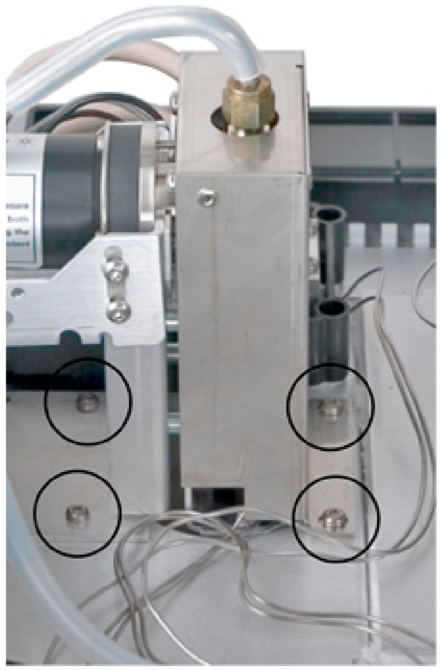
Replacing the FPD

1 Before this can be done you must first disconnect some cables originating from the FPD board in the electronics panel.

2 From the side panel side, disconnect heater sensors to the Aux 2 heater and to the back detector, the ignitor cable, the high voltage connector, and the PMT signal cable.



3 Remove the top four T- 20 screws retaining the PMT assembly.



4 Lift up the entire assembly and lay it down on the top GC surface.

5 Loosen the one screw holding the adjacent cover and pivot the cover up and off.

6 The FPD is now ready for replacement, if required.

7 If not, reassembly is the reverse of these steps.

Replacing the Heater/Sensor Assemblies

Replacing the heater/sensor assemblies takes about 30 minutes. It requires you to turn off the GC, remove the vent, the detector cover, and, on the dual- wavelength detector, the left PMT assembly.

CAUTION When turning the GC off, turn off the flame first to prevent condensation from dripping into the jet and column.

You may wish to replace or check the FPD heater/sensor assemblies for the following reasons:

- One or both of the heaters or sensors are defective.
- The actual temperature reading on the display of the heaters is cycling more than 1 °C.

Materials needed

- G1535- 60610 Heater/Sensor assembly with short lead for the emissions block assembly.
- G1535- 60620 Heater/Sensor assembly with long lead for the transfer line.

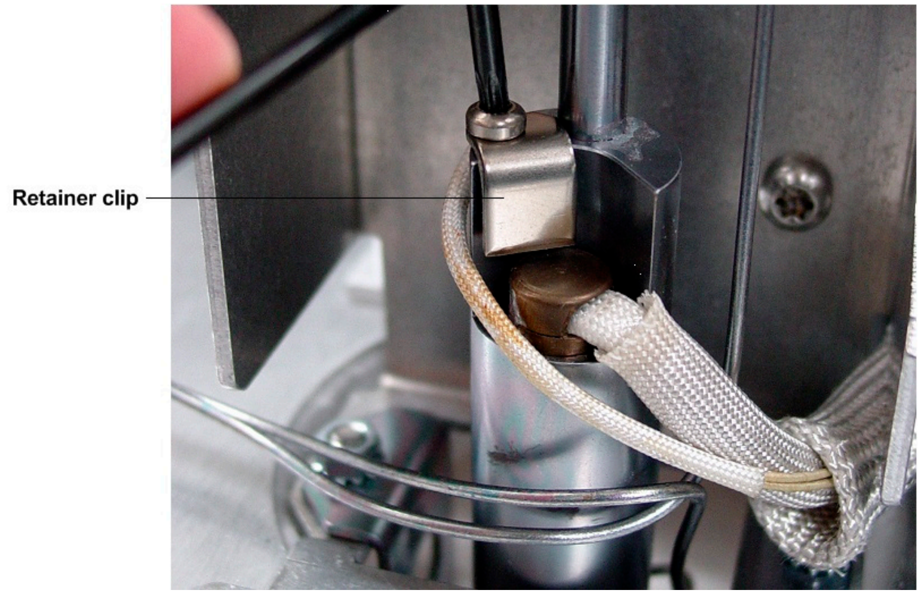
Procedure

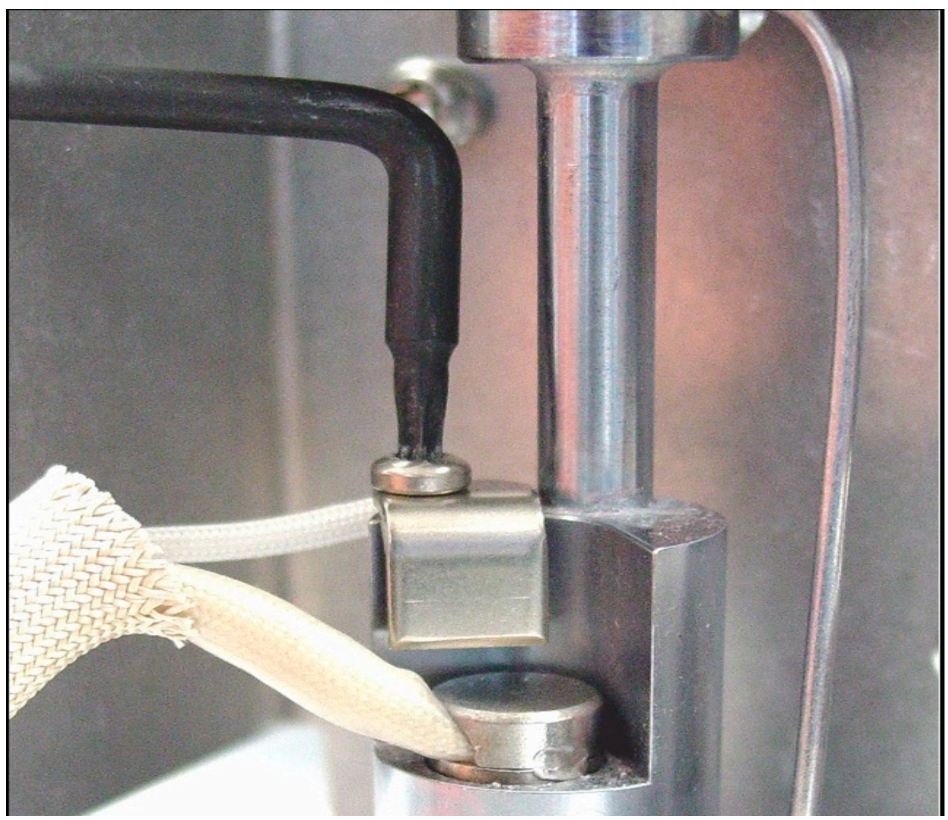
1. Turn off the flame.
2. Turn off the GC.
3. Remove the vent assembly and cover.
4. Put on an ESD wrist strap. Remove the right- side cover to access the GC electronics. Disconnect the heater/sensor leads from the auxiliary heater board and the connectors above the main board.
5. Carefully pull the cables up onto the top of the GC.

Transfer line

1. Use a Torx T- 10 driver to remove the screw and retainer clip holding the lower heater/sensor assembly. Remove the heater and sensor from the transfer line.
2. Remove the protective cap from the temperature sensor of the heater/sensor assembly with the short cable.
3. Insert the heater and sensor into the transfer line. Make sure the sensor is seated at the bottom of the hole. If not, the AUX temperature will wander above and below the detector setpoint.

4 Position the retainer clip over the heater/sensor assembly and install the screw.





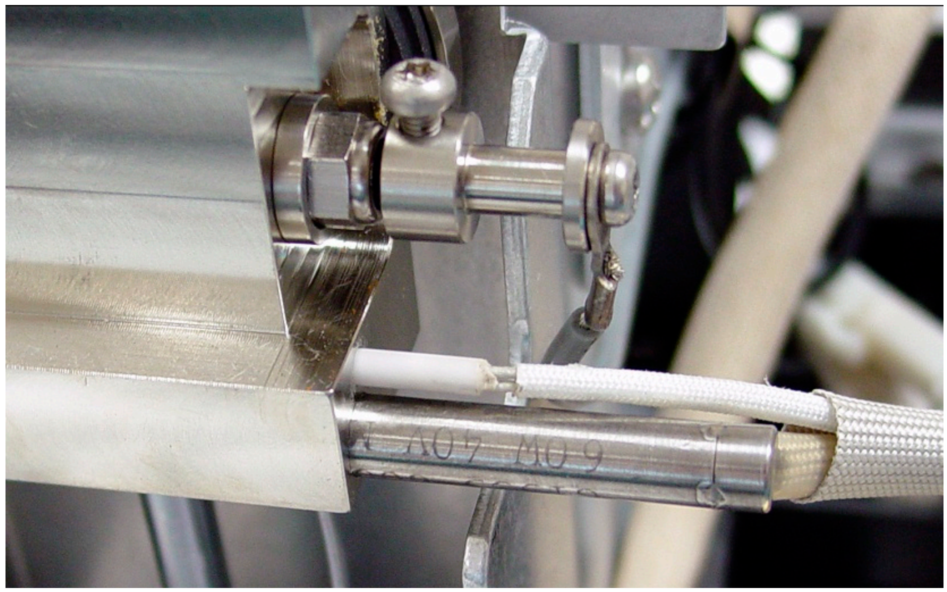
Emissions block assembly

1 Remove the upper heater and temperature sensor from the

emissions block assembly.

2 Remove the protective cap from the sensor of the heater/sensor assembly with the long cable.

3 Install the upper heater and sensor in the emissions block assembly.



Closing up

1 Route the heater/sensor cables out of the bracket as shown.

2 Replace the cover, vent assembly, and, on the dual- wavelength detector, the left PMT assembly. Refer to Accessing Heaters and Ignitor.

3 Carefully thread the heater/sensor cables into the electronics compartment.

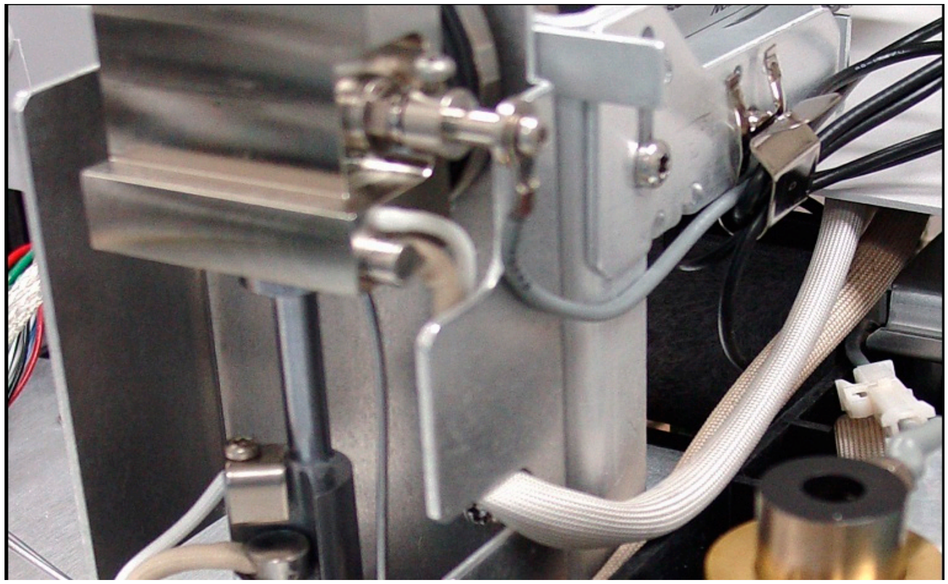
4 Put on an ESD wrist strap. Connect the short cable as shown in Back- top panel cutouts. Connect the long cable to the auxiliary heater board as shown in Long cable connectors and leads.

5 Replace the right- side cover to the GC electronics compartment.

6 Turn on the GC. Confirm that the flame is off.

7 Restore the operating conditions.

8 Wait 20 minutes for the detector to heat up, then ignite the flame.



Long cable connectors and leads

Detector type	Location	Connector
Single-wavelength	Front	A1
Single-wavelength	Back	A2
Dual-wavelength	Back	A2

Replacing the FPD board

If changing the GC configuration, see ***Changing the GC configuration*** (222) for important information regarding GC methods. Then proceed with the steps below.

1 Cool down the oven and all heated zones.

2 Turn off all gas flows at their sources.

3 Turn off the GC main power switch and disconnect its power cord.

WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC**

panels.

CAUTION

Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

4 Disconnect all attached electrical connections to the FPD board.
5 Turn thumb screw counterclockwise, lift screw to disengage, slide board down, and then lift out. (Note that the grounding point for the board is at the thumbscrew).
6 Replace board if required. (Note that the FPD board is longer than the FID board and is attached to the full length of the GC board receptacle.)
7 Replace connections in reverse order of disassembly.
8 Reconfigure the modified GC from the front panel keypad supplying requested information.

5 EPC modules

EPC overview

An Electronic Pressure Controller (EPC) module senses gas pressure or mass flow and controls that pressure or flow.

There are four kinds of EPC modules:

- Inlet flow modules
- Detector flow modules
- Pressure control modules (PCM)
- Auxiliary pressure controllers

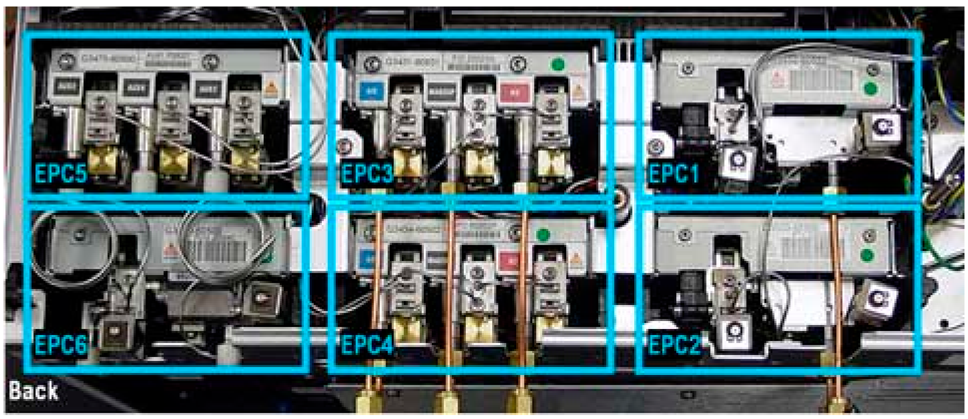
Inlet and detector modules are each designed for specific inlets and detectors.

A PCM has two control channels. One is intended for carrier gas. The other may function as either a forward- or back-pressure regulator, depending on the external plumbing.

An auxiliary pressure controller provides three independent forward- pressure regulation channels.

Repairing EPC modules

The 7890A can control up to 6 EPC modules. Each has a particular purpose and is limited to a particular location in the EPC carrier. A TCD or AUX EPC module can be located in the optional 3rd detector carrier.



Repairs on EPC modules should be in this order:

1 Verify the EPC module is receiving 24 VDC power, the green LED is ON, and the EPC appears configured in the GC display.

2 Compare the Communication buss connection with a neighbor that has a good power and signal connection.

3 Replace proportional valve or valves for flow or pressure problems.

4 Replace the module only after 1 and 2.

Repairs should be verified by the following:

- Inlets: With the inlet capped, perform pressure decay test. With column installed, compare calculated flow read from the display with measured flow for column, septum purge, and split vent.
- Detectors: With the detector capped, compare calculated flow read from the display with measured flow for each gas.

Accessing EPC modules

1 Turn off all gas flows at their sources.

2 Turn off the GC main power switch.

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Remove the top rear cover by pressing in the two black side tabs and lifting the cover up and off.

4 Disconnect the gas plumbing to the module that is being replaced. If the module is towards the back (slots 2, 4, or 6), the gas plumbing on the front module may need to be removed.

NOTE In some cases, it may be necessary to remove the upper rear cover plate. Do this by first loosening the three retaining T-20 screws along the bottom and then lifting the cover plate up and off.

Replacing the EPC modules

1 Access the EPC module. See ***To access the EPC modules*** (157).

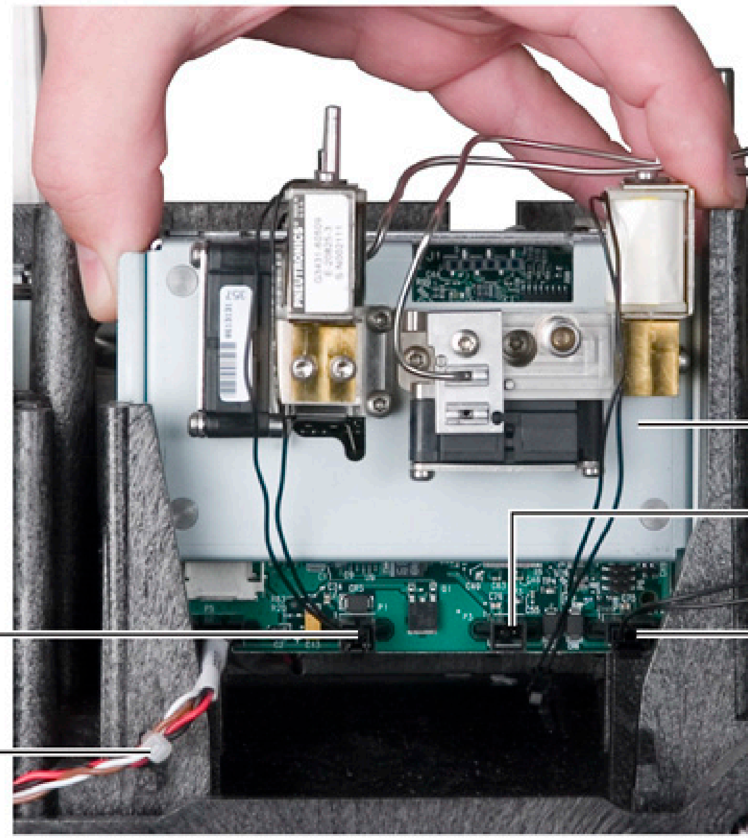
WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.**

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

2 EPC moodules are secured by one or two clamps on the top edge. Remove the one or two retaining clamps holding the EPC module in place.

3 Lift the EPC module up and remove the communication

buss connector. The SSL, PTV, and VI EPC modules also require removal of an electrical connector to their split vent valves. This illustration (a split/splitless module) shows these features.



4 Remove the 1/8 inch Swagelok tubing connections (1, 2, or 3) from the gas source.

5 Remove the 1, 2, or 3 tubing connector plates using a T- 10 driver. This is the EPC module for an FID detector.

6 Remove the EPC module by lifting straight up.

7 Install the new EPC module. Remember to plug in the Communication buss. If a SSL, PTV, or VI inlet module, plug in the split vent valve.

8 Remove the O- rings for the pneumatic connector plates. Clean the sealing surface under the O- rings with a lint- free cloth. Install new O- rings.

9 Install the connection plates and tighten the screws.

10 Turn ON the GC and configure the EPC module. See ***Replacing a GC module*** (220) for details.

11 Zero the flow and/or pressure sensors (***Options*** / ***Calibrations***).

12 Verify the flow or pressure control.

Replacing the EPC module proportional valve

1 Turn off all gas flows at their sources.

2 Turn off the GC main power switch.

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

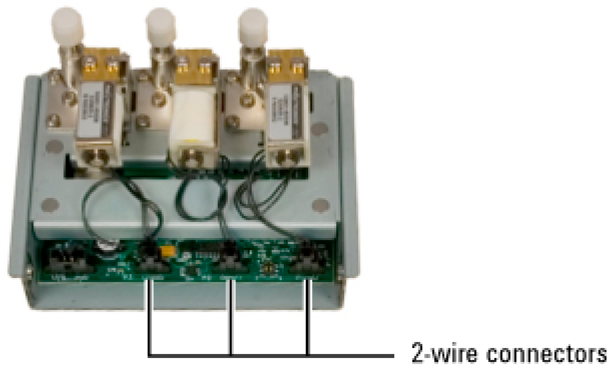
3 Place the instrument into Inlet or GC maintenance mode.

Let instrument go ready.

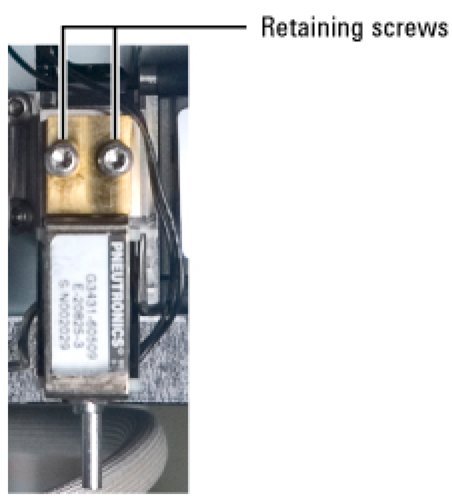
4 Turn off instrument and gas supply pressure. The proportional valve can be replaced without disconnecting the plumbing.

5 Remove 1 or 2 retaining brackets.

6 Lift the EPC module and disconnect the 2- wire connector from the printed circuit board. The figure shows an Auxiliary EPC module, which has three proportional valves.

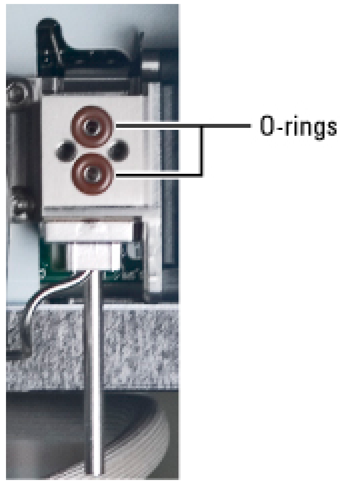


7 Using a T- 10 driver, remove the two retaining screws holding the proportional valve to the EPC module. Save and reuse the screws.



8 Remove the valve and the O- rings. Clean the seat of the O- ring on the flow block with a lint free cloth.

9 Insert 2 new O- rings.

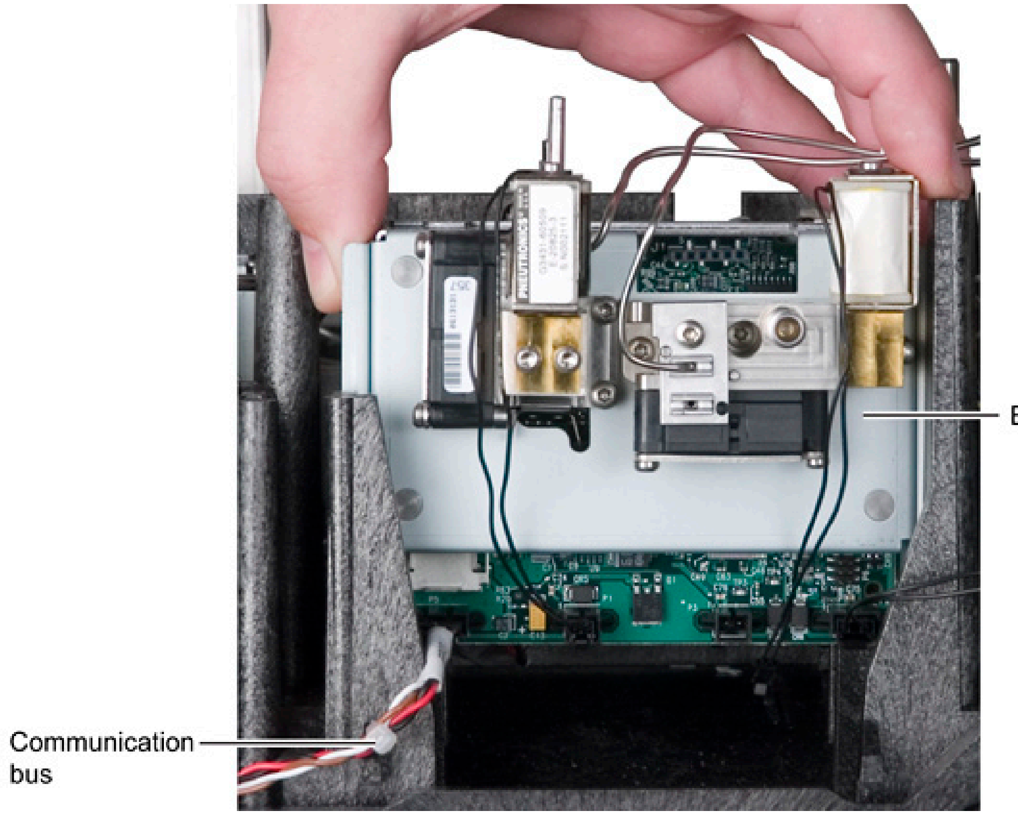


10 Reattach the proportional valve, the electrical connector, the EPC retaining clamps, and body panels.

Inlet modules

These modules are essentially carrier gas regulators. The FID and PTV modules also have a split vent valve, and the TCD module supplies both carrier and reference gases and has a switching valve in the reference gas supply.

This is a split/splitless inlet module:



It consists of

- One or more proportional valves
- Gas tubing connections
- A printed circuit board
- A connection to the communications buss in the lower left corner

Inlet modules

Description	Part number	O-rings	Slot
COC	G3454-60554	3	1 or 2
PP	G3451-60551	3	1 or 2
PTV	G3500-60500	3	1 or 2
S/SL 100 PSI	G3452-60552	3	1 or 2
S/SL 150 PSI	G3452-60510	3	1 or 2
VI	G3504-60501	4	1 or 2

The type of proportional valve varies with the module.

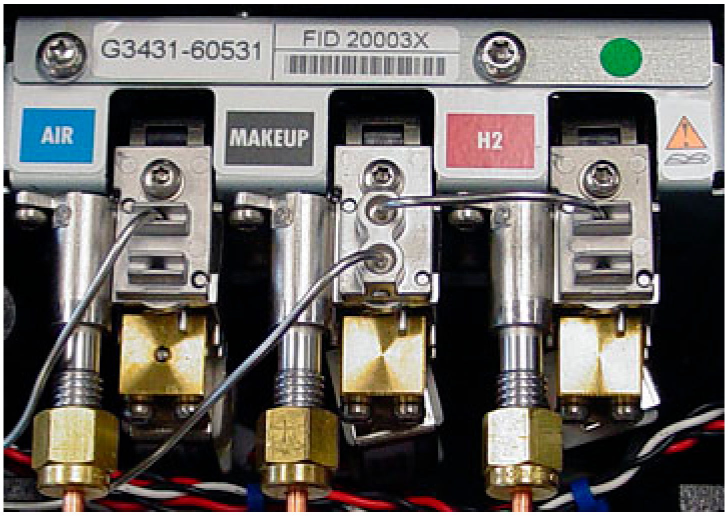
Proportional valves

Description	Carrier	Septum purge	Split vent	AUX
COC	G3431-60508	G3431-60509		
PP	G3431-60508	G3431-60509		
PTV	G3431-60508	G3431-60509	G3430-60527	
S/SL 100 PSI	G3431-60508	G3431-60509	G3430-60527	
S/SL 150 PSI	G3431-60508	G3431-60509	G3430-60527	
VI	G3431-60508	G3431-60509	G3430-60527	

Valves require 2 O- rings each (5180- 4181, 12/pkg).

Detector modules

These are generally more complicated than inlet modules, since they must often supply multiple detector gases and a makeup gas. This is a typical FID module.



Detector modules

Description	Part number	Slot
uECD	G3433-60533	3 or 4

FID	G3431-60531	3 or 4
FPD	G3435-60535	3 or 4
NPD	G3434-60502	3 or 4
TCD	G3432-60532	3 or 4 or AUX Det 2

Proportional valves

Description	Air	Makeup	Hydrogen	Reference
uECD		G3431-60508		
FID	G3431-60508	G3431-60509	G3431-60509	
FPD	G3431-60508	G3431-60508	G3431-60508	
NPD	G3431-60508	G3431-60509	G3431-60509	
TCD		G3431-60508		G3431-60508

Pneumatics Control Module (PCM)

This module contains two channels.

- The PCM carrier channel has both pressure and flow sensors. It is functionally identical to the Purged Packed inlet flow module.
- The PCM auxiliary channel has only a pressure sensor. When plumbed normally (gas in at the threaded connector, out via the tubing), it provides forward pressure regulation. If the plumbing is reversed, it operates as a back- pressure regulator.

PCM module

Description	Part number	O-rings	Slot
PCM	G3476-60501	3	1, 2, 5, or 6

Proportional valves

Description	Carrier	AUX
PCM	G3431-60508	G3430-60528

Calibrating the PCM interface

The interface's flow module contains a pressure sensor that must be zeroed after it is installed on the GC. Calibration ensures an accurate interface pressure display.

Do not connect the carrier gas to the flow module until you have zeroed the interface's pressure sensor.

1 If the gas supply is connected to the GC, turn off the supply at the source, then disconnect the supply line from the PCM inlet fitting.

2 Turn on the GC and wait 15 minutes to allow it to reach thermal equilibrium.

3 When the GC has reached thermal equilibrium, press ***[Options]***, scroll to **Calibration** and press ***[Enter]***.

4 Scroll to the module to be zeroed and press ***[Enter]***.

5 Scroll to a zero line and press ***[Info]***. The GC will remind you of the conditions necessary for zeroing that specific sensor.

   `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.

6 Press ***[On/Yes]*** to zero or ***[Clear]*** to cancel.

7 Turn off the GC.

8 Plumb the carrier gas to the flow module.

9 Turn on the GC.

If you were calibrating the flow sensor after replacing the PCM, check for leaks.

Changing the flow restrictor_7890

To change a frit:

1. Gather the following:
   - O- rings, package of 6, 5181- 3344
   - Restrictor
2. Turn off the gas supply to the channel.
3. Remove the screw holding the block with the output tubing.
4. Remove the block. Remove the frit and O- ring. Be careful to avoid scratching the metal surfaces.
5. Remove the other O- ring as well. Replace it with a new O- ring.
6. Place a new O- ring on the new frit and press it down into the block.
7. Place the block on the module and tighten the screw firmly.
8. Restore the gas supply.

Correcting PCM leaks

1. Use the electronic leak detector to check all areas of the PCM that are potential sources of a leak.
2. Tighten any connections which are leaking and retest.

NOTE If the pressure drop is now 0.05 psi/min or less, you can consider the interface system leak–free.

3. If the interface still leaks, continue to check for and correct leaks.

Potential leak areas

Check the following areas when checking for leaks in the PCM.

Purged Packed channel

- Two O- rings behind the block where the pneumatic lines enter the PCM

- Two O- rings for the valve in the PCM

Aux channel

- The plugged purge vent
- Two O- rings behind the block where the pneumatic lines enter the PCM
- Two O- rings for the valve in the PCM

Forward pressure valve leaks

Occasionally an increase in pressure, rather than a decrease, may be observed. This is usually due to slight leakage into the module across the forward pressure control proportional valve. Although slight leaks of this nature do not create chromatographic problems, they may obscure other small leaks that do cause problems by allowing air into the system. The valves can leak at about 0.2 mL/min and be within specification.

To check for internal valve leakage (when leak testing the PCM only):

1. Remove the supply pressure at the carrier inlet fitting, and quickly cap the fitting with a solid 1/8- inch Vespel plug and a Swagelok nut.
2. Check the actual pressure on the display and monitor it for 5 minutes. Pressure loss should not be greater than 0.5 psi.

Auxiliary pressure controllers

Up to three of these modules can be installed, for a possible total of 9 pressure- regulated channels. Each channel has a block connector covering a frit with O- ring for the gas output via the block connector.

The module is shipped with a brown (low resistance) frit in each channel.

Module

Description	Part number	Slot
AUX	G3470-60501	5 or 6 or AUX

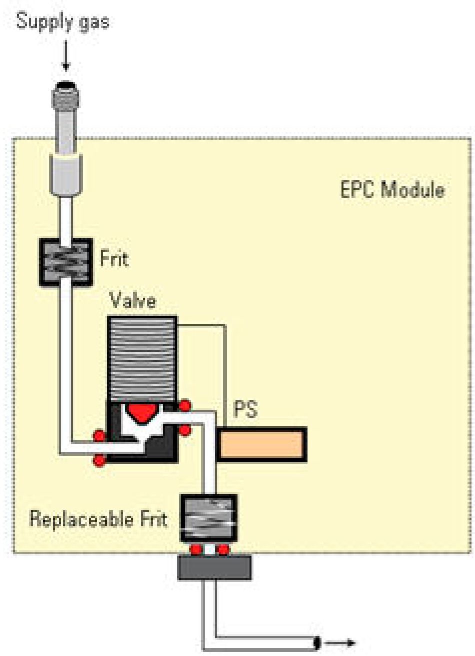
Proportional valves

Description	Air	Makeup	Hydrogen
AUX	G3431-60508	G3431-60508	G3431-60508

Frits for auxiliary flow control

The auxiliary flow control channels in the Auxiliary EPC module are used to provide a flow to various devices including a purged splitter or a QuickSwap or a headspace sampler. The PCM Aux channel can be used to provide a flow in forward pressure control mode.

A replaceable frit is used in these auxiliary channels to optimize control for the range of flows.



NOTE

Different frits may require different PID constants. See ***Updating PID Constants*** (170).

This table lists the 4 types of frits, their flow characteristics, and common uses.

Kit	Component	Marking	Flow characteristic	Resistance	Often used with
No	G3430-80061	1 ring Brown	400 +/- 30 SCCM AIR @ 40 PSIG	Low	FID Air, QuickSwap, Splitter, Deans Switch
Yes	G3430-80062	2 rings Red	30 +/- 1.5 SCCM H2 @ 15 PSIG	Medium	FID Hydrogen
Yes	G3430-80063	3 rings Blue	3.33 +/- 0.3 SCCM H2 @ 15 PSIG	High	NPD Hydrogen
Yes	G3430-20011	None	No restriction	Zero	Headspace vial pressurization

Notes for this table

- The Air frit, G3430- 80061, ships in each channel in the AUX

EPC module. No frit ships in the PCM Aux channel.

- Yes indicates this part is included in the Restrictor Kit G3470- 60502 which is included in the AUX module ship kit and the PCM ship kit.
- Always use a new O- ring. 5181- 3344, O- rings 6/pk

Procedure for replacing frit

1 Select the appropriate frit.
2 Gather a new O- ring, a T- 10 Torx driver, and a tweezer.
3 Loosen the captured screw for the channel that you want to change.
4 Lift up the pneumatic block.
5 Replace the O- ring and frit.
6 Replace the pneumatic block and tight the screw.

Updating PID Constants

Pneumatic PID constants are the coefficients used by the EPC modules to control flows and pressures. Certain gases or special applications (such as QuickSwap, Headspace vial pressurization, or splitter and backflush applications) require different PIDs than provided at the factory. For the G3440A Agilent 7890A Series GC, you must use G4600AA Agilent Lab Monitor & Diagnostic Software (LMD) revision A.01.03 or greater to download new PIDs to the EPC modules. If you must use LMD revision A.01.02, read Service Note G4600AA- PID.

The table below summarizes custom PID values required for selected applications. Note that if updating an Aux EPC module, you will need to change the frit for the channel used.

Application	Module	AUX Frit	Select Avail
QuickSwap	AUX EPC	G3430-80061 brown or 1 ring	**Quickswap**
Purged Splitter and Deans Switch	AUX EPC	G3430-20011 no color or no rings	**Quickswap**
Purged Splitter and Deans Switch	AUX EPC	G3430-80061 brown or 1 ring	**Standard**
Headspace vial pressurization	AUX EPC	G3430-20011 no color or no rings	**AUX_EPC_H**
Headspace sampling loop	PCM in backpressure control	NA	**PCM_Heads**

Updating PID constants in LMD

Follow these steps to update the PID constants for any EPC module (inlet, detector, AUX, or PCM). Use these same directions to apply special PIDs for use with QuickSwap, Capillary Flow Technology devices, and Headspace samplers, or to restore factory defaults. This procedure is accurate for LMD revision A.01.03 or greater.

The PID Constants screen displays (for the selected instrument):

- **Current**—lists devices (and the associated Module for each) installed on the selected GC
- **Version**—version number of the currently- installed PID values for the selected module
- **Available**—PID files available for upload to the selected

module

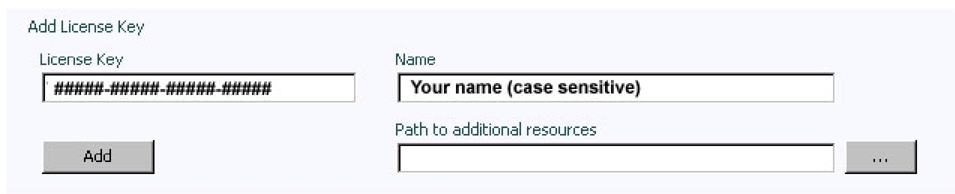
- **Selected Version**—version number of the Available PID values selected for update
- **Status**—indicates (after an update) whether or not the PID values were uploaded to the module successfully

To set your PID values:

1 Open LMD.

2 From the **Lab Monitor Management** screen, select **Licenses.**

3 Enter your CE license key and user name.

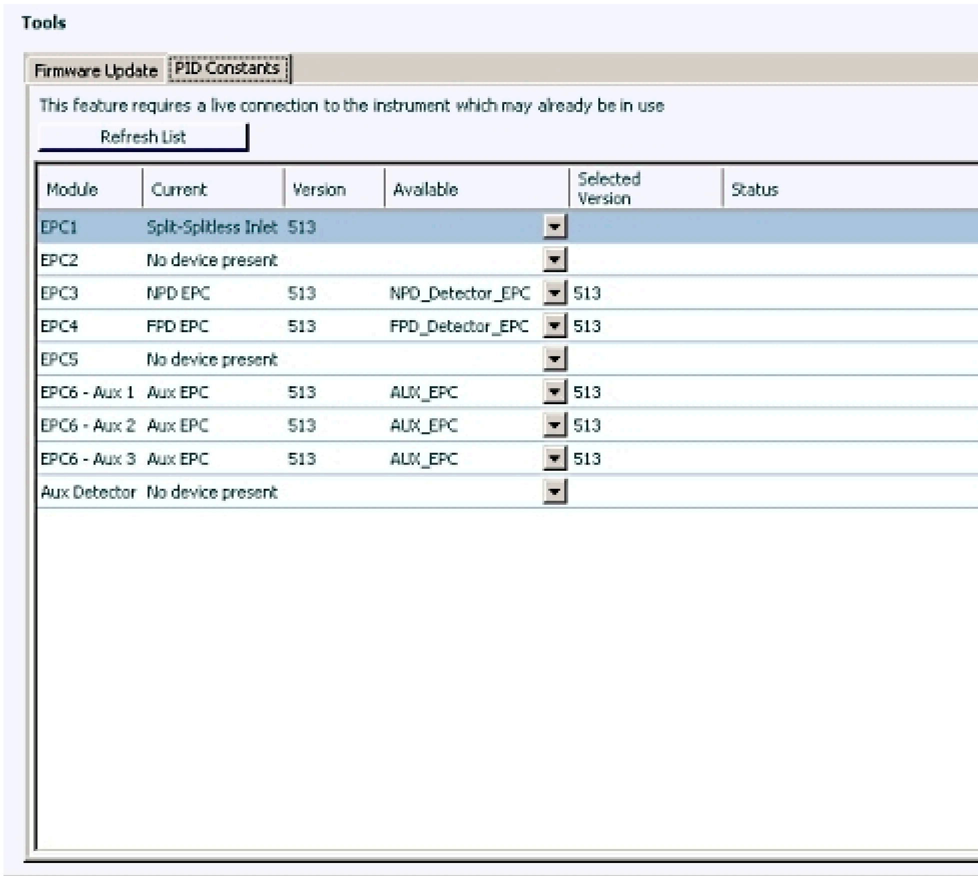


4 If CE help files are stored on a portable device such as a USB drive or CD and you wish to view them, enter the path to the files in the **Path to additional resources** text box, or click **...** to browse to them. During the session, LMD will use these help files rather than the program's installed help.

5 Select the GC with the module(s) you wish to update. You must be monitoring the GC in order to update PID values.

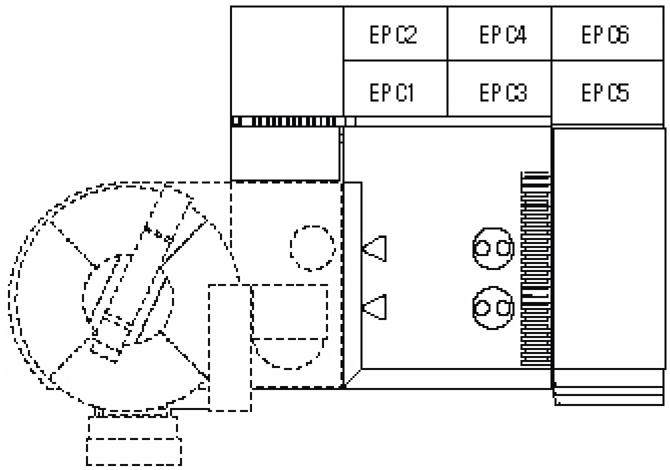
6 From the **Lab Monitor & Diagnostic Software** screen, select **Tools > PID Constants**.

7 Click Refresh List to make sure you are displaying the correct list of modules for this GC. The list may not appear immediately.



8 Locate the **Module** you wish to update. If updating an EPC AUX or PCM module, determine the specific channel to be updated.

- If you are unsure of the channel to be updated, remove the pneumatics cover and trace the wiring from the device to the EPC module. Use the figure below to determine the module’s EPC location.



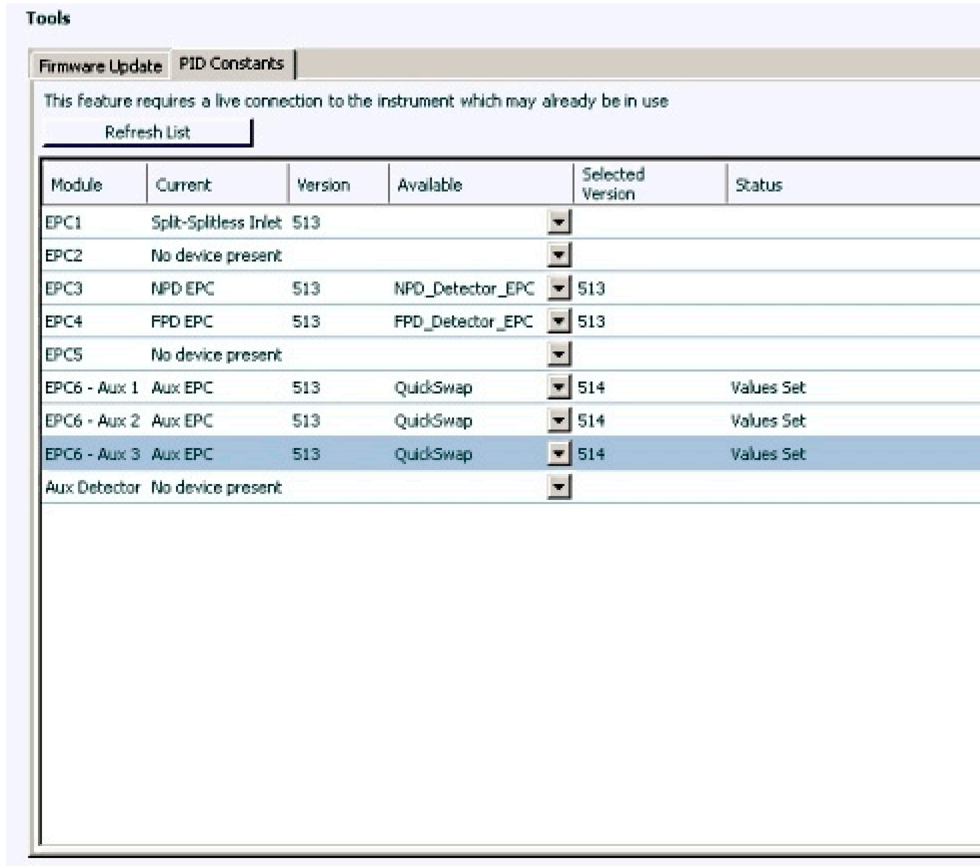
9 Select the row of the EPC module (and channel) that you need to update. This is most often an AUX_EPC module.

10 From the **Available** selection box, select the appropriate set of values to download. Note the Selected Version number that appears.

11 When finished specifying your desired values, click **Update** in the row(s) of the module(s) you wish to update. This will download the PIDs to the appropriate EPC modules.

12 If the download is successful, the status will read **Values Set** (see below). If the file is not accepted by LMD, the status will read **Invalid File**.

The following screen capture illustrates updating PIDs for QuickSwap.



Module	Current	Version	Available	Selected Version	Status
EPC1	Split-Splitless Inlet	513			
EPC2	No device present				
EPC3	NPD EPC	513	NPD_Detector_EPC	513	
EPC4	FPD EPC	513	FPD_Detector_EPC	513	
EPC5	No device present				
EPC6 - Aux 1	Aux EPC	513	QuickSwap	514	Values Set
EPC6 - Aux 2	Aux EPC	513	QuickSwap	514	Values Set
EPC6 - Aux 3	Aux EPC	513	QuickSwap	514	Values Set
Aux Detector	No device present				

13 Power cycle the GC to activate the new PIDs.

14 When finished, close LMD to remove your CE key from the customer’s system.

Updating PID constants available for use by LMD

If at any time the PID constant values are updated, follow the procedure below to update the files within the LMD directory. Perform this procedure ***before*** accessing the PID Constants interface.

1 Obtain the latest EEPROM files.

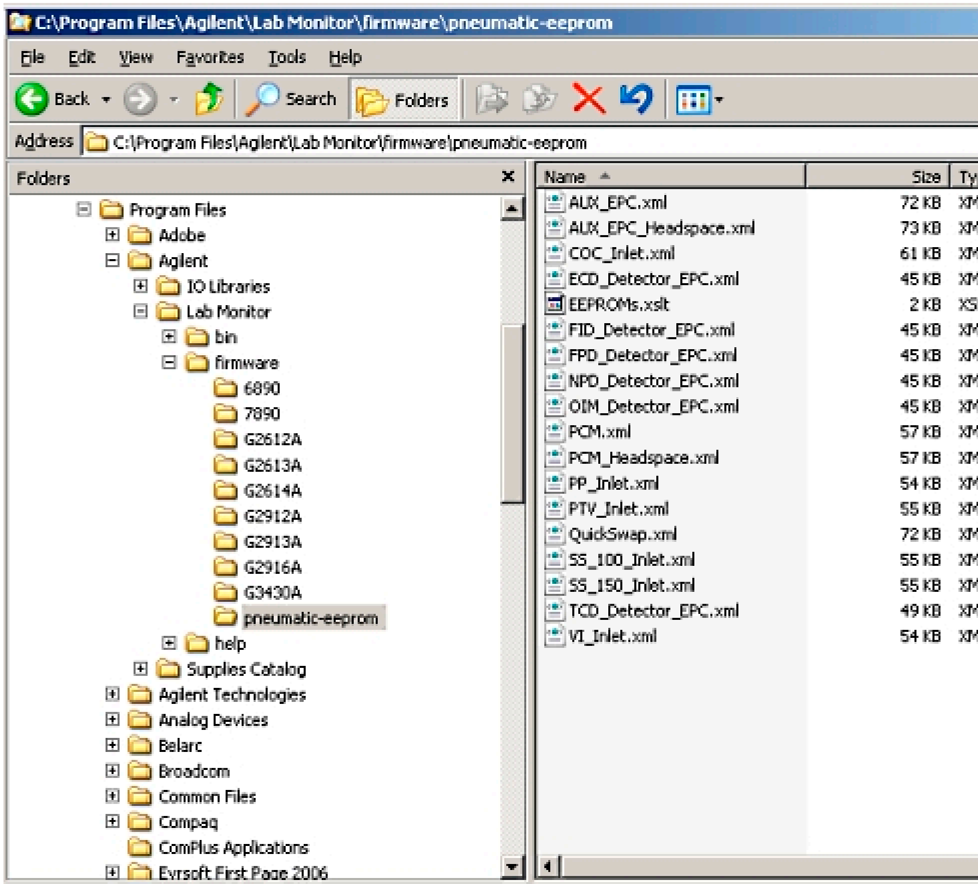
2 Browse to where the LMD is installed (default is **C:\Program Files\Agilent\Lab Monitor**).

3 In this LMD directory, browse to **firmware\pneumatic-eeprom**.

4 If the latest EEPROM file dates are newer than the files in this directory:

a Delete the old .xml files.

b Copy the new .xml files into the **firmware\pneumatic-eeprom** directory. The directory will look similar to the one below.



c See "Updating PID constants in LMD" to download these values to the EPC modules.

6 Performance Verification

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 for the 1- µL injections described here.
- 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.

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).

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
Packed column inlet	
Syringe, 10-µL	5181-1267
O-ring	5080-8898
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
7683B Needle support assembly for .250/.320 mm injections	G2913-60977
Insert, fused silica, 0.32-mm id	19245-20525
PTV inlet	
Syringe, 10-µL -- for septum head	5181-1267
Syringe, 10-uL, 23/42/HP -- for septumless head	5181-8809
Inlet adapter, Graphpak-2M	5182-9761
Silver seal for Graphpak-2M	5182-9763
Glass liner, multibaffle	5183-2037
Teflon 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
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 Install the evaluation column. (See the procedure for the SS, PP, COC, or PTV 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, or PTV in the Maintenance manual.)
   - Be sure to configure the column.
4 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.
5 If the output is too low:
   - Check that the electrometer is on.
   - Check that the flame is lit.

6 Create or load a method with these parameter values.

Table 1. 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
Purged packed 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
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
Injection volume	1 µL
Syringe size	10 µL
PreInj Solvent A Washes	2
PreInj Solvent B Washes	0
PostInj Solvent A Washes	2
PostInj Solvent B Washes	0
Viscosity delay	0 s
Plunger speed	Fast
PreInjection dwell	0
PostInjection dwell	0
Manual injection	
Injection volume	1 µL
Data system	
Path	**Setting**
Method and Run Control View: Instrument>Edit Parameters>Options	Keep instrument keyboard locked after method is loaded? = No
Method and Run Control View: Instrument>Edit Parameters>Signals	Assign Signal 1 to the detector Choose Save Data All Data Rate = 5 Hz

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

8 Start the run.

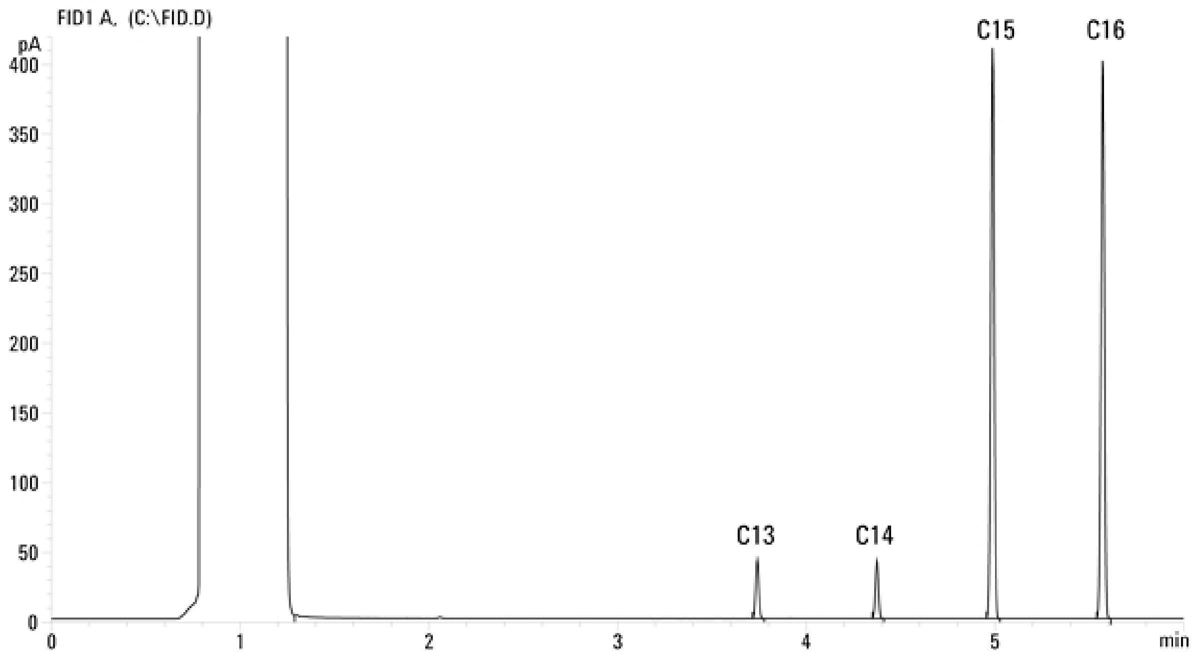
If performing an injection using an autosampler, start the run using the data system or press `[Start]` on the GC.

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 and nitrogen makeup gas.



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
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 If present, remove any protective caps from the inlet manifold vents.

4 Install the evaluation column. (See the procedure for the SS, PP, COC, or PTV 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, or PTV in the Maintenance manual.)
- Be sure to configure the column.

5 Create or load a method with these parameter values.

Table 2. 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 pressure	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
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
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
Injection volume	1 µL
Syringe size	10 µL
PreInj Solvent A Washes	2
PreInj Solvent B Washes	0
PostInj Solvent A Washes	2
PostInj Solvent B Washes	0
Viscosity delay	0
Plunger speed	Fast
PreInjection dwell	0
PostInjection dwell	0
Manual injection	
Injection volume	1 µL
Data system	
Path	**Setting**
Method and Run Control View: Instrument>Edit Parameters>Options	Keep instrument keyboard locked after method is loaded? = No
Method and Run Control View: Instrument>Edit Parameters>Signals	Assign Signal 1 to the detector Choose Save Data All Data Rate = 5 Hz

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

7 Start the run.

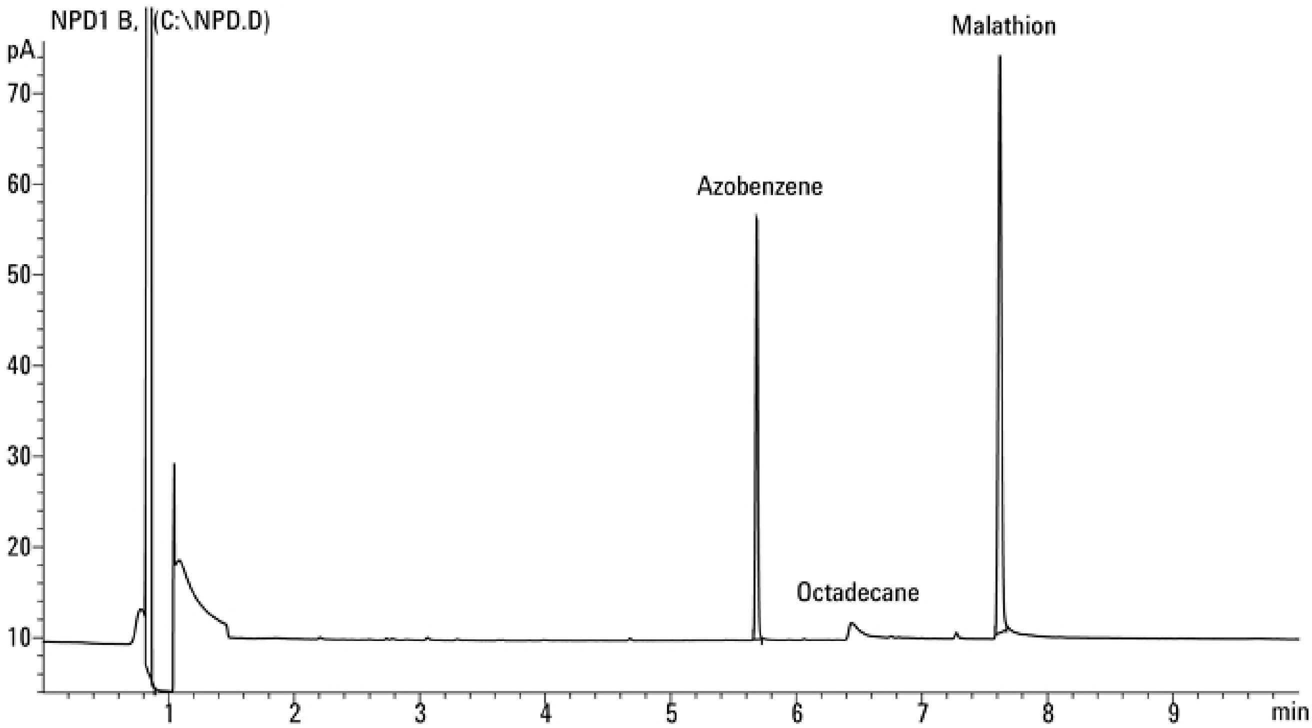
If performing an injection using an autosampler, start the run using the data system or press `[Start]` on the GC.

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.

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



3396B or 3396C or 3397A integrator sample conditions with analog input [GC Analog output, Range 0]
>>Set DATE and TIME<<

Zero	10	Pk wd	0.04
Att 2^	7	Thresh	7
Cht sp	1	[Stop time 12.0]	
Ar Rej	1000		

SS/COC/PTV/PP

Sensitivity	Azobenzene area counts Malathion area counts	306,000 575,000

Agilent ChemStation

		SS/COC/PTV/PP
Sensitivity	Azobenzene area counts Malathion area counts	38 71

Agilent Chemstation—ASTM noise
Measured with GC isothermal @ 100°C
10 minute blank run, noise range(s) >1 minute
Performance + noise report
NPD ASTM noise ≤ .0765 pA

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
2 Verify the following:
   - 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 Install the evaluation column. (See the procedure for the SS, PP, COC, or PTV 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, or PTV in the Maintenance manual.)
   - Be sure to configure the column.
4 Create or load a method with these parameter values.

Table 3. TCD Checkout Conditions

Column and sample	
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
Purged packed 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
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 ChemStation (< 750 µV)
Oven	
Initial temp	40 °C
Initial time	0 min
Rate 1	25 °C/min

Final temp	90 °C
Final time	0 min
Rate 2	15 °C/min
Final temp	170 °C
Final time	2 min

ALS settings (if installed)

Sample washes	2
Sample pumps	6
Injection volume	1 µL
Syringe size	10 µL
PreInj Solvent A Washes	2
PreInj Solvent B Washes	0
PostInj Solvent A Washes	2
PostInj Solvent B Washes	0
Viscosity delay	0
Plunger speed	Fast
PreInjection dwell	0
PostInjection dwell	0

Manual injection

Injection volume	1 µL

Data system

Path	**Setting**
Method and Run Control View: Instrument>Edit Parameters>Options	Keep instrument keyboard locked after method is loaded? = No
Method and Run Control View: Instrument>Edit Parameters>Signals	Assign Signal 1 to the detector Choose Save Data All Data Rate = 5 Hz

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

data system will output a chromatogram.

7 Start the run.

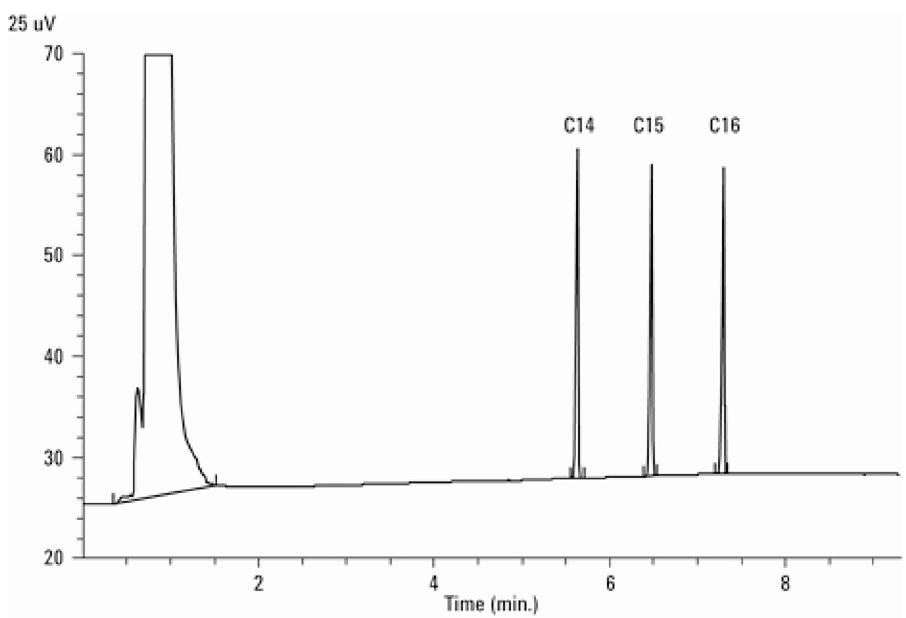
If performing an injection using an autosampler, start the run using the data system or press [Start] on the GC.

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.

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



Typical values

The following are typical values for the detector results. The results for a detector depend on site preparation related factors.

Agilent ChemStation

SS/COC/PTVPP

Sensitivity C_{14}, C_{15}, C_{16} area counts 73 65

Discrimination C_{14}/C_{16} area ratio 1.00±0.10 1.00±0.10

Agilent ChemStation—ASTM noise

Measured with GC isothermal at 100 °C

10 minute blank run, noise range(s) > 1 minute

Performance + noise report

TCD ASTM noise ≤0.05733 display units (25 µV/display unit)

Detector signal set to 5 Hertz

3396B or 3396C or 3397A integrator sample conditions with analog input (GC Analog output, Range 0)

>>Set DATE and TIME<<

Zero	10	Pk wd	0.04
Att^2	7	Thresh	5
Cht sp	1	Stop time	8.75
Ar Rej	1000		

SS/COC/PTVPP

Sensitivity C_{14}, C_{15}, C_{16} area counts 585,000 515,000

Discrimination C_{14}/C_{16} area ratio 1.00±0.10

1.00±0.10

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
2 Verify the following:
   - Clean fused silica indented mixing liner installed. If not, install it.
   - Chromatographic- grade gases plumbed and configured: helium.
   - Empty waste vials loaded in sample turret.
   - 4- mL vial with diffusion cap filled with hexane and inserted in Solvent A injector position.
3 Install the evaluation column. (See the procedure for the SS, PP, COC, or PTV 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, or PTV in the Maintenance manual.)
   - Be sure to configure the column.
4 Display the signal output to determine baseline output. A stable baseline output at any value between 0.5 and 1000 Hz (ChemStation 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.

5 Create or load a method with the parameter values listed in the table below.

Table 4. 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 pressure	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
Purged packed 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	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 ChemStation (< 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
Injection volume	1 µL
Syringe size	10 µL
PreInj Solvent A Washes	2
PreInj Solvent B Washes	0
PostInj Solvent A Washes	2
PostInj Solvent B Washes	0
Viscosity delay	0
Plunger speed	Fast
PreInjection dwell	0
PostInjection dwell	0
Manual injection	
Injection volume	1 µL
Data system	
Path	**Setting**
Method and Run Control View: Instrument>Edit Parameters>Options	Keep instrument keyboard locked after method is loaded? = No
Method and Run Control View: Instrument>Edit Parameters>Signals	Assign Signal 1 to the detector Choose Save Data All Data Rate = 5 Hz

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

7 Start the run.

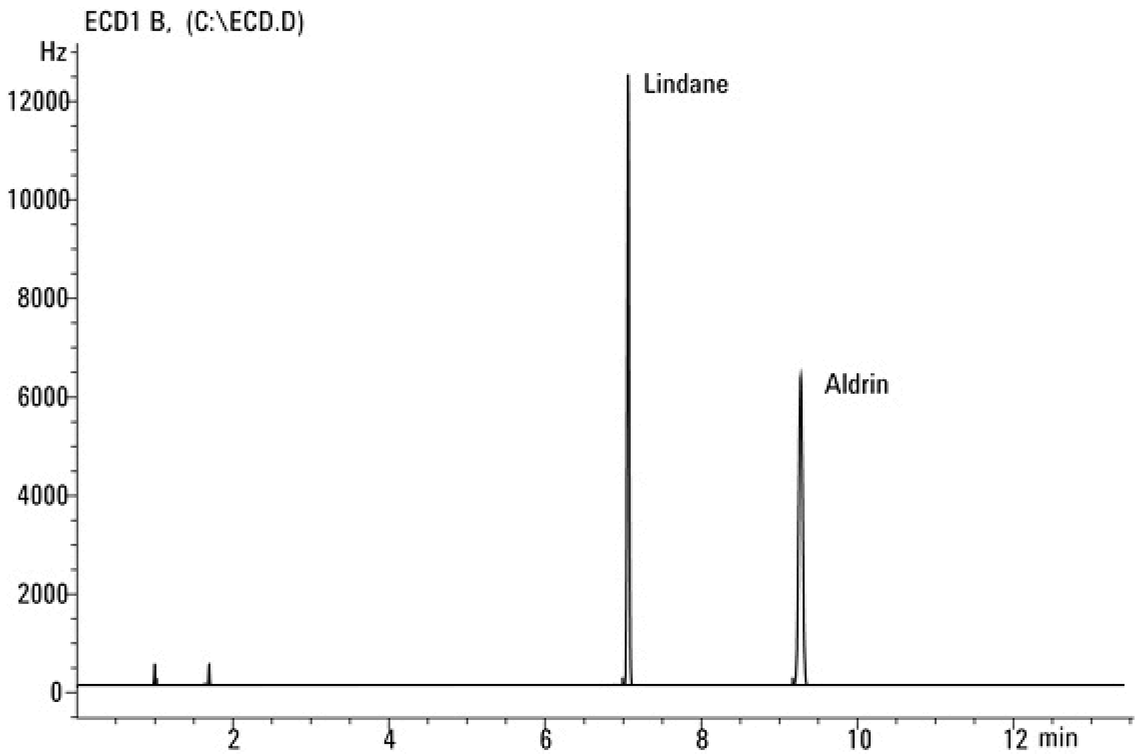
If performing an injection using an autosampler, start the run using the data system or press `[Start]` on the GC.

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.

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



3396B or 3396C or 3397A integrator sample conditions with analog input [GC Analog output, Range 0]

>>Set DATE and TIME<<

GC Analog output

Noise ([N1])

Measured at [GC Range 0], [3396 Attn. 3, Chart speed 1, zero 50]	<37 mm for 1 min. measurement

Signal

GC Range 6

3396

Zero	10	Pk wd	0.04
Att 2^	5	Thresh	5
Cht sp	1	Stop time	11.0
Ar Rej	100000		

Area, Lindane peak	47,950 × [N1]

Agilent ChemStation

Noise ([N3])

Measured by ChemStation, ASTM [N3]	< 3 Hz

Signal

Area, Lindane peak	7500 × [N3]

To Check FPD Performance (Sample 5188-5953)

If sample FPD checkout sample 5188- 5953 is available, use it to test FPD performance.

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

ChemStation macros

If you are using a ChemStation with your GC, the testing process can be automated using two macros. The macros are available on the CE- ROM and from the EPI Warehouse and the Agilent Website.

Macro name	Description
MEPCK_S.MAC	Processes data collected from sulfur tests.
MEPCK_P.MAC	Processes data collected from phosphorus tests.

CE-ROM

Look in Gas Chromatography / Patches and Firmware / FPD Checkout Macros.

EPI Warehouse

The download page is: ***http://whadmin.cos.agilent.com/Search/DownloadSource.asp?iWHID=39943***.

Agilent Website

Go to http:/www.chem.agilent.com/Scripts/cag techsupport.asp. Click Agilent ChemStation Macros, then

Multitechnique
ChemStation, then FPD Checkout Macros. Download the files from this link.

Using the macros

Copy the macros into the Core directory of the ChemStation. This is usually either C:\HPCHEM or C:\CHEM32\CORE.

As a post-run command

Enter the command on the Run- Time Checklist screen. The syntax is: macro "<macro name>.mac",go. The macro will run after each analysis and send a report to the designated printer.

From the command line

From the Data Analysis view, type the macro command (same syntax as above) into the command line and press Enter.

To modify the noise start time

Noise measurements normally start at 3.8 minutes. If you notice a contaminant peak in that area, you can change the start time with this syntax: macro "<macro name>";cko_p (or s) 3. Use p for phosphorus and s for sulfur. The noise measurement will now begin at 3 minutes.

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)
   - 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

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

4 Install the evaluation column. (See the procedure for the SS, PP, COC, or PTV in the Maintenance manual.)
   - Set the oven, inlet, and detector to 250 °C and bake out for at 15 min. (See the procedure for the SS, PP, COC, or PTV 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 the table below.

Table 5. 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
Purged packed inlet	
Temperature	200 °C

Septum purge	3 mL/min
Cool on-column inlet	
Temperature	Oven track (cool on-column)
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
Electrometer	On
Oven	
Initial temp	70 °C
Initial time	0 min
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
Injection volume	1 µL
Syringe size	10 µL
PreInj Solvent A Washes	2

PreInj Solvent B Washes	0
PostInj Solvent A Washes	2
PostInj Solvent B Washes	0
Viscosity delay	0
Plunger speed	Fast
PreInjection dwell	0
PostInjection dwell	0
Manual injection	
Injection volume	1 µL

CAUTION If you receive a message like the following, check your printer setup and make any corrections.
... has problems. , with page file:
C:\WINNT\TEMP\~P3D042A.TMP
Initial printing problem, 202.
System resources are low and/or device has problems.

Path	Setting
Method and Run Control View: Instrument>Edit Parameters>Options	Keep instrument keyboard locked after method is loaded? = No
Method and Run Control View: Instrument>Edit Parameters>Signals	Assign Signal 1 to the detector Choose Save Data All 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 level off. This takes approximately 1 hour.

If the baseline output is too high:

- Check column installation. If installed high, the stationery phase burns out 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 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.

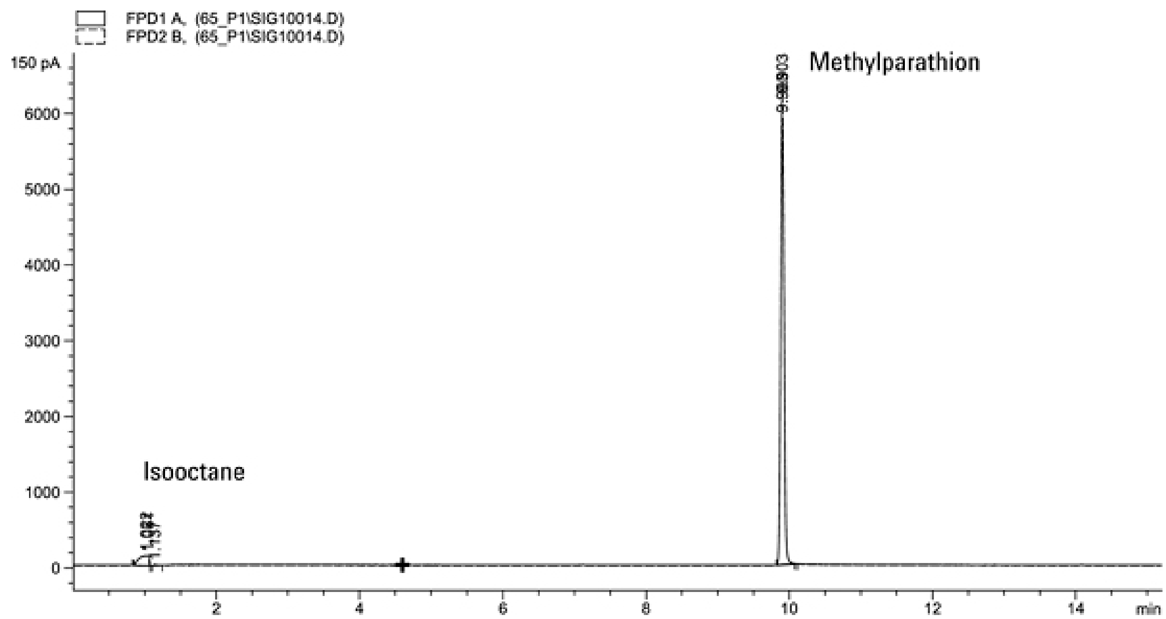


Table 6. Evaluating checkout runs

FPD P filter	Typical range after 24 hours	Limits at installation
MDL (pg/sec)	0.06 to 0.08	≤ 0.10
Peak area	19000 to 32000	≥ 19000
Signal height	5000 to 11000	--
Noise	1.6 to 3.0	≤ 4
Half-width (min)	0.05 to 0.07	--
Output	34 to 80	≤ 80

Sulfur performance

1 Install the sulfur filter and filter spacer.

2 Make the following method parameter changes.

Table 7. Sulfur method parameters (S)

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

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 level off. This takes approximately 1 hour.

If the baseline output is too high:

- Check column installation. If installed high, the stationery phase burns out 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 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.

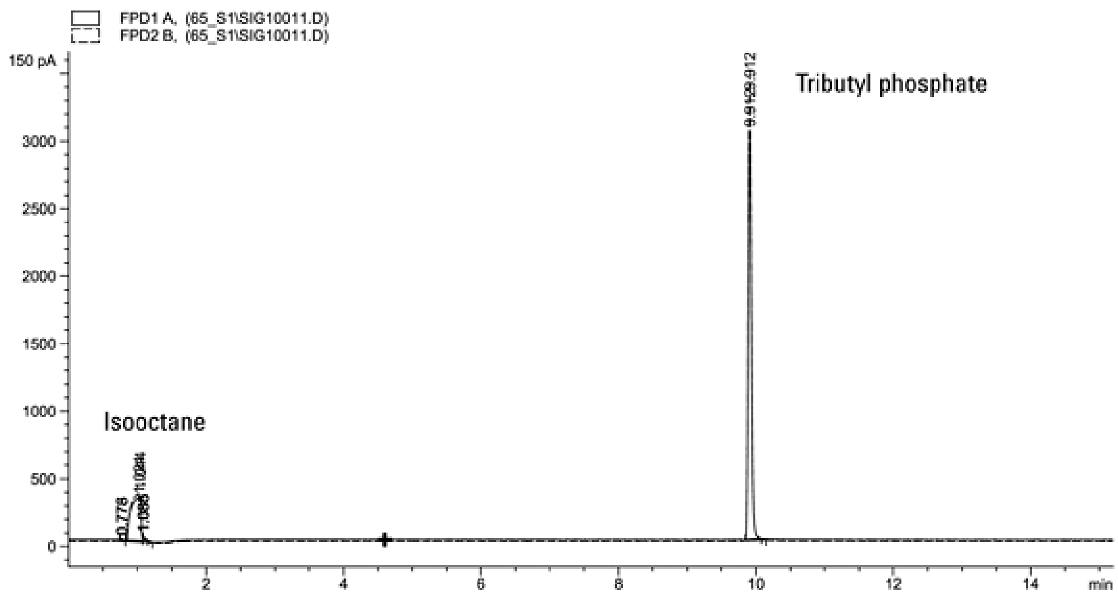


Table 8. Evaluating checkout runs

FPD P filter	Typical range after 24 hours	Limits at installation
MDL (pg/sec)	3.8 to 5	≤ 6
Peak area	8000 to 19000	≥ 8000
Signal height	2500 to 6000	--
Noise	2 to 4	≤ 5
Half-width (min)	0.06 to 0.08	--
Output	34 to 65	≤ 70

To Check FPD Performance (Sample 5188-5245)

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)
- 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.

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 Verify the lit offset is set appropriately. Typically, it should be about 2.0 pA for the checkout method.

4 Install the evaluation column. (See the procedure for the SS, PP, COC, or PTV in the Maintenance manual.)
   - Set the oven, inlet, and detector to 250 °C and bake out for at 15 min. (See the procedure for the SS, PP, COC, or PTV 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 these parameter values.

Table 9. FPD Phosphorus Checkout Conditions

Column and sample	
Type	DB-5MS, 15 m — 0.320 µm — 1.0 µm (123-5513)
Sample	FPD checkout (5188-5245)
Column mode	Constant flow
Column pressure	7.5 mL/min

Split/splitless inlet	
Temperature	250 °C Split/splitless
Mode	Splitless
Total purge flow	69.5 mL/min
Purge flow	60 mL/min
Purge time	0.75 min
Septum purge	3 mL/min
Purged packed 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
Electrometer	On
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
Injection volume	1 µL
Syringe size	10 µL
PreInj Solvent A Washes	2
PreInj Solvent B Washes	0
PostInj Solvent A Washes	2
PostInj Solvent B Washes	0
Viscosity delay	0
Plunger speed	Fast
PreInjection dwell	0
PostInjection dwell	0
Manual injection	
Injection volume	1 µL
Data System	

ChemStation macros for FPD performance testing

Macro name	Description
JFPD_S.MAC	Processes data collected from sulfur tests.
JFPD_P.MAC	Processes data collected from phosphorus tests.

Macro subdirectories

Software rev.	Macro location	Summary result log location
B.01.xx or later	CHEM32\CORE	CHEM32\n1
A.10.xx or earlier	HPCHEM\CORE	HPCHEM\n

*n is the instrument number.

CAUTION

If you receive a message like the following, check your printer setup and make any corrections.
... has problems. , with page file:
C:\WINNT\TEMP\~P3D042A.TMP
Initial printing problem, 202.
System resources are low and/or device has problems.

Path	Setting
Method and Run Control View: Instrument>Edit Parameters>Options	Keep instrument keyboard locked after method is loaded? = No

Method and Run Control View: Instrument>Edit Parameters>Signals	Assign Signal 1 to the detector Choose Save Data All 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 level off. This takes approximately 1 hour.

   If the baseline output is too high:

   - Check column installation. If installed high, the stationery phase burns out 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 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.

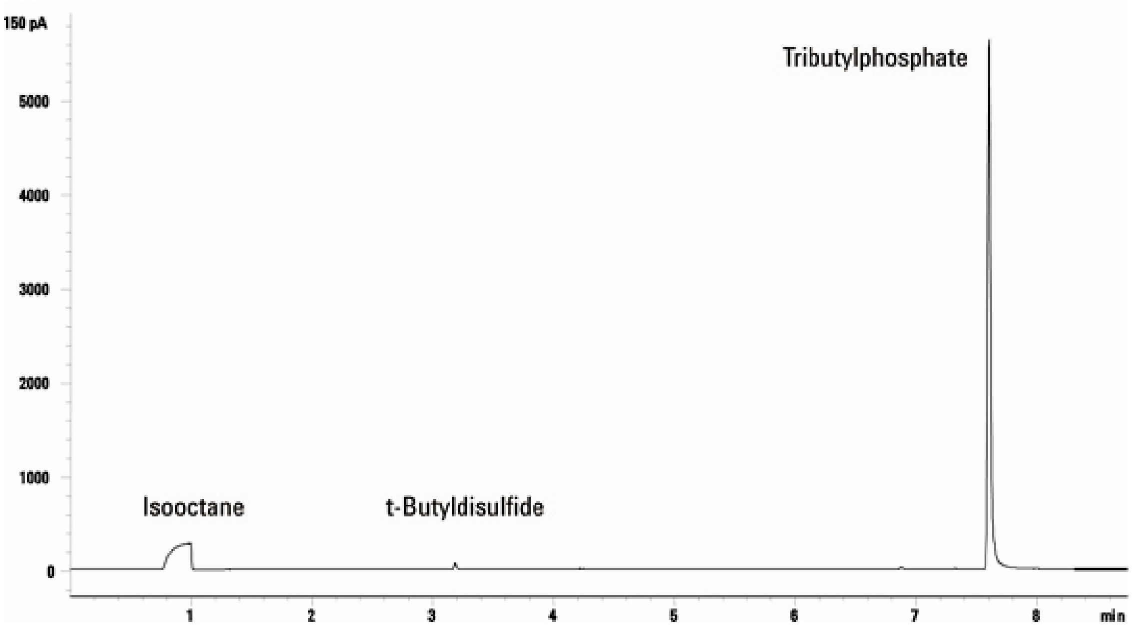


Table 10. Evaluating checkout runs

FPD P filter	Typical range after 24 hours	Limits at installation
MDL (pg/sec)	0.06 to 0.08	≤ 0.10
Peak area	19000 to 32000	≥ 19000
Signal height	5000 to 11000	--
Noise	1.6 to 3.0	≤ 4
Half-width (min)	0.05 to 0.07	--
Output	34 to 80	≤ 80

Sulfur performance

1 Install the sulfur filter.

2 Make the following method parameter changes.

Table 11. 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 level off. This takes approximately 2 hours.

If the baseline output is too high:

- Check column installation. If installed high, the stationery phase burns out 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 system or press `[Start]` on the GC.

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

- Press `[Prep Run]` to prepare the inlet for splitless injection.
- 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.

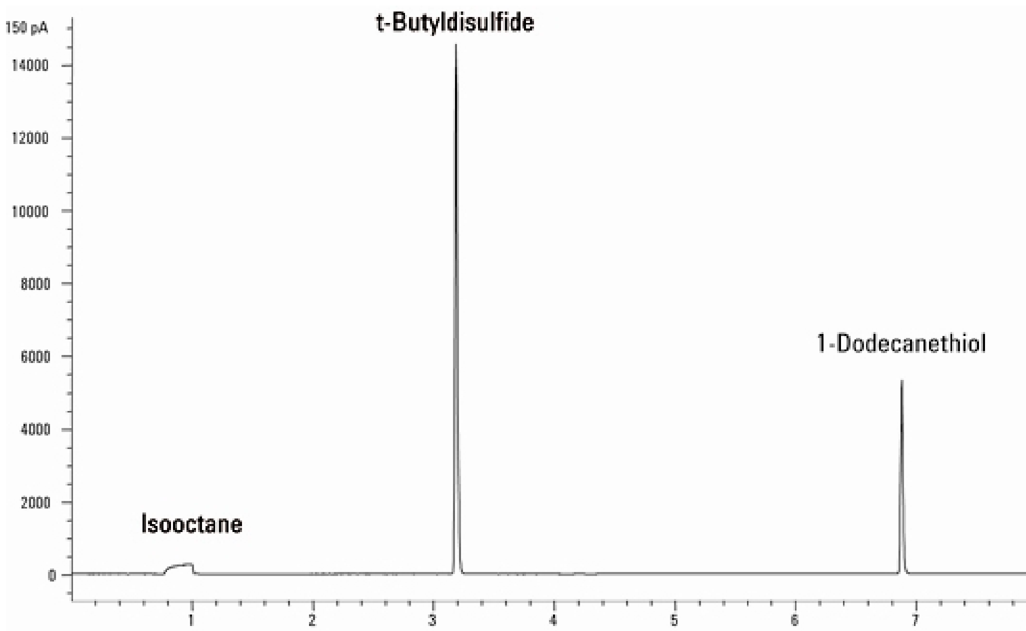


Table 12. Evaluating checkout runs

FPD S filter	Typical range after 24 hours	Limits at installation
MDL (pg/s)	3.8 to 5	≤ 6
Peak area	8000 to 19000	≥ 8000
Signal height	2500 to 6000	--
Noise	2 to 4	≤ 5
Half-width (min)	0.06 to 0.08	--
Output	34 to 65	≤ 70

7 Configuration

Configuration overview

There are 2 kinds of configuration information: hard and soft.

- Hard configuration includes what hardware options are installed on the GC: the type of inlets and detectors, where they are located, and what auxiliary heaters are connected.
- Soft configuration includes application specific information: carrier gas type, make up gas type, inlet control modes, column dimensions.

The GC modules that make up an instrument (i.e., EPC modules, detector boards, and heaters) are initially configured during manufacturing. This information is stored in the logic board memory.

- An inlet is configured as an EPC module and a heater.
- A detector is configured as an EPC module, a detector signal board, and a heater.
- A pneumatic control module (PCM) is configured as an EPC module and can be associated with a heater.
- An auxiliary pressure control module (AUX) is configured as 3 channels of auxiliary pressure control and can be

associated with a heater.

- A valve box is configured with one or two heaters.
- An AUX thermal zone is configured with a heater. For example, an MSD transfer line or a nickel- catalyst accessory.

There are many custom configuration options available. Most are explained in G3430- 90024, Firmware A.01.05 Instructions For Channel Partner Devices.

You can configure the GC modules by pressing [Config] and then pressing the key for the GC module, for example, [Config] [Front Det]. Under the configuration menu, you will find these features:

- Install or remove the module.
- If you wish to ignore a ready or not ready status.
- The type of gas that the EPC module is controlling.
- The baseline output to use for reigniting the flame.

Inlet example

The configuration control table for a front SSL Inlet includes 5 items.

CONFIGURE FRONT INLET	
Configured:	Split/Splitless
Ignore Ready =	FALSE
Makeup gas type	He
[EPC1] = (INLET)	(SS)
FINLET (OK) 68 watts	250.0

This list interprets each line of the control table.

- Configured: The type of module configured as a front inlet is an split/splitless capillary inlet.
- Ignore Ready: If TRUE, the GC will ignore a Not Ready status. If the inlet actuals do not match their setpoints, the GC will go ready. The ignored items are displayed under Status.
- This line indicates the EPC module. In this case, it is plugged into the 4- wire connector labeled EPC1 and is an inlet EPC module for an split/splitless inlet.
- This line describes the heater and sensor. In this case, there is a 64 watt heater cartridge associated with the front inlet and the sensor is reading 250.0°C.

Detector example

The configuration control table for a front FID detector includes 7 items.

CONFIGURE FRONT DETECTOR	
Configured:	(FID)
Ignore Ready =	FALSE
Makeup gas type	N2
Lit offset	2.0
[F-DET] = (SIGNAL)	(FID)
[EPC3] = (DET_EPC)	(FID)
F-DET (OK) 64 watts	300.0

This list interprets each line of the control table.

- Configured: The type of module configured as a front detector is an FID.
- Ignore Ready: If TRUE, the GC will ignore a Not Ready status. If the detector actuals do not match their setpoints, the GC will go ready. The ignored items are displayed under Status.
- Lit offset: The detector will try to reignite if the output drops to this level.
- This line indicates the signal board. In this case, it is plugged into the 4- wire communication buss connector labelled F- DET and is an FID signal board.
- This line indicates the EPC module. In this case, it is plugged into the 4- wire connector labeled EPC3 and is a detector EPC module for an FID.
- This line describes the heater and sensor. In this case, there is a 64 watt heater cartridge associated with the front detector and the sensor is reading 300.0°C.

PCM example

The configuration control table for an pneumatic control Module (PCM) module includes 6 items. For custom hardware, the configuration could include a heater.

CONFIGURE PCM C	
Configured:	PCM
Ignore Ready =	FALSE
Gas type	N2
Aux Gas type	N2
Aux Mode	Forward Pressure
[EPC6] = (AUX_EPC)	(PCM)

This list interprets each line of the control table.

- Configured: The type of module configured as a pneumatic control module or PCM.
- Ignore Ready: If TRUE, the GC will ignore a Not Ready status. If the PCM actuals do not match their setpoints, the GC will go ready. The ignored items are displayed under Status.
- The next two lines indicate what gas type is associated with

each channel. The Gas type refers to channel one. The options for an both channels are: Helium, Hydrogen, Nitrogen, Argon methane 5%, and Air.

- This line indicates the Aux Mode for the pressure control channel. This can be Forward Pressure or Back Pressure control.
- This line indicates the EPC module. In this case, it is plugged into the 4- wire connector labelled EPC6 and is an AUX EPC module for a PCM.
- There are no heaters configured in this example. However, you can associate a PCM with a front or back inlet heater.

CONFIGURE PCM C	
Install EPC6	Htr = NONE
Install EPC6	Htr = FINLET
Install EPC6	Htr = BINLET

AUX example

The configuration control table for an Auxiliary EPC module includes 6 items. For custom hardware, the configuration could include a heater.

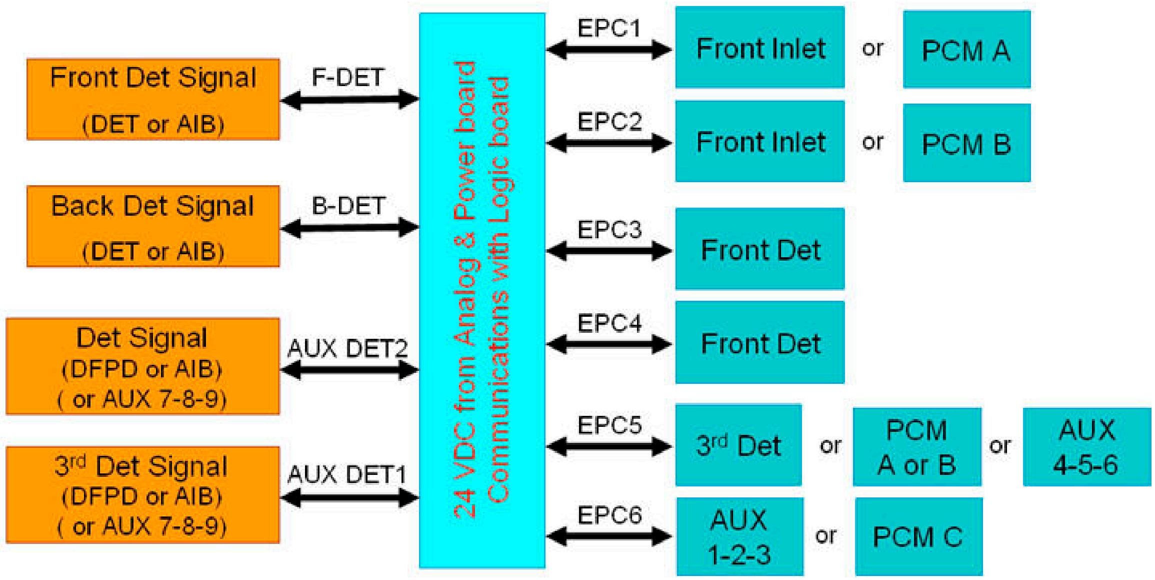
CONFIGURE APC 1,2,3	
Configured:	Aux Pressure
Ignore Ready =	FALSE
Chan 1 Gas type	N2
Chan 2 Gas type	N2
Chan 3 Gas type	N2
[EPC6] = (AUX_EPC)	(AUX)

This list interprets each line of the control table.

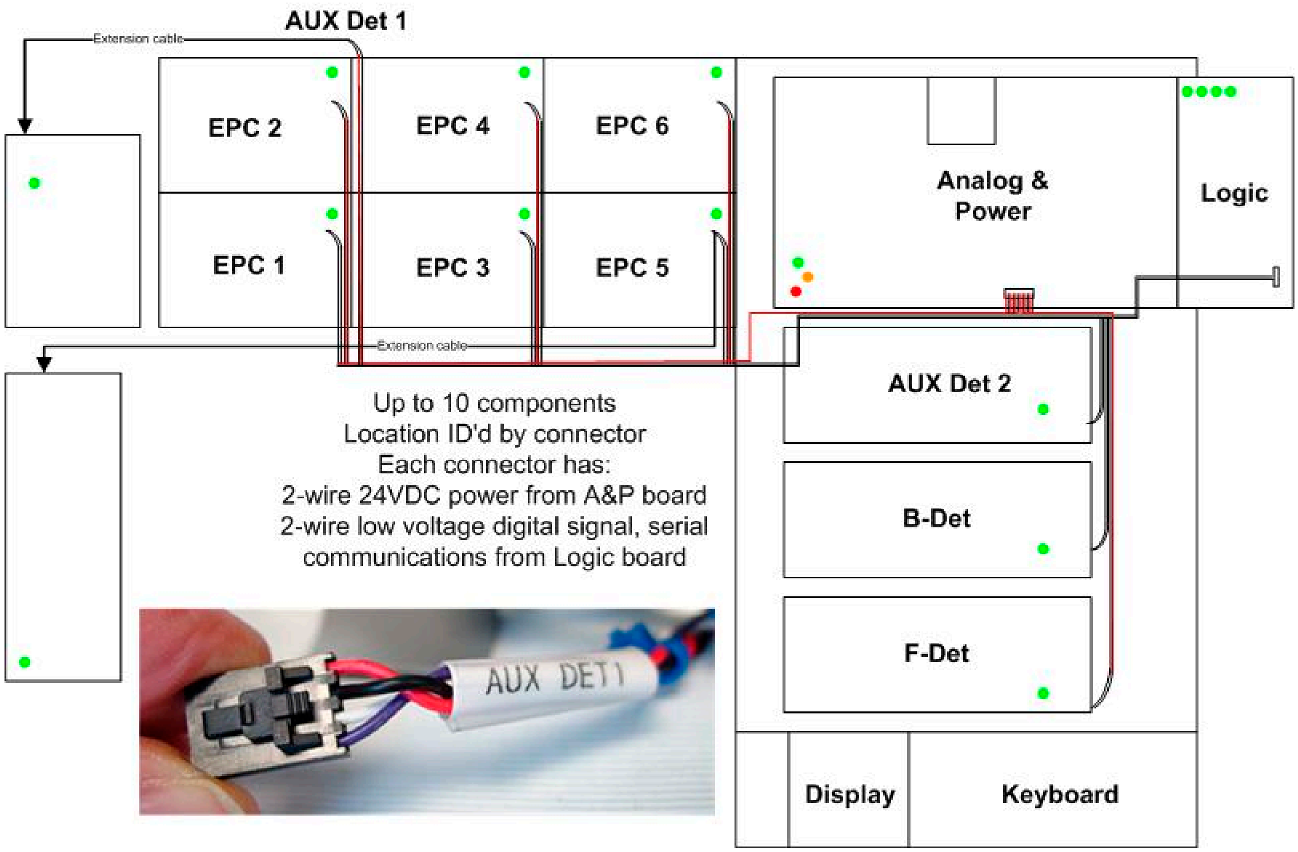
- Configured: The type of module configured as auxiliary pressure control channels 1, 2 and 3 is Aux Pressure module.
- Ignore Ready: If TRUE, the GC will ignore a Not Ready status. If the AUX actuals do not match their setpoints, the GC will go ready. The ignored items are displayed under Status.
- The next three lines indicate what gas type is associated with each channel. The options for an AUX channel are: Helium, Hydrogen, Nitrogen, Argon methane 5%, and Air
- This line indicates the EPC module. In this case, it is plugged into the 4- wire connector labeled EPC6 and is an AUX EPC module labeled AUX.
- There are no heaters associated with an AUX module in this position.

GC modules and the communications buss

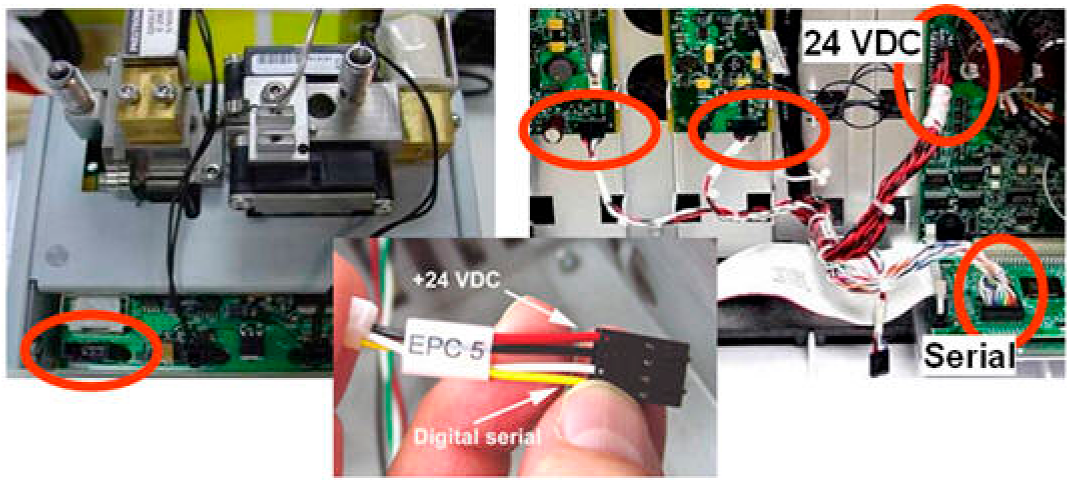
The 7890A provides a more flexible architecture than our 6890 GC. Along with the flexibility, the configuration of the GC can be more complex. The flexible architecture is represented in this schematic. Above each arrow is a label that represents an address on a communications buss.



The 4- wire communications buss is the nervous system of the GC. It connects to up to 6 EPC modules and up to 4 detector signal boards. On each of the 10 connectors, there is a label to help identify what can be plugged in.

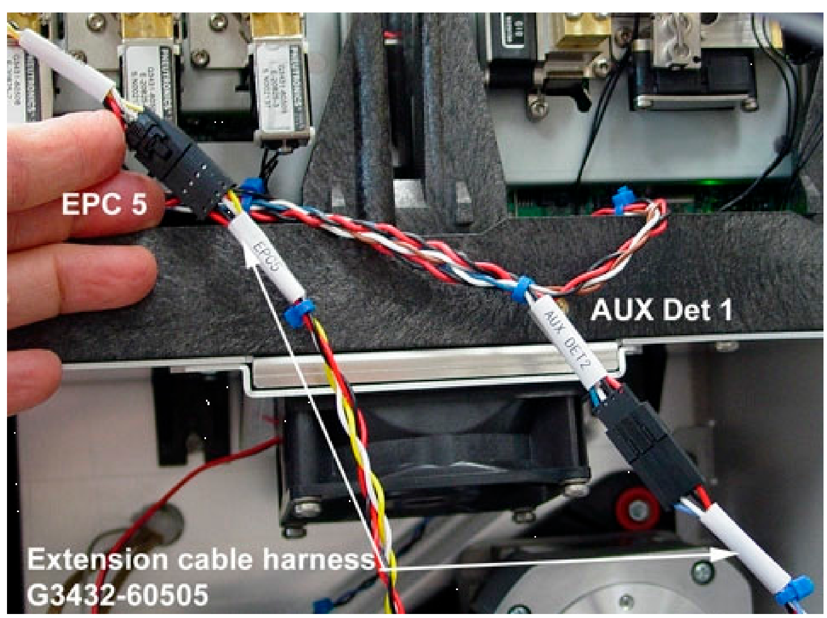


The red and black wires on the buss provide power to the module. The black wire is ground. The red wire is switched, unregulated +24 VDC. All of these wires plug into the Analog and Power Board. The white and colored wires provide serial communications between the Logic Board and the module.



There are 2 extension cables for the GC modules of the 3rd detector:

- For the GC modules, there is an extension cable for both the EPC module and the signal board; G3432- 60505.
- For the heater, there is an extension heater cable to connect to the AUX 2 heater; G3432- 60506.



Replacing a GC module

When replacing an EPC module or a detector signal board, you will have to update the configuration of the GC. This is because the configuration information includes the unique ID# and manufacturing date for these parts.

To configure the new GC module

1 Replace the module and power on the GC. The GC will list the Exceptions to the configuration and indicate that these modules are broken or missing.
2 Unlock the ***Configuration locks*** (223).
3 Press **[Config]** and select the GC module that you replaced.
4 Press **[Mode/Type]**. The GC displays **Remove module**. Press **[Enter]**.
5 A Caution message tells you to reboot the GC.
6 Press **[Mode/Type]**. The GC displays **Install module**. Press **[Enter]**.

CAUTION Be sure that you select the correct module configuration. Incorrect selections can cause operation problems. For example, for an FPD select the 2 heater version.

7 A Caution message tells you to reboot the GC.
8 Press **[Options]**. Scroll to Communications and press **[Enter]**.
9 Scroll to Reboot the GC. Press **[Yes/On]** twice.
10 Navigate to the configuration table for the GC module.
11 Verify that the configuration is correct. Modify any additional configuration items, such as, Gas type or Lit offset.

Removing a GC module

It is easy to unconfigure a module and make it appear to be uninstalled without disconnecting any cables. This is useful if a module fails and the customer still wants to use the other modules. For example, if the back inlet fails, the customer can unconfigure the back inlet and continue to use the front inlet and detectors.

1 Press **[Options]** and select Keyboard & Display.
2 Press **[Off / No]** to turn the Configuration Lock off.
3 Press **[Config]** and the key for the GC module to remove.
4 From the line labeled Configure, press **[Mode/Type]**.
5 Press **[Enter]**. The GC will display a message requesting you to power cycle the instrument.
6 Power cycle the instrument.
7 Verify the removal by pressing the key for the GC module. The GC should display an uninstalled message.

Changing the GC configuration

The GC configuration is changed when you do any of the following:

- Add or replace a detector signal board.
- Add or replace an EPC module.
- Replace the Logic board.
- Add or remove a tray or auto- injector.
- Add or remove a heater.
- Change any soft configuration items, such as, gas types, heater types, and Lit offset.

Changing the GC configuration impacts ChemStation methods and methods stored in the GC.

ChemStation methods

During the first connection and when loading any of the methods created with the old configuration, the ChemStation will note the change in configuration and force you to resolve the differences. If you do not resolve differences in both the configuration and method parameter screens the method will not load. Run method or run sequence will not start the run.

- Use the GC Configuration Connection screen to get the new configuration. Review and update any configuration setpoints.
- Use the Edit parameters screen to review and update any method setpoints.

Methods stored in GC

Methods stored in the GC that do not match the new configuration must be updated. Make the necessary additions or modifications. Store this method over the old method.

When you load a method, the GC compares the method against the current hardware it detects (inlet types, detector types, auxiliary EPC, PCM, heaters, valves, and so forth). A method which does not match is not loaded. Default setpoints for this configuration are loaded. Before adding new hardware or changing the installed hardware type, verify that any methods stored in the GC have been documented.

Configuration locks

When trying to change the GC configuration—as by adding, removing, or changing an Inlet module—you may encounter this or a similar message:

```
Configuration is Locked

Go to keyboard options to unlock
```

To unlock the configuration

1. Press [**Options**].
2. Select **Keyboard and Display**.
3. Select **Hard Configuration lock**, then press [**No/Off**].

When you power cycle the GC, the configuration lock is automatically set to On.

When you use the Reboot GC feature under Options | Communications, the configuration lock is not changed.

Installing New Devices

When a new device is added to the GC, it must be described so that the GC knows what it is and how to use it.

This procedure, using a PCM module as an example, illustrates the process.

1. Replace all instrument covers in the reverse order in which they were removed.
2. Plug in the GC and turn on the power.
3. Unlock the GC keypad.
   a. Press [**Options**].
   b. Select **Keyboard & Display**.
   c. Select Hard Configuration lock, then press [**No/Off**].
4. Press [**Configure**].

5 Scroll to select the entry for the new PCM module (**PCM A**, **PCM B**, or **PCM C**) and press [**Enter**].

6 On the GC keypad, press [**Mode/Type**].

7 The GC presents available configuration options.

- If using the PCM for something other than an inlet (for example, to provide carrier gas to a splitter), scroll to **Install EPC# Htr = None** (where # indicated the slot chosen).
- If using the PCM for inlet carrier gas supply, refer to the inlet manufacturer's documentation for the correct configuration choice.

8 Press [**Enter**]. A caution message appears instructing you to reboot.

9 Reboot the GC.

a Press [**Options**].

b Scroll to **Communications** and press [**Enter**].

c Scroll to **Reboot the GC?** and press [**Yes/On**] twice to reboot the GC and have the changes take effect. This also resets the Hard Configuration lock.

10 Zero the pressure sensors.

11 Configure the gas types and control mode.

a Press [**Config**], then scroll to the correct **PCM** entry (**PCM A**, **PCM B**, or **PCM C**).

b Scroll to **Gas type** and use the [**Mode/Type**] key to set the gas type connected to the PCM's Channel **1**.

c Scroll to **Aux Gas type** and use the [**Mode/Type**] key to set the gas type connected to the PCM's Channel **2**.

d Scroll to **Aux Mode** and use the [**Mode/Type**] key to set the pressure control mode (forward or backward) for the PCM's Channel **2**.

Configuring time

To localize the date/time stamp in the Run and Event logs, use this procedure.

1 Press **[Config][Time]**.

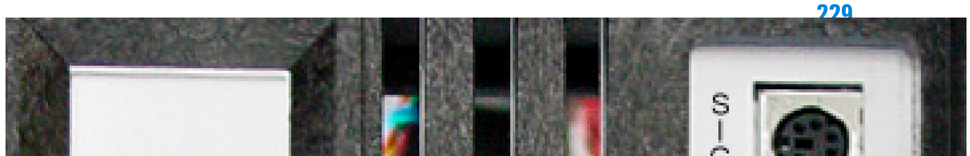
2 Enter the offset from Greenwich Mean Time using 24-hour format. Press **[Enter]**.

3 Enter the local time (24 hour format). Press **[Enter]**.

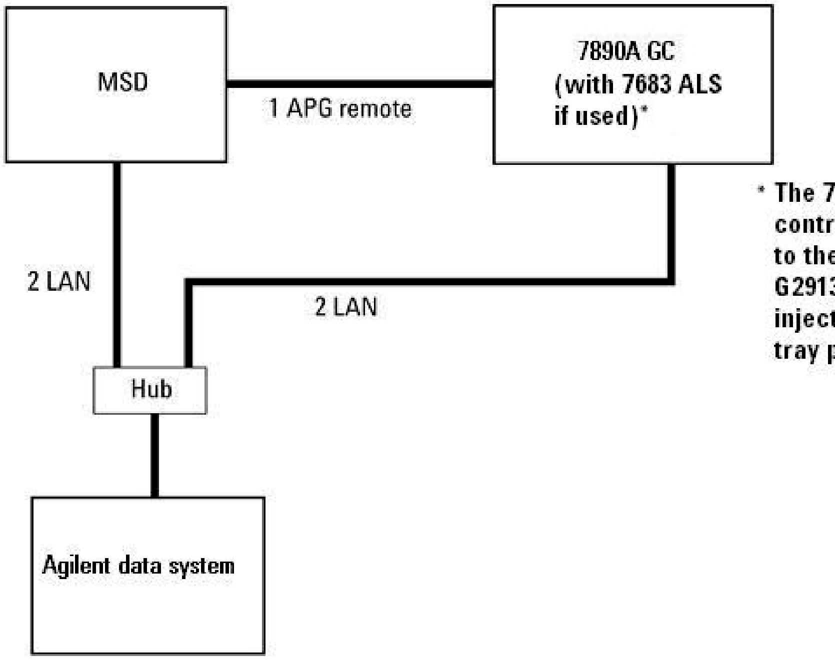
4 Enter the date, in ddmmyy format. Press **[Enter]**.

8 External Cabling

Connectors on the back of the GC

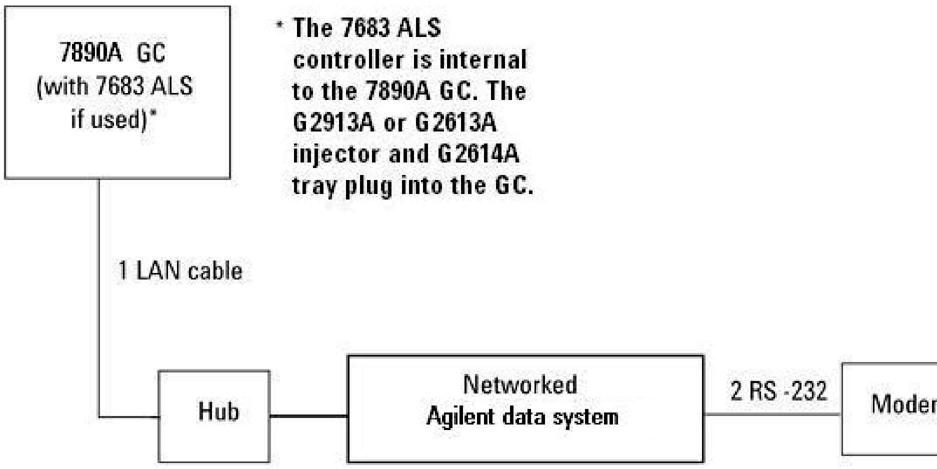


7890A GC: Mass Selective Detector / Agilent data system / GC Automatic Liquid Sampler



Number	Part no. and description
1	G1530-60930, 2-m APG remote cable, 9-pin male/9-pin male
2	8121-0940, Cable, 100 Base T-LAN

7890A GC: GC ChemStation/CerityGC Automatic Liquid Sampler



*RS- 232 cables for future support.

Number	Part no. and description
1	8121-0940, Cable, 100 Base T-LAN
2	G1530-61120, RS-232/modem cable or 24540-80012, RS232/modem cable

7890A GC: ALS/NonAgilent Data System

Part no. and description

G1530-60930, 2-m APG remote cable, 9-pin male/9-pin male

G1530-60590, External event cable, 8-pin/spade lugs

35900-60670 APG remote cable spade lug identification

Connect 1 9 pin (male)	Signal name	Connector 2 spade lugs
1	GND	Black
2	Prepare	White

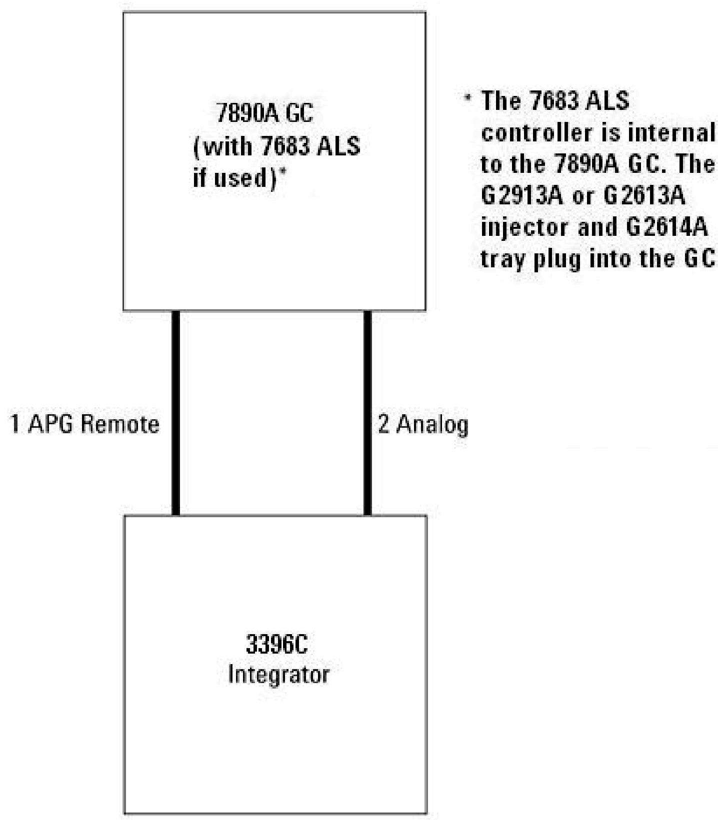
G1530-60590 External event cable spade lug identification

Pin	Color	Signal
1	Yellow	24 V Out 1
2	Black	24 V Out 2

3	Start	Red
4	Shut down	Green
5	Reserved	Brown
6	Power on	Blue
7	Ready	Orange
8	Stop	Yellow
9	Start Request	Violet

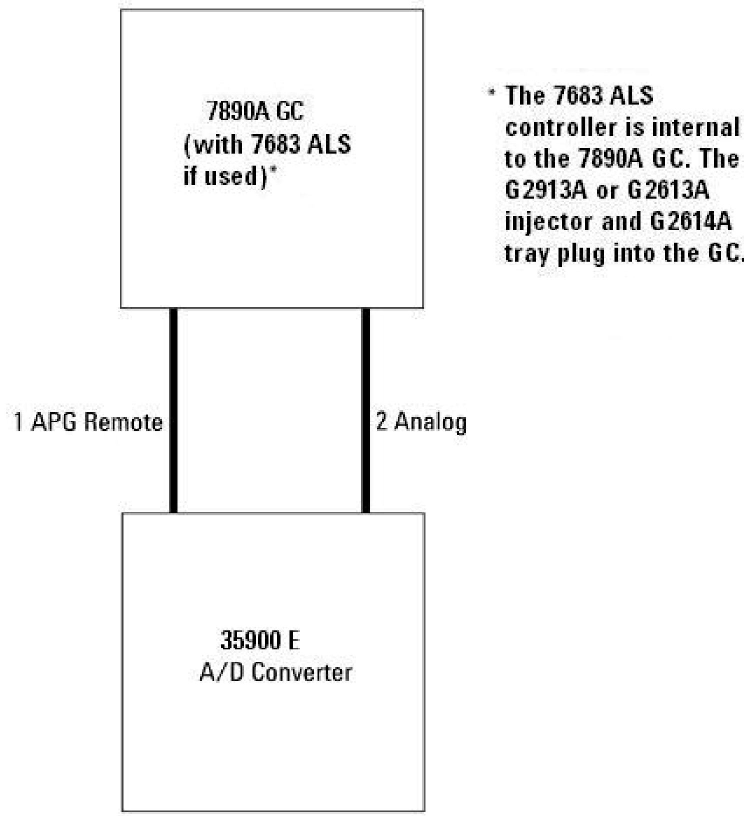
3	Red	Ground
4	White	Ground
5	Orange	Contact 1
6	Green	Contact 1
7	Brown	Contact 2
8	Blue	Contact 2

GC / 3396C Integrator / ALS



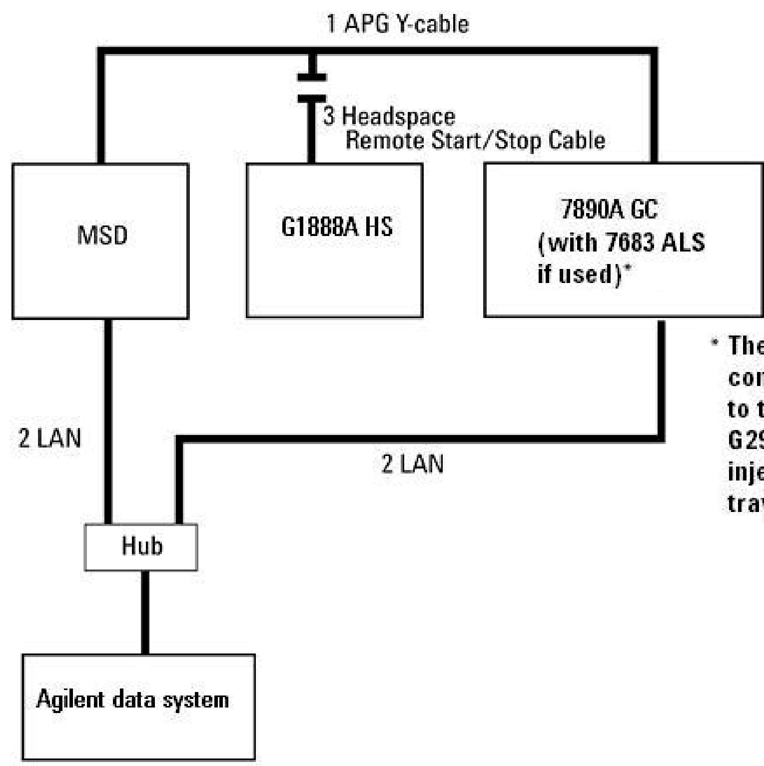
Number	Part no. and description
1	G1530-60930, 2-m APG remote cable, 9-pin male/9-pin male
2	G1530-60570, 2-m Analog cable, 6-pin

GC / 35900E Analog to Digital Converter / ALS



Number	Part no. and description
1	G1530-60930, 2-m APG remote cable, 9-pin male/9-pin male
2	G1530-60570, 2-m Analog cable, 6-pin

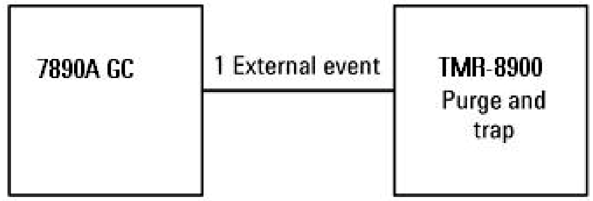
GC / MSD / Agilent data system / Headspace



*7694B Headspace supported.

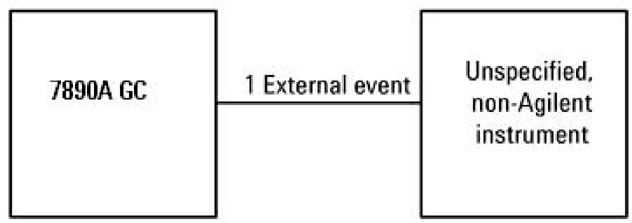
Number	Part no. and description
1	G1530-61200, 2m APG Ycable
2	8121-0940, Cable, 100 Base T-LAN
3	G1290-60575, Headspace Remote Start/Stop cable

GC /TMR-8900 Purge and Trap



Number	Part no. and description
1	14-6689-086, APG remote cable

GC / External Event (unspecified, nonAgilent instrument)

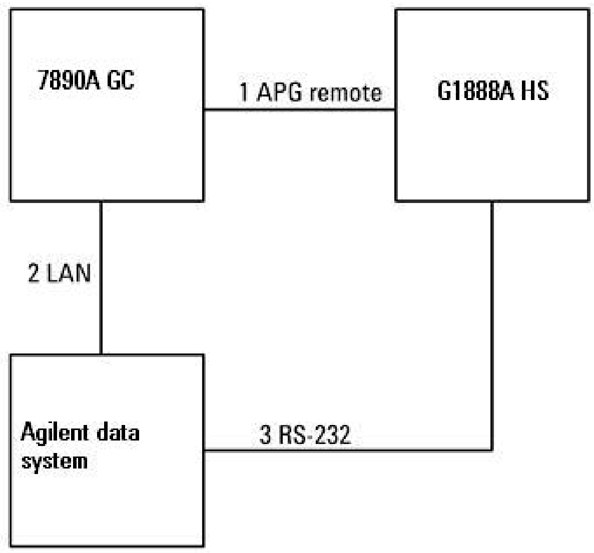


Number	Part no. and description
1	G1530-60590, External events cable, 8-pin/spade lugs

Connector	Signal name	Maximum rating	Wire terminations	Corresponds to valve #
24 volt control output				
1	24 volt output 1	75 mA output	Yellow	5
2	24 volt output 2	75 mA output	Black	6
3	Ground		Red	
4	Ground		White	
Relay contact closures (normally open)				
5	Contact closure 1	48V AC/DC, 250 mA	Orange	7
6	Contact closure 1		Green	7

7	Contact closure 2	48 V AC/DC, 250 mA	Brown or violet	8
8	Contact closure 2		Blue	8

GC / G1888A Headspace Sampler / Agilent data system



*RS- 232 will be supported in the future.

*7694B Headspace supported.

Number	Part no. and description
1	G1530-60930, 2-m APG remote cable, 9-pin male/9-pin male
2	8121-0940, Cable, 100 Base T-LAN
3	G1290-60650, RS-232 cable, 9-pin female/9-pin female

Remote Start/Stop

These cables are used to link multiple instruments together, so that they start and stop together.

APG Remote Control

Remote control allows easy connection between single instruments or systems to ensure coordinated analysis with simple coupling requirements. For example, you might have an integrator, automatic sampler, and a gas chromatograph connected with Remote cables.

You can synchronize a maximum of ten instruments using Remote cables. Control of analysis is maintained by instrument readiness - READY for next analysis, followed by START of run and optional STOP of run triggered on the respective lines. In addition, PREPARE may be issued to initiate pre- run activities. All devices connected to APG remote are connected in parallel. For example, if one device is NOT READY then all devices on the bus are also NOT READY.

Electrical specifications

The APG signals are a modified open collector type. The signal levels are generally TTL levels (low voltage is logic zero, high voltage is logic one) but the open circuit voltage will be between 2.5 to 3.7 Volts. The typical voltage is 3 Volts. A voltage over 2.2 volts will be interpreted as a high logic state while a voltage below 0.4 volts will be interpreted as a low logic state. These levels provide some margin over the specifications of the devices used.

The pull- up resistance, connected to the open- circuit voltage, is in the range of about 1K ohms to 1.5K ohms. For a logic- low state, for a single device on the bus, the minimum current you must be able to sink is 3.3 milliamps. Since devices are connected in parallel, when you have multiple devices this minimum current must be multiplied by the number of devices attached on the bus. The maximum voltage for a low- input state = 0.4V.

The bus is passively pulled high. Leakage current out of a port must be less than 0.2 milliamps to keep the voltage from being pulled lower than 2.2 volts. Higher leakage current may cause the state to be interpreted as a low.

Over- voltage protection - APG Remote connections are clamped by a zener diode to 5.6 Volts. Exceeding this voltage will damage the circuit (main board).

Suggested Drive Circuits

A signal on the APG bus may be driven by another APG device or by one of the following circuits.

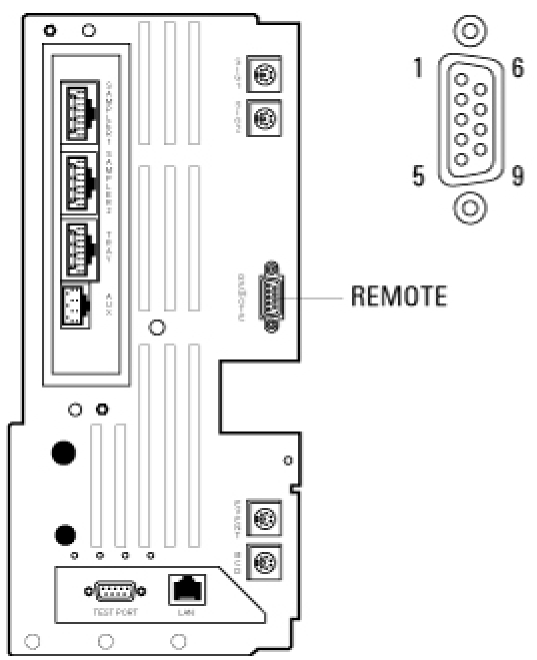
A relay, with one side connected to ground, when closed will set a logic- low state.

An NPN transistor, with the emitter connected to ground and the collector connected to the signal line will set a logic- low state if proper base current is supplied.

An open- collector logic gate will perform this same function.

A low- side drive IC will also work, but Darlington- type drivers should be avoided as they will not meet the low- side voltage requirement of less than 0.4V.

The Remote Connector



JP1, REMOTE

Pin	Function	Logic
1	Digital ground	
2	Prepare	LOW tru
3	Start	LOW tru
4	Start relay	
5	Start relay	
6	No connection	
7	Ready	HIGH tru
8	Stop	LOW tru
9	No connection	

Signal Descriptions

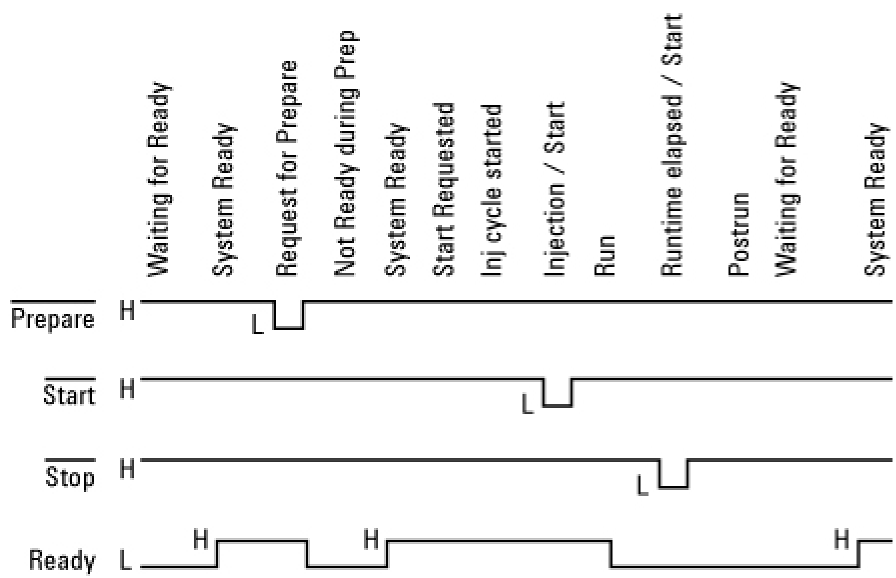
Prepare (Low True)–Request to prepare for analysis. Receiver is any module performing pre- analysis activities. For example, shorting pin 2 to ground will put the GC into “Prep- Run” state. This is useful for Splitless Mode to prepare the inlet for injection or when using “Gas Saver Mode.” This function is not needed by Agilent autosampler systems.

Ready (High True)– If The Ready Line is high (> 2.2 VDC) then the system is ready for next analysis. Receiver is any sequence controller.

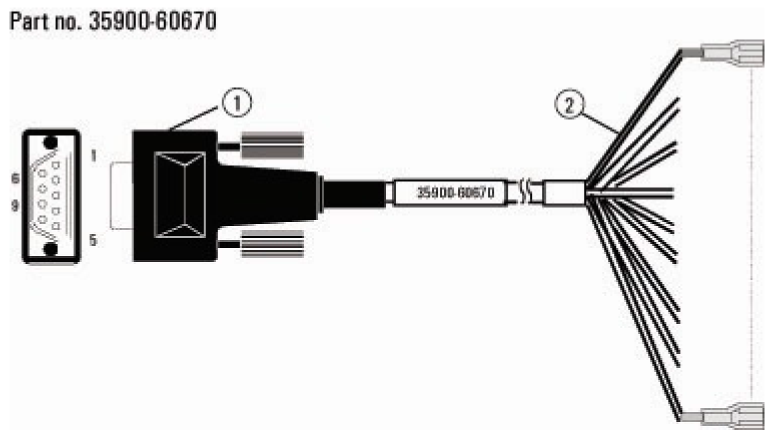
Start (Low True)—Request to start run/timetable. Receiver is any module performing runtime- controlled activities.

Stop (Low True)—Request to reach system ready state as soon as possible (for example, stop run, abort or finish, and stop injection). Receiver is any module performing runtime- controlled activities. Normally this line is not connected, if the GC oven program is used to control the method “Stop” time.

Timing Diagram

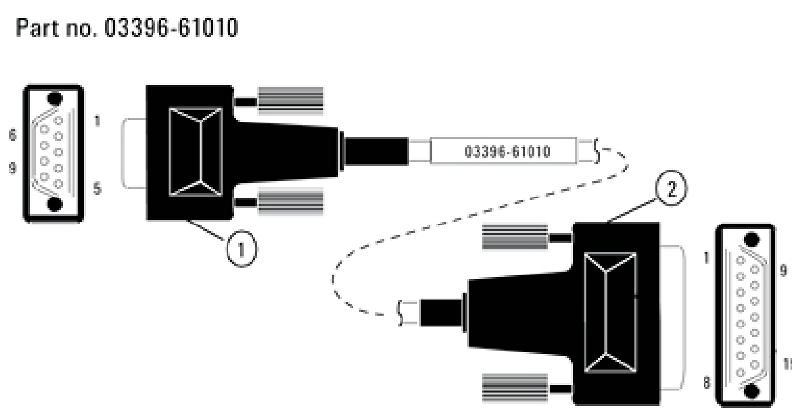


Cable pinouts, remote start/stop, general use



Connector 1 9 pin (male)	Signal name	Connector 2 (spade lugs)
1	GND	Black
2	Prepare (low true)	White
3	Start (low true)	Red
4	Start relay	Green
5	Start relay	Brown
6	No connection	Blue
7	Ready (high true input)	Orange
8	Stop (low true)	Yellow
9	No connection	Violet

Cable pinouts, GC to 3395B/3396C Integrator

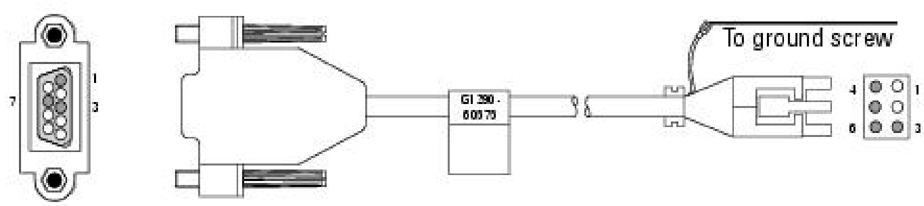


Connector 1 9 pin (male)	Signal name	Connector 2 15 pin (male)
1	GND	9 — Ground
2	Prepare	NC*
3	Start	3 — Start in
4	Start relay	NC*
5	Start relay	NC*
6	No connection	NC*
7	Ready	14 — Ready out
8	Stop	4 — STOP2 In
9	No connection	NC*

*NC = no connection

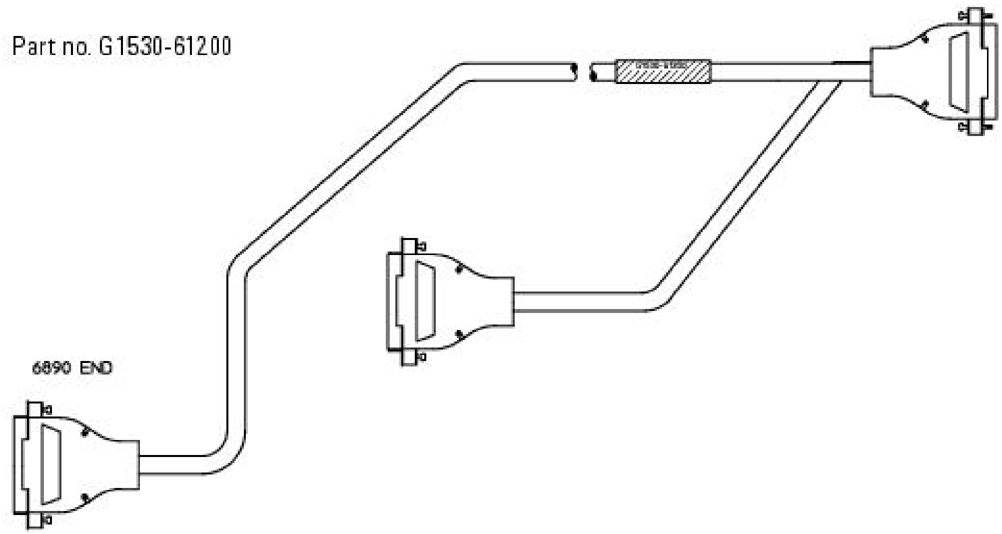
Cable pinouts, GC to Headspace Sampler

Part no. G1290-60575



Connector 1 3-pin male	Signal name	Connector 4-pin male
1	GND	4, 5
3	Start	6
7	Ready	3

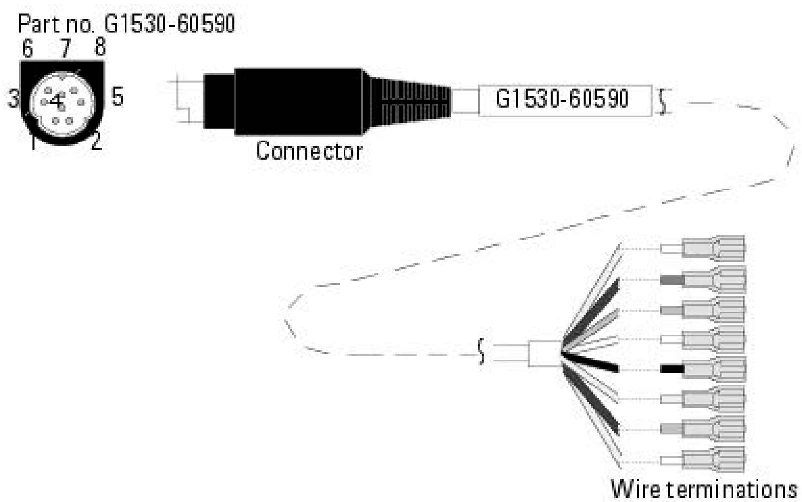
Cable pinouts, APG Remote Y-cable



Connector 1 9 pin (male)	Signal name
1	GND
2	Prepare
3	Start
4	Start relay
5	Start relay
6	No connection
7	Ready
8	Stop
9	No connection

External event

Two passive relay contact closures and two 24- volt control outputs are available for controlling external devices. Devices connected to the passive contact closures must be connected to their own power source.



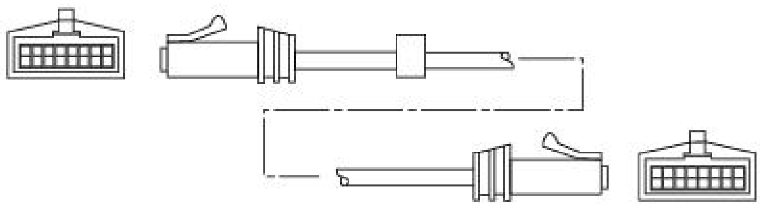
Connector	Signal name	Maximum rating	Wire terminations	Corresponds to valve #
24 volt control output				
1	24 volt output 1	75 mA	Yellow	5
2	24 volt output 2	75 mA	Black	6
3	Ground		Red	
4	Ground		White	
Relay contact closures (Normally open)				
5	Contact closure 1	48V ac/dc, 250 mA	Orange	7
6	Contact closure 1		Green	7
7	Contact closure 2	48 V ac/dc, 250 mA	Brown or Violet	8
8	Contact closure 2		Blue	8

Automatic sampler for GC

There are three connectors, Sampler 1, Sampler 2, and Tray, for the 7683 Autosampler system.

Cable pinouts, GC to G2613A Injector

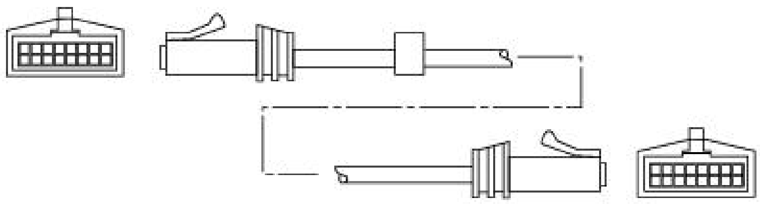
Part no. G2613- 60590



Connector 1 —16 pin (female)		Connector 2 — 16 pin (female)	
A1	RXD	A1	TXD
A2	CTS	A2	RTS
A3	DSR	A3	DTR
A4	NCTL Reset	A4	NCTL Reset
A5	GND	A5	GND
A6	VAC 1	A6	VAC 1
A7	GND	A7	GND
A8	VAC 2	A8	VAC 2
B1	TXD	B1	RXD
B2	RTS	B2	CTS
B3	DTR	B3	DSR
B4	GND	B4	GND
B5	GND	B5	GND
B6	VAC 1	B6	VAC 1
B7	GND	B7	GND
B8	VAC 2	B8	VAC 2

Cable pinouts, GC to G2614A Tray

Part no. G2614- 60610

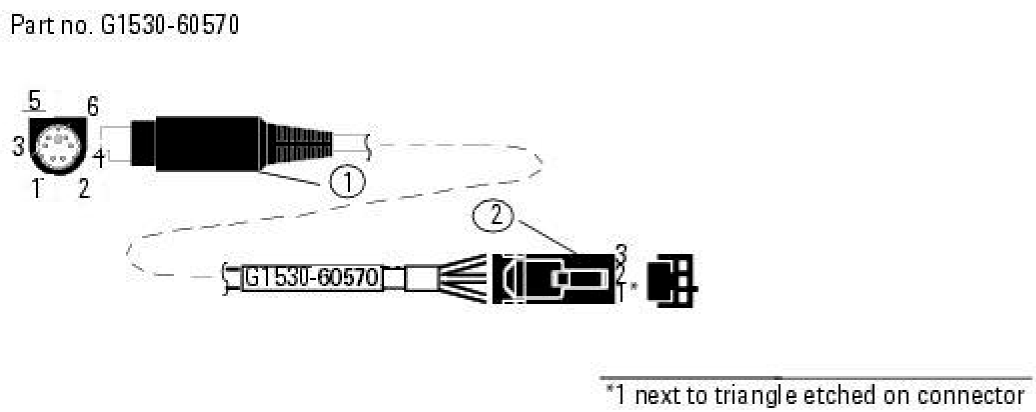


Connector 1 —16 pin (female)		Connector 2 — 16 pin (female)	
A1	RXD	A1	TXD
A2	CTS	A2	RTS
A3	DSR	A3	DTR
A4	M Reset	A4	M Reset
A5	GND	A5	GND
A6	VAC 1	A6	VAC 1
A7	GND	A7	GND
A8	VAC 2	A8	VAC 2
B1	TXD	B1	RXD
B2	RTS	B2	CTS
B3	DTR	B3	DSR
B4	GND	B4	GND
B5	GND	B5	GND
B6	VAC 1	B6	VAC 1
B7	GND	B7	GND
B8	VAC 2	B8	VAC 2

Analog signal outputs

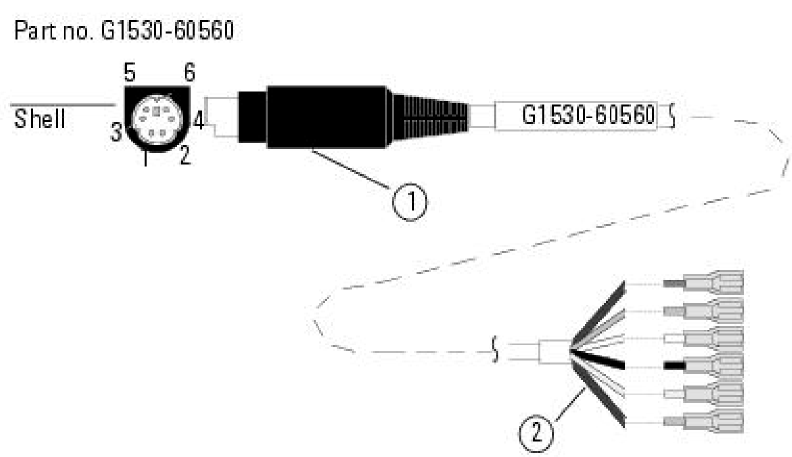
There are two channels of analog output available on the back panel, labeled *Sig 1* and *Sig 2*. Two cables are available – one for 3395/6 series integrators and one for general use.

Analog cable — GC to 3395A/B or 3396B/C Integrators and 35900 C/D/E Analog to Digital Interface instrument



Connector 1	Signal Name	Color	Connector 2
4	1 V	Black	3
2	Common	White	2
Shell	Ground	Orange	1

Analog cable — general use



Connector 1	Signal name	Connector 2 — quick disconnects
1	not used	Brown
2	0 to 1 V, 0 to 10 V(–)	White
3	not used	Red
4	1 V (+)	Black
6	10 V (+)	Blue
Shell	Ground	Orange

9 Internal Cabling

This section covers wiring harnesses in the gas chromatograph. The following wiring harnesses are described:

- Communication harness
- Motor harness and AC control assembly
- Third detector EPC communication cable
- Inlet/Detector harness
- Aux zone / valve box cable
- Third detector heated zone cable
- Keyboard/Display harness
- Interconnect board, keyboard
- Ignitor cable, FID
- Ignitor cable, FPD
- RS- 232 cable, ALS controller
- PTV thermocouple cable
- NPD power cable
- MSD transfer line heater cable

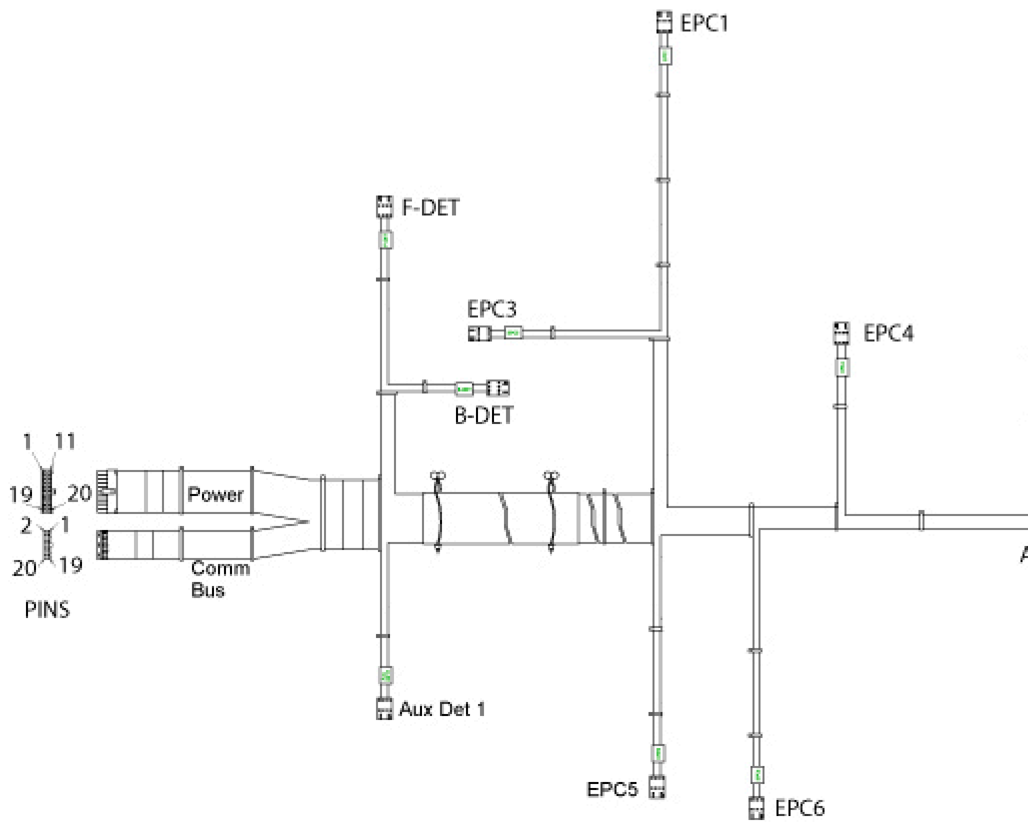
Internal cabling overview

The various modules that make up the GC are powered and interconnected by a set of cables and wiring harnesses. These modules include inlets, detectors, temperature controllers, printed circuit boards, and power supplies.

Communication harness

Part number G3430- 60513

This harness provides 24 VDC from the Analog and Power board to all EPC modules. It also carries communications between the EPC modules and the logic board.The harness connector labeled "power" connects to P1 on the Analog and Power board. The harness connector labeled "Comm Bus" connects to P7 on the Logic board.

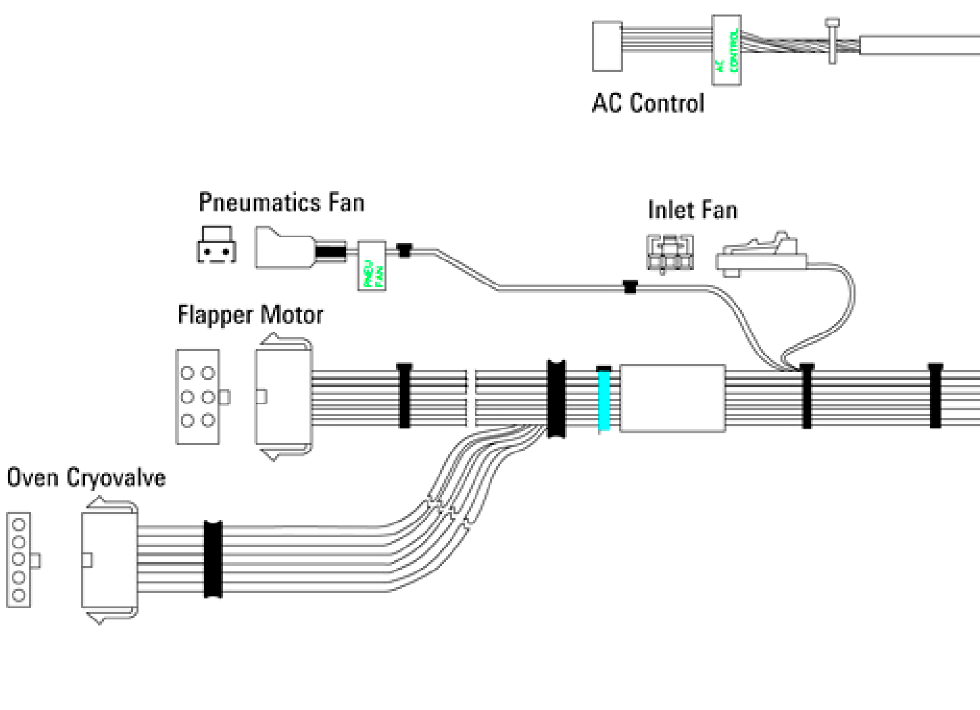


Motor Harness & AC Control Assembly

Part number G3430- 60512

This harness provides 24 VDC power from the Analog and Power board at P18 for the following functions:

- Flapper motor (6 pin, 2 x 3 connector)
- Inlet fan motor (3 pin)
- Oven sensor (2 pin, shortest)
- Pneumatics fan motor (2 pin)
- Cryogenic cooling valve for the oven (5 pin)
- Shut- off solenoid on the AC board (5 pin, 3 used)



Third detector EPC communication cable

Part number G3432-60505

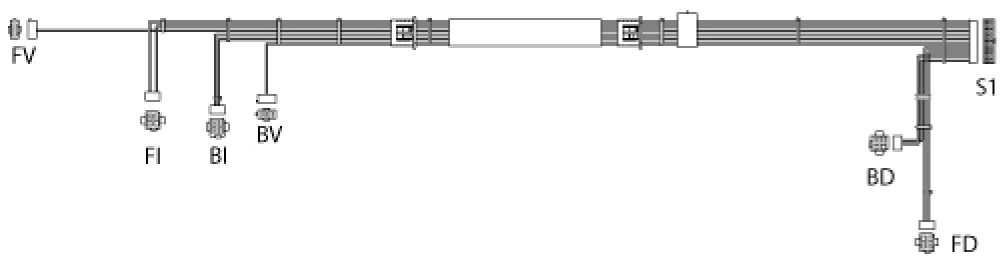
This cable extends the communications harness to a third detector mounted on the left side of the GC. It connects to the EPC 6 connector and extends across the top of the GC to the side mount.

When removing and replacing the third detector cable, note carefully how it enters the side detector carrier. You may need to loosen the screws holding the carrier to the GC body.

Inlet/Detector harness

Part number G3430-60535

This harness connects the inlet and detector EPCs to the logic board at P7.

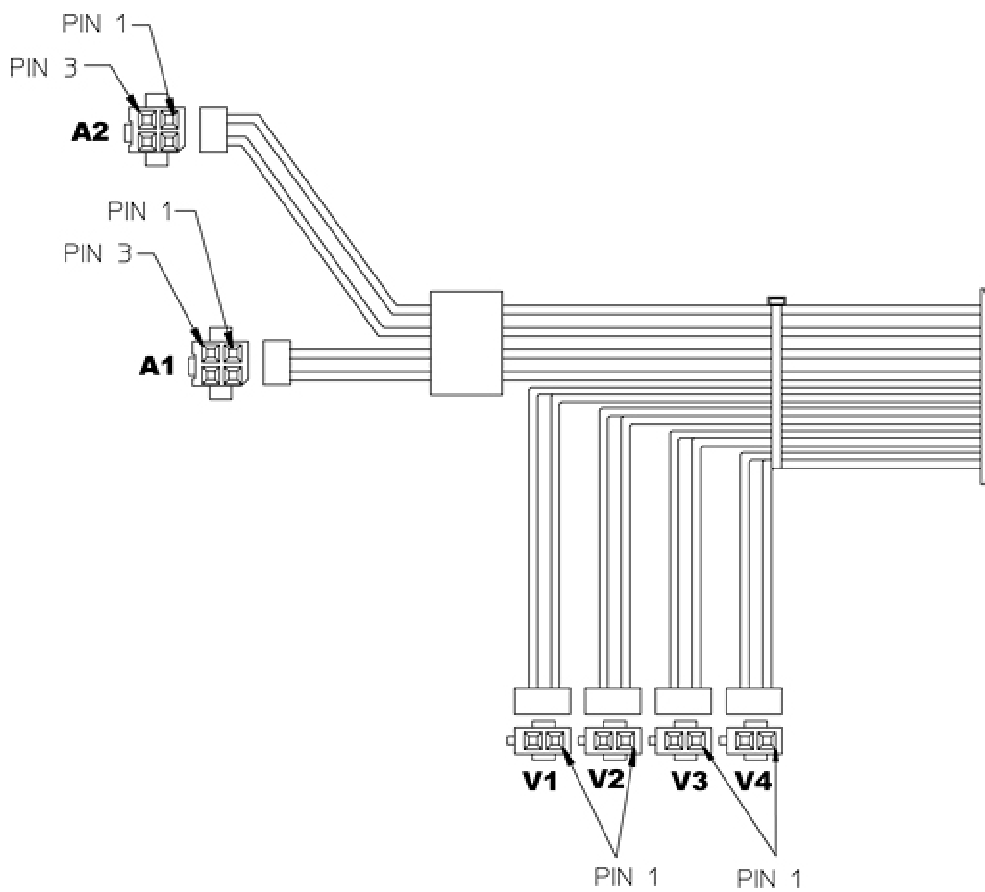


The FI and BI connectors are for inlets; FD and BD are for detectors. FV and BV are two-conductor connectors mounted on the top left edge of the GC near the inlets. They supply 24 VDC to various accessories.

Auxiliary zone/Valve box harness

Part number G1530-60660

The Auxiliary zone/Valve box harness runs from connector P22 on the A&P board to the valve driver bracket screwed on to the right side of the GC above the analog and power board. It powers the valve actuator drivers and two auxiliary heater/sensors.



Wire color	Pin # on P21	Signal name	Destination (and Pin #)
Violet	1	Aux 1 Sense	A1 (2)
	2	Aux 2 Sense	A2 (2)
Green	3	Heater GND	A1 (4)
	4	Heater GND	A2 (4)
Yellow	5	+24 Volts	V1 (1)
	6	+24 Volts	V2 (1)
	7	+24 Volts	V3 (1)
	8	+24 Volts	V4 (1)
Black	9	Sensor GND	A1 (3)
	10	Sensor GND	A2 (3)

Red	11	Aux 1 Heater	A1 (1)
Orange	12	Aux 2 Heater	A2 (1)
Brown	13	Valve #1	V1 (2)
Blue	14	Valve #2	V2 (2)
Gray	15	Valve #3	V3 (2)
White	16	Valve #4	V4 (2)

Third detector heated zone cable

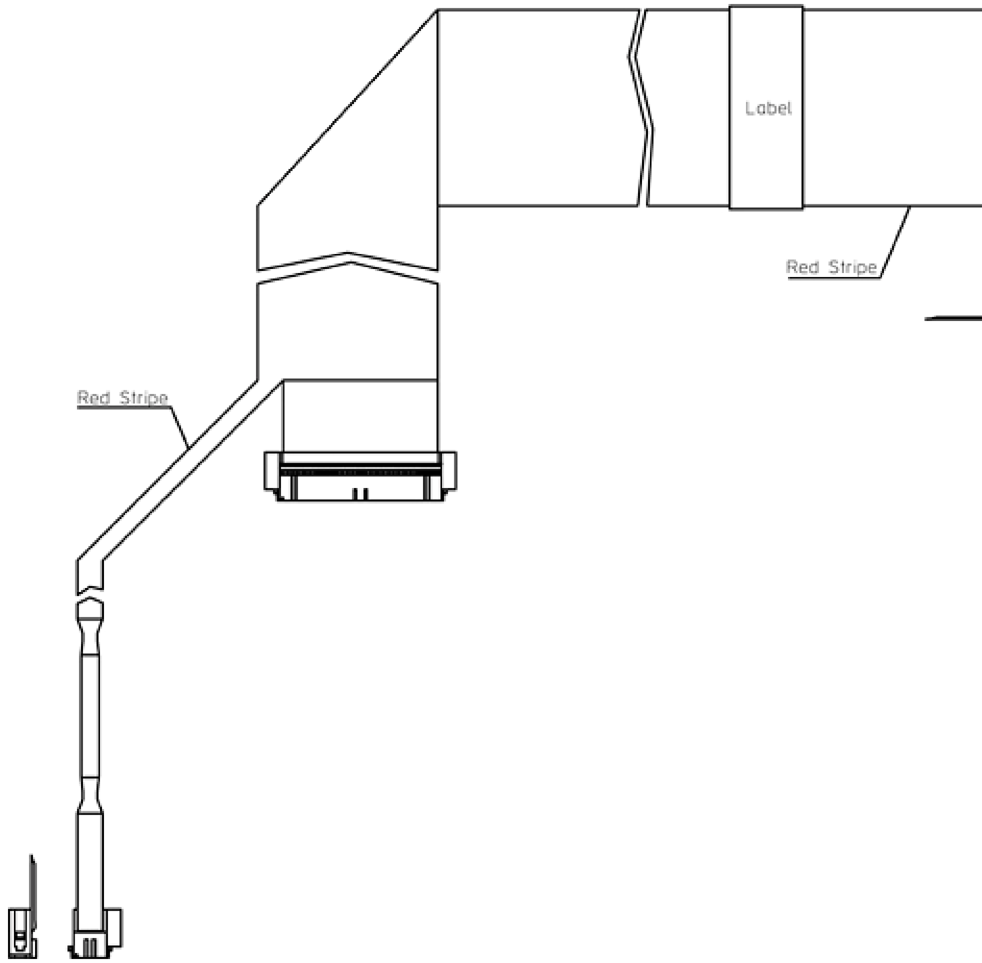
Part number G3432- 60506

This is a 4- conductor cable that provides heater power and sensor connections for a third detector mounted on the left side of the GC.

Keyboard/Display harness

Part number G3430- 60514

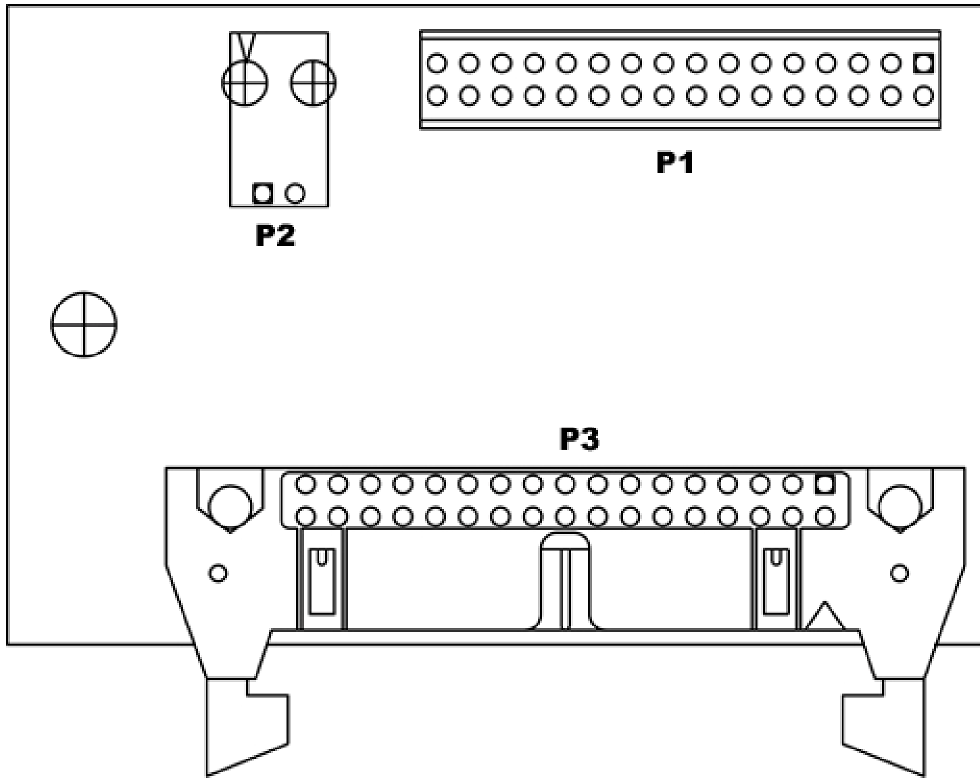
This harness connects the keyboard and display to the logic board at P8.



PCA, interconnect, 7890A keyboard

Part number G3430-60003

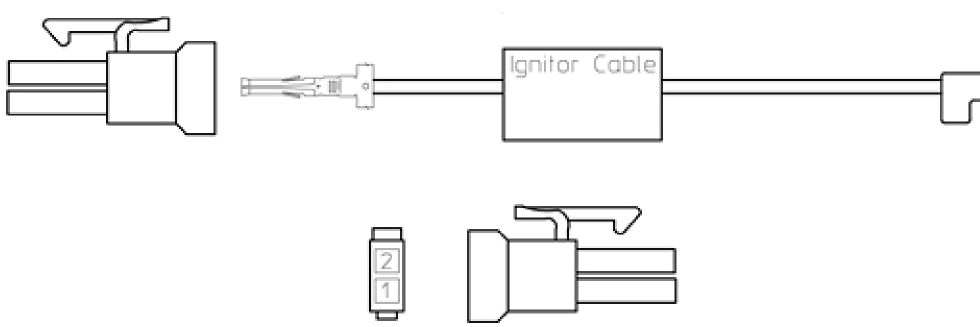
This board, mounted behind the keyboard/display module, connects the keyboard to the keyboard/display harness.



Ignitor Cable, FID, 7890A

Part number G3431- 60680

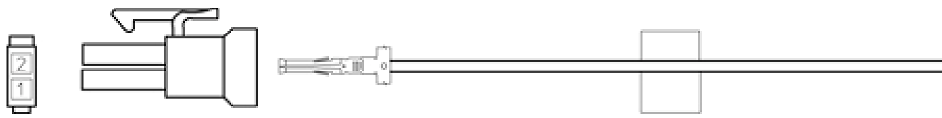
The ignitor cable connects the glow plug ignitor to its power source.



Ignitor cable, FPD, 7890A

Part number G3435-60600

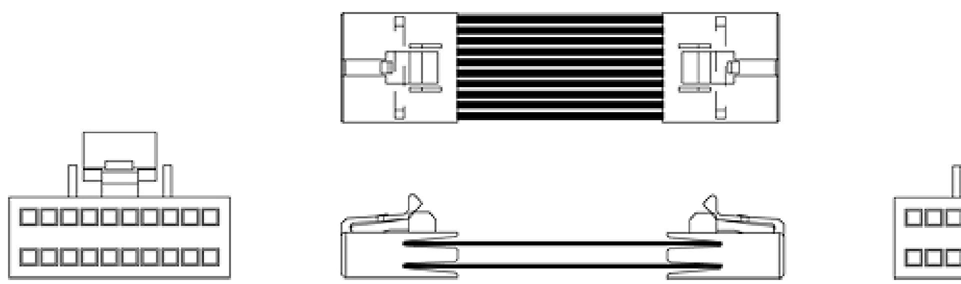
This cable connects the glow plug ignitor to its power source.



RS-232 cable, ALS controller

Part number G2612-60510

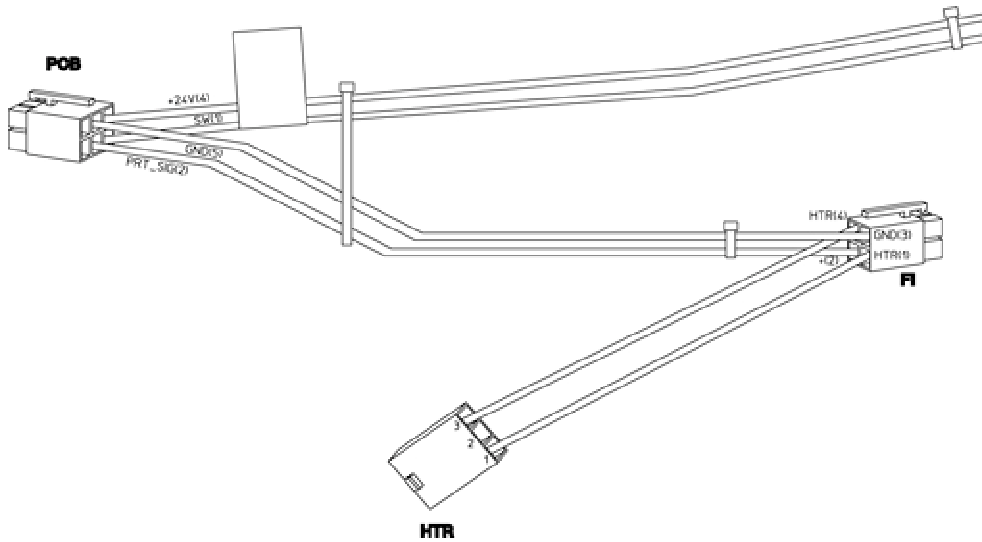
The ALS controller is driven by the analog and power board. This cable makes the connection at J8.

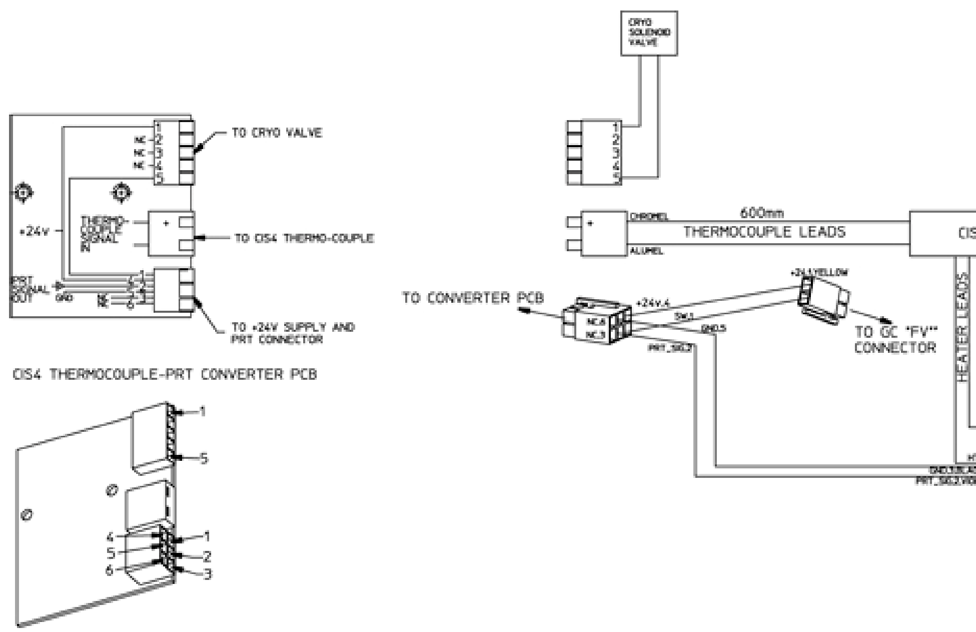


PTV thermocouple cable

Part number G62617-60505

The Thermocouple Cable connects the PTV thermocouple board to the PTV inlet heater/sensor cable, and to the valve and power connectors on the inlet/detector wiring harness.

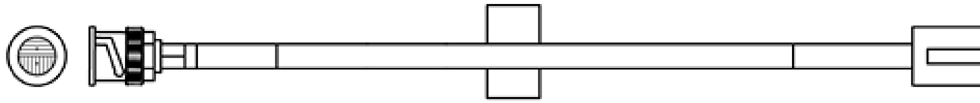




NPD power cable

Part number G3434-60600

This cable provides power to the heated bead in the NPD.



MSD transfer line heater cable

Part number G1530- 60790

This cable provides heater power and temperature sensing for an MSD transfer line heater.

10 Mainframe

Mainframe overview

The GC mainframe consists of the chassis (baseplate) plus the following:

- A set of metal and plastic covers
- The oven, oven door, and related parts
- Electronic components inside the right side cover. These are the "mind" of the GC.
- Power handling components inside the lower back cover
- Wiring cables and harnesses

Inlets, detectors, valves, and other selected components are mounted on or in the mainframe.

Covers and Fans

Metal and plastic covers protect the GC components and guard the user from exposure to heat and electric shock. The covers also play a part in controlling the flow of cooling air through the instrument. The GC should not be operated unless all covers are in place.

Additional cooling is needed in two areas, the inlets and the EPC pneumatic controllers. The inlet fan is located at the rear of the inlet cover. The preumatics fan is located on the back of the GC under the center of the pneumatics slots.

Removing and replacing the covers

Detector top cover

This cover protects the detectors, valve box, and valve assembly. To remove it, raise it to a vertical position, lift the right side, and disengage the pin on the lower left side.

CAUTION Do not force the cover, either when installing it or closing it. This could break the plastic parts.

To replace the cover, make certain that the slot in the brass bushing (lower right corner) is vertical and that the bushing is fully seated. Installation is then the reverse of removal.

The pneumatics top cover

The large plastic cover over the pneumatics area on the top, rear of the GC is held by a black button on each end. Press both buttons and lift the cover off.

Replacing the pneumatics top cover buttons

The two button assemblies are identical. When replacing one, use the other as a model.

1 Remove the cover from the GC.
2 Turn the cover over and remove the two screws holding the button to be replaced.
3 Assemble the plastic button and the metal mount. Position the assembly over the two nuts and install the screws.

The electronics top cover

1 Raise or remove the top cover.
2 This exposes a screw near the left front side of the electronics cover. Loosen this screw.
3 Raise the cover to the vertical position.
4 To remove the cover completely after raising it to the vertical position, Tilt it to the right to disengage the left end, then slide it to the left and remove it.

The side covers

The left and right side covers are each held by 2 captive screws at the bottom and a hook at the rear. Unfasten the screws, slide the panel to the rear, and remove it.

The rear covers

The upper and lower rear covers are held by several screws each, but all are visible from behind the GC. Note that some of the screws are in slots rather than holes; these screws do not need to be completely removed.

The side cover on the third detector assembly

Remove 2 screws at the bottom of the panel, then lift and remove the combined side and top panel.

Replacing the oven bezel

WARNING **Be careful! The oven and/or bezel may be hot enough to cause**

burns. If it is hot, wear gloves to protect your hands.

The bezel consists of a plastic cover over a metal plate. It is held by two screws that are reached through holes in the top of the bezel.

1 Unscrew the two mounting screws.
2 Lift the bezel and metal plate off the GC.
3 When reinstalling, note that the lip on the bezel extends forward over the top of the oven door. Be very certain that the metal plate is between the plastic part and the top of the GC.

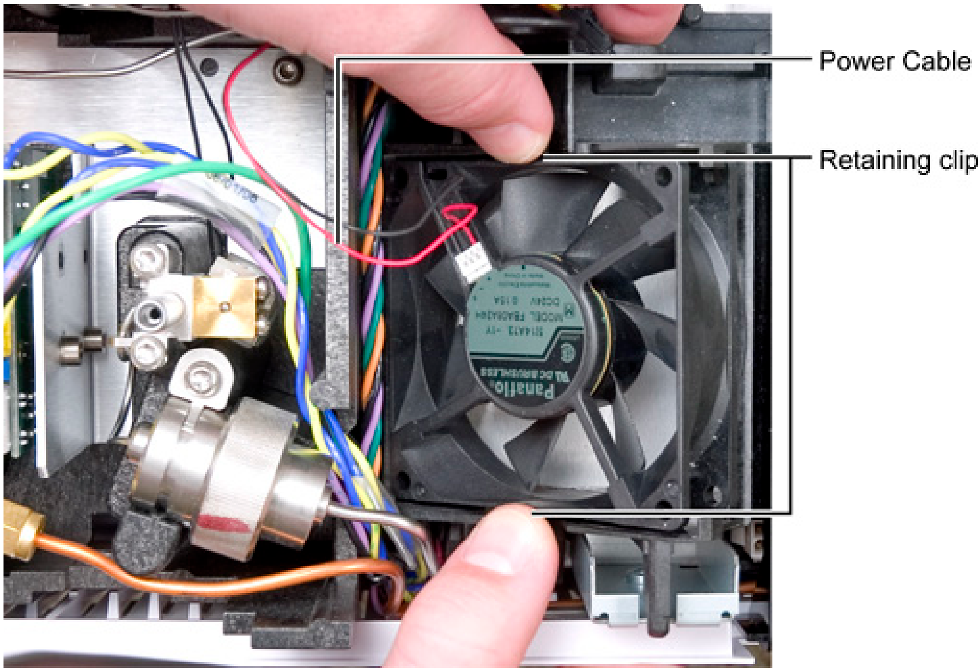
Replacing the inlet cooling fan

1 Cool down the oven and all heated zones to below 70 °C to avoid the creation of active sites.
2 Turn off the GC main power switch.

CAUTION

Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Remove the top rear cover by pressing in on the side buttons and lifting off.



4 Disconnect its cable from the GC wiring harness.

5 Remove the fan from its clips.

6 In reassembly, make sure the label side of the fan faces upwards (flow must be in the upwards direction). Also, the cable should exit nearest its connector on the GC wiring harness.

Replacing the EPC cooling fan

1 Cool down the oven.

2 Turn off the GC main power switch and disconnect its power cord.

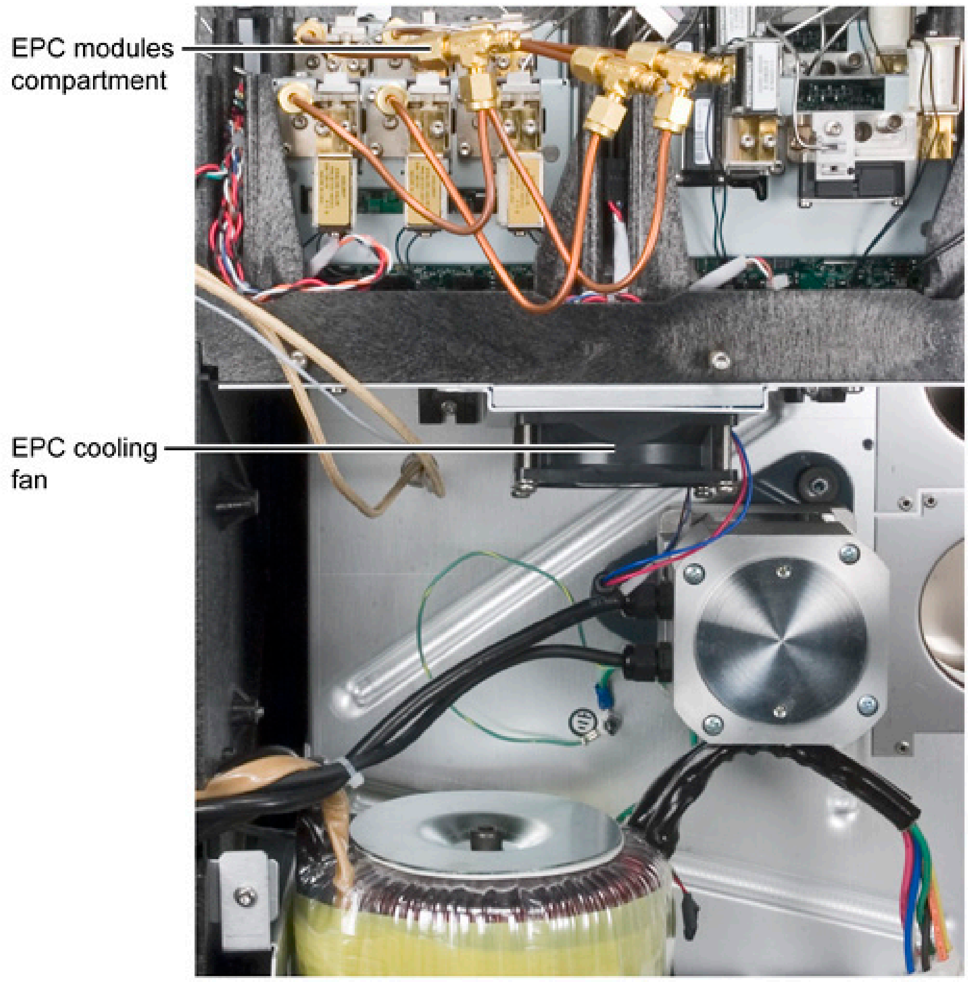
WARNING

Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Remove the lower rear cover on the GC.

4 The fan is located below the EPC module compartment; begin by disconnecting the fan's cable.



5 Remove 4 screws.

6 In replacement, be careful to not overtighten the screws such that the fan's plastic frame is cracked. Also, in replacing the screws, it may be easiest to start with the one at the right forward corner due to interference caused by the nearby oven fan motor.

NOTE In reassembly, make sure fan orientation is such that air flow is directed

upwards through the EPC modules.

Replacing the oven door

WARNING **Be careful! The oven and/or inlet may be hot enough to cause burns. If the inlet is hot, wear gloves to protect your hands.**

1 Remove the GC rear top cover.
2 Remove the six T- 20 screws retaining the injection port cover, lift off and remove the cover.
3 Using a T- 20 driver loosen the rod holding the door to the hinge on the GC body.
4 Lift up the rod to separate the door from the hinge.
5 Remove the door.
6 Installation of the new door is the reverse of these steps.

Replacing the oven door button

WARNING **The oven door button mechanism is under the mainframe. To reach it, you must either tip the GC on its side or slide it part way off the bench so that the right front corner is accessible. Be very certain that the GC is stable and cannot fall.**

1 Move the GC so that the bottom of the mainframe near the button is accessible.
2 Open the oven door and operate the button several times. Note that the operating lever from the button is in front of the vertical lever that moves the latch,
3 To remove the mechanism, remove the two screws that hold it and pull it down out of the mainframe.
4 Replacement is the reverse of these steps. Be certain that the button lever is *behind* the latch lever.

Replacing the keypad assembly

1 Cool down the oven.

2 Turn off the GC main power switch and disconnect its power cord.

WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.**

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Remove three screws with ¼- inch nut heads from the detector electronics panel side. Two of the screws are near the upper left and lower left corners of the front detector signal board; the other is on the bottom of the GC in a slotted hole.

4 Disconnect the large keypad ribbon cable from the logic board.

5 Remove the T- 20 screw from the bracket near the top of the keypad assembly to release it from the GC body.

6 From the front, slide the keypad panel forward.

7 At this point there are two servicing options: replacement of the entire keypad assembly or just the display. [See next topic for the replacement of the display only.]

8 Disconnect the connector cable from the display board.

9 Disconnect the large ribbon cable from the inner connector board.

10 Disconnect the cable (at the lower left of the inner connector board) from the oven door safety switch.

11 Remove the inner connection board from the GC.

12 Replace the entire keypad assembly with a new one.

13 Reassembly is the reverse of these steps.

Replacing only the display board

If changing the GC configuration, see ***Changing the GC configuration*** (222) for important information regarding GC methods. Then proceed with the steps below.

1 Cool down the oven and all heated zones.

2 Turn off all gas flows at their sources.

3 Turn off the GC main power switch and disconnect its power cord.

WARNING

Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.

CAUTION

Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

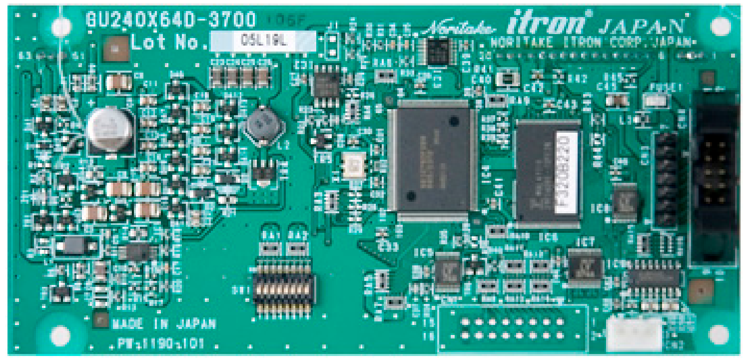
4 Perform steps 4 through 8 of the ***Replacing the keypad assembly*** (268) procedure.

5 Disconnect the connector cable from the display board to the inner connection board.

6 Remove the four screws holding the display assembly to the keypad panel.

7 Replace the display panel, making sure it is oriented as shown in the figure, with the connector receptacle on the

right.



8 Reassemble all screws and cables in the reverse order of disassembly.

Oven temperature control

The oven temperature is controlled by a combination of the shroud heater, the flapper assembly, and (optionally) a cryogenic cooling assembly.

CAUTION

Temperature control and safety require a tight seal between the oven door and the oven body. DO NOT place anything (such as thermocouple leads) between these two parts.

The small gap created by a wire allows hot air to escape, which can damage or melt nearby parts.

Oven temperature troubleshooting

For each problem below, the probable causes and corrective actions are listed in order of complexity/expense. The cheapest, most common, easiest to check causes are listed first with the more complex, expensive causes following.

After identifying the problem, test for the probable causes in order from top to bottom.

Problem	Probable cause	Corrective action
Oven does not heat.	Faulty fuse F1 or F2 on power supply board.	Check/replace both fuses.
	Oven heater is open.	Check resistance of oven heater.
	Faulty power supply board.	Replace power supply board.
	Faulty fuse F1 or F2 on main board.	Check/replace both fuses.
	Faulty main board.	Replace main board.
Oven does not control	Fast oven but GC configuration is for regular oven.	Check oven configuration.
	Oven flap stuck.	Check oven flap.
	Faulty main board.	Replace main board.
Oven temperature runs away.	Oven heater partially grounded.	Ensure that the oven heater is not coming in contact with the oven shell or other nearby components.
	Faulty main board.	Replace main board.
Oven temperature will not go to maximum.	Fast oven but power is 208 V rather than 240 V.	Correct power wiring in lab.

Testing resistance of the heater coil

If you believe that your heater coil is cracked or otherwise damaged and has caused an open circuit, you can check it by measuring its resistance.

WARNING **Before proceeding, turn off the main power switch and unplug the power cord.**

CAUTION Make sure you are properly grounded with an ESD strap before continuing.

1 Turn the instrument power off.
2 Disconnect the oven heater leads (P3, P4) from the AC power board.
3 Use an ohmmeter to measure resistance at the ***connectors***.

Acceptable resistance ranges (in ohms) are given below. Acceptable resistances range from the nominal value for a new, cold heater to +5% from the nominal value.

NOTE Resistance goes up approximately 3% after heating the coil.

Nominal cold heater resistances, ohms

	Standard oven	Fast-ramp oven
120 V	9.07–9.52	n/a
200 V	n/a	17.78–18.7
220 V	n/a	21.51–22.6
230 V	33.06–34.71	23.51–24.7
240 V	n/a	25.60–26.9

n/a = not available

Cryo valve installation/replacement

A cryogenic valve allows liquid nitrogen or CO_2 to be dispersed into the double- walled plenum of the GC oven where the fan blows the vapors into the oven itself. Use the procedures that follow to install a new cryogenic valve or to replace an existing cryogenic valve or nozzle.

Installing a new cryo valve

1 Cool down the oven.

2 Turn off the GC main power switch and disconnect its power cord.

WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.**

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Remove the left side cover on the instrument and remove

the plug for the cryo valve.

If a TCD side mount carrier is installed on the left side of the instrument, remove its left cover by removing the two bottom screws, sliding the panel towards the back of the instrument and lifting it off.

4 Remove the knockout on the left side of the instrument. Use a screwdriver to pry it out.
5 Insert the cryogenic valve probe though the insulation into the oven plenum.
6 Screw the valve to the side of the GC oven using the two Torx T- 20 screws provided.
7 If you are installing COC cryo blast for the front and/or rear inlet(s), connect it at this time. See ***Cool On- Column Inlet*** (39) for details.
8 Plumb the valve to the liquid nitrogen or carbon dioxide source.
9 Plug the cryo valve's wiring harness into the five pin connector to the left of the valve.
10 Route the cryo tubing through the cutout in the GC side cover and reinstall the cover.

If a TCD side mount carrier is installed, route the cryo tubing out of the slot in the back of the carrier.

Replacing an existing cryo valve

1 Cool down the oven.
2 Turn off the GC main power switch and disconnect its power cord.

WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.**

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

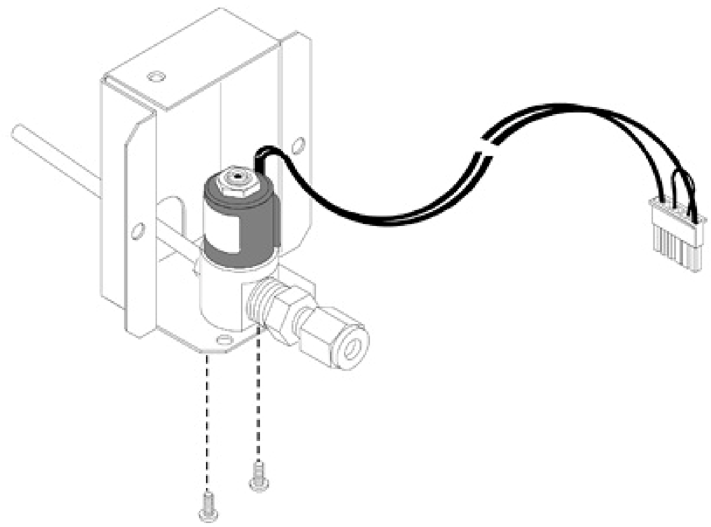
3 Remove the left side cover on the instrument.

If a TCD side mount carrier is installed, remove its left cover by removing the two bottom screws, sliding the panel towards the back of the instrument and lifting it off.

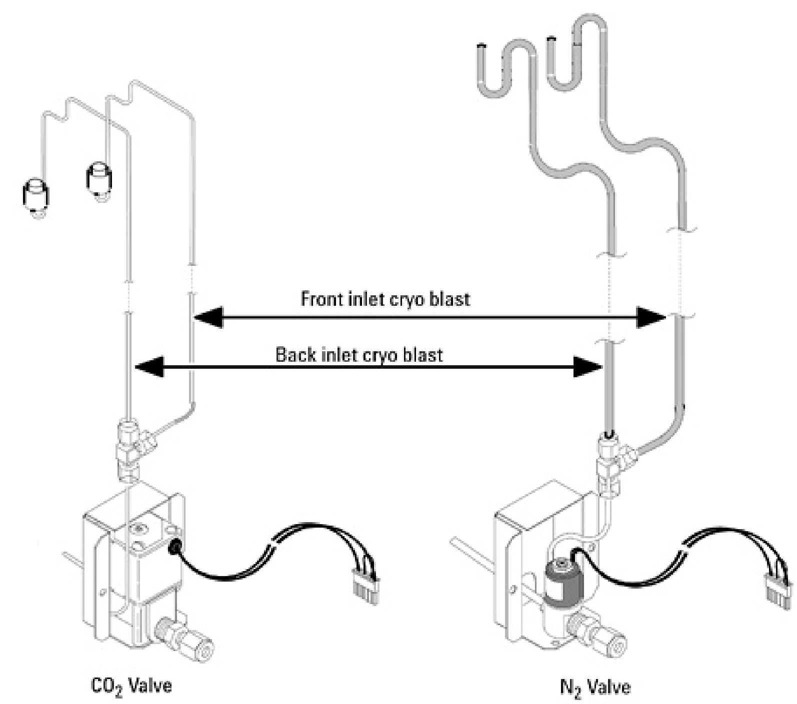
4 Shut off the cryo fluid supply and crack the valve at the supply to release any residual pressure.
5 Use a 9/16- inch wrench to disconnect the cryogenic fluid supply tube at the cryo valve.
6 Disconnect the cryo valve’s wiring harness from the connector to the left of the valve.
7 Remove the two Torx T- 20 screws holding the old cryo valve and pull it straight out from the instrument.
8 To remove the valve from the bracket, disconnect any cryo blast plumbing from the valve at the Swagelok tee. Remove the two Torx T- 20 screws on the bottom of the bracket.
9 To replace the cryogenic nozzle, proceed as follows:
   a Use a 9/16- inch wrench to unscrew the old nozzle. Discard the nozzle.
   b Wrap the threads of the new nozzle with Teflon tape, being careful not to cover the first two threads of the nozzle.
   c Screw on the new nozzle and tighten firmly with a 9/16- inch wrench.
10 Insert the cryogenic valve probe though the insulation into the oven plenum.
11 Screw the valve assembly back on to the side of the GC oven using the two Torx T- 20 screws.
12 If you are installing COC cryo blast for the front and/or rear inlet(s), connect it at this time. See ***Cool On- Column Inlet*** (39) for details.
13 Plumb the valve to the liquid nitrogen or carbon dioxide source.
14 Plug the cryo valve’s wiring harness into the connector to the left of the valve.
15 Route the cryo tubing through the cutout in the GC’s side cover and reinstall the cover.

If a TCD side mount carrier is installed, route the cryo tubing out of the slot in the back of the carrier.

Removing the valve from the valve bracket (N2 valve shown)



Cryo blast attachments



Replacing the oven sensor

The oven temperature sensor can be replaced after removing the oven shroud.

WARNING **Before proceeding, turn off the oven and let it and any heated zones cool. Turn off the main power switch and unplug the power cord.**

1 Remove the oven shroud as described in Replacing the oven shroud assembly.
2 Loosen the two Torx T- 20 screws securing the sensor retainer to the back of the shroud.
3 Slide the old sensor out of the retainer. Thread a new sensor through the opening in the rear of the oven.
4 Slide the new sensor under the retainer. One of the grill holes on the front of the shroud is stamped. Make sure that the end of the sensor is positioned behind the stamped hole before tightening the retainer.

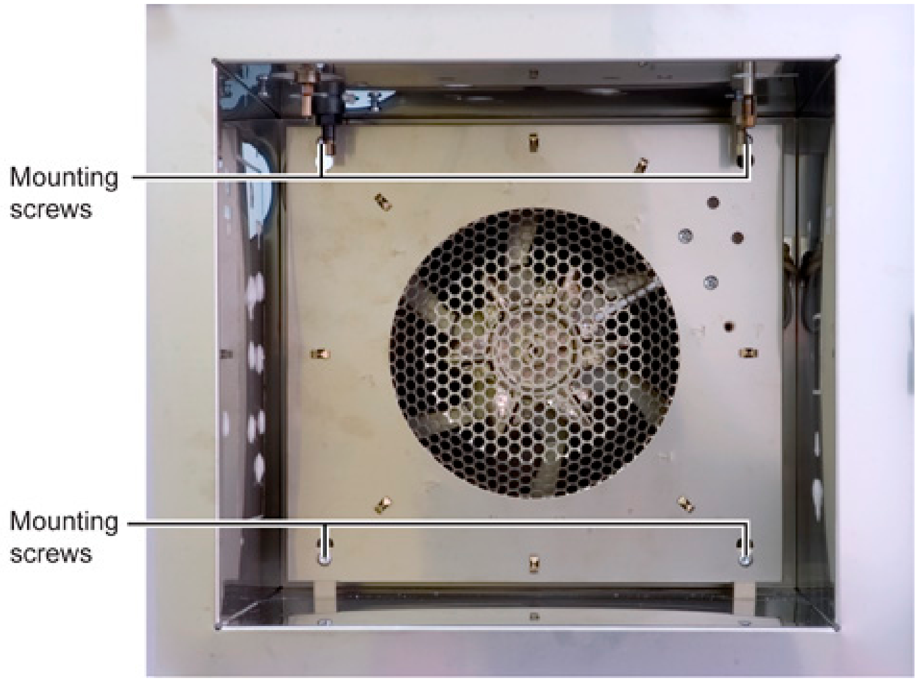
Replacing the oven shroud, oven fan, and oven fan motor

1 Cool down the oven.
2 Turn off the GC main power switch and disconnect its power cord.

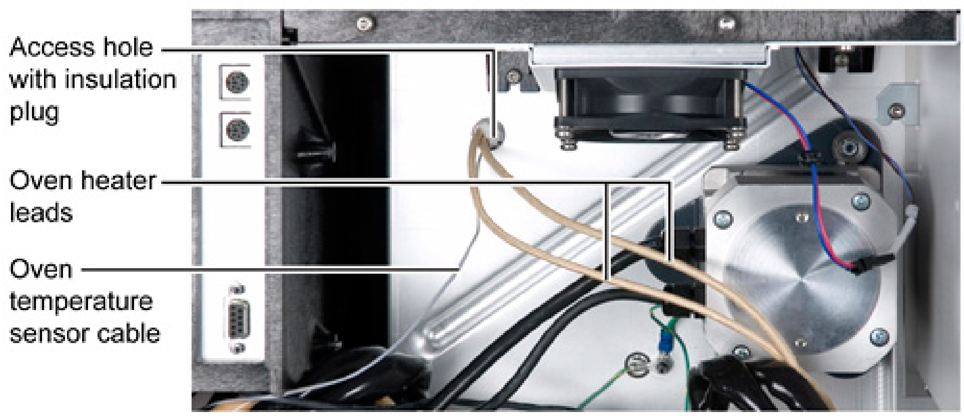
WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.**

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 At the front of the GC, remove all obstructing items from inside the oven (column(s), column hanger(s), inlet/detector insulation cups, and so forth).



4 At the rear of the GC, disconnect the oven sensor cable at the Analog and Power board and feed the cable back to the rear of the GC. Also disconnect the two oven heater leads at the AC board.



5 From the oven, remove the two lower screws securing the oven shroud and loosen the upper two. These are special stainless steel screws: the ones removed must not be confused with any other screws.

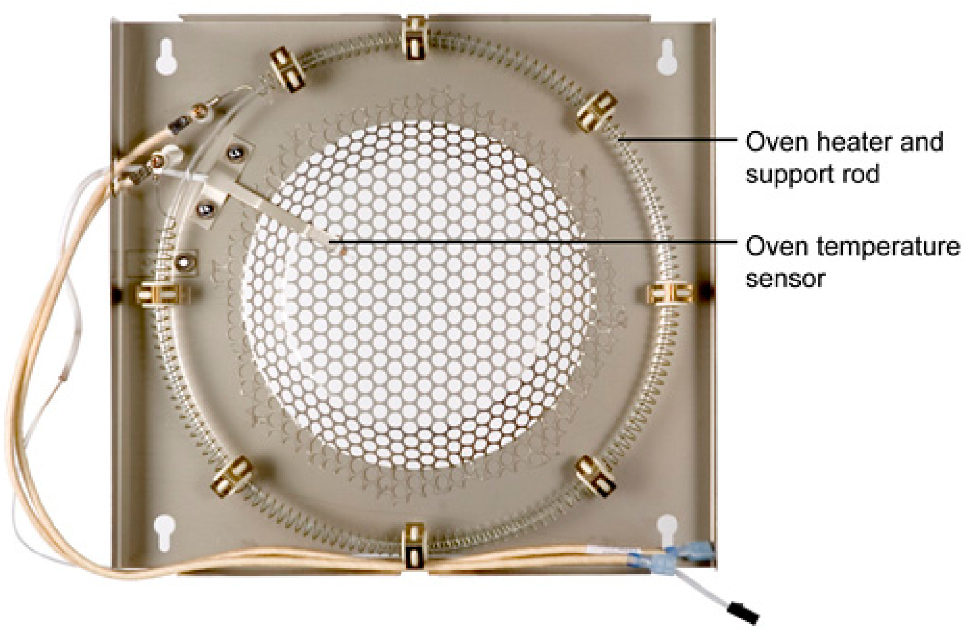
6 Lift the shroud over the upper screws and work it out of the

oven.

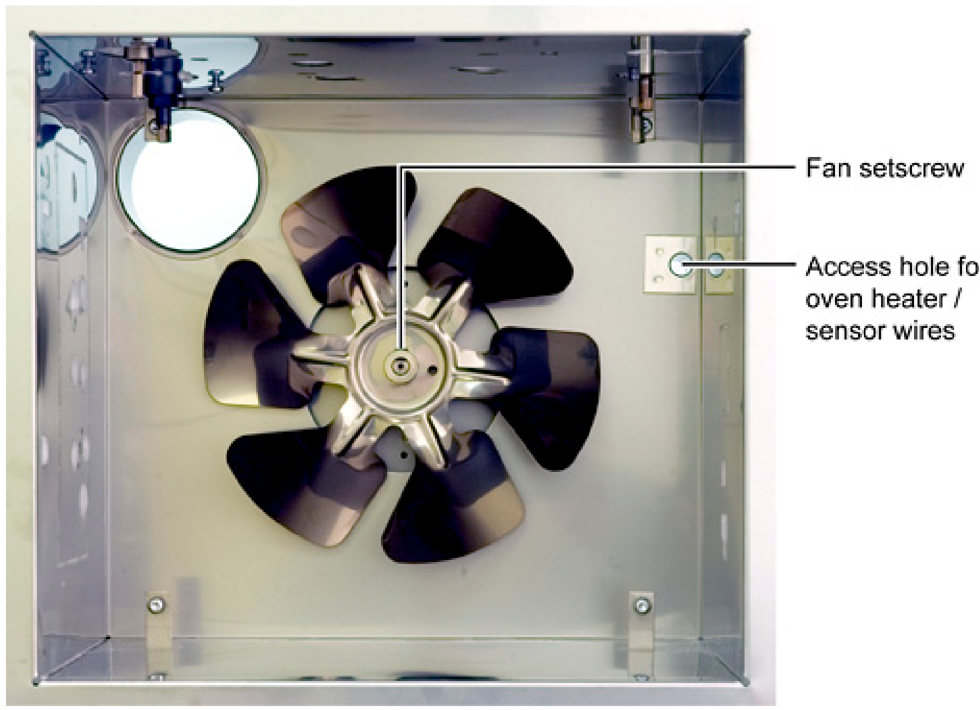
NOTE Connectors for the oven heater wires and for the oven sensor must be carefully worked through the access hole at the rear of the oven. There is also a 'plug' of insulation which may fall from the access hole during this process: it must be replaced in reassembly from the rear of the GC.

7 Inspect the oven heater and its supporting circular quartz glass rod: they must be undamaged in any way.

NOTE Be very careful to not disturb the oven temperature sensor: it is fragile and easily damaged. Also, its physical location is critical to proper oven temperature control: do not alter its position in any way.

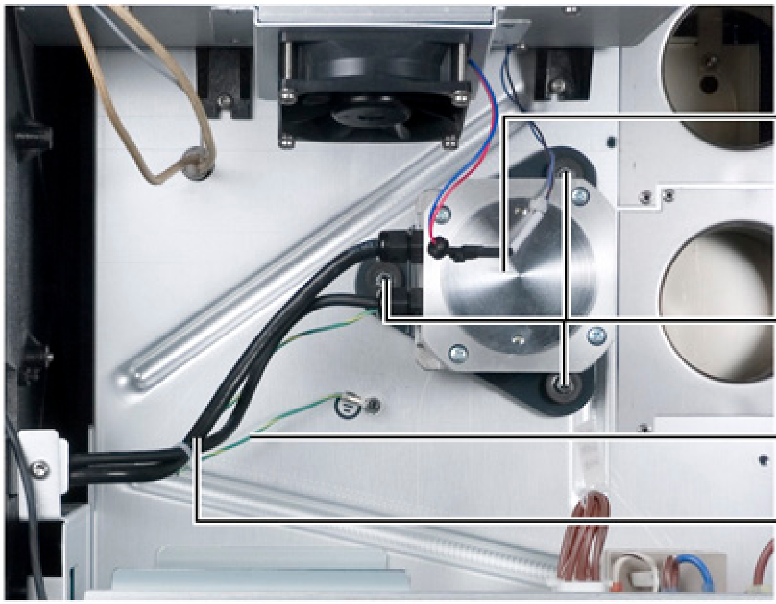


8 In replacement, insert oven heater leads first through the access hole, followed by the oven sensor cable.



9 Before removing the oven fan, note its hub's physical location on the fan motor shaft so as to return it to the same position in reassembly.

10 Being careful to not deform its blades, remove the fan by loosening the 5/32- inch Allen setscrew on its hub and then pulling the fan from the motor shaft.



11 At the rear of the GC, disconnect the fan motor ground lead. Then disconnect the cable to the Analog and Power board and work the cable back to the rear of the GC.

WARNING

The oven fan motor is heavy! Make sure you have a firm grip on the motor before removing / replacing it. Always handle the motor by the body. Do not carry the motor by the shaft.

12 Remove three 7- mm nuts with lockwashers and cone washers to release the motor. Remove the top nut last to maintain mechanical support for the motor. Manually support the motor as the top nut is removed.

13 Reassembly is the reverse of these steps with the following considerations:

- Each motor mount must have both an inner and outer cone washer
- Orient the motor such that its power cable exits towards the electronic side of the GC
- Reinstall the top nut first to support weight of the motor
- After motor reassembly into the GC, check that its shaft

extends perpendicularly from the back oven wall. If not perpendicular, there may be mounting part(s) missing or misplaced, and/or mounting nut(s) untightened.

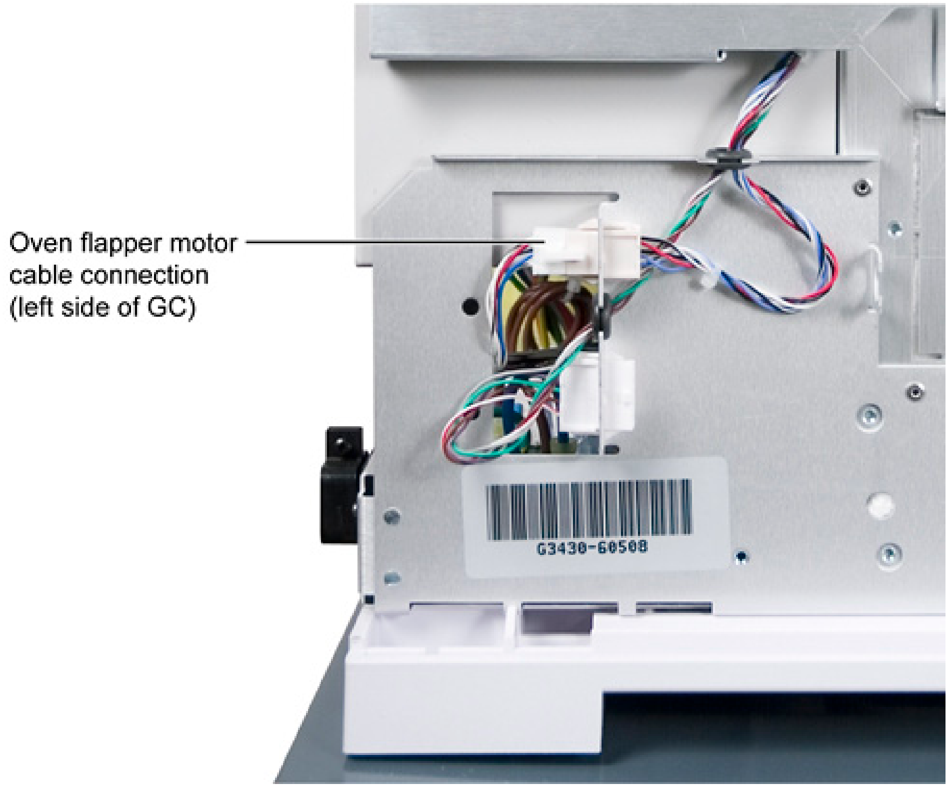
- In fan replacement, make sure the fan's hub is returned to its original location, or slightly rearward from being exactly flush with the end of the motor shaft. Also make sure the setscrew is tightened against the flat side of the motor shaft.
- For the oven heater/sensor shroud, if not already done, inspect the oven heater and its supporting circular quartz glass rod: they must be undamaged in any way
- After the oven heater/sensor shroud is reinstalled, remember to return the plug of insulation in the access hole at the back of the oven.

Replace the oven flapper assembly

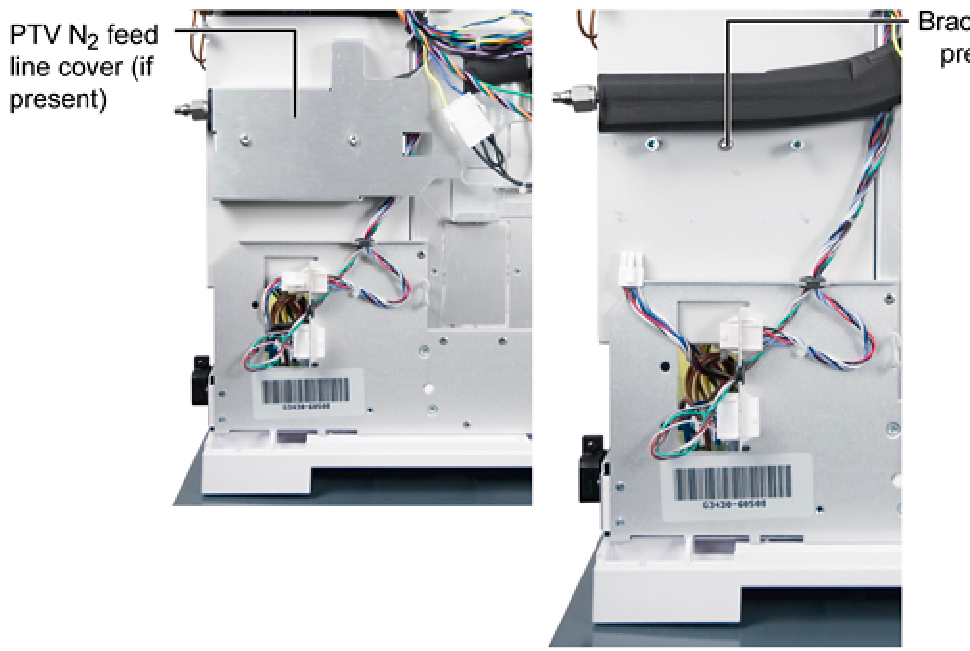
CAUTION Components can be damaged by electrostatic discharge (ESD). Be sure to wear a grounded ESD strap while performing this procedure.

1. Remove rear GC cover.
2. Remove left side GC cover.

3 Disconnect flapper motor cable and pull it back to the motor.

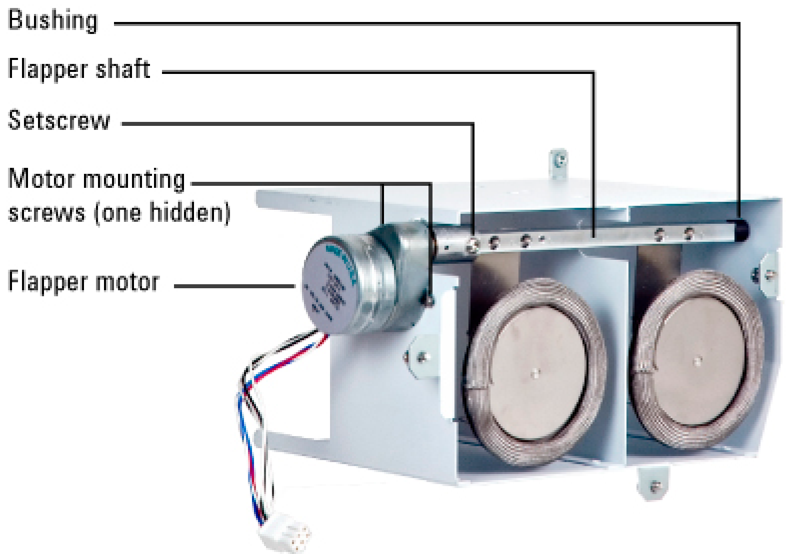


4 If present, remove the PTV N2 cryo feed line cover by removing two screws. If necessary, also remove the bracket behind the feed line cover.



5 Loosen three captured T- 20 screws to remove the flapper assembly. To support the weight of the assembly, the top- most screw should be removed last.

6 Pull the assembly straight out.



7 In replacing the assembly, steps are the reverse of removal steps.

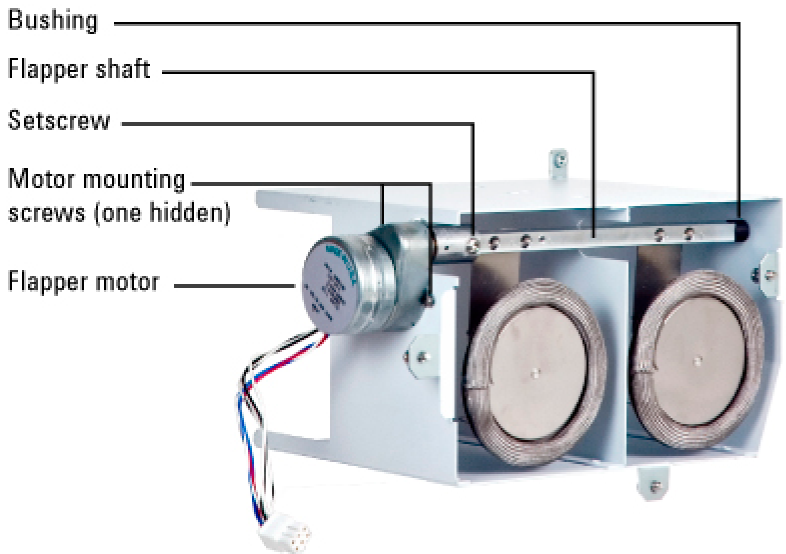
   Install the top- most screw first to support the weight of the assembly

Replace the flapper or flapper motor

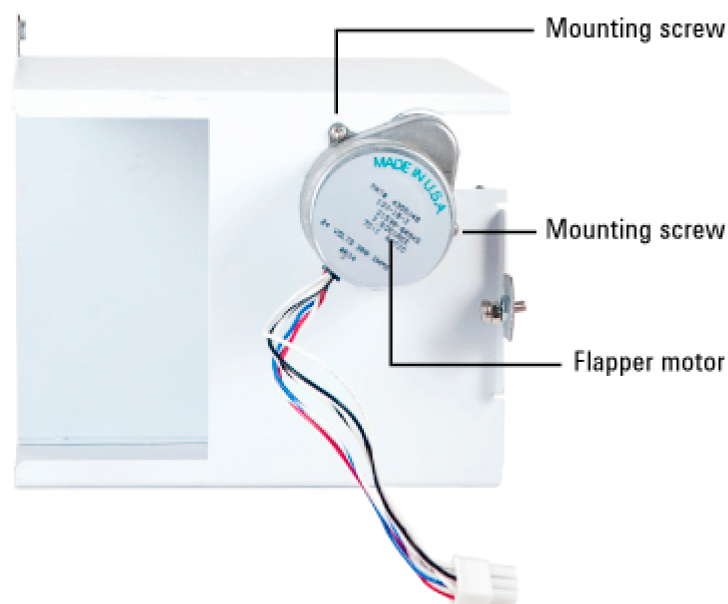
This disassembly procedure enables you to replace either the flapper or flapper motor.

1 Remove the flapper assembly. See ***Replacing the oven flapper assembly*** (282).

2 Remove the T- 20 set screw on the coupling between motor and flapper shafts.



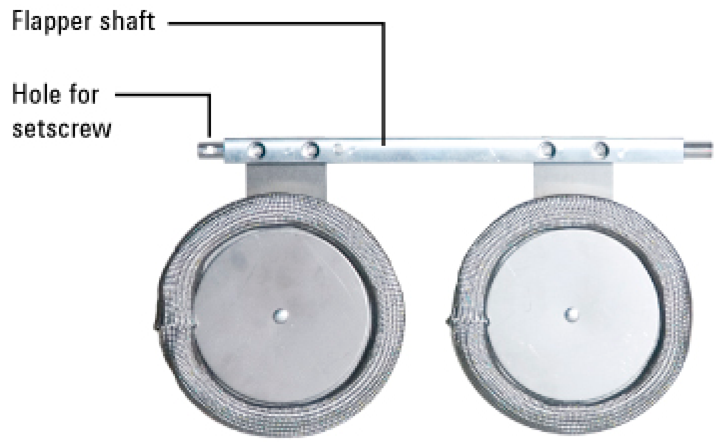
3 Remove three T- 10 screws securing the motor to the frame.



4 Slide the motor off the flapper shaft and replace it with a new motor.

If you are replacing the flapper, slide the flapper out of the duct assembly.

Be careful to not lose the bushing at the upper end of the flapper shaft.



In reassembly, do the following:

- Insure the upper part of the flapper shaft is inserted into its bushing at the top of the duct before securing motor mounting screws.
- Line up the hole in the flapper shaft with the set screw on the coupler mounted on the motor shaft.

Verify the flapper operation by:

- Observing the flapper behavior at turn on. The flapper self- adjusts by closing.
- Set the oven temperature to 70C. The flapper should close.
- Set the oven temperature to 45C. The flapper should go to full open.

Replacing Components Inside the Electronics Panel

Accessing the main analog and power boards

Replacing the ALS board

Removing the valve bracket

Replacing the logic board

Replacing the analog and power board

Accessing the analog & power board

To access the analog & power board in the rear of the electronics carrier, you must first remove:

- The ALS controller board
- The valve bracket
- The logic board

Replacing the ALS board

1 Cool down the oven.
2 Turn off the GC main power switch and disconnect its power cord.

WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.**

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

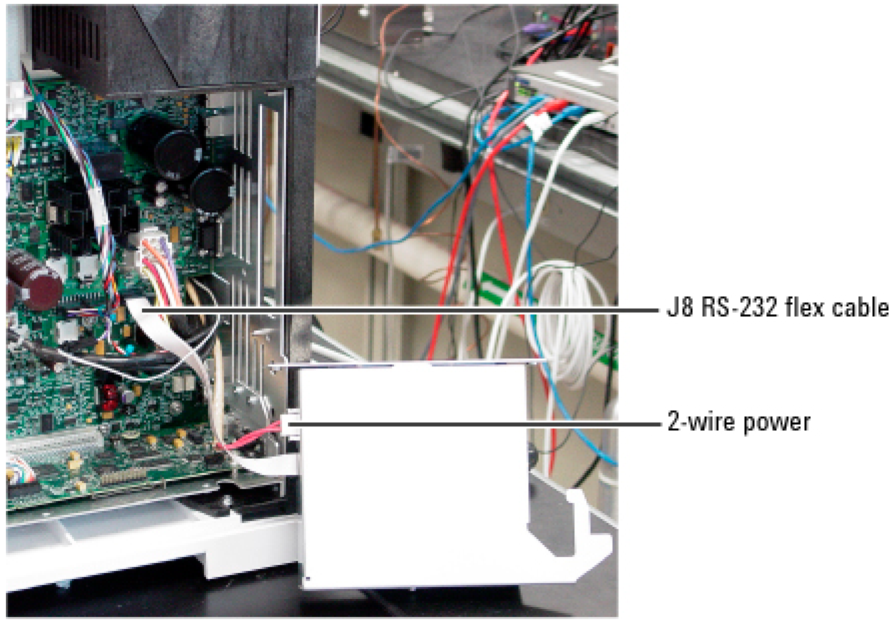
3 Remove the right side panel.

4 Remove 2 T- 20 screws holding the assembly to the back of the electronics carrier.

5 Slide out the ALS assembly.

6 Pinch and pull the 2- wire power connection at the bottom of the assembly and set the assembly aside.

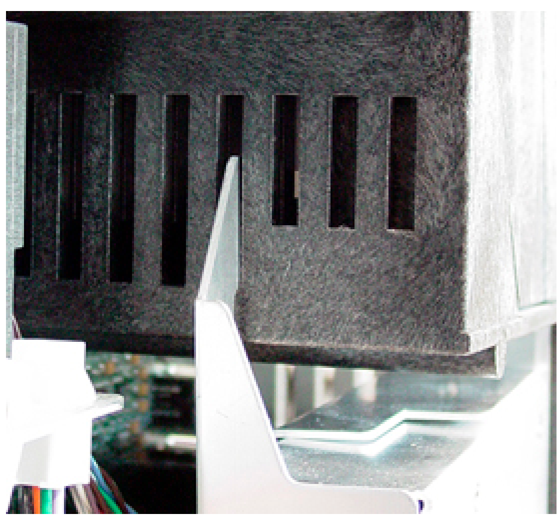
7 Carefully pinch and disconnect the flex cable from J8 on the Analog & Power board.



8 Pull the ALS module free from the back panel.

9 Connect the flex cable of the new ALS module to the Analog & Power board.

10 Slide the ALS module hook into the 4th slot.



11 Connect the 2- wire power cable.

12 Secure the assembly with 2 screws.

13 Plug in the ALS modules and power on the GC.

14 Press **[Service Mode]** and select **Diagnostics**, **ALS Status**. Verify

that the ALS controller model number and firmware revision appear on the display.

15 Update the ALS controller board firmware if necessary.

Replacing the fuse of the ALS controller board

A small fuse on the ALS controller board protects it from over- currents originating in the Tray, Auto- injectors, or shorts in their cables. The fuse is associated with the 42 VAC circuit. You can easily replace this fuse.

1 Cool down the oven.

2 Turn off the GC main power switch and disconnect its power cord.

WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.**

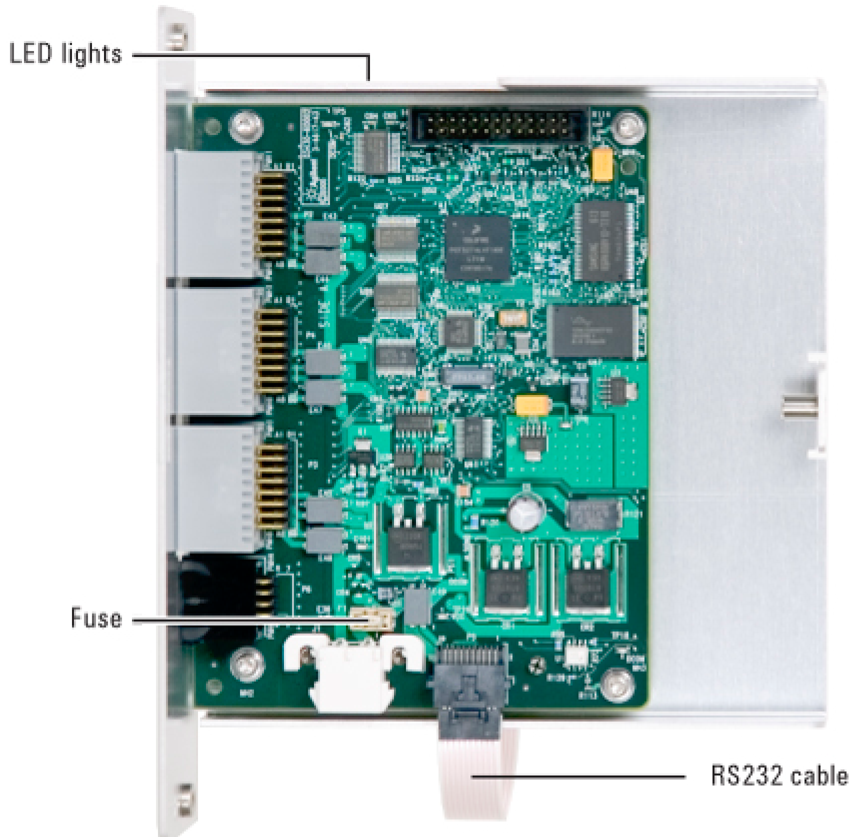
CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Gather ESD protection, T- 10 driver, and tweezer.

4 Remove the ALS controller board. See ***Replacing the ALS board*** (288).

5 Unscrew the T- 10 screw and remove the cover.

6 Using the tweezer, carefully replace the fuse.



7 Reinstall the cover. Insure that the connectors are visible.

8 Reinstall the ALS controller board.

9 Before plugging in the Auto-injector or tray, power on the GC. Check Service Mode | Diagnostics | ALS status to make sure the model number and firmware revision of the board are displayed.

10 If appropriate, update the firmware to the ALS controller.

Troubleshooting

- If the ALS Controller is not installed, check the cable connections. Consider replacing the assembly.
- If the firmware revision is blank, the ALS controller board may not be programmed correctly.

Removing the valve bracket

1 Cool down the oven.

2 Turn off the GC main power switch and disconnect its power cord.

WARNING

Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.

CAUTION

Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

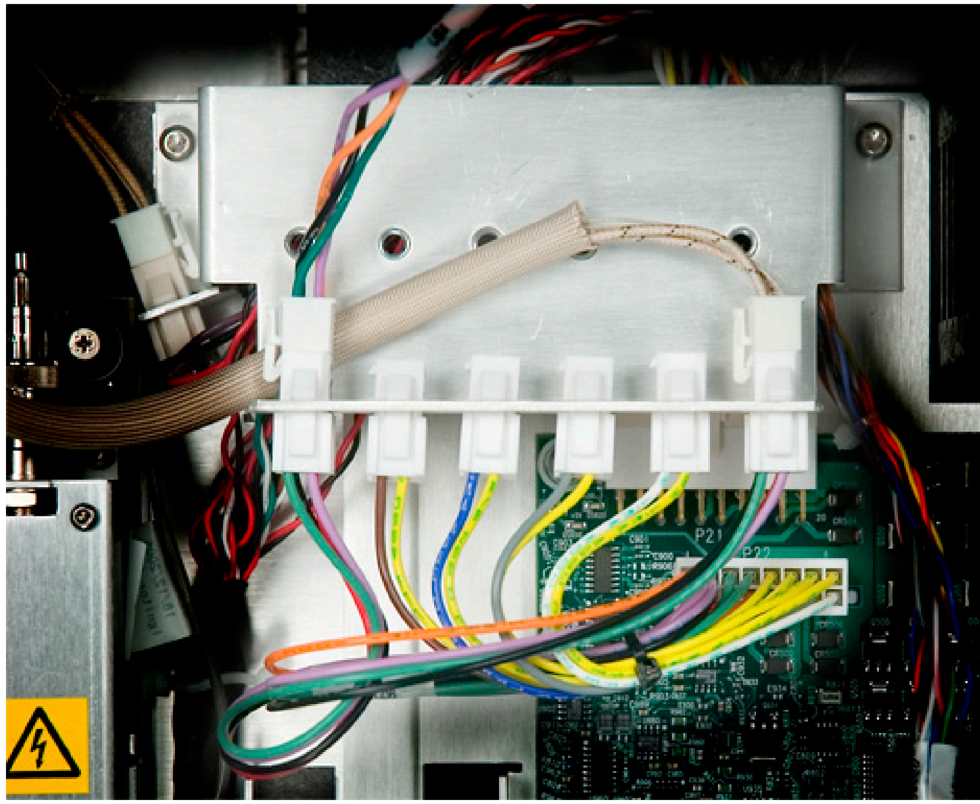
3 Remove the GC right side cover.

4 Remove the ALS board. See ***Replacing the ALS board*** (291).

5 Remove all cables connected to the upper side of the valve bracket (the illustration shows 2).

6 Loosen the screws at the top left and top right corners of the bracket. Remove the bracket.

7 Disconnect the wiring harness from the Analog and Power board at P22.



Replacing the logic board

The logic board contains information specific to the GC and its configuration, including methods, sequences, serial number, date of manufacture, the Gateway, Subnet Mask, and IP address of the LAN, logs, oven type, AUX heater configuration(s), and so forth. These items must be reentered after the new logic board is installed.

If the GC is functional, use the keypad to view and record the following information:

- Configuration- required
- Gas types
- Cryogenic cooling, if present
- Heater assignments: valve box, MSD transfer line, others
- Valve types
- If the configuration includes non- Agilent components or specials, you may need to re- enter custom heater or pneumatic PIDs. View and record this information.

1 Cool down the oven.

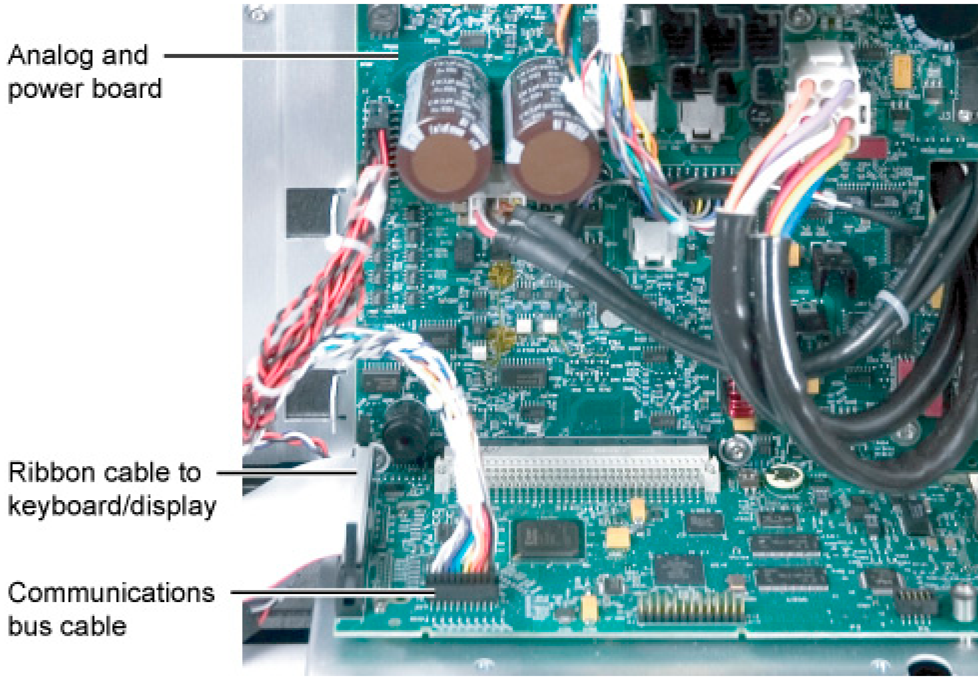
2 Turn off the GC main power switch and disconnect its power cord.

WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.**

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

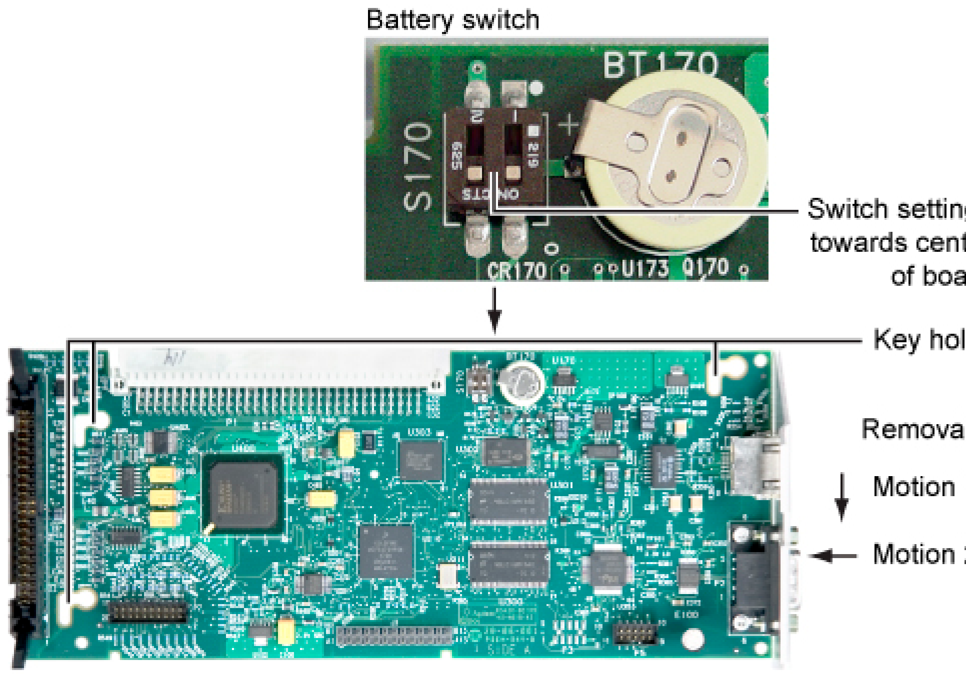
3 Remove the right side electronics panel cover.

4 Disconnect the ribbon cable to the keyboard/display.



5 Disconnect the communications bus cable and cable to the keypad and display. If present, also remove the external LAN cable.

6 Remove the two screws that secure the logic board to the rear panel.



1 Slide the logic board toward you while using a rocking motion to unplug the board from its main board receptacle.

2 Once free of the main board, slide the logic board to the left and lift it out.

3 With respect to the new logic board, verify, and if necessary change, the two battery- connect switches found next to the battery: BOTH switches must be in positions away from the main board (see above).

NOTE If switches are incorrectly-set (battery disconnected), critical internal GC information will be lost any time AC power is not present.

4 Reinstallation is the reversal of removal steps.

5 Restore power to the GC.

6 The zero offsets for the flow and pressure sensors are stored on the logic board rather than in the EPC modules. You must now zero all sensors. Navigate to Service Mode | Diagnostics | Electronics | Pneumatics to do this.

7 You must now restore information stored on the logic board specific to the GC and its configuration.

8 Press Service mode. Scroll to Diagnostics and press `[Enter]`.

9 Scroll to Instrument Status. Press `[Enter]`.

10 Press [.][.][`Mode/Type`], select the country, and press `[Enter]`.

11 Press [.][.] and enter the 8- digit serial number; press `[Enter]`.

12 Scroll to Mfr date. Press [.][.] and enter 6 digits in ddmmyy format. Press `[Enter]`.

13 You have changed the configuration of the GC. See ***Changing the GC Configuration*** (222) for important information regarding GC methods.

Check GC configuration

- Gas types
- Cryogenic cooling
- Heater assignments: valve box, MSD transfer line, others
- Valve types
- If the configuration includes non- Agilent components or specials, you may need to re- enter custom heater or pneumatic PIDs.

Replacing the analog and power board

1 Cool down the oven.

2 Turn off the GC main power switch and disconnect its power cord.

WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.**

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

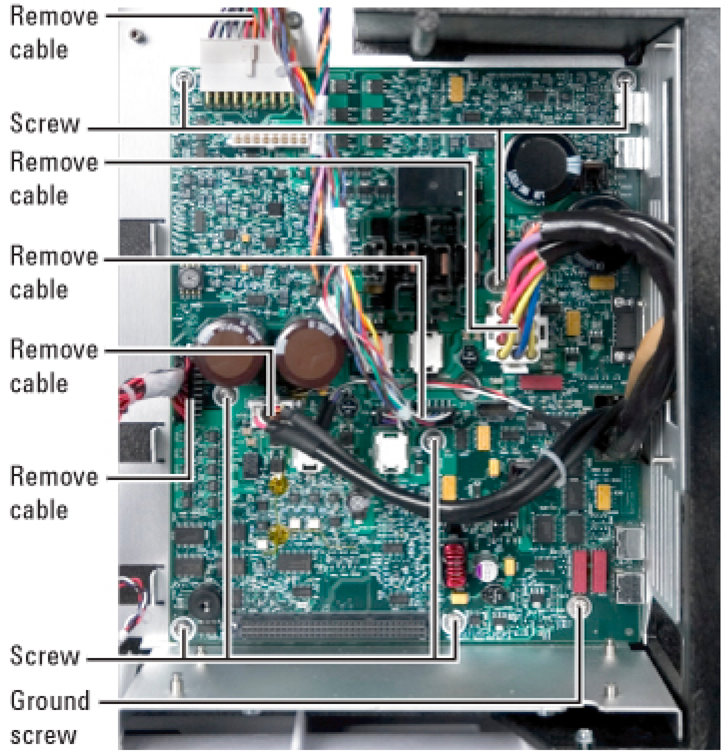
3 Remove the right side electronics panel cover.

If present, remove the ALS controller module. See ***Replacing the ALS board*** (288).

4 Remove the logic board. See ***Replacing the logic board*** (295).

5 If present, disconnect valve box heater/sensor(s) from the valve bracket and remove the bracket. See ***Removing the valve bracket*** (293).

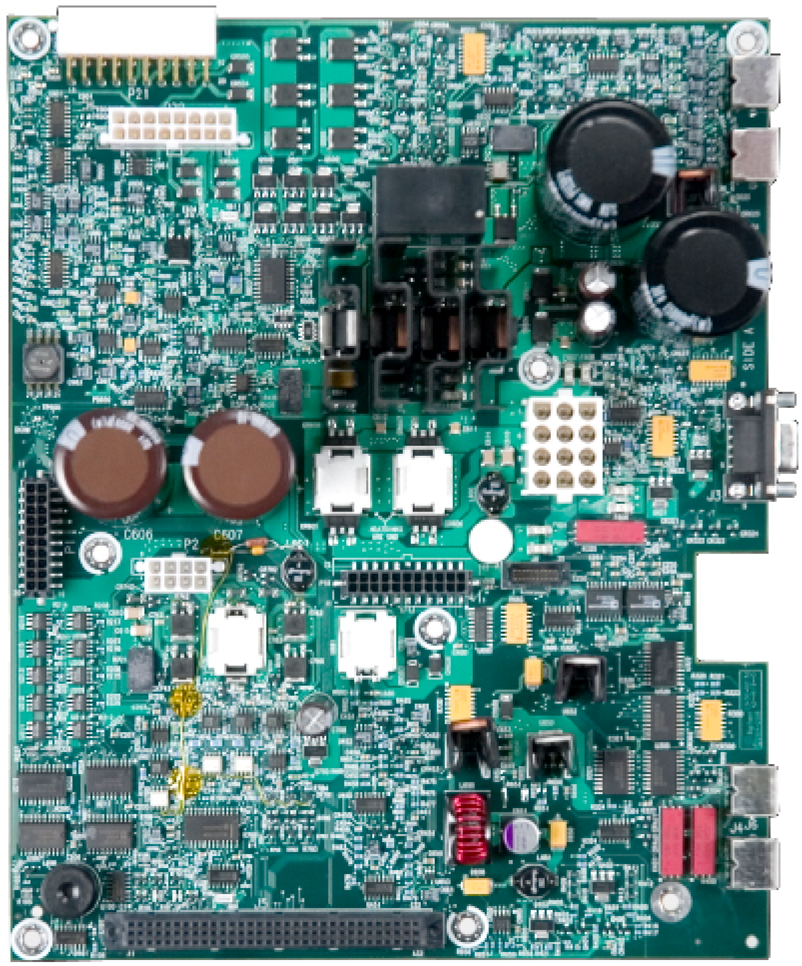
6 Disconnect cables at all board receptacles.



7 Remove 8 T- 20 screws:

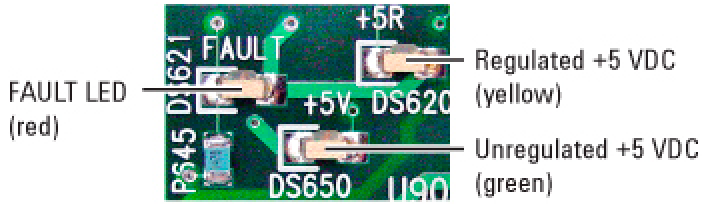
- One is a long grounding screw found at the lower right corner of the board
- One screw is difficult to locate next to and above the transformer receptacle near the right center of the board
- In all cases, locate the specific screw first before you attempt to remove it: a misplaced screwdriver may damage nearby board components.

8 Slide the board slightly outward and to its left to release it from the GC.



9 Installation of the new board is essentially the reverse of removal steps with the following considerations:

- Make sure the long grounding screw is returned to its proper location
- Be careful in returning all screws to their proper locations in that you avoid accidental contact with / damage to nearby board components

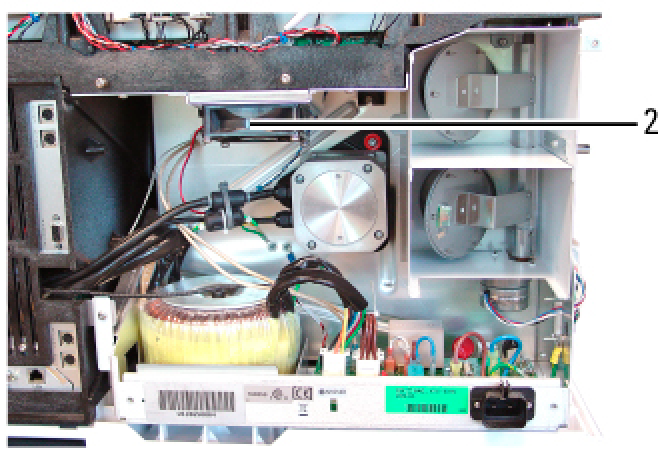


10 There are three LEDs at the upper left corner of the board:

red, yellow, and green. When power is restored, yellow and green LEDs should be lit (on) indicating, respectively, that regulated and unregulated +5 VDC supplies are functional. The red LED is lit only under FAULT conditions.

Replacing Components Inside the Lower Rear Metal Cover

Item	Description	Part number	Qty.
1	GC chassis		
2	Pneumatics fan		1
3	Screw		3
4	Flapper assembly		1
5	Oven fan motor		1
6	Back of oven		
7	Transformer		1
8	AC power board		1



Replacing AC board fuse sets

1 Cool down the oven.

2 Turn off the GC main power switch and disconnect its power cord.

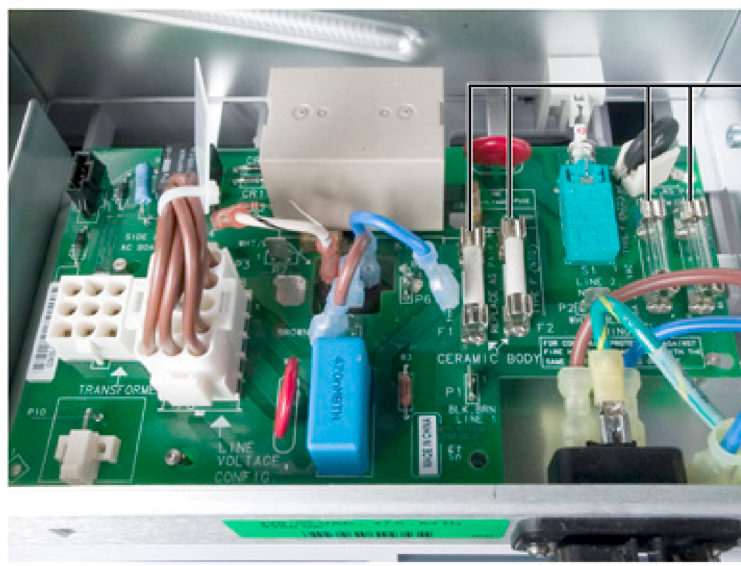
WARNING **Hazardous voltages are present in the mainframe when the GC**

power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Remove the lower rear metal cover from the GC.

4 Replace the necessary fuse set. Use of a fuse puller is recommended for ease of removal.



NOTE The two sets of fuses on the AC board are each always replaced as a set.

Replacing the AC board

1 Cool down the oven.

2 Turn off the GC main power switch and disconnect its power cord.

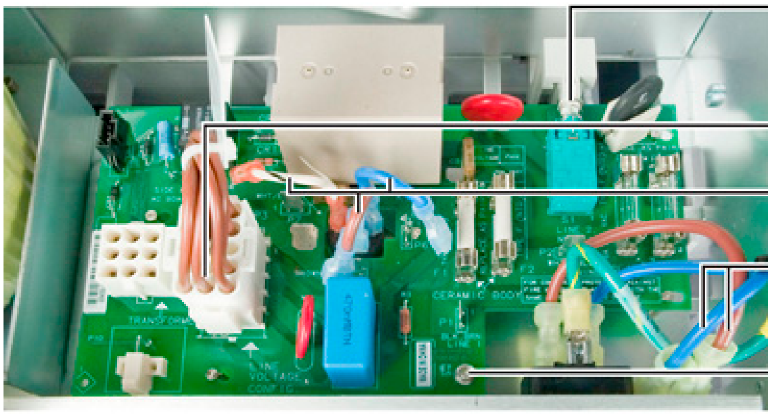
WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC**

panels.

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Remove the rear lower metal cover on the GC.

4 The AC board is located below the oven flapper assembly. Disconnect cables (4), 2 wires to AC power receptacle, and 3 wires to the oven triac located below the board. The configuration plug on the original board must be removed and moved to the new replacement board.



5 At the front right corner of the board, disconnect the on/off power switch's connecting push rod by pushing the rod forwards towards the front of the GC until it releases from the switch on the board.

6 Rotate the mounting thumbscrew counterclockwise until an audible "click" sound is heard. Then slide the board slightly towards the center of the GC and lift it off its standoffs.

7 In reassembly, pay attention to the following:

- Do not forget to reconnect the power switch push rod.
- Make sure the new board is located on its standoffs. Then slide it slightly away from the center of the GC such that the mounting thumbscrew is properly positioned.
- Engage the thumbscrew threads by pressing it downwards gently while rotating clockwise.

Replacing the oven triac

1 Cool down the oven.

2 Turn off the GC main power switch and disconnect its power cord.

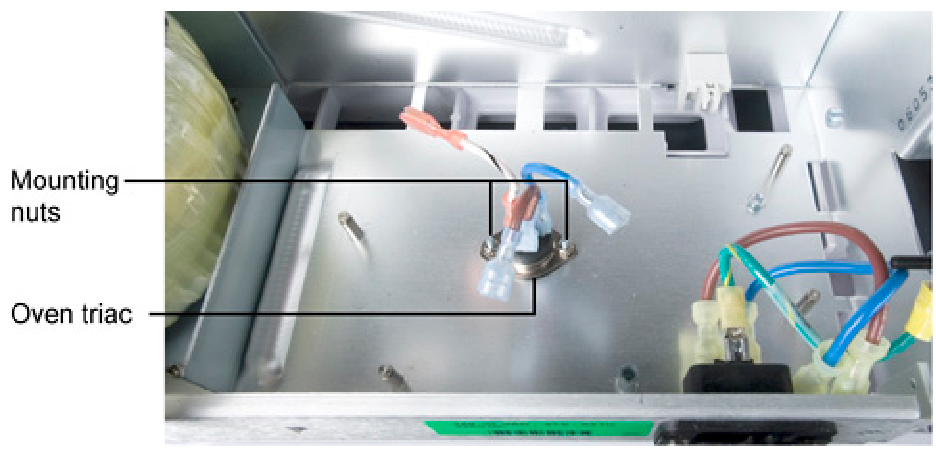
WARNING

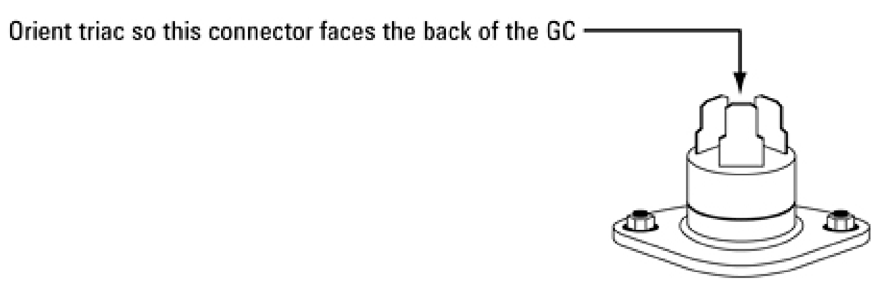
Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.

CAUTION

Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

3 Remove the AC board. See ***Replacing the AC board*** (303).





CAUTION

Carefully note BOTH physical orientation of the triac AND which of its three leads connects to each of its terminals. A mistake here in reassembly may destroy the new triac and/or result in a lack of proper oven control.

4 Remove three wires from the triac.

5 Remove two 5.5- mm hex nuts with captured lockwashers securing the triac.

6 Lift the triac straight up to remove it. Also, if necessary, remove the thin piece of plastic film found under the triac.

7 In reinstallation, remember to first install the piece of plastic film supplied with the new triac.

Replacing the power transformer

1 Cool down the oven.

2 Turn off the GC main power switch and disconnect its power cord.

WARNING

Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.

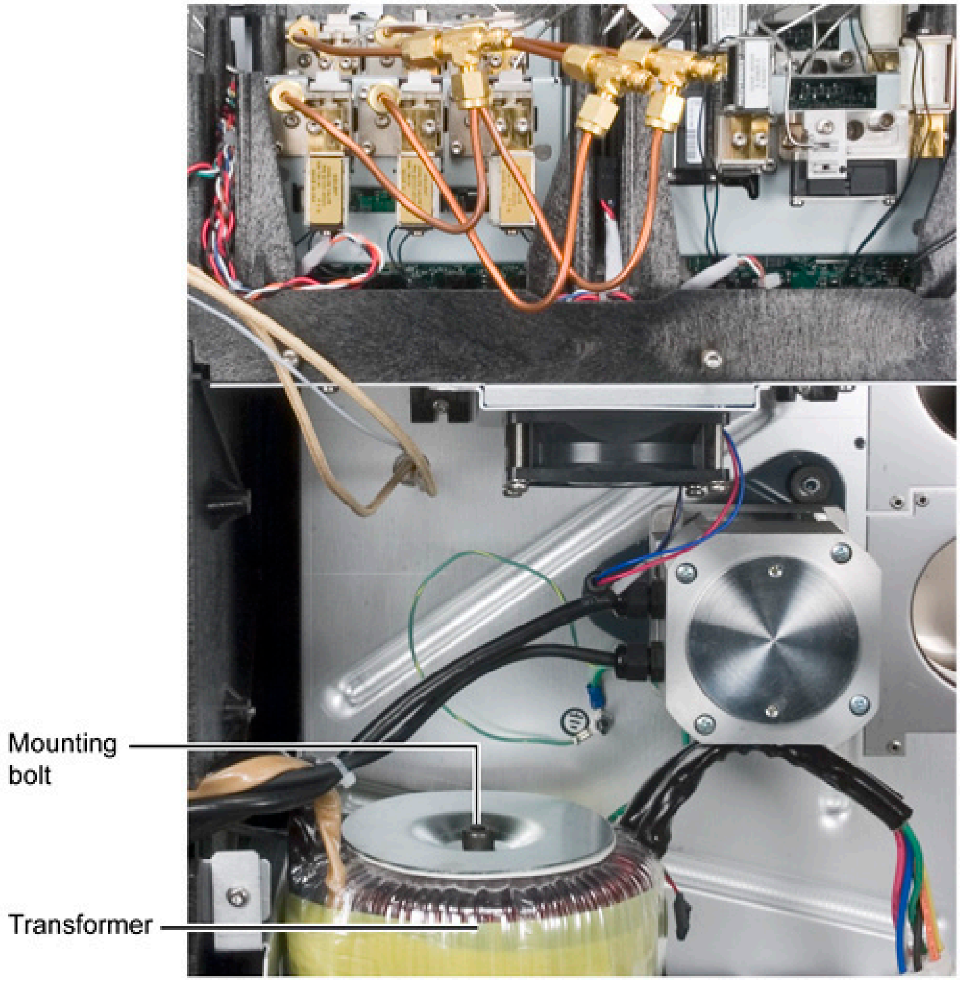
CAUTION

Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

WARNING

The transformer is very heavy! Make sure you have a firm grip on the transformer before removing / replacing it.

3 Remove the lower rear metal cover on the GC.



4 Disconnect the cable from the transformer to the AC board. Also disconnect the ground wire to the GC frame. Finally, disconnect the cable harness to the Analog and Power Board and feed the harness and connector back to the rear of the GC. Feed the two smaller cable connectors through first to maximize room to pass through the largest of the three cable connectors.

5 Note the orientation of the old transformer with respect to the various cables, then remove the Allen bolt to release the transformer. Carefully lift it from the GC.

6 In replacement, make sure the lower pad is in place, then orient the new transformer onto the pad.

7 Replace the upper pad and associated hardware. In restoring cables, feed the large cable and connector through

to the electronics side of the GC first.

11 Valves

Valve overview

Valves are used to modify the carrier gas flow during an analysis. Among their uses are:

- Highly reproducible injections, both liquid and gas
- Changing the order of columns
- Backflushing to eliminate high- boilers
- Column selection

and many others. Some examples are included in this section.

In this GC, valves are rotated by air- driven actuators. This keeps electrical activity away from where hot sample might leak. The air is controlled by solenoid valves located behind the right side cover.

Introduction

This document does not provide instruction for first time installation of any of the options discussed. The addon sheets, which accompany the various options, exist for just this purpose, and should be referenced when performing a first time installation.

The valves described in this manual are W-series minivalves, manufactured by VALCO Instruments Co, Houston, Texas. The valve body is made of Nitronic-60 nickel steel with 1/16-inch fittings.

Proper instrument operation will prolong the life of the valve system. Read all the accompanying information and avoid the following operational abuses:

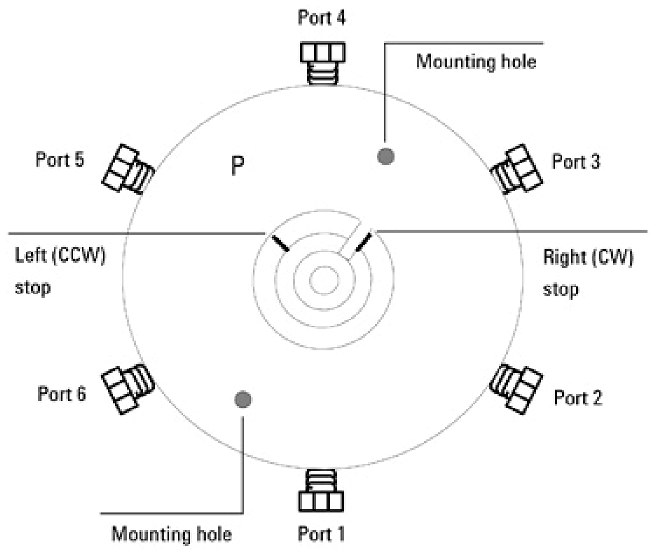
- Exceeding the specified temperature and pressure ranges
- Plugging a valve with column packing or sample precipitation
- Scoring valve surfaces with column packing or particulates in liquid or gas sample
- Contaminating the system with samples (non-eluting materials) or poor quality support gases

Because valves operate best at a constant temperature, the GC places valves in their own heated compartment.

WARNING **To reduce the fire hazard when sampling flammable gases or liquids under pressure, operators should routinely make pressure-leak tests of the plumbing, fitting and valves. Both valve positions should be checked. Depending on the nature and pressure of the sample stream, periodic pressure leak test and visual inspection should be made since wear or use could cause leaks to develop. Leaks may occur inside the valve box and be concealed from the operators view.**

Valco W-series minivalves

Valves consist of a driver, valve body, rotor, and preload assembly.



Valve bodies

Body parts are made from Nitronics 60 nickel steel. If required, the valve may also be produced from Hastelloy C. External tubing (plumbing) is connected to the valve body ports by ferrules and fittings provided with the instrument.

The left (CCW, counterclockwise) and right (CW, clockwise) stops on general purpose valve bodies limit rotor rotation so the correct flow path results when the index pin is close to or against either stop of the index lip.

CAUTION

Intermediate positions of the rotor may result in an interrupted flow path which could cause damage to the valve or other components in the chromatograph.

Valve rotors

Rotor type can be identified by color:

- An ***off- white*** rotor is made of a PTFE composite and may be used from room temperature to 200°C.
- A ***black*** rotor is made of polyimide and may be used from 100 to 350°C.

CAUTION

The life of a valve is shortened if used outside its specified temperature range
Do not mix rotor types in the same system.

The rotor seats on a highly polished conical surface. When properly seated, the polished surface prevents leakage around the rotor and between non- selected ports. The finish precludes adsorption of most GC samples.

The rotor assembly is a one- piece part with an integral molded and machined conical hub and the parts necessary for proper seating. The sample contacts only the PTFE composite (low temperature) or polyimide (high temperature) as well as the stainless steel of the valve.

Grooves in the rotor surface form the paths between specific ports. The index pin prevents rotation beyond either stop of the index lip. Valve ports are connected by the grooves only when the index pin is close to or against either stop. Intermediate positions result in flow shutoff through the valve and possible damage if left in this position.

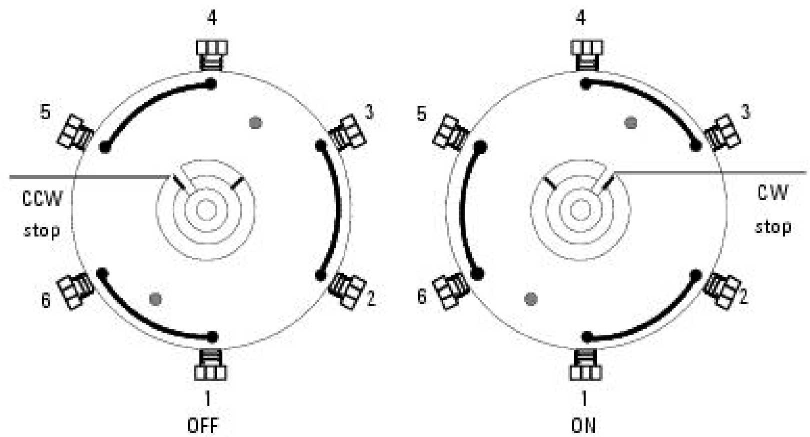
Preload assembly (not shown)

This assembly consists of a body, a spring, and an adjusting nut. It holds the rotor in the valve body.

Gas sample valves

The standard gas sample valves have 1/16- inch zero dead volume fittings and an internal port diameter of 0.016- inch.

6-port valve (actuator side view) showing flow path grooves



Gas sample loops

A 0.25 mL sample loop is included with all gas sampling valve systems. 10 mL and 5 mL loops occupy one valve position, limiting the number of valves that can be housed in a valve compartment.

Adjustable restrictor valves

Adjustable restrictors are used to balance flow resistance between the two valve positions. They are available with ambient to 225°C (part no. 0101- 0633) or ambient to 350°C (part no. 0101- 0948) operating ranges.

Liquid sample valves

Agilent Technologies offers 4- port LSVs with 0.2, 0.5, or 1 µL internal loops.

These valves are designed for liquefied gases under pressure such as ethane, propane, butane, LNG, etc. They are not intended for nonvolatile liquids (at room conditions) where a concealed leak could allow an accumulation or pool of liquid to form that may present a significant fire hazard.

All liquid sample valves have 1/16- inch fittings. The 0.5 µL size is available in low- (1000 psig limit) and high- pressure (5000 psig) versions; the other sizes are low- pressure (1000 psig) only.

An adjustable restrictor may be used on the sample outlet line to maintain internal sample pressure to keep a compressed gas liquefied.

Temperature ranges

1/16 inch Teflon rotor valves	0 to 200 °C
Adjustable restrictor valves	Ambient to 225 °C

CAUTION The life of an LSV is shortened if used outside its specified pressure and temperature ranges. Highly dangerous leaks can occur if the valve box temperature ever exceeds the specified temperature limits.

Adjustable restrictor valve

The adjustable restrictor supplied with a liquid sample valve is designed for temperatures up to 225°C; it is NOT compatible with high- temperature valves.

Removing the valve box assembly

1 Place the main power switch in the off position.

WARNING **Hazardous voltages are present in the instrument when the power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before working on the instrument.**

2 Unplug the line power cord from its receptacle.
3 Allow some time for the oven and heated zones to cool.
4 When the oven has cooled, turn off all gas supplies.
5 Switch the solenoid valve off so the actuator is in its fully extended position (piston rod extended).
6 If variable restrictors are present, remove their mounting hardware in the following order: two Torx T- 20 screws, hex nut, and mounting bracket for each restrictor valve.

7 Remove the two Torx T- 20 screws securing the valve box top assembly to the standoffs. Lift the valve box top assembly straight off the valve box. Be careful not to move the valve rotor index pin from its "at rest" position.

NOTE If valve/actuator alignment is to be made, see ***Valve/Actuator Alignment*** (321) in this section.

8 To reassemble: Align the two mounting holes in the valve box top assembly with the standoffs in the valve box. Lower the box top assembly until it rests on the standoffs.

9 Secure the valve box top assembly with two Torx T- 20 mounting screws. Tighten these screws firmly. Reinstall hardware for variable restrictors if present.

10 Exercise the valve(s) on and off a few times to verify operation.

Actuators

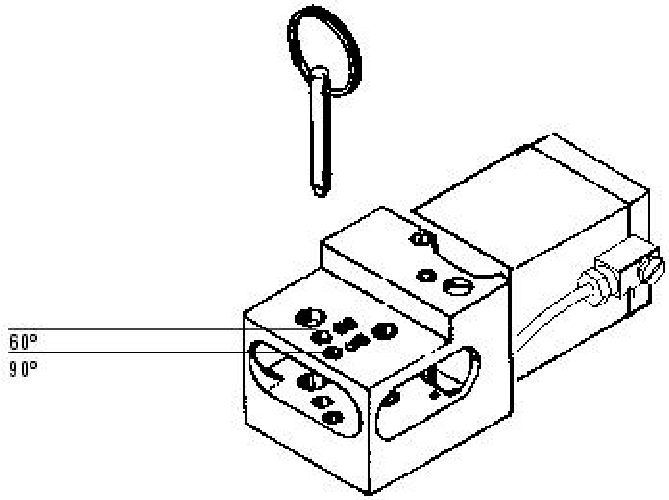
Valve rotors are driven by air- operated actuators. The air is controlled by solenoid valves inside the right side panel.

Installing the actuators

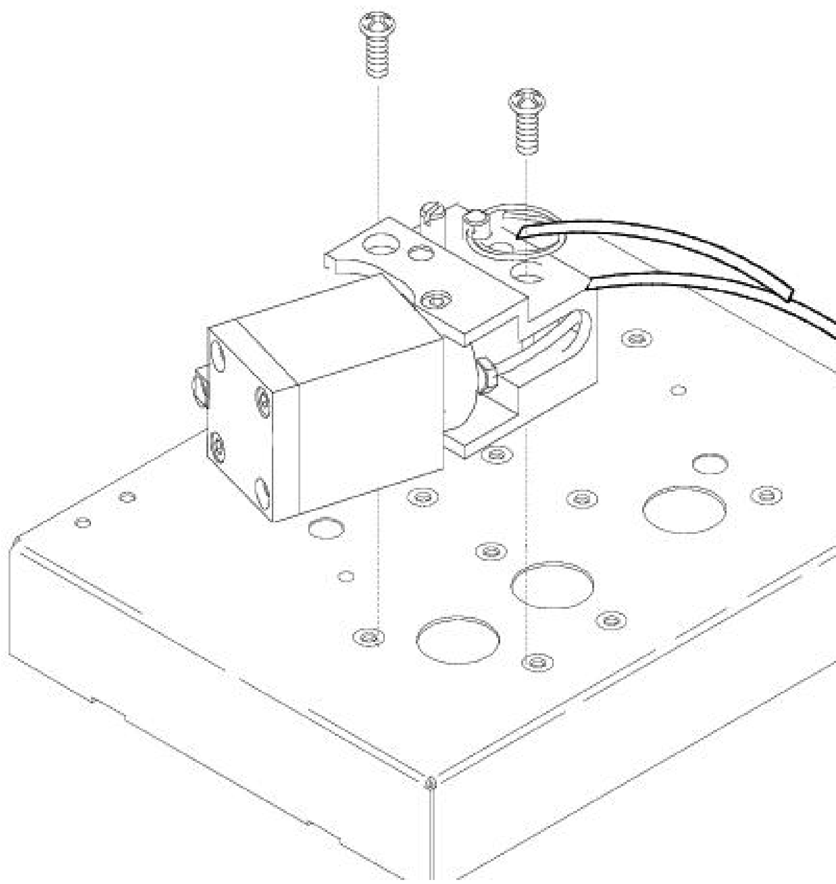
The actuators use pneumatic pressure (40 to 70 psi) to switch the valves between their two positions.

1. After installing the valves and valve box as described in the Valve Box section, you can install the valve actuators.
2. Set each actuator to the appropriate degree of rotation. Move the grenade style pin to the hole on the actuator marked with the correct degree of rotation, as shown below:
   - Four port valves—Place the pin in the 90° hole
   - Six port valves—Place the pin in the 60° hole
   - Ten port valves—Same as six port valves, but with the tubular 36° actuator limiter on the pin.
3. Mount an actuator over each valve installed using two Torx T- 20 screws.
4. Engage the actuator drive shaft coupler with the valve.
   - a Loosen the hex nut on the actuator near the drive shaft.
   - b Slide the shaft down.
   - c Insert a flat bladed screw driver in the slot on the top of the actuator and turn the shaft back and forth until you feel the coupler engage the valve.
   - d Tighten the set screw.

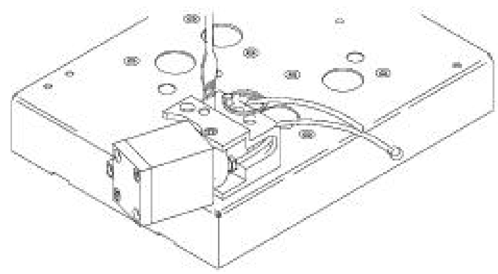
5 Install the valve actuator drivers.



Mounting the actuator on the valve box



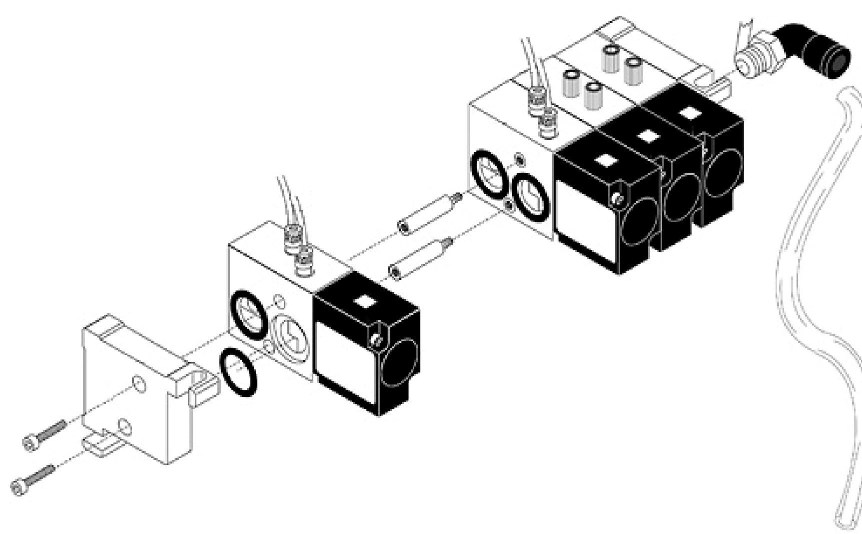
Engaging the actuator drive shaft with the valve



Assemble the valve driver block

The valve driver block accommodates up to four valve drivers. A valve driver must be installed for each valve/actuator installed.

1. Install two mounting posts on the intake/exhaust endplate (two large threaded holes). Install an O- ring in the supply/exhaust ports on the inside of the plate.
2. Slide a valve driver over the mounting posts in the orientation shown. Install two O- rings in the valve driver supply/exhaust ports as shown.



3. For each additional valve installed, install two more mounting posts and a valve driver with O- rings in the same

manner as the first.

4 When all the drivers have been installed, screw on the other end plate with the two hex screws as shown.

Install the bracket and cabling

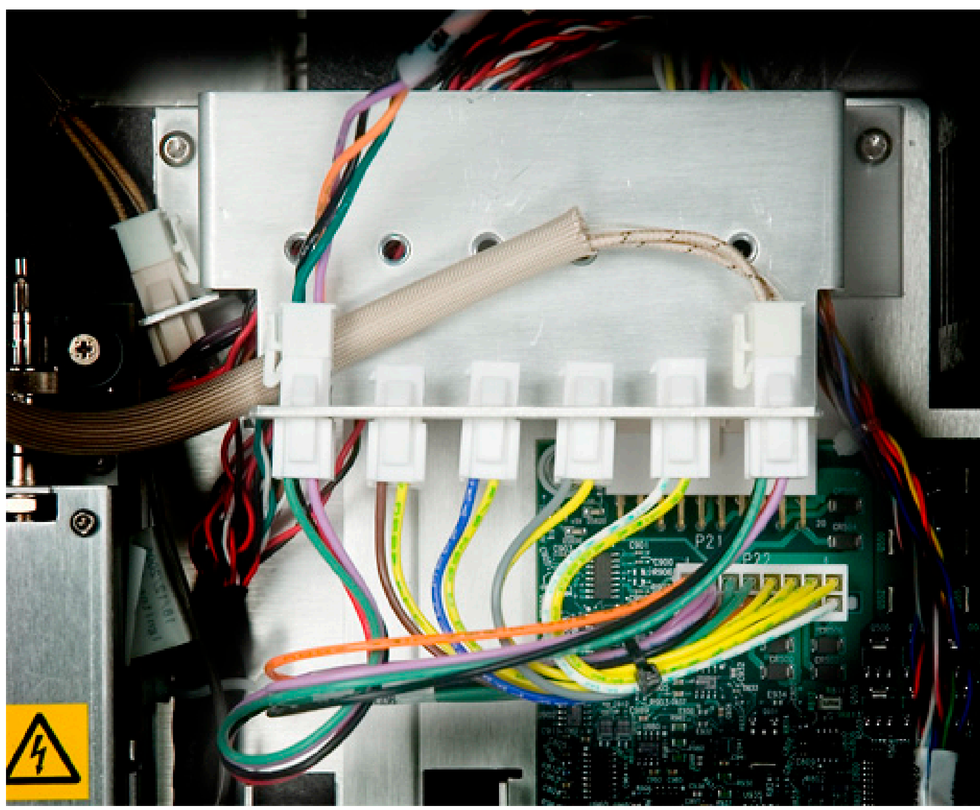
1 Install the valve actuators before installing the valve actuator drivers.

2 Screw the valve driver bracket into the right side of the GC using the two captive screws.

3 Plug the connectors on the valve driver cable harness up through the slots on the valve driver bracket.

   Plug the larger 2 × 2 heater sensor connectors (P1, P2) into the outside slots and the smaller 1 × 2 valve driver connectors (P3 to P6) into the four middle slots.

4 Plug in the heater/sensor lead(s) from the valve heater blocks on top of the GC. Thread the heater/sensor lead(s) to the right side of the instrument, through one of the keyhole wiring slots and into the P1 or P2 connector on the actuator bracket.



Install the valve driver block

1 Slide the valve driver block down into the driver bracket until the drivers plug into the connectors.

NOTE

To remove drivers from the driver block, use a hex wrench to unscrew the two hex screws on the left side of the block. Remove the driver, collapse the block to the width of the remaining drivers and reinstall the hex screws.

2 Plug the other end of the valve driver cable harness into the P22 connector on the analog and power board.

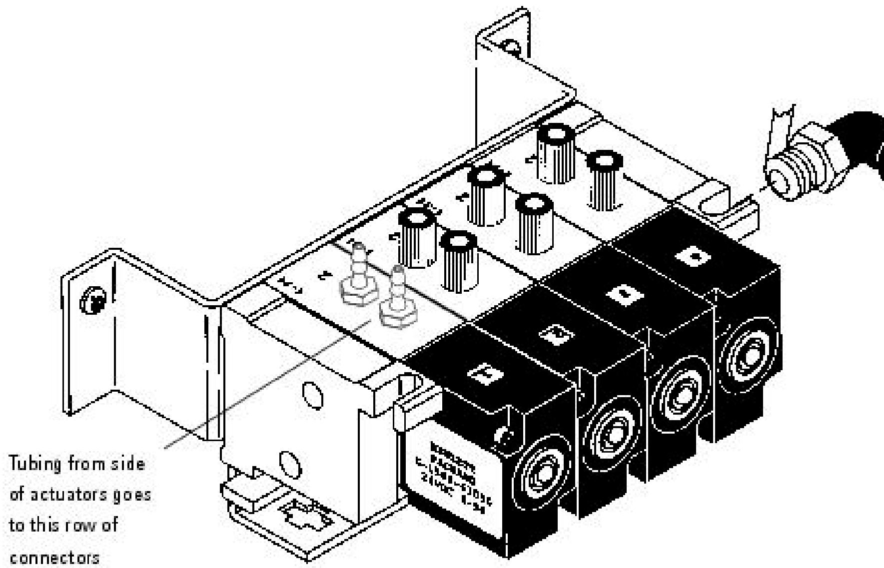
3 Wrap the threaded ends of the 90° elbow fitting in Teflon® pipe tape. Screw the fitting into the air supply intake on the side of the valve driver block facing the rear of the GC.

   The supply intake is the outside threaded hole, the one farthest from the analog and power board.

4 Run a length of 1/4- inch tubing out the hole on the rear of the GC in the lower left corner (when facing the rear of the instrument). Connect this tubing to your air supply.

5 Unscrew the screw plugs (if present) on the top of each driver you are using. Replace the screw plugs with tubing connectors.

6 Plumb the tubing from each installed actuator to the tubing connectors on the corresponding driver. The tubing from the side of the actuator goes to the connector farthest from the board. Grip the tubing with a piece of sandpaper and push it onto the tubing connector.



Valve actuator alignment

1 Remove the valve box top assembly. See steps 1 through 3 of ***Removing the valve box assembly*** (314) for the procedure.

2 Loosen the actuator link arm lock screw at each actuator with a 3 mm hex key wrench so that the coupling/shaft assembly is free to rotate. Push the coupling shaft fully into the actuator.

3 Turn the valve rotor index pin of each valve counterclockwise until it is 0.010 inch (0.25 mm) from the counterclockwise (left- hand) valve stop.

4 Reinstall the valve box top assembly.

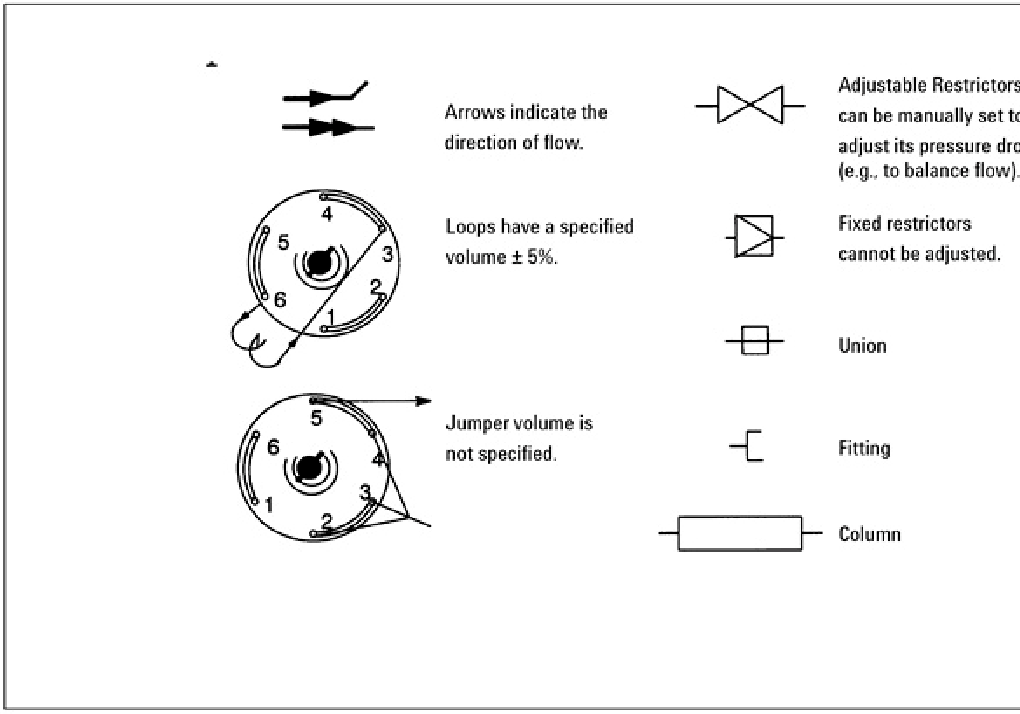
5 Gently rotate and push the coupling/shaft assembly with a blade- type screwdriver until the slot on the coupling fully engages the valve rotor index pin. Repeat this procedure for each valve installed.

CAUTION Use care in performing the following operation so as not to accidentally turn the valve rotor away from its preset (step 3) position.

6 Make sure that all solenoid valves are turned "off" by the appropriate valve controller. Turn on the air supply to the solenoid valve(s). The piston rod of each actuator will move all the way out to the extended (OFF) position. Very firmly tighten the link arm lock screw for each actuator.

7 Install the hardware for any variable restrictors present.

Typical Valve Configurations

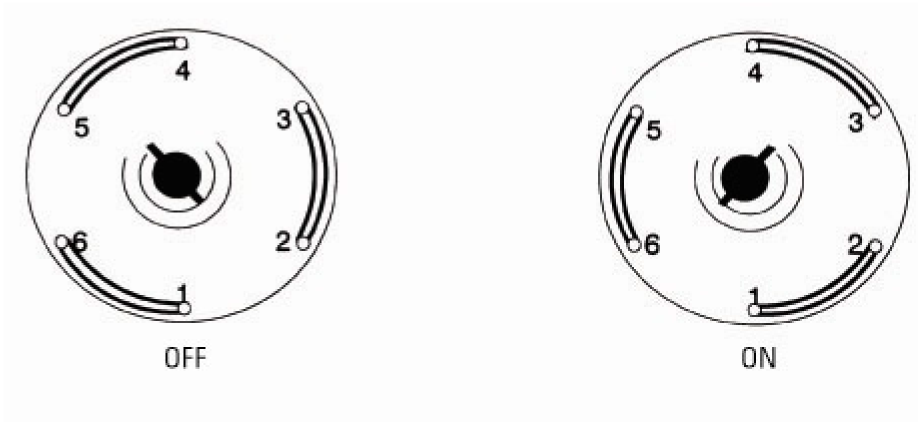


Option numbers

Numbers of the form n0n are for standard temperatures (ambient to 200 °C).

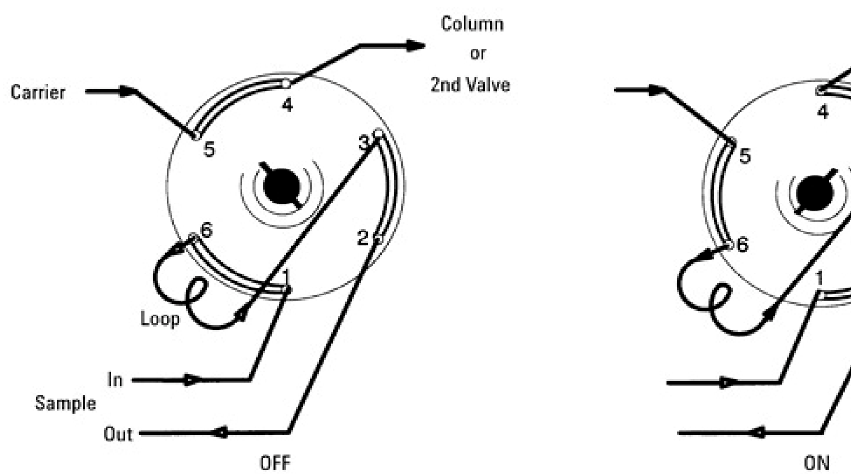
Numbers of the form n3n are for high temperatures (100 to 350 °C).

Custom Plumbing (diagram required), Option 700 or 730



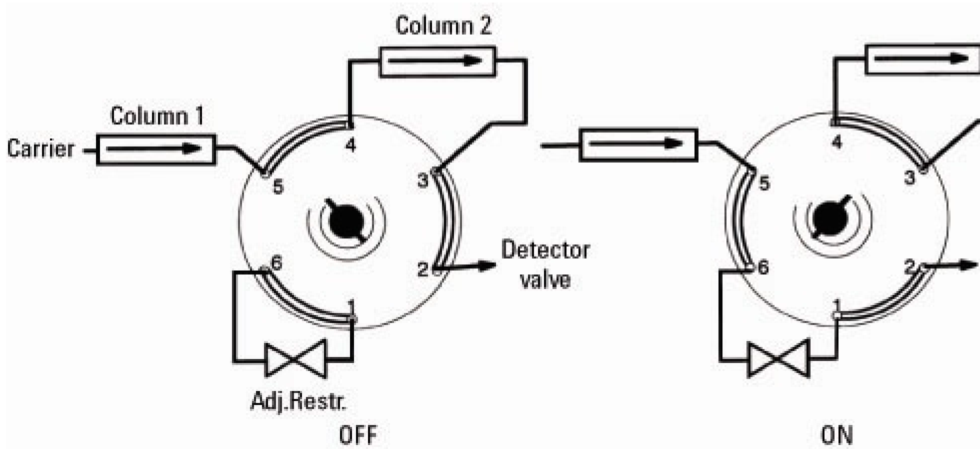
Custom Plumbing (Diagram Required), Option 700 or 730

Gas Sampling Option, Option 701 or 731



Gas Sampling Option, Option 701 or 731

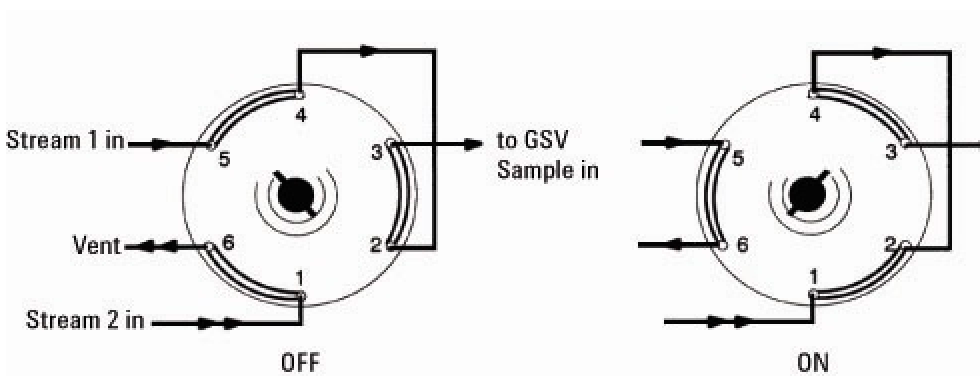
Column Isolation, Option 702 or 732



Column Isolation, Option 702 or 732

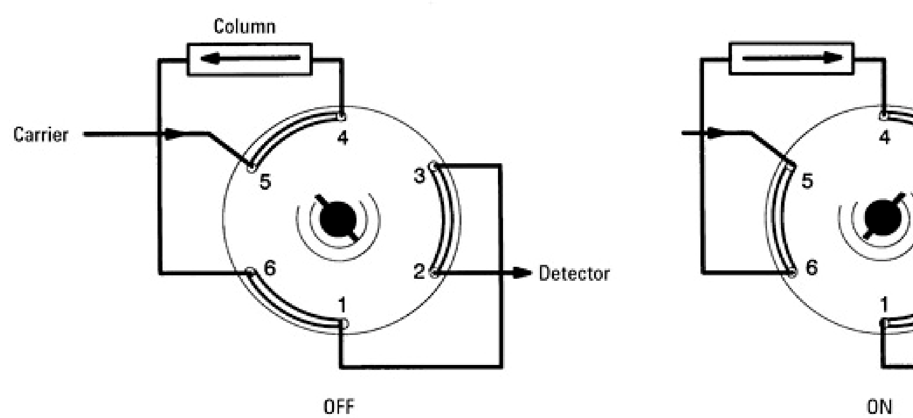
High temperature needle valve supplied with option 732

Two Stream Selection (Requires Gas Sampling), Option 703 or 733



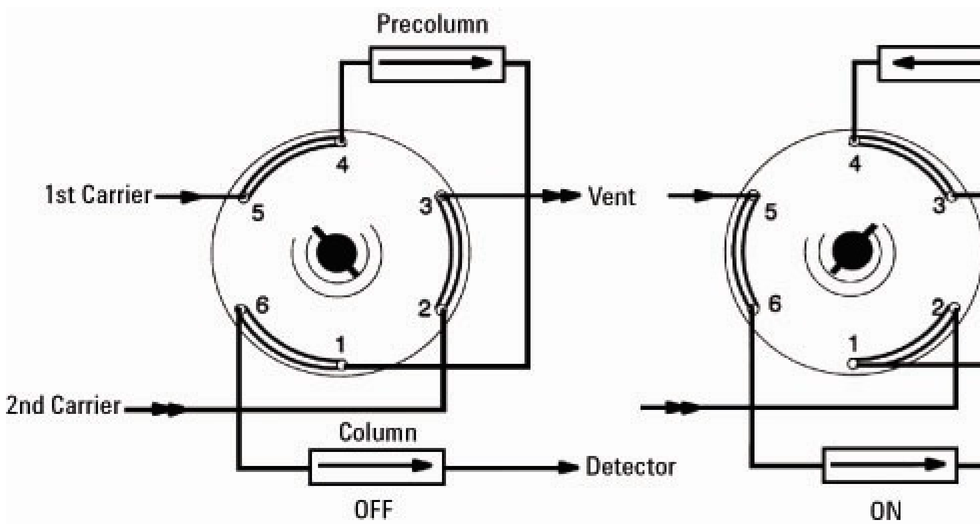
Two Stream Selection (Requires Gas Sampling), Option 703 or 733

Backflush to Detector, Option 704 or 734



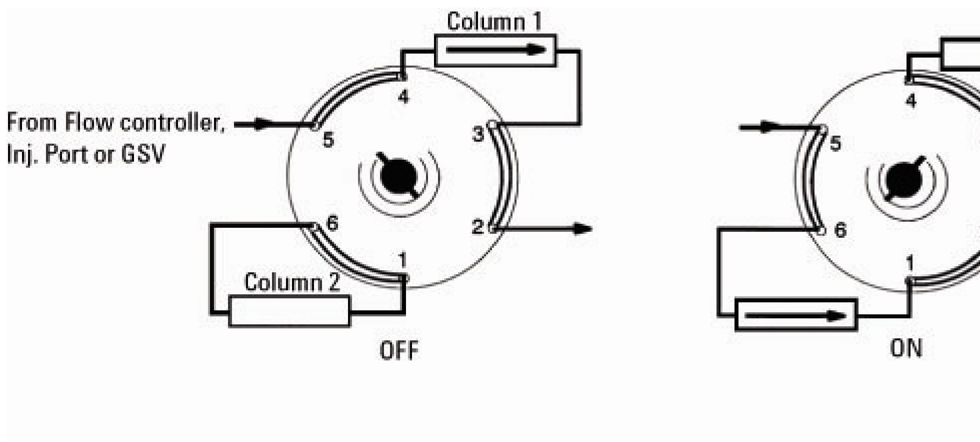
Backflush to Detector, Option 704 or 734

Backflush a Precolumn to Vent, Option 705 or 735



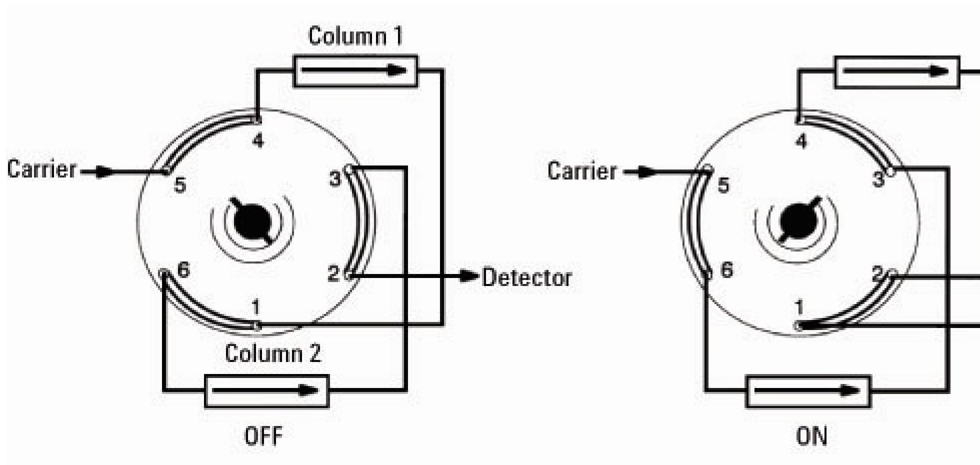
Backflush a Precolumn to Vent, Option 705 or 735

Column Selection (Unused Column Isolated), Option 706 or 736



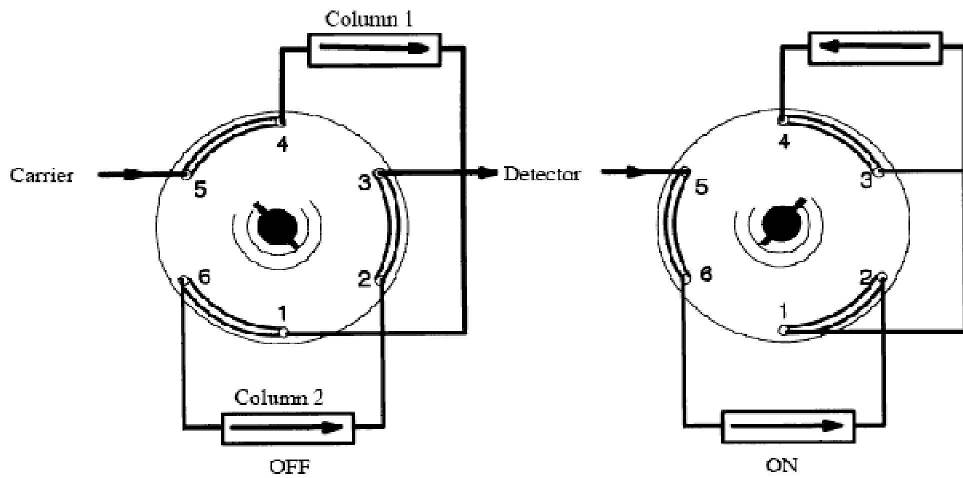
Column Selection (Unused Column Isolated), Option 706 or 73

Sequence Reverse, Option 707 or 737

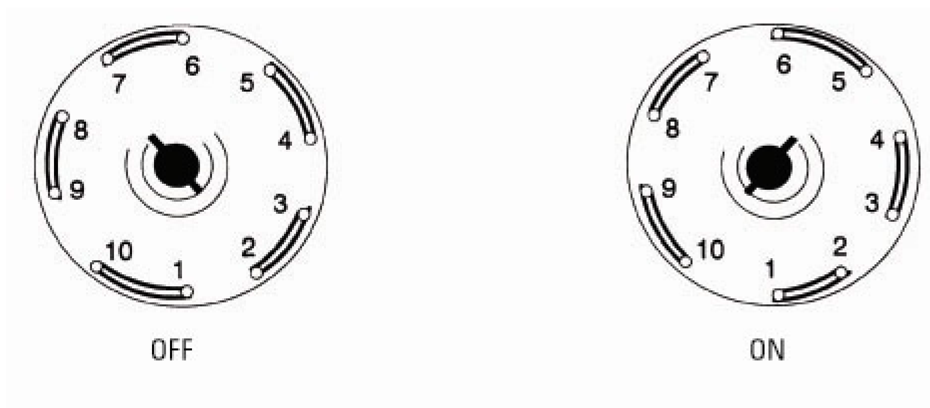


Sequence Reverse, Option 707 or 737

Sequence Reverse with Backflush of Column 1, Option 708 or 738

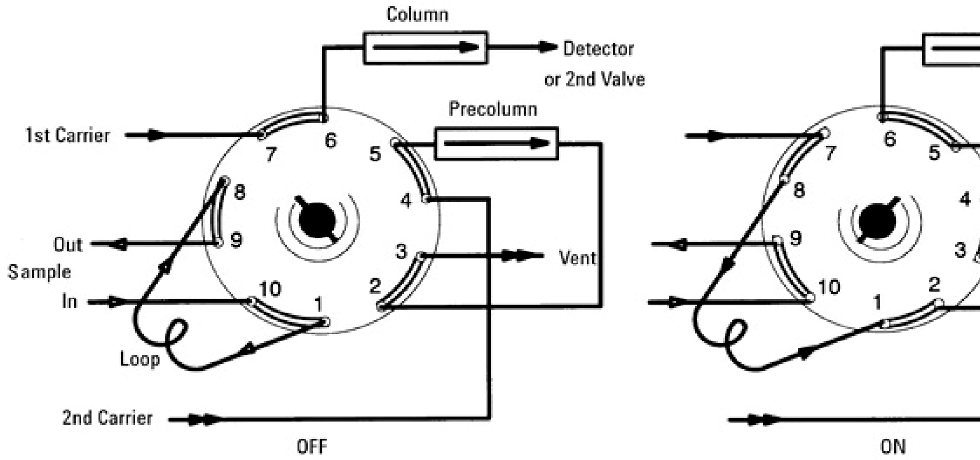


Custom Plumbing (Diagram Required), Option 800 or 830



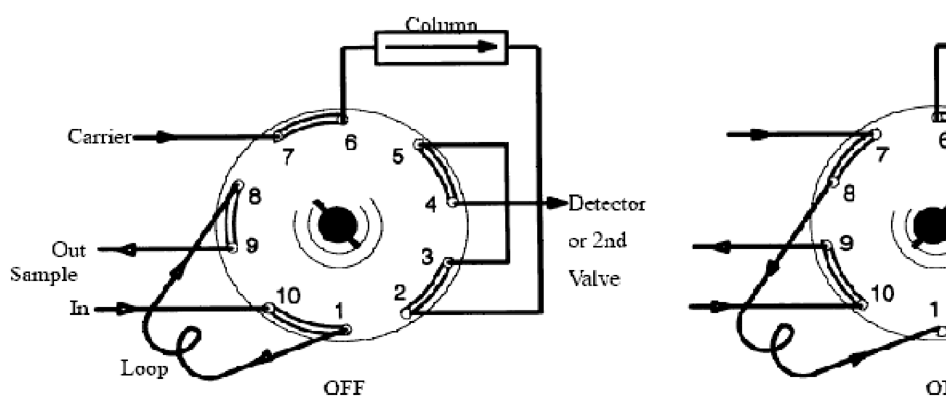
Custom Plumbing (Diagram Required), Option 800 or 830

Gas Sampling with Backflush of Precolumn to Vent, Option 801 or 831

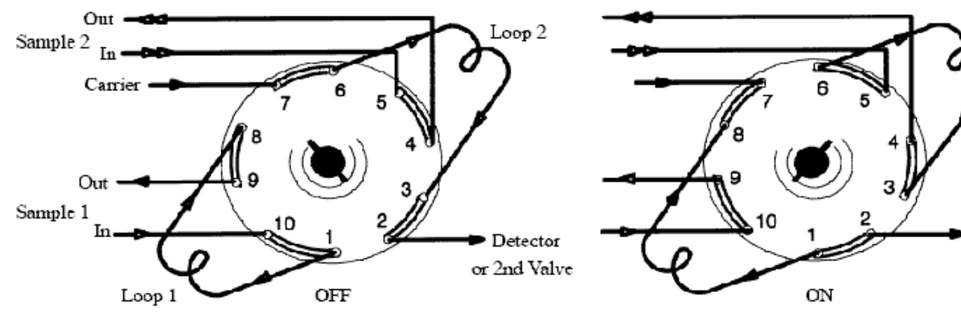


Gas Sampling with Backflush of Precolumn to Vent, Option 801 or 831

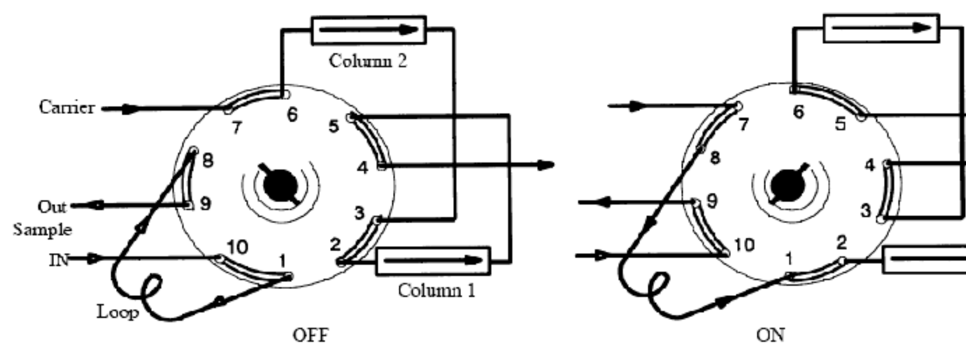
Gas Sampling with Backflush to Detector, Option 802 or 832



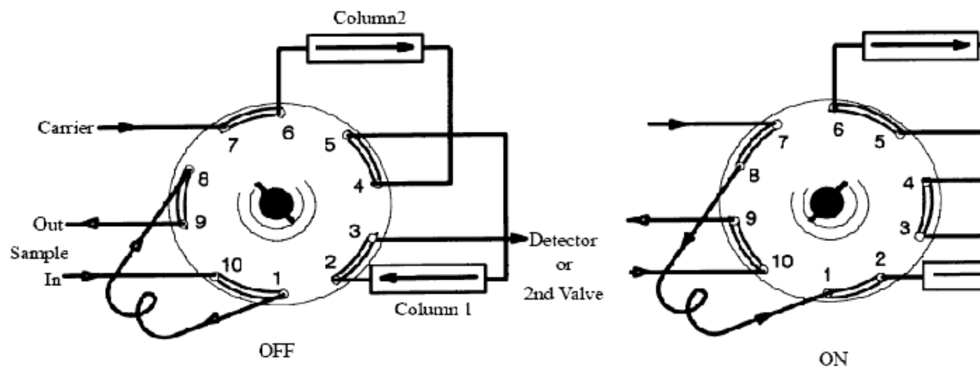
Gas Sampling of Alternate Streams, Option 803 or 833



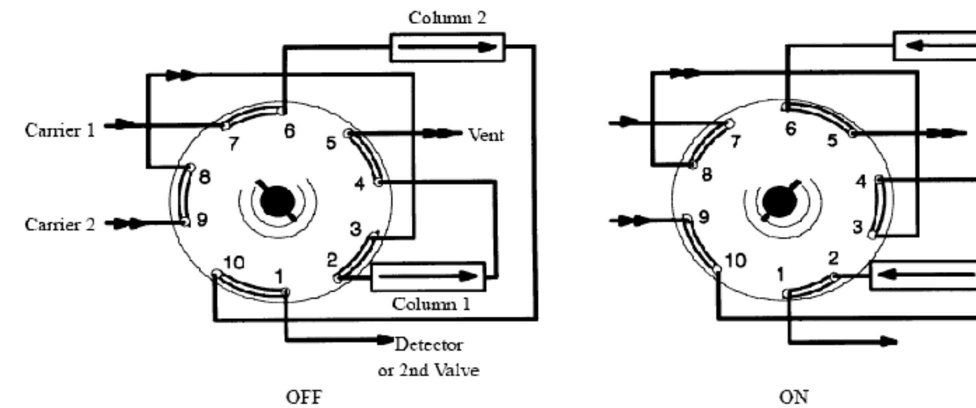
Gas Sampling with Sequence Reverse, Option 804 or 834



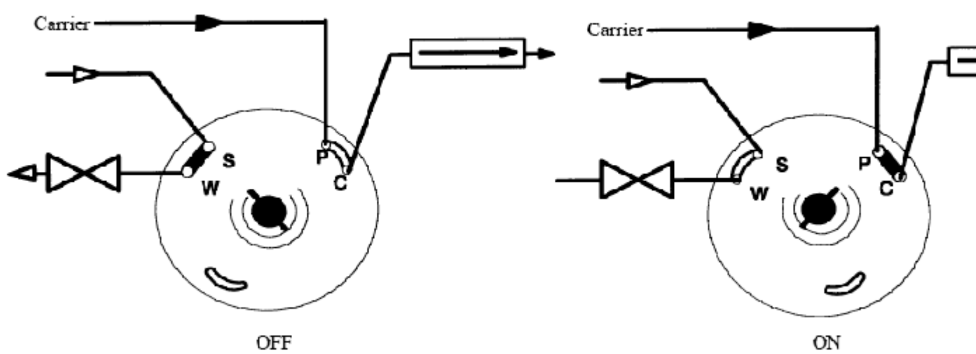
Gas Sampling with Sequence Reverse and Backflush of Column 1, Option 805 or 835



Column Selection with Backflush to Vent, Option 806 or 836



Liquid Sampling, Options 850, 852, 854, and 856



Troubleshooting

Most of the problems associated with sampling valves are related to peak broadening in transfer lines and inlets, sample adsorption by the valve or transfer lines, leaks, and perturbations in the baseline.

Chromatographic symptoms

Troubleshooting valves and their related plumbing is primarily a matter of systematic checking and verification of unimpaired mechanical operation of any moving part. This requires an understanding of how the valve functions internally and how the plumbing is configured. A plumbing diagram is essential for effective troubleshooting.

The following "symptom- cause" list gives the most commonly encountered problems found with valves and their solution.

Symptom	Possible cause	Solution
Lost peaks (degradation)	Valve or transfer lines too hot	Reduce temperature 50 °C, reevaluate
	Transfer line activity	Use nickel or Hastelloy tubing
Lost or tailing peaks	Valve or transfer line too cold	Increase temperatures 50 °C, reevaluate
Baseline perturbation	Slow valve rotation	Increase actuator pressure
	Rotor distorted	Replace rotor
	Sample/column pressure too different	Add back-pressure regulator to sample drain
Peak tailing broad peaks	Column overload	Use smaller sample loop Increase split flow
	Flow too slow	Increase column flow Increase split flow
	System voids	Check connections Reduce volume of connecting tubing

Loss of sensitivity or excessive drift

Several possible causes exist for overall deterioration of the chromatogram.

- Contamination in the valve requires a thorough cleaning.
- Internal leakage requires a complete disassembly and inspection of the mating surfaces.
- Poor temperature control may require a full check of electronic and thermal components.
- Lack of proper conditioning techniques, columns, etc.
- Failure or deterioration of other components (columns, detectors, etc.).

Loss of peaks in specific areas of the chromatogram

Entire sections of chromatographic data can be lost due to a valve that does not rotate or one that rotates improperly. Other than obvious component failures (solenoid, actuator, etc.), improper adjustments and misalignments cause most problems.

- Check that adequate air (about 482 kPa or 70 psi) is supplied.
- Check the valve. Is it rotating?
- If the valve rotates, check for proper alignment of the actuator, mechanical binding or slippage of connecting parts.
- Check for blocked flow paths with valve in both positions.

Extraneous peaks

Air peaks are sometimes seen in a chromatogram when leakage occurs because the valve rotor does not seal properly. These leaks may not be detectable using the soap- bubble method.

If a leak is suspected but cannot be located with soap bubbles, a pressure check will determine definitely if a leak exists. Extraneous peaks can occur due to contamination or improper conditioning of the valve. If leaks are not apparent, clean or condition the valve.

Other causes, totally unrelated to the valve, may produce similar symptoms. Impure carrier gas (i.e., containing water) can cause extraneous peaks.

Peak broadening and tailing

Voids in the flow system (valve and connecting tubing) cause tailing and peak broadening. Use inlets and liners with small internal diameters and connect the valve to the inlet or column with short lengths of connecting tubing of narrow inner diameter.

If early- eluting peaks are too broad, stationary phase or thermal focusing effects should be used with packed- column ports or increased split flows when capillary split inlets are used. Inlets should be equipped with narrow inner diameter liners, and narrow- bore connecting tubing should be used between the valve and inlet.

Baseline shifts

Baseline perturbations are caused by changes in column flow as the valve is rotated and as the sample loop equilibrates to system pressure. Slow valve rotation momentarily stops carrier gas flow and, when the valve stops rotating, a sudden increase in flow occurs which slowly returns to the set point. Check actuator pressure (usually 40 to 75 psi), valve rotor tension, and valve temperature to ensure that the valve rotates as quickly as possible. A restrictor or backpressure regulator can be added to the sample vent line to maintain the sample loop at system pressure. This will reduce the time it takes for the flow to stabilize after the valve is switched.

Baseline upsets

Frequently, baseline upsets are seen on chromatograms when valves are switched. These upsets are caused by pressure changes within the system, injections of large volume samples, or by changing the amount of restriction in the flow path. These upsets will become more of a problem when high sensitivity is required. Addition of a fixed restriction downstream from the valve may help minimize the upset. Changes in column length may also help reduce the upsets.

Fixed restrictors are used immediately before flame detectors to prevent flameout and are used in some instances to prevent pressure surges from damaging TCD filaments. An adjustable restrictor (needle valve) can also be used where a matched restriction is desired but not for preventing pressure or flow surges.

Often confused with baseline upsets, an offset is a shift in the baseline that does not return quickly to the original level. Baseline offsets may be caused by air leaks but more commonly are due to a change in gas purity or flow rate in the detector. Poor carrier gas or improperly conditioned filters and traps should be suspected whenever offsets occur.

Variation in peak area and retention time

The amount of sample contained in the loop and, therefore, the amount injected onto the column is affected by loop pressure and temperature. Variations in pressure and temperature lead to variability in peak areas. Flow restrictors or back- pressure regulators help to maintain constant loop pressure, and valve boxes help maintain temperature.

Leaks can occur in the valve itself or at any of the connecting points with transfer lines. Leaks usually cause area irreproducibility, retention times changes, and increases in the area of air peaks (with thermal conductivity detectors). Leaks in rotors can sometimes be fixed by tightening the nuts holding the rotor in the valve body. Leaks in connections are usually found with an electronic leak detector or with a liquid leak detection fluid (e.g., Snoop).

Pressure check

Leak checking the plumbing involved in a valve system must be done carefully and methodically. The pressure check method below will indicate, but sometimes not isolate, a leak in the flow path. Since this method does not necessarily isolate the leak, other leak check methods may be needed to locate the leak specifically.

NOTE Each valve in a system has two flow paths, ON and OFF. A leak sometimes occurs in only one of these two positions. Check both.

1 Disconnect the detector from the valve system.
2 Cap the valve system at its outlet and pressurize to 689 kPa (100 psi). Allow 2 to 5 minutes for pressure to equilibrate. If your instrument has flow control, it should read zero flow.

3 Turn off the gas supply at the source.

4 Generally, the pressure will drop quickly for approximately 30 to 60 seconds, then stabilize. After this initial pressure drop, the gauge should not indicate more than a 7 to 14 kPa (1 to 2 psi) drop during a 10 minute period.

5 If no leak is indicated, actuate all valves and repeat steps 2 to 4.

6 If a leak does show up, try to pinpoint the source using a soap bubble meter. Do not assume that the leak exists only at the valve. Often plumbing connections such as unions or bulkhead fittings are at fault. See Valve Box should it become necessary to expose the valve system.

7 If the leak cannot be found easily, divide the system in half and repeat the pressure check. Continue dividing in halves, and pressure check until the leak is isolated.

12 Capillary flow technology (CFT) devices

CFT overview

CFT devices consist of a plate and tubing. Ultimate unions are often used with CFT devices and are described here.

A CFT plate consists of two thin metal plates that are bonded together. Gas passages are left between the plates, and tubing fittings are brazed to the surface. Finally, the gas passages are deactivated. This results in a sturdy and inert unit with a very low thermal mass.

Accessories contain the plate, plus installation/use instructions and some related parts (ferrules, nuts, tubing, etc.) needed for use.

The following accessories and plates are available at the time of writing.

Description	Accessory	Plate only
Deans switch	G2855B	G2855-61500
Splitter, 2-way with make-up gas	G3180B	G3180-61500
Splitter, 2-way without make-up gas	G3181B	G3181-60500
Splitter, 3-way with make-up gas	G3183B	G3183-60500
Quick Swap for MSD	G3185B	G3185-60065

Tubing connects plates with one another and with other parts of the analytical path.

Description	Part Number
CPM-1/16-inch x 0.010 -inch id tube, 50cm	G1580-80060
CPM-1/16-inch x 0.20-inch id tube, 50cm	G1580-80062

Fused silica, deactivated, 0.20 mm x 5 m	160-2205-5
Fused silica, deactivated, 0.25 mm x 5 m	160-2255-5
Fused silica, deactivated, 0.18 mm x 10 m	160-2615-10
Fused silica, deactivated, 0.10 mm x 5 m	160-2635-5

Miscellaneous parts are used in making column connections.

Description	Part number
Oven bracket kit	G2855-60140
Reducing union, 1/8-inch to 1/16-inch	0100-0241
Restrictor, SS, 1/16-inch od x 0.01-inch id x 1 m	0100-2354
Union, SS, 1/16-inch	0100-0124
Screw, T-20, M4 x 8 mm	0515-2755
Column storage fitting	G2855-20590
Wire, SS, 0.015-inch x 40 mm	G2855-60593
Plug for CFT fittings or unions	G2855-60570
QuickSwap transfer line locking nut	G3185-20501
Deans switch supplies kit	G2855-60150

Ultimate union

This union combines a stainless steel body, SilTite metal ferrules, and very low dead volume to provide durable connections of capillary columns, retention gaps, pre- columns, and other capillary devices.

Tools and kits

The kits do not contain ferrules. The appropriate size must be ordered separately.

Part number	Description
G3182-61580	Union kit, deactivated
G3182-61581	Union kit, non-deactivated
G2855-20530	Internal nut
G2855-20555	Swaging nut
8710-0510	5/16 x 1/4 open end wrench (need 2)
5181-8836	Column cutter

Metal ferrules and nuts

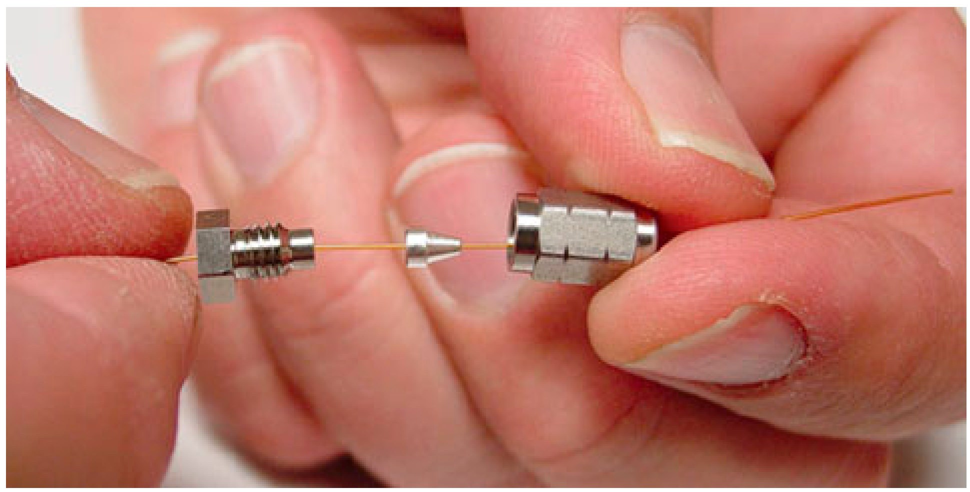
Identify the internal diameter of your column and select the part number for the appropriate sized nut and ferrule. Each packet contains an internal nut.

Part number	Description
5184-3569	SilTite ferrules, 0.1- to 0.25-mm columns, pkg of 10

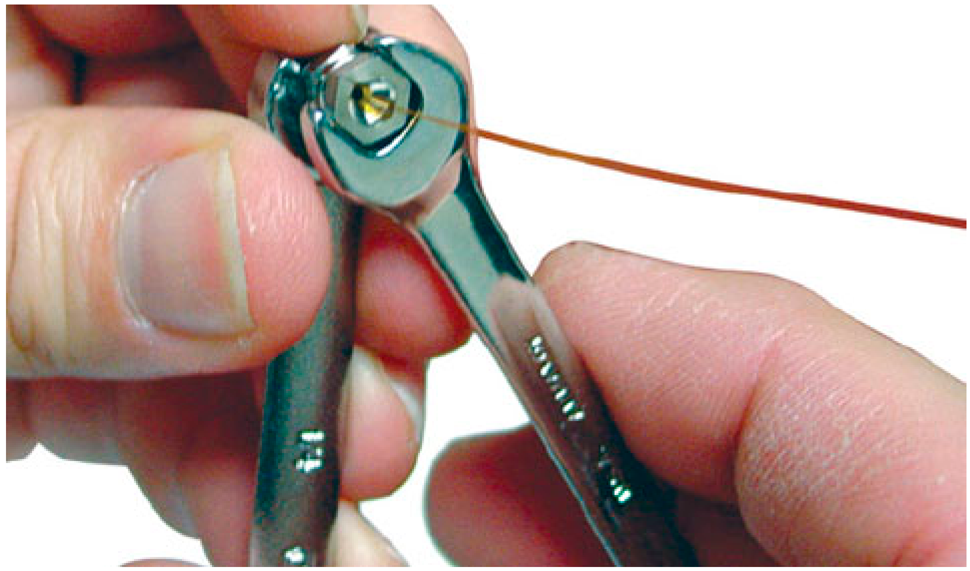
5184-3570	SilTite ferrules, 0.32-mm columns, pkg of 10
5188-2789	SilTite ferrules, 0.53-mm columns, pkg of 10

Assembling nut, ferrule and swaging nut

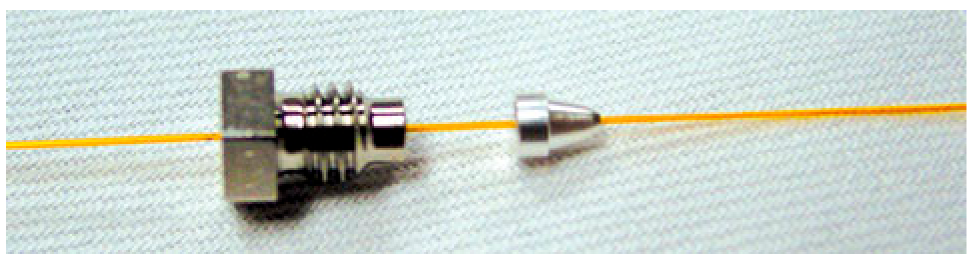
1 Thread the column end through the internal nut and the ferrule leaving approximately 3 cm of column protruding beyond the ferrule. Thread the swaging nut onto the internal nut with the column protruding.



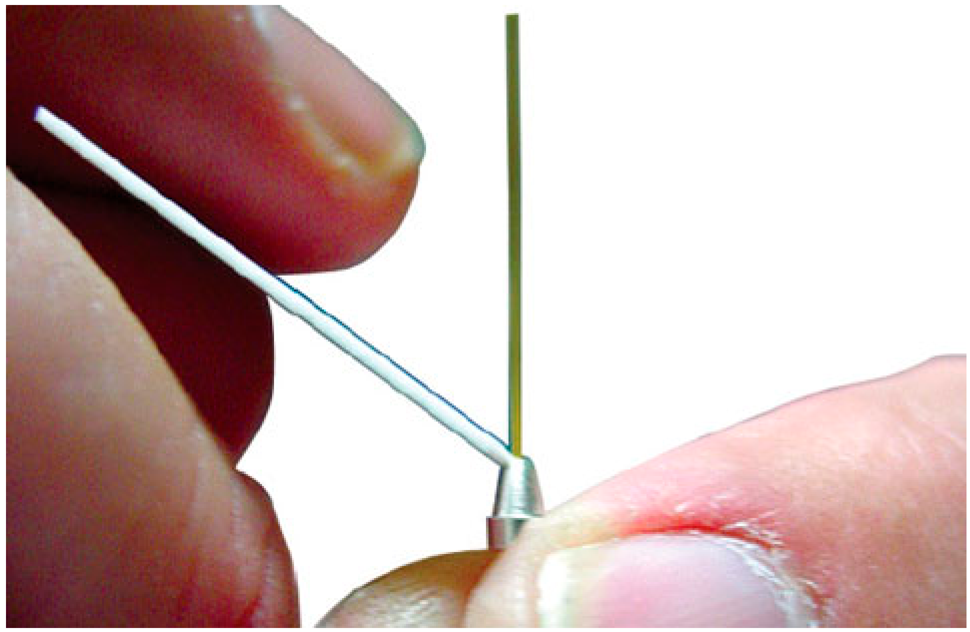
2 Tighten the two nuts together a little at a time, occasionally checking to see if the ferrule is grabbing the column. When the ferrule just starts to grab, notice the position of the nut and then tighten the nuts by turning 60 degrees (one flat).



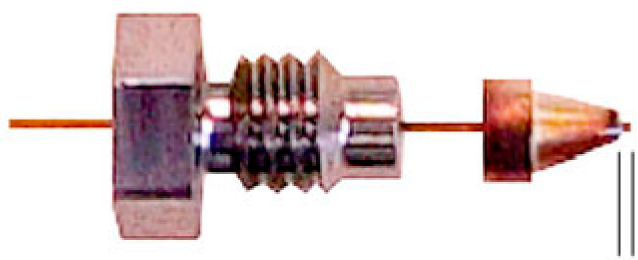
3 Remove the swaging nut.



4 Rest the ceramic column cutter on the small end face of the ferrule at a 45- degree angle.



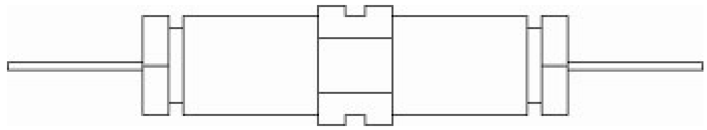
5 Scribe the column, then break off the end. It should break off with approximately 0.3 mm of column extending beyond the ferrule. It is important that you cut the column to a maximum of 0.5 mm beyond the swaged ferrule end. The end of the column need not be perfectly square, but should not have cracks that extend under the ferrule.



Connecting and disconnecting columns

Connecting columns

Connect columns to the union with internal nuts and preswaged SilTite ferrules. Finger- tighten the nuts. Further tighten with a wrench only 15 to 20 degrees.

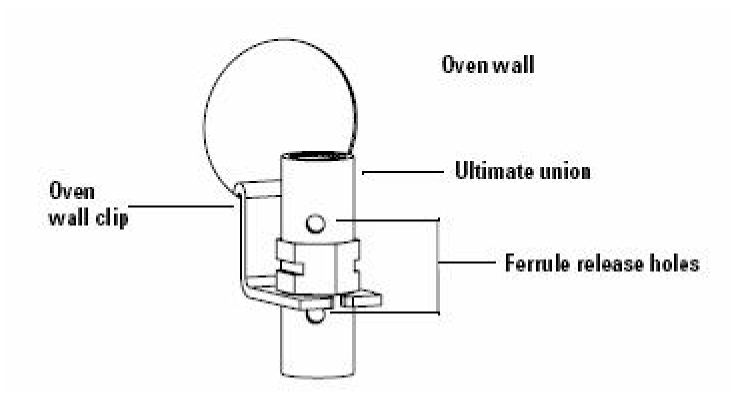


Disconnecting columns

Loosen and remove the internal nut. If the column and ferrule do not come free, insert a pointed object (pen, paper clip) into the ferrule release hole and press firmly. You will hear a click as the ferrule releases.

Mounting the union

Use the oven wall clip to support the weight of the union by attaching it to an opening in the oven wall.



13 Electrical

Power options

There are 8 power option kits. These contain the configuration plug, oven shroud, label, and power connector for each option. If you are converting from one power option to another you can order the kit or order the unique individual parts.

The power cord must be ordered separately. See ***Power cords*** (504).

Regular oven

There are 4 power options for the regular oven:

- G1530- 63800 Regular power kit 120V
- G1530- 63810 Regular power kit 220V
- G1530- 63820 Regular power kit 230V
- G1530- 63830 Regular power kit 240V

Kits	120VAC G1530-63800	220VAC G1530-63810	230VAC G1530-63820	240VAC G1530-6383
Configuration plug	G1530-60690	G1530-60710	G1530-60720	G1530-6073
Oven shroud	G1530-61610	G1530-61230	G1530-61670	G1530-6124
Label	G1530-90928	G1530-90921	G1530-90922	G1530-9092
Power receptacle	G1530-61550	G1530-61560	G1530-61560	G1530-6156
Clamp	1400-1663	NA	NA	NA

Common to all regular power options:

- 0515- 1084 Screw, M3x0.5x12mm T20, quantity 2 for power input assembly
- 0515- 2711 Screw, M4X0.7x12mm T20, coated, quantity 4 for shroud
- 0535- 0043 Nut with lock washer, M4X0.7x3.2mm 7mm for grounding wire
- 05890- 00460 Insulation plug for heater/sensor tube
- G3430- 00104 Heater Wire Insulation Sleeving

Fast oven

There are 4 power options for the fast oven:

- G1530- 63840 Fast power kit 200V (Japan)
- G1530- 63850 Fast power kit 208 or 220V
- G1530- 63860 Fast power kit 230V
- G1530- 63870 Fast power kit 240V

Kits	200VAC G1530-63840	208 220VAC G1530-63850	230VAC G1530-63860	240VAC G1530-6
Configuration plug	G1530-60700	G1530-60710	G1530-60720	G1530-6
Oven shroud	G1530-61620	G1530-61630	G1530-61650	G1530-6
Label	G1530-90924	G1530-90925	G1530-90926	G1530-9

Common to all fast power options:

- 0515- 1084 Screw, M3x0.5x12mm T20, quantity 2 for power input assembly

- 0515- 2711 Screw, M4X0.7x12mm T20, coated, quantity 4 for shroud
- G1530- 61550 Power input assembly
- 1400- 1663 Clamp, 1.25x1.0 inch
- 0535- 0043 Nut with lock washer, M4X0.7x3.2mm 7mm for grounding wire
- 05890- 00460 Insulation plug for heater/sensor tube
- G3430- 00104 Heater Wire Insulation Sleeving

Table of GC voltage by country

Country	Kit	Voltage	Oven type
Australia, 10 amp	G1530-63830	240 V	Regular
Australia, South Africa	G1530-63870	240 V	Fast
China	G1530-63810	220 V	Regular
China, Hong Kong	G1530-63850	220 V	Fast
Continental Europe, dual phase	G1530-63860	230 V	Fast
Continental Europe, single phase: Russia	G1530-63850	220 V	Fast
Denmark, Switzerland, 10 amp	G1530-63820	230 V	Regular
India, Denmark, Switzerland, 16 amp	G1530-63860	230 V	Fast
Israel	G1530-63850	220 V	Fast
Japan	G1530-63840	200 V	Fast
United Kingdom, Ireland	G1530-63870	240 V	Fast
USA	G1530-63800	120 V	Regular
USA	G1530-63850	208 V	Fast
USA	G1530-63870	240 V	Fast

Converting the power option

This procedure outlines the steps you must complete to prepare a GC for use in another country or to configure for a different oven heating speed.

The basic requirements for use of the fast heating oven are:

- The electric service must be capable of providing ≥ 200 V at ≥ 15 amperes.
- In the United States, the electric service must be 208 V or

240 V.

Procedure

1. Select the appropriate power option kit. See ***Power options***[1]. Compare the parts listings for the present and new power option to see what must be replaced.
2. Select the appropriate power cord. See ***Power cords*** (504).
3. Cool down the oven.
4. Turn off the GC main power switch and disconnect its power cord.

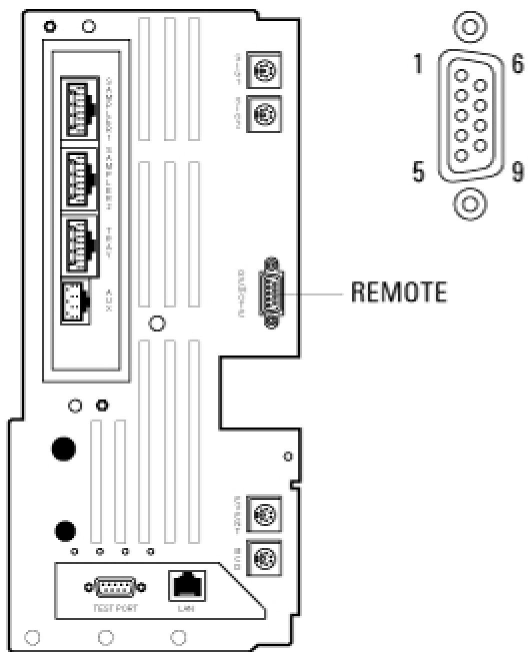
WARNING **Hazardous voltages are present in the mainframe when the GC power cord is connected. Avoid a potentially dangerous shock hazard by disconnecting the power cord before removing any GC panels.**

CAUTION Components can be damaged by static electricity: be sure to wear an ESD strap grounded to the GC chassis while performing this procedure.

5. If necessary, replace the oven shroud. See ***Replacing the oven shroud, oven fan, and oven fan motor*** (277).
6. Replace the oven configuration plug. See ***Line voltage configuration plug*** (352).
7. If necessary, replace the power cord connector.
8. Attach the new label.
9. Power on the unit. Watch for any errors after self- test.

[1] There are 8 power option kits. These contain the configuration plug, oven shroud, label, and power connector for each option. If you are converting from one power option to another you can order the kit or order the unique individual parts.The power cord must be ordered separately. See Power cords.Regular ovenThere are 4 power options for the regular oven:G1530-63800 Regular power kit 120VG1530-63810 Regular power kit 220VG1530-63820 Regular power kit 230VG1530-63830 Regular power kit 240VKits12 ...

Remote start/stop connection



JP1, REMOTE

Pin	Function	Logic
1	Digital ground	
2	Prepare	LOW tru
3	Start	LOW tru
4	Start relay	
5	Start relay	
6	No connection	
7	Ready	HIGH tru
8	Stop	LOW tru
9	No connection	

Prepare (low)—Request to prepare for analysis. Receiver is any module performing pre- analysis activities.

Start (low)—Request to start run/timetable. Receiver is any module performing runtime- controlled activities.

Ready (high)—System is ready for next analysis. Receiver is any sequence controller.

Stop (low)—Request to reach system ready state as soon as possible (for example, stop run, abort or finish, and stop injection). Receiver is any module performing runtime- controlled activities.

Remote control

Remote control allows easy connection between single instruments or systems to ensure coordinated analysis with simple coupling requirements.

Start Relay—A 120 millisecond contact closure

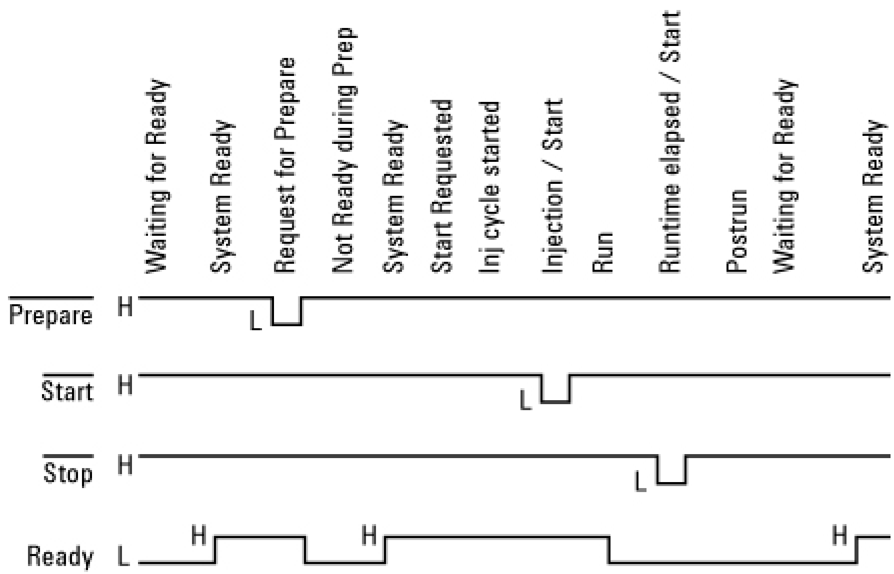
Control of analysis is maintained by signal readiness READY for next analysis, followed by START of run and optional STOP of run triggered on the respective lines. In addition, PREPARE and START REQUEST may be issued.

The signal levels are defined as standard TTL levels (0 V is logic true, +5 V is logic false).

Input Load >= 2.2 kOhm against +5 V

Output type is open collector.

Remote control timing



Temperature sensor resistance

The approximate resistance of a temperature sensor is:

$$R = 100 + (.35 \times t)$$

where R is resistance in ohms and t is sensor temperature in °C.

Temperature Sensor Resistance by Heater Temperature

°C	+0°	+10°	+20°	+30°	+40°	+50°	+60°	+70°	+80°	+90°	+100°
0°	100.00	103.90	107.79	111.67	115.54	119.40	123.24	127.07	130.89	134.70	138.50
100°	138.50	142.28	146.06	149.82	153.57	157.32	161.04	164.76	168.47	172.16	175.84
200°	175.84	179.51	183.17	186.82	190.46	194.08	197.70	201.30	204.88	208.46	212.03
300°	212.03	215.58	219.13	222.66	226.18	229.69	233.19	236.67	240.15	243.61	247.06
400°	247.06	250.50	253.34	257.34	260.75	264.14	267.52	270.89	274.25	277.60	280.93

Oven heater coil resistance

If you believe that your heater coil is cracked or otherwise damaged and has caused an open circuit, you can check it by measuring its resistance.

To measure the resistance:

1. Turn the instrument power off.
2. Disconnect the oven heater leads (P3, P4) from the AC power board.
3. Use an ohmmeter to measure resistance at the ***connectors***.

Acceptable resistance ranges (in ohms) are given below. Acceptable resistances range from the nominal value for a new, cold heater to +5% from the nominal value.

NOTE Resistance goes up approximately +3% after heating the coil.

Resistances of the Heater Coil

Nominal cold heater resistances, ohms

	Standard oven (1600 VA)	Fast-ramp oven (2250 VA)
120 V	9.07 – 9.52	n/a
200 V	n/a	17.78 – 18.7
220 V	n/a	21.51 – 22.6
230 V	33.06 – 34.71	23.51 – 24.7
240 V	n/a	25.60 – 26.9

n/a = not available

Setting the instrument power configuration

There are seven possible line voltage power configurations for the GC.

To change the power configuration for the instrument, you must install the appropriate types of the following components:

- Line voltage configuration plug
- Ceramic fuses on the AC power board
- Oven shroud assembly

These three components are explained in the following topics.

Table 13. Voltage configuration information

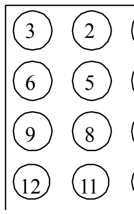
Voltage (–10%, +5%)	Frequency (Hz)	Maximum power consumption (VA)	Power line requirement	Oven type
120 V	48-66	2,250	20-amp dedicated receptacle	Regular
200 V	48-66	2,950	15-amp dedicated receptacle	Fast-heating
208 V	48-66	2,950	15-amp dedicated receptacle	Fast-heating
220 V	48-66	2,950	15-amp dedicated receptacle	Fast-heating
230 V	48-66	2,250	10-amp dedicated receptacle	Regular
230 V	48-66	2,950	16-amp dedicated receptacle	Fast-heating
240 V	48-66	2,950	13- or 16-amp dedicated receptacle	Fast-heating

Line voltage configuration plug

There is a different line voltage configuration plug on the AC power board for each power configuration. Each configuration uses three or five jumper wires, each connecting to two different pins on the plug. The 120 VAC configuration uses five jumper wires and all other configurations use three jumper wires.

Jumper locations for power configuration plug

	120 VAC	200 VAC	208/220 VAC	230 VAC	240 VAC
Transformer	3 « 13	2 « 13	3 « 13	5 « 13	3 « 13

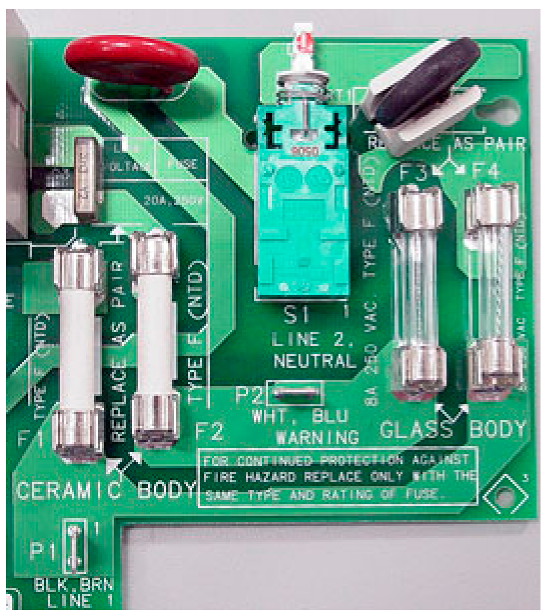


	6 « 15 9 « 14	6 « 12	6 « 12	6 « 9	6 « 9
Oven fan	1 « 10 4 « 8	1 « 4	1 « 4	1 « 4	1 « 4

Ceramic and glass fuses

The two sets of fuses on the G3440A AC power board:

- Two ceramic fuses to protect the board from the oven heating circuit (F1, F2)
- Two glass fuses to protect the board from the main supply (F3, F4)



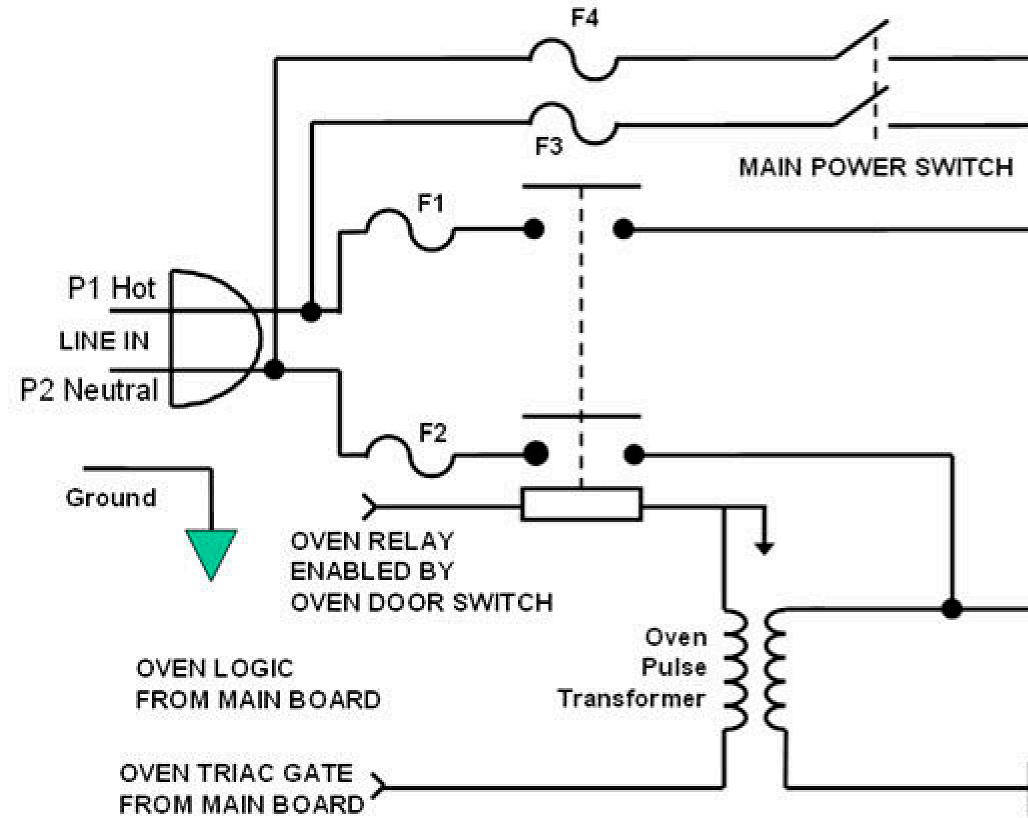
See the table below for the part numbers. When replacing both the glass and ceramic fuse types, always replace them in pairs.

I.D.	Description	System	Part no.
F1	Ceramic Type F 20A/250 V	Oven heater	2110-0098
F2	Ceramic Type F 20A/250 V	Oven heater	2110-0098

F3	Glass Type F 8A/250 V	Main supply	2110-0036
F4	Glass Type F 8A/250 V	Main supply	2110-0036

7890A AC power board schematic

The AC power board supplies AC power to the oven heater and to the main transformer.



Oven shroud

There are two different oven shrouds depending on the power option used. The oven shroud contains the oven heater and sensor as part of the assembly. If you need to replace the heater or sensor, you should replace the entire shroud assembly. See Replacing the oven shroud assembly in the ***Oven and Temperature Control*** (271) chapter for more details.

Part numbers for Oven Shrouds and Configuration Plugs

Regular oven shrouds

Voltage	Shroud part no.	Configuration plug part no.
120 V	G1530-61610	G1530-60690
	G1530-61670	G1530-60720

Fast ramping oven shrouds

Voltage	Shroud part no.	Configuration plug part no.
200 V	G1530-61620	G1530-60700
208 V	G1530-61630	G1530-60710
220 V	G1530-61630	G1530-60710
230 V	G1530-61650	G1530-60720
240 V	G1530-61640	G1530-60730

14 Firmware

Firmware overview

The firmware is the programming that controls the entire GC. Periodic updates to correct errors and/or add features are available from the Agilent Web site and may be downloaded using the LMD software.

About 160 7890A GC were shipped to channel partners, distributors, and regional sales offices with very early versions of firmware. Contact the CAS factory problem manager (FPM) for instructions on how to update these units.

Firmware History

Serial number ≤ number in table - the unit could be updated to the latest revision.

Serial number > number in the table - the unit should already have this revision or greater.

Revision	CN serial number break	US serial number break
A.01.07	TBD	TBD
A.01.06	CN10738001	US10737020

A.01.05	CN10731026	US10731014
A.01.04 **http://cas.service.agilent.com/gc/7890A/Firmware/Files/7890/7890A.01.04.bin**	CN10722043	US10722003
A.01.03 **http://cas.service.agilent.com/gc/7890A/Firmware/Files/7890/7890A.01.03a.bin**	CN10717036	US10717009
A.01.02.581	CN10716014	US10715013
A.01.02	CN10708001	US10710002

7890A.01.04

Described in service note.G3440A-005.

The following defects or perceived defects were fixed:

- Fixed PTV inlet configuration defect where Install Inlet (Cryo) was not a selection in the configuration list after a power cycle.
- Fixed the PCM Autoflow zero feature. Symptom would include PCM issues when in flow control mode. Measured flow is greater than flow displayed on screen. To confirm problem, navigate to Options, Calibration, PCM and scroll to Flow zero. Press Off / No to reset to factory defaults after updating firmware.
- Fixed symptom where pneumatic shutdown of PCM cannot be cleared without fixing the leak and power cycling the GC. Symptom may appear as PCM does not accept On / Yes or entering a new flow or pressure.
- Fixed symptoms where text alignment is incorrect and the cursor disappears when Options | Keyboard & Display | Language is set to Chinese.
- Fixed symptom where GC method is not downloaded from control software.
- Fixed the symptom where GC triggers a thermal shutdown with the flaps wide open. Chromatographic results indicate

that the flaps were partially open for several runs.

- Fixed the symptom where the PP inlet behaves as if there is an oven track temperature mode.
- Fixed the symptom where no exception or error message is displayed when back detector heater, signal board, or EPC module is "broken."
- Fixed the symptom where your cannot program User Key 2 until after programming User Key 1. If you go through the steps of programming User Key 2 before User Key 1, the key will not work.
- Default configuration for the Auxiliary 2 Heater changed to MSD transfer line.

The following modifications were added to enable channel partners to configure and control their applications:

- Increased the maximum temperature of a small heated zone from 400 to 450°C. Using this maximum on our standard inlet or detector may cause damage to the instrument.
- Added a lock to the configuration settings so that someone cannot modify the configuration without turning the lock off. The lock is located under Options | Keyboard & display. At power On the lock is set to On.
- Added the capability to specify the wattage of the heater for a small heated zone: inlet, detector or auxiliary heater.
- Added the capability to configure 3 custom heaters with specific PID coefficients and store those coefficients.
- Added the capability for our channel partners to configure a variety of heaters.
- The Valve Box heater can be configured as an independent isothermal heater.
- Added the capability to configure an Auxiliary heated zone to have a maximum temperature between 40 and 450 °C.
- Adds the capability to configure a 140 watt inlet or auxiliary heater and program it to heat between 1 to 5 °C/min.

Added the capability to configure the PTV without a heater.

7890A.01.03

Described in service note G3440A-004.

The modifications in this firmware revision include:

- Adjusts control of oven flapper. Eliminates flapper not closing completely.
- Improves communication using DHCP with lower baud rate hubs. Lower baud rate hubs include the generation of early twisted-pair hubs. An example hub is the Hewlett-Packard J3128A AdvanceStack Hub-8e 10 base-T hub with the speed of 10 Mb/sec.
- Fixes this symptom: Aux EPC channel 6 always reads 0 pressure in the software Edit Parameters screen.

7890A.01.02.581

Described in service note G3440A-003.

The modifications in this revision include:

- Prevents interruption of firmware update process when using the standard tool.
- Fixes sequencing with multi-position and gas sampling valves.
- Fixes the displayed flow when column inlet is unspecified for SSL and PTV inlets. The flow was displayed as zero, even though the flow was accurate.
- Prevents inappropriate thermal shutdown for inlet, detector, and AUX heated zones when they are heating slowly.
- Fixes pressure setpoint ranges for Pneumatic Control Module (PCM).
- Eliminates cycling or multiple GC reboots after a power cycle.

Ohana Utilities, Ohana Firmware

This instruction sheet describes a temporary utility for updating the firmware for the G3440A Agilent 7890A GC system and how to use it. This is a special utility that can be used until Agilent's Lab Monitor & Diagnostic Software is distributed.

The general steps are:

1 Download the required files from Agilent's website.

2 Extract the files.

3 Load Microsoft .NET Framework 2.0 onto the PC if not already installed.

4 Load the the Utility onto the PC.

5 Cable and configure a LAN connection to the GC.

6 Launch the utility and update the firmware.

If you have already installed the Agilent ChemStation B.03.01 or the Agilent Lab Monitor & Diagnostic Software, step 3 is not required.

Please read the entire sheet before beginning. The procedure takes about 1 hour including the download of the files from Agilent's website.

Minimum requirements

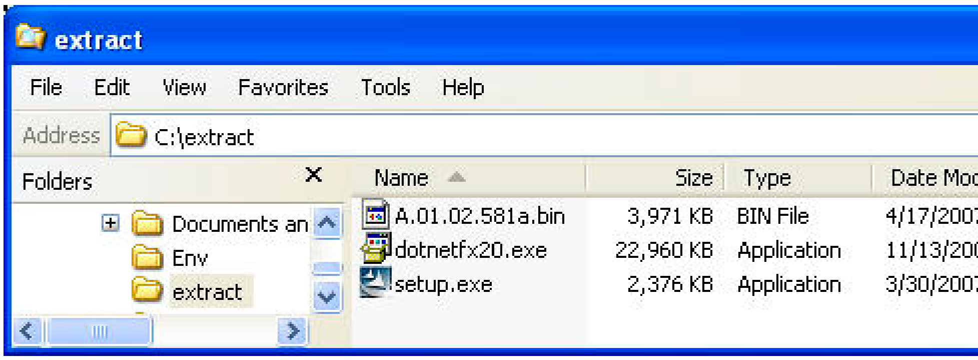
- PC operating system: Windows XP SP2.
- Microsoft .NET Framework 2.0 installed
- LAN connection to GC. LAN cable and IP address information.

  LAN cable, part number 8121- 0940 or

  Cross- over ethertwist cable, part number 5183- 4649

Please download and extract the following files:

- setup.exe for installing the Ohana Firmware Update Utility
- The firmware file A.01.04.bin
- If your PC does not have it installed, dotnetfx20.exe for installing Microsoft .NET Framework 2.0.

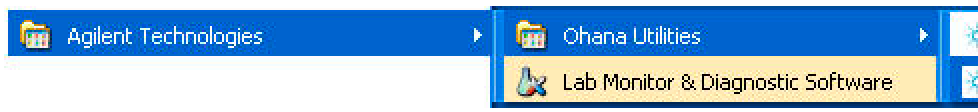


Procedure

1 If not already installed, double- click on the dotnetfx20.exe and follow the directions for installing Microsoft .NET Framework 2.0.

2 Double- click the setup.exe file to install the Ohana Firmware Utility.

3 Launch the utilty from the Start menu.

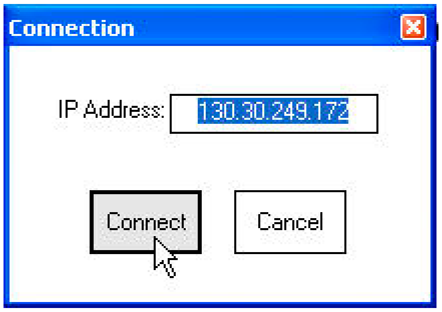


4 Select the File | Connect to Ohana Unit menu item.

5 From the GC keyboard, press **[Options]**. Scroll to Communications and press **[Enter]**. You will need the IP adress of the GC in the next step.

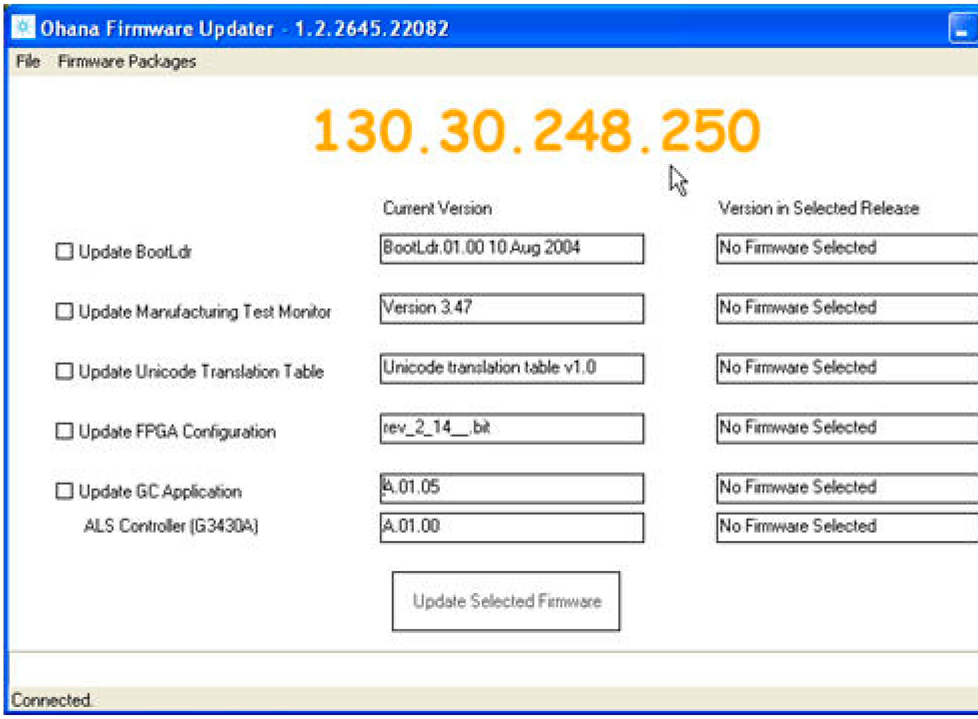
COMMUNICATION SETPOINTS	
-------------- LAN --------------	
IP:	130.030.249.172
GW:	130.030.248.001

6 Enter the IP address of the GC into the Connection dialog box and click OK.



7 If the utility connects successfully, the IP address will appear across the top of the window and display the current version of the firmware components. This example shows version A.01.05 firmware is installed.

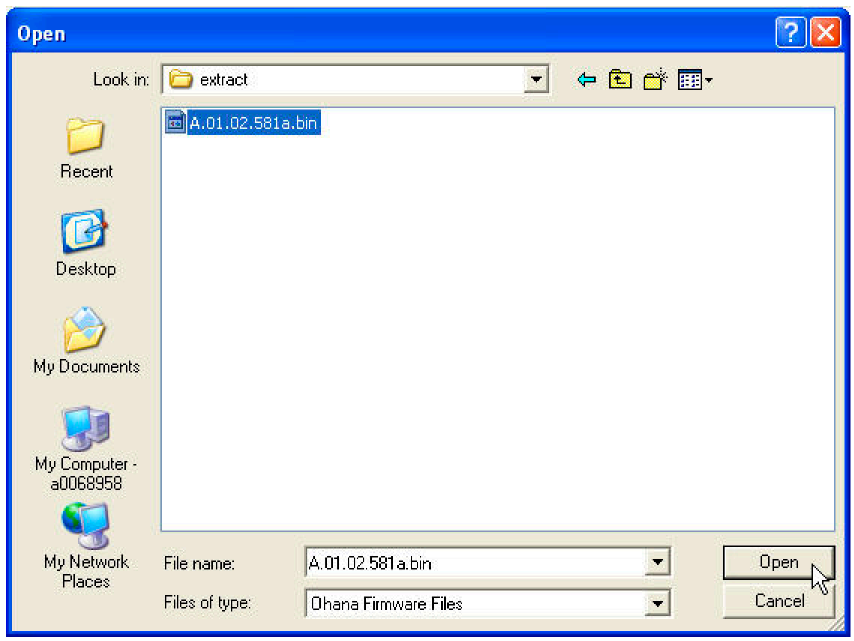
CAUTION It may take several minutes for the current versions to display on the screen. The update may not work if this information is not displayed.



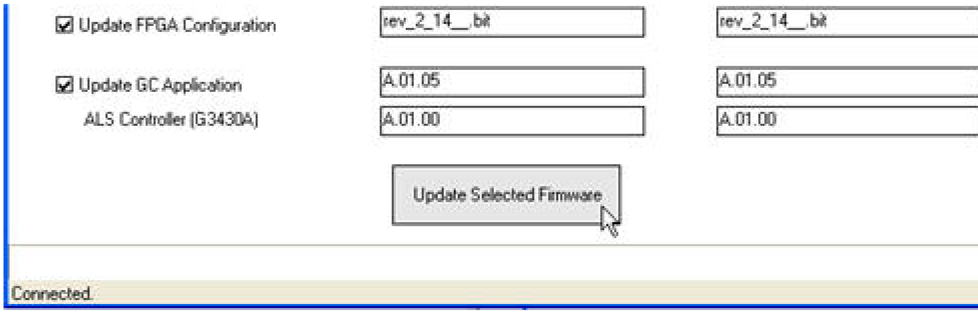
8 Select the Firmware Packages | Select Firmware Package menu item.

9 Find the firmware file with the name <version number>.bin and select it. An example of the file name is A.01.04.bin.

10 Click OK to close the Release Notes window.



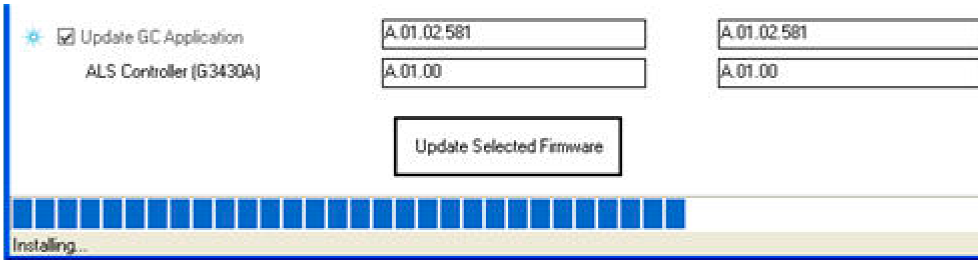
11 Select 2 check boxes: the Update FPGA Configuration and the Update GC Application.



12 Click Update Selected Firmware. Note the time that you start the firmware update.

CAUTION Do not interrupt the firmware update during the process. Do not disconnect any cabling or power off the instruments during the process. Do not press any keys on the GC keyboard.

13 The utility will download and install 3 firmware files: FPGA, GC App and ALS update. A progress bar and messages appear on the bottom of the screen. It should take about 3 minutes.



14 When the update is completed, the following message will appear. Click yes to reboot the GC.

CAUTION If the progress bar stops, repeat the procedure from step 3. If the utility does not display the Update complete message, wait 1 additional minute and power cycle the GC.

Confirm firmware update

Confirm the firmware update by pressing **[Status][Clear]**. The display should look like this.

Agilent 7890A GC A.01.05

Power on successful

The firmware update will become part of the GC's Event Log.

Configuration information can be lost during a firmware update from A.01.02 and A.01.02.581 to a higher revision. Please check the following setpoints on the GC:

- Inlet and detector gas types - Config | <Front or Back><Inlet or Det>.
- Heater configuration. For example, the MSD transfer line may need reconfiguration.
- LAN configuration information - Options | Communications.
- Serial number and manufacturing date - Service Mode | Diagnostics | Instrument Status.

CAUTION If the GC does not have a valid serial number, you may have issues connecting with the ChemStation software. If the GC does not have a valid manufacturing date, the configuration settings will not be saved and will be lost if you power cycle the GC.

Problems and solutions

If the update is interrupted or there is a defect in either of the boards, the update may fail. Click on the link to see more information about each of these symptoms.

- GC firmware update unsuccessful and GC reboots into MMON mode
- ALS firmware update incomplete

Possible solutions to unusual behaviors

At installation and after a firmware update, we have had some communication issues between the GC and the software. The symptoms include unexpected changes to configuration or to method setpoints. Here are some suggested actions for eliminating these symptoms.

- Load the default method. Press Method.
  1.
- Replace the Logic board, G3430- 60100.
  1. From the keyboard and display, check the configuration and method in the hardware.
  2. From the software, upload the GC method.
  3. From the software, select Instrument | GC Configuration. Review the GC configuration after clicking on Get GC configuration.
  4. From the software, select Instrument | Edit GC parameters. Review your method setpoints.
- Save the method under a new name.

Clearing battery-backed PF-RAM

After updating to a firmware revision before A.01.06, clearing all or part of the PF- RAM memory has eliminated some symptoms, such as, heater faults and corrupted ChemStation methods.

Clearing some or all of the memory forces the GC to reload defaults. See ***Default method*** (370) for a listing of the values.

Partial clear

This procedure resets both configuration and current setpoints. Here is a listing of what is reset to defaults.

- Configuration items: Oven, Display, Inlets, Detectors, Aux EPC modules, PCM EPC modules, Valves, Thermal Aux, and Valve box.
- Sequence items: All items stored under the sequence including: Sample numbers, Overlap, Auto- injector, and Method number.
- Current setpoints (Workfiles): GC and ALS setpoints.
- Instrument state flags: Run states, Blank run, Power fail, Method directory dirty, Status table, Analog column compensation values.

Procedure

1 Power OFF the GC.
2 Press and hold down **[Clear]**.
3 Power ON the GC.
4 When the GC Status screen appears on the display, release **[Clear]**.

Total clear

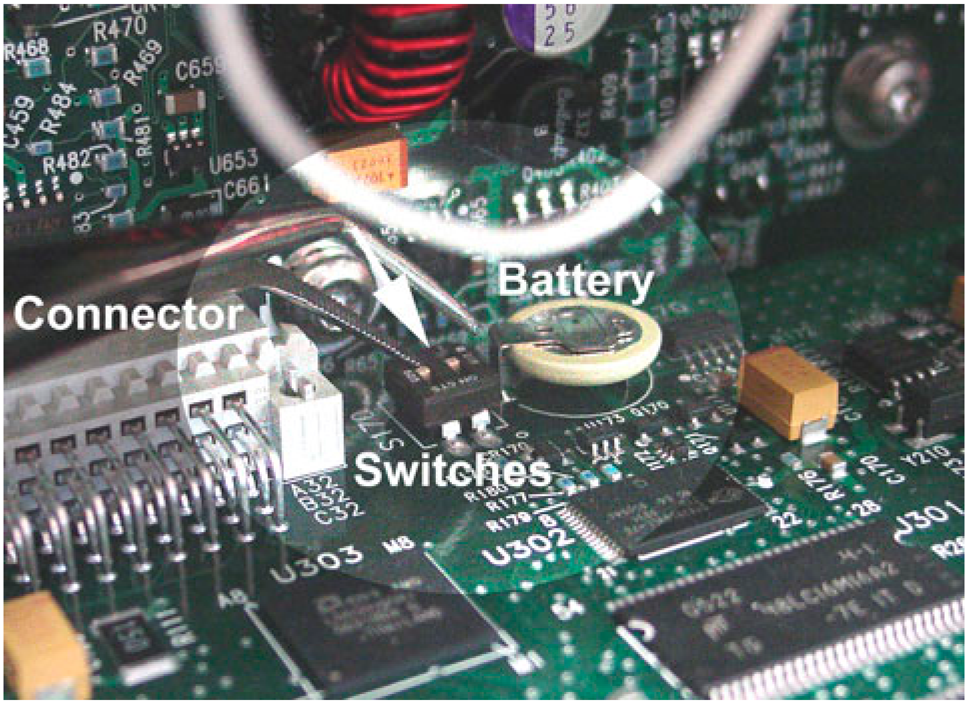
This procedure clears all of the battery- backed PF- RAM. In addition to what is reset by holding down the Clear key, these items are reset to defaults:

- ID items: Serial number, IP networking setpoints, Uptime clock, Column names
- Other: Service counters, Event log

Procedure

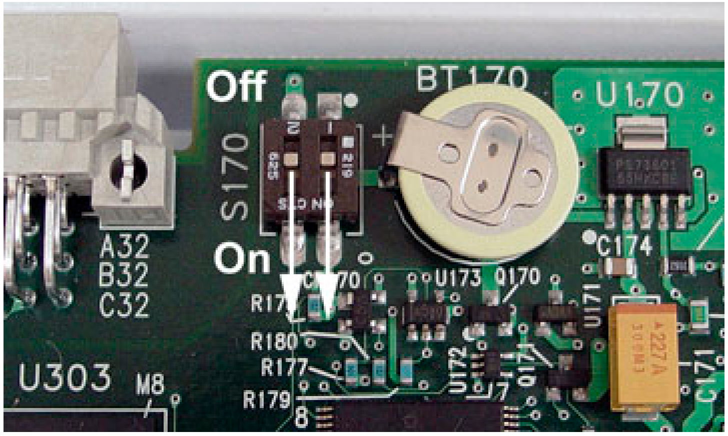
1 Power off the GC.
2 Remove the left- side panel to access the Logic board. Find the small DIP switches between the battery and the large connector.

3 Move both switches away from you toward the GC oven. This is the Off position.



4 Wait 5 minutes to allow the battery- backed RAM to clear.

5 Reset the battery switches to On.



6 Power on the GC. The GC will post some messages about loading default configuration and method files.

7 Re- enter any lost configuration information, such as, gas type and method setpoints.

Set the default method

To set the default method conditions, do the following:

1. Press **[Method]**.
2. Scroll to the last line of the table: **Set default method** and press **[Enter]**.
3. Press **[On/Yes]** to confirm the request.

Default method listing

This page lists the default configuration and method setpoints for the GC.

Instrument

- Post run hold time = 0
- Auto Prep Run = Unknown
- Keyboard lock = False
- Type of connection = LAN
- GCName = blank
- GCNotes = blank

Inlets

	COC	PP	PTV	SSL	VI
Determine readiness	True	True	True	True	True
COC oven track		False	False	False	
Septum purge flow		3	3	3	
Septum purge state		On	On	On	
Septum purge switching		False	False	False	
Purge switching time		0	0	0	
Total flow		3	18	3	
Total flow state		Off	Off	Off	
Control mode		Pressure	Pressure	Pressure	

Temperature state	______	Off	Off	Off
Initial hold time	______	0	0	0
Initial value	______	250	250	250
Post run value	______	250	0	250
Pressure state	______	Off	Off	Off
Initial hold time	______	0	0	______
Initial value	______	689475.7	689475.7	689475.7
Post run value	______	689475.7	689475.7	689475.7
Cryo	______	Off	Off	Off
Cryo temperature	______	25	25	25
Time out detection	______	Off	Off	Off
Time out time	______	30	30	30
Fault detection	______	Off	Off	Off
Quick cool	______	Off	Off	Off
Gas saver time	______	2	2	2
Gas saver flow	______	20	20	20
Gas saver state	______	Off	Off	Off
Operation mode	______	Splitless	Solvent vent	Split
Split ratio	______	0	100	100
Purge flow	______	15	15	15
Purge time	______	0.75	0.35	0.75
Pressure pulse	______	0	689475	689475
Pulse time	______	0	0.75	0.75
Vi Inject time	______	0	0	0
Vent flow	______	0	100	0
Vent pressure	______	0	344737	0
Vent time	______	0	0.25	0

Columns 1 to 6

- Ignore ready = True; except for Columns 3 through 6 = False
- Mode = Constant pressure
- Flow state = Unknown
- Initial hold time = 0
- Initial value = 1; except for Column 1 where Initial value = 0
- Post run value = 1

Oven

- Ignore ready = True
- Cyro = Off
- Use Temperature = 0
- Time out detection = Off
- Time out = 0
- Fault detection = Off
- Quick cool = Off
- Equilibration time = 3
- Temperature state = Off
- Initial hold time = 0
- Initial value = 50
- Post run value = 50

Auxiliary Thermal Zones

- Thermal Aux 1, Determine readiness = True
- Thermal Aux 2, Determine readiness = True
- Thermal Aux 3, Determine readiness = False

Detectors

	FID	FPD	NPD	TCD	µECD
Determine readiness	True	True	True	True	
Temperature	250	200	250	250	
Heater	Off	Off	Off	Off	Off
Fuel flow	40	75	2	0	
Fuel	Off	Off	Off	Off	Off
Utility flow	450	100	60	10	
Utility	Off	Off	Off	Off	Off
Makeup flow	50	60	30	5	
Makeup	Off	Off	Off	Off	Off
Constant total flow	False	False	False	False	False
Total flow	0	0	0	0	0
Electronics	On	On	On	Off	
Flame	Off	Off	Off	Off	Off
State	Unknown	Unknown	Unknown	Unknown	Unknow

Auxiliary flow and pressure control modules

For each of the 9 possible auxiliary pressure control channels (AUX).

- Determine readiness = False

For each of the PCM channels that function like a purged packed inlet.

- Determine readiness = True
- Mode = Forward pressure control
- Total flow = 0
- Pressure = 689475.7
- Pressure State = Off
- Initial hold time = 0
- Initial value = 689475.7
- Post run value = 689475.7

For each of the PCM channels that function like an auxiliary pressure control channel.

- Determine readiness = False
- Pressure state = Off
- Initial hold time = 0
- Initial value = 689475.7
- Post run value = 689475.7

Valves

For GC x GC Valve.

- GCxGC Valve sample time = 250
- Modulation time = 60000
- Valve idle state = Off
- Delay time = 60000

For each of the 8 possible valves.

- Valve initial state = Off

For Cyro- focusing valve.

- Pre- run time = 1
- Hold time =1

Automatic liquid sampler

	Front injector	Back injector
Fan	On	On
Pre-wash A Reps	0	0
Volume	80	80
Draw speed	200	200
Dispense speed	10	10
Viscosity delay	0	0
Pre-wash B Reps	0	0
Volume	80	80
Draw speed	200	200
Dispense speed	10	10
Viscosity delay	0	0
Sample wash Reps	0	0
Volume	80	80

Draw speed	200	200
Dispense speed	10	10
Viscosity delay	0	0
Depth offset	0	0
Sample pumps Reps	6	6
Draw speed	200	200
Dispense speed	10	10
Viscosity delay	0	0
Depth offset	0	0
Sample volume	10	10
Draw speed	200	200
Viscosity delay	0	0
Depth offset	0	0
Injection dispense speed	10	10
Pre-injection dwell time	0	0
Post-injection dwell time	0	0
Large volume reps	1	1
Large volume delay	0	0
Post-wash A Reps	0	0
Volume	80	80
Draw speed	200	200
Dispense speed	10	10
Viscosity delay	0	0
Post-wash B Reps	0	0
Volume	80	80
Draw speed	200	200
Dispense speed	10	10
Viscosity delay	0	0

Tray

- Temperature = 0
- Barcode reader = false
- Mixing intensity = Unknown
- Time = 0
- First sample preference = 2
- Enable ALS tray = False
- Overlapped injection mode = No overlap
- Overlapped injection delay = 0

Service counters

- Twenty (20) counter IDs set to a default number.
- Enabled = False.

Signals

Each of the 4 digital signals are set to

- Test Plot at 50 Hertz
- Signal is saved = False.

15 Firmware A.01.05 Instructions for Channel Partner Devices

Firmware overview for channel partners

This section contains instructions for installing and configuring channel partner inlets, detectors, thermal aux zones, and cryo focus valves, on an Agilent 7890A GC. Each section includes information on:

- How to wire your hardware
- How to configure the GC to recognize your hardware
- How to access the method parameter screen for your hardware

For configuration of standard Agilent devices for the GC, see the Accessory Installation sheets and the Agilent 7890A GC Advanced User Guide.

Tuning a small heated zone

1. Disable the I and D terms. The D term is set to zero to disable it, but the I term has an inverse effect, i.e. the larger the I term the smaller its effect, so set the I term to its maximum value.
2. Increase the P term as needed to achieve oscillation, then

decrease it until the oscillation is barely maintained. Note the value of the P term, which we call Ku, and the period of the oscillation in seconds, which we call Pu.

3 Use these values in one of the standard PID tuning methods, such as Ziegler- Nichols, to calculate the PID terms.

For example: using Ziegler- Nichols tuning the PID values would be:

P = Ku / 1.7

I = Pu / 2

D = Pu / 8

Ziegler- Nichols is probably a good tuning to use for any zone that needs to be temperature programmed. It has a small amount of overshoot but it settles fairly quickly. For zones that don't need to be temperature programmed there are other tunings that have less overshoot but are slower to settle, such as Tyreus- Luyben tuning. The PID values using Tyreus- Luyben tuning are:

P = Ku / 2.2

I = Pu * 2.2

D = Pu / 6.3

Reference: ***http://www.chem.mtu.edu/~tbco/cm416/zn.html*** (***http://www.chem.mtu.edu/~tbco/cm416/zn.html***)

Thermal Aux Configuration

There are several control models to select for the standard Agilent thermal aux zones. These include the AED transfer line, the MSD transfer line, and the Nickel catalyst. This section only covers the custom configuration of a thermal zone that is available by selecting ***User configurable heater*** as the auxiliary heater type during configuration. See the *Agilent 7890A GC Advanced User guide* for configuration of standard thermal aux zones.

Up to 3 thermal auxiliary zones can be configured. All 6 of the GC's small heated zones are available for use. If cooling and heating are required in the thermal zone's control, a cryo valve is selected during configuration of a thermal zone.

Heater and cryo connection locations

Each heater connector has a 40 to 180 watt heater power supply and a temperature sensor for the control loop. Labels on the wiring harness near the connector identify the connection. The labels match the GC display except for the FI or BI wiring harness labels displayed as FINLET and BINLET.

Connector label / GC display identifier	Connector location on GC
A1	Right side electrical compartment position A1 (far left) on valve bracket elec harness
A2	Right side electrical compartment position A2 (far right) on valve bracket electrical harness
FI/FINLET	Left top side of GC frame adjacent to front inlet
BI/BINLET	Left top side of GC frame adjacent to back inlet
F-DET	Right side electrical compartment at top position adjacent to front detector
B-DET	Right side electrical compartment at top position adjacent to back detector
FV	Left top side of GC frame adjacent to front inlet
BV	Left top side of GC frame adjacent to back inlet

Connections assigned to a thermal zone

Each Aux thermal zone can support one of two fixed heating connections containing a heater and temperature sensor. When one of the two allowed heater connections is configured to an Aux Zone the other connection is not available for thermal zone assignment. Additionally each thermal zone can support a cryo valve.

Thermal Zone	Thermal Aux 1	Thermal Aux 2	Thermal Aux 3
Heater Connection	Aux1 or BI/BINLET	Aux2 or B-DET	FI/FINLET or F-DET
Cryo Valve Connection	BV	BV	FV

The *User Configurable Heater* allows heated zones ranging from 40 watts to 180 watts.

Auxiliary Type Selection

After assigning a heater or heater and cryo valve to an Aux thermal zone and rebooting the GC, you configure the type of device requiring thermal control. This is done by selecting the ***Auxiliary type:*** field from the configuration menu and pressing the [Mode/type] key. Several Agilent standard devices are listed along with a selection for a ***User configurable heater***.

When configuring a device for thermal control that is not listed you can select the ***User configurable heater*** and create a custom thermal control model. All but the ***User configurable heater*** control model have a fixed maximum device setpoint of 400 deg C. The only auxiliary type to support a cryo valve is ***User configurable heater***.

Auxiliary type	Use
AED transfer line	For the AED transfer line
MSD transfer line	For the Agilent GC/MSD transfer line
Nickel Catalyst	For the Agilent nickel catalyst
Unknown	
User configurable heater	For creation of a custom thermal device

User Configurable Heater

The control algorithm used to maintain a stable temperature setpoint requires several constants in order to model the thermal response of a physical device. These constants can be modified to model a custom control device when the ***Auxiliary type:*** is set to ***User configurable heater.***

Custom heater parameters

The PID and Mass fields

These fields allow entry of custom constants for the Proportional, Integral, Derivative, and Mass associated with a thermal device's control algorithm.

The Power field

This field allows for entry of the maximum power that the heater requires. This value must be within 10% of the actual maximum or an error is generated.

The Maximum Programming Rate field

Enter the maximum rate that the temperature of the device can change from one temperature to another in a fixed period of time. If this field is left at the default value of zero, the device cannot be temperature controlled.

The Maxmimum Setpoint field

Enter the maximum setpoint allowed for the custom thermal device. The GC will not allow the user to enter a value higher than this number.

Sensor

Pressing the [Mode/Type] key on this field brings up the sensor type for selection. Select from RTD and TC.

The zone control model

Pressing the [Mode/Type] key on this field brings up the available zone control models summarized in the table below.

Control Model	Use
SS	Isothermal zone with cryo
PTV	High power requirement with cryo and the ability to program temperature ramps during a run
COC	Low power requirement with cryo and the ability to program temperature ramps during a run

Programmable temperature zones

The PTV and COC zone control models for the ***User configurable heater*** Auxiliary type and the ***Unknown*** Auxiliary type, allow a temperature program to be entered for the device similar to that available on an Agilent standard PTV and COC inlet.

Cryo control model

This field is only displayed if a cryo valve is configured in the hardware.

Pressing the [Mode/Type] key on this field brings up the available cryo control models summarized in the table below.

Cryo control model	Use
PTV	A control model that is similar to the Agilent PTV inlet.
CryoTrap	A control model that lowers a device's temperature anywhere during a and then increase the device's temperature at a later time during the ru

Configuring the thermal Aux zone

1. With the GC disconnected from its power source, install the device containing the heater and temperature sensor and optionally install a cryo valve.
2. Plug the heater and sensor cable from this device into one of the six small heated zone connections.
3. Optionally plug the cryo valve 24 volt power supply into the FV or BV connector.
4. With all covers installed, attach the power supply to the GC and power the GC on.
5. Unlock the GC configuration. Press the [Options] key, select ***Keyboard & Display*** and press the [Enter] key. Scroll down to ***Hard Configuration Lock*** and press the [off] button.
6. From the section above titled “Connections assigned to a thermal zone” determine the Aux Zone (1, 2 or 3) that you are using based on the heater connection.
7. On the GC keypad press [Config] [Aux Temp #] press the number of the thermal zone 1, 2, or 3.
8. With ***Unconfigured:*** selected press the [Mode/Type] key on the GC keypad and if necessary scroll to see all selections. You must only make a selection that contains the GC identifier for the heater zone that your device is attached to. If a cryo valve is attached to the FV or BV connector, the GC also displays a selection for your heater zone and a cryo valve configuration. Press [Enter] to complete your selection.
9. When the GC prompts to power cycle the GC, reboot the GC

by pressing the [Options] key and select ***Communications***. From this option scroll down and select the reboot option and press [Enter] on the GC keypad. This soft reboot keeps the GC configuration unlocked for subsequent steps. Power cycling the GC forces you to unlock the GC configuration on power- up.

10 On the GC keypad, press [Config] [Aux Temp #] press the number of the thermal zone 1, 2, or 3. The display now shows your configured devices.

11 Scroll to ***Auxilliary type:*** and press the [Mode/Type] key on this field to bring up the available Auxiliary types. Select ***User Configurable Heater*** to create a custom thermal device and press [Enter].

12 If a cryo valve is included in this Aux Temperature zone, scroll to ***Cryo type:*** press the [Mode\Type] key and select the coolant supplied to the cryo valve. Next scroll to ***Cryo control model:*** and press the [Mode/Type] key and select a suitable model from the list.

13 To display all the configuration parameters select ***View Custom Heater Conf*** and press [On/Yes].

14 Next scroll to and enter the initial values for ***Proportional gain***, ***Integral time***, ***Derivative time*** and ***Mass.*** These values are usually later modified based on empirical results until stable thermal performance is achieved.

15 Scroll to ***Zone control model:*** and press the [Mode/Type] key on this field to bring up the available zone control models. Select a suitable control model and press [Enter].

16 Scroll to the ***Sensor:*** field and make sure the sensor type agrees with your hardware. To change the sensor type, press the [Mode\Type] key and select the RTD or TC (thermocouple with conversion board) type.

17 Scroll to ***Power (watts)*** and enter the maximum power used to heat the device.

18 Scroll to ***Maximum setpoint*** and enter a value that is within the safe operating temperature of the device.

19 Scroll to ***Maximum programming rate*** and enter a rate of temperature rise per minute that your device is capable of achieving.

20 Power cycle the GC to lock this configuration.

21 On the GC keypad press [Aux Temp #]. If other Thermal Aux zones exist, press the keypad number (1, 2, or 3) for

this zone. This display the Thermal Zone's parameter list for entering operating values for a method.

Valve Box Configuration

The GC allows for a valve box hardware configuration consisting of one or two heaters in the valve box. An Agilent standard configuration uses one or two 70 watt heaters in the valve box. If you set the ***Custom Heater Conf. Parameter*** to [Off/ No] the PID, Mass, and Power fields use values optimized for these 70 watt heaters and any custom setting is ignored.

You may also design a custom heated valve box with a need for different heater parameters. To do this, set the ***Custom Heater Conf. Parameter*** to [On /Yes] and enter custom values for the PID, Mass, and Power fields.

Heater connection locations

Each heater connector has a 40 to 180 watt heater power supply and a temperature sensor for the control loop. Labels on the wiring harness near the connector identify the connection.

Connector label / GC display identifier	Connector location on GC
A1	Right side electrical compartment position A1 (far left) on valve bracket electrical harness
A2	Right side electrical compartment position A2 (far right) on valve bracket electrical harness

Custom heater parameters

Custom Heater Conf.

Set the value to [On/Yes] to enable your custom heater parameters entered below. Setting the value to [Off/No] defaults to the Agilent standard valve box values for these numbers.

View Custom Heater Conf.

Set the value to [On/yes] to display the custom heater field values of PID, Mass, and Power.

The PID and Mass fields

These fields allow entry of custom constants for the Proportional, Integral, Derivative, and Mass associated with a thermal device's control algorithm.

The Power field

This field allows for entry of the maximum power that the heater requires. This value must be within 10% of the actual maximum or an error is generated.

Configuring the Valve Box Zone

1 With the GC disconnected from its power source, install the custom heater(s) and temperature sensor(s). You can install up to 2 heaters and temperatures for this zone.
2 Plug the heater and sensor cable(s) from the heater(s) into the A1 and/or A2 small heated zone connection.
3 With all covers installed, attach the power supply to the GC and power the GC on.
4 Unlock the GC configuration. Press the [Options] key, select ***Keyboard & Display*** and press the [Enter] key. Scroll down to ***Hard Configuration Lock*** and press the [off] button.
5 On the GC keypad press [Config] [Aux Temp #] and select ***Valve Box***.
6 With ***Unconfigured:*** selected press the [Mode/Type] key on the GC keypad and select one of the following: Install Heater A1; Install Heater A2; Install 2 htr A1 & A2.. Press [Enter] to complete your selection.
7 When the GC prompts to power cycle the GC, reboot the GC by pressing the [Options] key and select ***Communications***. From this option scroll down and select the reboot option and press [Enter] on the GC keypad. This soft reboot keeps the GC configuration unlocked for subsequent steps. Power cycling the GC forces you to unlock the GC configuration on

power- up.

8 On the GC keypad, press [Config] [Aux Temp #] and select valve box. The display now shows your configured heater(s).

9 To allow use of the custom heater parameters, scroll to ***Custom Heater Conf.*** And press the [On/Yes] key.

10 To display all the configuration parameters select ***View Custom Heater Conf*** and press [On/Yes].

11 Next scroll to and enter the initial values for ***Proportional gain***, ***Integral time***, ***Derivative time,*** and ***Mass.*** These values are usually later modified based on empirical results until stable thermal performance is achieved.

12 Scroll to ***Power (watts)*** and enter the maximum power used to heat the device.

13 Power cycle the GC to lock this configuration.

14 On the GC keypad press [Aux Temp #] and select Valve Box. This displays the Valve box heating setpoint value for a method.

Inlet configuration

A custom inlet can be configured using a channel partner PTV with or without a heater or cryo valve. Additionally a channel partner PCM configuration allows an Agilent PCM flow control to be used in a heated inlet control loop.

This section does not cover the configuration of the standard Agilent inlet EPC modules. See the *Agilent 7890A GC Advanced User Gguide* for the configuration of Agilent standard inlets.

Hardware Configuration

Use this table to determine the allowable hardware configurations, where the hardware electrical connection must be made, and the configuration to select for this hardware as displayed by the GC. All hardware must be installed before attempting to configure the inlet.

GC configuration display selections	Hardware Configuration	EPC wiring connection	Heater wiring connection	Cryo va connec
Front inlet PTV				
Install Front Inlet	PTV + HTR	EPC1	FI	None
Install Front Inlet (CRYO)	PTV+HTR+CRYO	EPC1	FI	FV
Install Front Inlet (NO HTR)	PTV	EPC1	None	None
Front inlet PCM				
Install Front Inlet	PCM + HTR	EPC1	FI	None
Install Front Inlet (CRYO)	PCM+HTR+CRYO	EPC1	FI	FV
Back inlet PTV				
Install Back Inlet	PTV + HTR	EPC2	BI	None
Install Back Inlet (CRYO)	PTV+HTR+CRYO	EPC2	BI	BV
Install Back Inlet (NO HTR)	PTV	EPC2	None	None
Back inlet PCM				
Install Back Inlet	PCM + HTR	EPC2	BI	None
Install Back Inlet (CRYO)	PCM+HTR+CRYO	EPC2	BI	BV

EPC module installation

A PCM or PTV EPC installed in the standard EPC module location for a front or back inlet can be custom configured as a channel partner (CP) inlet by the GC. This requires removal of the top EPC module cover.

EPC wiring harness label	Location
EPC1	Left front EPC module slot
EPC2	Left back EPC module slot

Heater and Cryo installation

Optionally install and attach your inlet device's heater and inlet controlled cryo valve to the GC's wiring harness. This requires the removal of the left side GC cover.

Wiring harness label	Location
FI	Left top side of GC frame adjacent to front inlet
FV	Left top side of GC frame adjacent to front inlet
BI	Left top side of GC frame adjacent to back inlet

BV	Left top side of GC frame adjacent to back inlet

The Inlet configuration display

Gas type

Pressing the [Mode/Type] key on this field brings up the choices for carrier gases connected to an inlet. Select the carrier gas going to this inlet and press the [Enter] key.

Cryo Parameters

These parameters are displayed when a cryo valve is included in the hardware configuration.

Cryo type

Pressing the [Mode/Type] key on this field brings up the choices for cryo gas connected to the inlet's cryo valve. Select the cryo gas connected to the inlet's cryo valve and press the [Enter] key. Changing this type requires rebooting the GC. This field displays when a cryo valve is configured to the inlet.

Cryo

Use the [On/Yes] key to enable cryo cooling on this inlet. The [Off/No] key disables cryo cooling. This field displays when a cryo valve is configured to the inlet.

Use Cryo temperature

Enter a maximum temperature for cryo cooling activation. This field displays when a cryo valve is configured to the inlet and the cooling type is not air.

Cryo timeout

Enter a time in minutes for the cryo valve to close if no run has started before this time elapses. This field displays when a cryo valve is configured to the inlet and the cooling type is not air.

Cryo fault

The GC can shut down temperature control of the inlet if setpoint is not reached in 16 minutes. Use the [On/Yes] key to enable temperature shutdown on this inlet. The [Off/No] key disables temperature shutdown. This field displays when a cryo valve is configured to the inlet.

Custom heater parameters

The control algorithm used to maintain a stable temperature setpoint requires several constants in order to model the thermal response of a physical device. To access these constants, from the inlet's configuration display select ***View Custom Heater Conf*** and press [On/yes].

The PID and Mass fields

These fields allow entry of custom constants for the Proportional, Integral, Derivative, and Mass associated with a thermal device's control algorithm.

The Power field

This field allows for entry of the maximum power that the heater requires. This value must be within 10% of the actual maximum or an error is generated.

The Maximum Setpoint field

Enter the maximum setpoint allowed for the custom thermal device. The GC will not allow the user to enter a value higher than this number.

Sensor

Pressing the [Mode/Type] key on this field brings up the sensor type for selection. Select from RTD and TC.

The Maximum Programming Rate field

Enter the maximum rate that the temperature of the device can change from one temperature to another in a fixed period of time. If this field is left at the default value of zero, the device cannot be temperature controlled. An inlet with a zone control model of PTV or COC requires a non- zero valve to allow temperature programming.

The zone control model

Pressing the [Mode/Type] key on this field brings up the available zone control models summarized in the table below.

Control Model	Use
SS	Isothermal zone with cryo
PTV	High power requirement with cryo and the ability to program temperature ramps during a run
COC	Low power requirement with cryo and the ability to program temperature ramps during a run

Programmable temperature inlets

The PTV and COC zone control models allow a temperature program to be entered for the device similar to that available on an Agilent standard PTV and COC inlet. The SS zone control model is for isothermal control and therefore can't be programmed.

Configured Hardware

The last few lines of the inlet's configuration screen lists the hardware controlled by the inlet. One line shows the EPC modules slot location and type. Another line indicates the heater used and its wattage, and the final line the cryo valve use.

Configuring a custom inlet

1 With the GC disconnected from its power source, install a PCM or PTV EPC module in the front or back inlet EPC module location. Plug the EPC module into the correct wiring harness connector. See EPC module location above.
2 Optionally install the inlet device containing the heater and temperature sensor.
3 Plug the heater and sensor cable from this device into one of the inlet's heated zone connections. See the “Heater and Cryo Installation” section above for the wiring harness connector to use.

4 Optionally install a cryo valve and plug it into the 24 volt power supply into the FV or BV connector.

5 With all covers installed, attach the power supply to the GC and power the GC on.

6 Unlock the GC configuration. Press the [Options] key, select ***Keyboard & Display*** and press the [Enter] key. Scroll down to ***Hard Configuration Lock*** and press the [off] button.

7 On the GC keypad press [Config] [Front Inlet] for the configuration of a front inlet device or [Config] [Back Inlet] for the configuration of a back inlet device.

8 With ***Unconfigured:*** selected press the [Mode/Type] key on the GC keypad and if necessary scroll to see all selections. See the table in the Hardware Configuration section for the correct display line to select. Press [Enter] to complete your selection.

9 When the GC prompts to power cycle the GC, reboot the GC by pressing the [Options] key and select ***Communications***. From this option scroll down and select the reboot option and press [Enter] on the GC keypad. This soft reboot keeps the GC configuration unlocked for subsequent steps. Power cycling the GC forces you to unlock the GC configuration on power- up.

10 Select the configuration display for this inlet. The display now shows your configured hardware devices.

11 Scroll to ***Gas type:*** and press the [Mode/Type] key on this field to bring up the available carrier gas types. Select the gas type attached to the inlet and press [Enter].

12 If a cryo valve is included in this inlet, scroll to ***Cryo type:*** press the [Mode\Type] key and select the coolant supplied to the cryo valve. Set the ***Cryo***, ***Cryo timeout***, and ***Cryo fault*** parameters as required. See above.

13 To display all the configuration parameters select ***View Custom Heater Conf*** and press [On/Yes]. This displays all the heater parameters that can be set.

14 Scroll to ***Zone control model:*** and press the [Mode/Type] key on this field to bring up the available zone control models. Select a suitable control model and press [Enter].

15 Next scroll to and enter the initial values for ***Proportional gain***, ***Integral time***, ***Derivative time*** and ***Mass.*** These values are usually later modified based on empirical results until stable thermal performance is achieved.

16 Scroll to the ***Sensor:*** field and make sure the sensor type agrees with your hardware. To change the sensor type, press the [Mode\Type] key and select the RTD or TC (thermocouple with conversion board) type.

17 Scroll to ***Power (watts)*** and enter the power used to heat the device.

18 Scroll to ***Maximum setpoint*** and enter a value that is within the safe operating temperature of the device.

19 Scroll to ***Maximum programming rate*** and enter a rate of temperature rise per minute that your device is capable of achieving. This setting is not used with the SS zone control model which does not allow temperature programming.

20 Power cycle the GC to lock this configuration.

21 On the GC keypad press [Front Inlet] or [Back Inlet] to display the inlet's parameter list for entering operating values for a method.

Cryo focus valve configuration

Use the cryo focus valve when temperature control is not required and the run must start out with a relatively low temperature in a device which must be held for a fixed period of time after the run begins. This valve is programmed to remain open for a minimum time period prior to the run (***equib time***) and a fixed period of time after the run begins (***delay time)***.

Operation

The cryo focus valve control energizes the cryo valve actuator for a minimum programmable time before a run begins and a fixed amount of time after the run begins. These two time setpoints are entered by the user pressing the [Valve] key and then selecting the cryo focus valve from the valve list.

To start a run using manual injection, the user presses the [prep run] key to actuate the valve. The run cannot start until the ***equib time*** programmed elapses. The valve remains continually energized from the time [prep run] is pressed until the ***delay time*** programmed after the start run completes. The run starts when the user presses the [Start] key. Using an automatic liquid sampler or injection valve automates this process and it is only necessary for the user to press the [start] key.

Assigned connections

The cryo focus valve actuator is connected to the FV or BV 24 volt socket adjacent to the front and back inlet connections.

Configuration procedure

1 With the GC disconnected from its power source, install the device containing the cryo focus valve.
2 Plug the 24 volt actuator cable from this device into the FV or BV connection.
3 With all covers installed, attach the power supply to the GC and power the GC on.
4 Unlock the GC configuration.
5 Press the [Config] key and select ***cryo focus valve*** from the list by scrolling to this entry and pressing [enter].
6 Select the Cryo Focus valve attached to FV or BV.
7 After rebooting the GC, selecting the configuration for this cryo valve will show the valve properly associated to the FV or BV connector.
8 To display the method parameters for the cryofocus valve press the [Valve #] key. If other valves exist, scroll down to set the ***Cryo focus equib time*** and ***Cryofocus delay time***.

Detector configuration

Use the following 3 tables to determine the component wiring connections for the hardware configuration you are designing. See the *Agilent Advanced User guide* for configuring Agilent standard detector types.

FID Signal 1 Detector Hardware Connections

The following table lists the hardware connections for an Agilent standard FID. Additionally listed is the hardware connections required for a channel partner primary FID signal board with or without a secondary FID or AIB signal board.

GC configuration display selection	EPC wire harness connection	Heater wire harness connection	Signal 1 Detector Board wire harness connection	Signal Detect Board harnes conne
Front detector				
FID	EPC3	F-DET	F-DET	None
FID + AIB	None	None	F-DET	AUX D
CPDET FID, No htr, No EPC	None	None	F-DET	None
CPDET FID & Htr, No EPC	None	F-DET	F-DET	None
CPDET FID & EPC, No Htr	EPC3	None	F-DET	None
CPDET FID & EPC & Htr	EPC3	F-DET	F-DET	None
CPDET FID & AIB & Htr, No EPC	None	F-DET	F-DET	AUX D
CPDET FID & AIB & EPC, No htr	EPC3	None	F-DET	AUX D
CPDET FID & AIB & Htr & EPC	EPC3	F-DET	F-DET	AUX D
CPDET FID & FID & Htr, No EPC	None	F-DET	F-DET	AUX D
CPDET FID & FID & EPC, No htr	EPC3	None	F-DET	AUX D
CPDET FID & FID & Htr & EPC	EPC3	F-DET	F-DET	AUX D
Back detector				
FID	EPC4	B-DET	B-DET	None
FID + AIB	None	None	B-DET	AUX D
CPDET FID, No htr, No EPC	None	None	B-DET	None
CPDET FID & Htr, No EPC	None	B-DET	B-DET	None
CPDET FID & EPC, No Htr	EPC4	None	B-DET	None
CPDET FID & EPC & Htr	EPC4	B-DET	B-DET	None
CPDET FID & AIB & Htr, No EPC	None	B-DET	B-DET	AUX D
CPDET FID & AIB & EPC, No htr	EPC4	None	B-DET	AUX D
CPDET FID & AIB & Htr & EPC	EPC4	B-DET	B-DET	AUX D
CPDET FID & FID & Htr, No EPC	None	B-DET	B-DET	AUX D
CPDET FID & FID & EPC, No htr	EPC4	None	B-DET	AUX D
CPDET FID & FID & Htr & EPC	EPC4	B-DET	B-DET	AUX D

In the above table, FID indicates a detector signal board with

igniter control support.
CPDET FID indicates a channel partner FID detector signal board without support for an igniter.

AIB Signal 1 Detector Hardware Connections

The following table lists the hardware connections required for a channel partner primary AIB signal board with or without a secondary FID or AIB signal board. The first two entries under Front Detector and Back Detector entries are for the standard legacy Agilent AIB installations.

GC configuration display selection	EPC wire harness connection	Heater wire harness connection	Signal 1 Detector Board wire harness connection	Sig Det wir con
Front detector				
Install AIB with No Heater	None	None	F-DET	Non
Install AIB with Heater	None	F-DET	F-DET	Non
CPDET AIB, No htr, No EPC	None	None	F-DET	Non
CPDET AIB & Htr, No EPC	None	F-DET	F-DET	Non
CPDET AIB & EPC, No Htr	EPC3	None	F-DET	Non
CPDET AIB & EPC & Htr	EPC3	F-DET	F-DET	Non
CPDET AIB & AIB & Htr, No EPC	None	F-DET	F-DET	AUX
CPDET AIB & AIB & EPC, No htr	EPC3	None	F-DET	AUX
CPDET AIB & AIB & Htr & EPC	EPC3	F-DET	F-DET	AUX
CPDET AIB & FID & Htr, No EPC	None	F-DET	F-DET	AUX
CPDET AIB & FID & EPC, No htr	EPC3	None	F-DET	AUX
CPDET AIB & FID & Htr & EPC	EPC3	F-DET	F-DET	AUX
Back detector				
Install AIB with No Heater	None	None	B-DET	Non
Install AIB with Heater	None	B-DET	B-DET	Non
CPDET AIB, No htr, No EPC	None	None	B-DET	Non
CPDET AIB & Htr, No EPC	None	B-DET	B-DET	Non
CPDET AIB & EPC, No Htr	EPC4	None	B-DET	Non
CPDET AIB & EPC & Htr	EPC4	B-DET	B-DET	Non
CPDET AIB & AIB & Htr, No EPC	None	B-DET	B-DET	AUX
CPDET AIB & AIB & EPC, No htr	EPC4	None	B-DET	AUX
CPDET AIB & AIB & Htr & EPC	EPC4	B-DET	B-DET	AUX
CPDET AIB & FID & Htr, No EPC	None	B-DET	B-DET	AUX
CPDET AIB & FID & EPC, No htr	EPC4	None	B-DET	AUX
CPDET AIB & FID & Htr & EPC	EPC4	B-DET	B-DET	AUX

Aux Detector Hardware Connections

GC configuration display selection	EPC wire harness connection	Heater wire harness connection	Signal 1 Detector Board wire harness connection	Signal 2 Detector Board w harness connecti
Aux Detector 1				
TCD	EPC5	A1 or A2 or BI/BINLET	AUX DET1	None
AIB	None	None	AUX DET1	None
Aux Detector 2				
AIB	None	None	AUX DET2	None

The Aux Detector 1 TCD installation requires an extension cable to reach the EPC module and detector board located in a side mounted enclosure. The heater and sensor for the Aux TCD also requires an extension cable.

EPC module installation

Optionally install and attach your detector device's EPC module to the GC's wiring harness.

EPC wiring harness label	Use
EPC3	Front detector EPC module
EPC4	Back detector EPC module
EPC5	3rd detector TCD EPC module

Detector Board Installation

Wiring harness label	Use
F-DET	Front detector board
B-DET	Back detector board
AUX DET1	3rd detector TCD board or AIB
AUX DET2	Aux detector board AIB

Heater installation

Optionally install and attach your detector device's heater to the GC's wiring harness.

Wiring harness label	Use
F-DET	Front detector heater
B-DET	Back detector heater
A1	3rd detector heater
A2	3rd detector heater

Configuring a custom detector

1. With the GC disconnected from its power source, remove the electronics side panel and install the detector boards in the detector slots. See the section on configuration and plug the correct communications cable into the board.
2. Install the detector optionally containing a heater and temperature sensor. Plug the heater and sensor cable from this device into one of the six small heated zone connections. See the “Heater Installation” section above for the wiring harness connector to use.
3. Optionally install an FID EPC module in the front, back, or aux detector EPC module location. Plug the EPC module into the correct wiring harness connector. See EPC module location above.
4. With all covers installed, attach the power supply to the GC and power the GC on.
5. Unlock the GC configuration. Press the [Options] key, select ***Keyboard & Display*** and press the [Enter] key. Scroll down to ***Hard Configuration Lock*** and press the [off] button.
6. On the GC keypad press [Config] [Front Det] for the configuration of a front detector device or [Config] [Back Det] for the configuration of a back detector device or [Config] [Aux Det #] for the configuration of a Aux detector device.
7. With ***Unconfigured:*** selected press the [Mode/Type] key on the GC keypad and if necessary scroll to see all selections. Select your hardware configuration from the list and press [Enter] to complete your selection.
8. When the GC prompts to power cycle the GC, reboot the GC

by pressing the [Options] key and select ***Communications***. From this option scroll down and select the reboot option and press [Enter] on the GC keypad. This soft reboot keeps the GC configuration unlocked for subsequent steps. Power cycling the GC forces you to unlock the GC configuration on power- up.

9 Select the configuration display for this detector. The display now shows your configured devices.

10 For an FID installation, scroll to ***Gas type:*** and press the [Mode/Type] key on this field to bring up the available makeup gas types. Select the gas type and press [Enter].

11 Power cycle the GC to lock this configuration.

12 On the GC keypad press [Front Det] or [Back Det] or [Aux Det #] to display the detector's parameter list for entering operating values for a method.

16 Service Mode Diagnostics

Service mode overview

Service mode generates a series of tables that include information that can help with diagnosing problems. For example, the detector signal board diagnostic includes information to verify a short in an FID ignitor. It also contains a measurement of the Noise in the signal output.

To access the service mode diagnostics:

1 Press [Service Mode].

2 Scroll to Diagnostics and press [Enter].

The list of diagnostics that are available vary with your configuration. Here is an example of a 7890A GC with 2 inlets, 2 detectors, an AUX module, and a PCM module.

DIAGNOSTICS
Instrument status
Front inlet
Back inlet
Front detector
Back detector
Auxiliary pressure (1,2,3)
Pcm B
Thermal PID control

Electronics

Detector diagnostics

For example, the detector signal board diagnostic includes information to verify a short in an FID ignitor. It also contains a measurement of the Noise in the signal output.

To access the detector diagnostics:

1. Press [`Service Mode`].
2. Scroll to `Diagnostics` and press [`Enter`].
3. Scroll to `<Front, Back, or AUX detector>` and press [`Enter`].

The list of diagnostics that are available vary with your configuration. Here is an example of an FID detector.

FRONT FID DIAGNOSTICS
Detector Signal
Pneumatics module
Hydrogen gas
Air gas
Makeup gas

Signal board diagnostics

Service mode is a series of tables that include information that can help with diagnosing problems. For example, the detector signal board diagnostic includes information to verify a short in an FID ignitor. It also contains a measurement of the Noise in the signal output.

To access the detector signal board diagnostics:

1. Press [`Service Mode`].

2 Scroll to Diagnostics and press [Enter].

3 Scroll to <Front, Back, or AUX detector> and press [Enter].

4 Scroll to Detector Signal and press [Enter].

The list of diagnostics that are available vary with your detector. Here is an example of an FID detector.

FRONT SIGNAL (FID)		
Signal Value		0.0
Noise		0
High Voltage		12.9V
Ignitor:	0.00V	0.0A
ADC Offset:	60.1mV	Ref: 2.48V
Input disable		Off
Ignitor voltage		Off
Mode:		Normal

Multiplexed ADC

This information is based on Service Mode | Diagnostics | Electronics | Multiplexed ADC.

MULTIPLEXED ADC	
Definition	Oven rtd
Reading noise	159.8
Reading value	1801821
Offset	54907
Gain counts/volt	4173672
Gain counts/ohm	14607
Reference Temperature	95.446
Reading value	1801887
Reading value	-95
Reading value	-180
Reading value	198
Reading value	64

Reading value	-45

There is a multiplexed analog- to- digital circuit (ADC) for each of the following resistance temperature detectors (rtd):

- Oven rtd reading
- Front detector rtd reading
- Back detector rtd reading
- Front inlet rtd reading
- Back inlet rtd reading
- Auxiliary 1 rtd reading
- Auxiliary 2 rtd reading
- Line Sense reading
- Temperature ref reading
- Atmospheric pressure reading
- Minus 24V power supply rdg
- Logic current reading
- 24 volt poser supply reading
- Valve current reading

To view the diagnostics for a particular reading,

1 With the cursor on the Definition line, press **[Mode/Type]**.
2 Scroll to the reading that you want and press **[Enter]**.

Pneumatics

This information is based on Service Mode | Diagnostics | Electronics | Pneumatics.

PNEUMATICS	
Atmospheric pressure	14.715
24 Volt valve drive	26.71
Zero all pressure sensors	

To zero all of the pressure sensors, do the following.

1 Set all flows and pressures to zero.
2 Disconnect the supply gases.
3 Wait 30 minutes.

4 Press [Enter] and confirm.

Power diagnostics

This information is based on Service Mode | Diagnostics | Electronics | Power Info.

POWER DIAGNOSTICS	
Front inlet	166.5 watts
Front detector	70.1 watts
Auxiliary 1	0.9 watts
Back inlet	73.9 watts
Back detector	63.6 watts
Auxiliary 3	65.4 watts
Logic current	1.370 amps
Valve current	0.326 amps
24 Volts	26.66 volts
-24 Volts	-27.03 volts
Zone supply	42.92 volts

17 Illustrated Parts Breakdown

Overview of the IPB

This section consists of parts lists and exploded views of the instrument modules. It is a major reference for part identification and part numbers.

Inlets

This section contains illustrated parts breakdowns for GC inlets and related components.

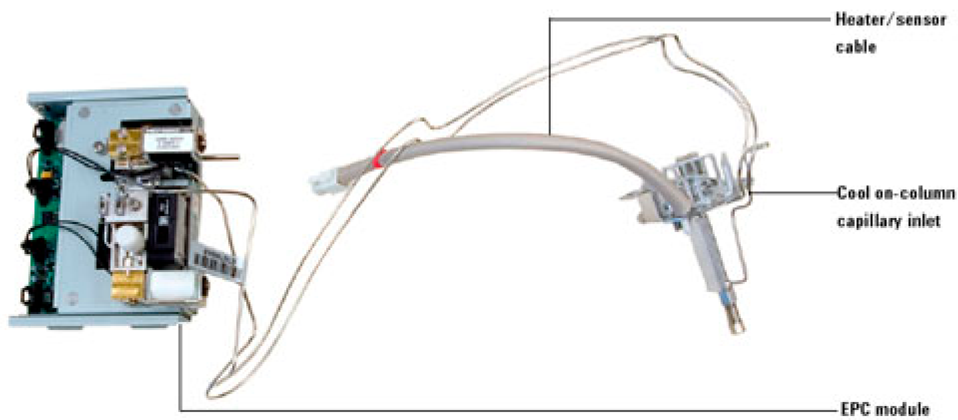
- Split/Splitless Inlet
- Split/Splitless Inlet Column Liners
- Purged Packed Inlet
- Purged Packed Column Inlet Port Supplies
- Cool On- Column Capillary Inlet
- Programmed Temperature Vaporization Inlet
- Volatiles Interface

Cool on-column inlet (COC)

Top level subassemblies for Cool on- column inlet accessories:

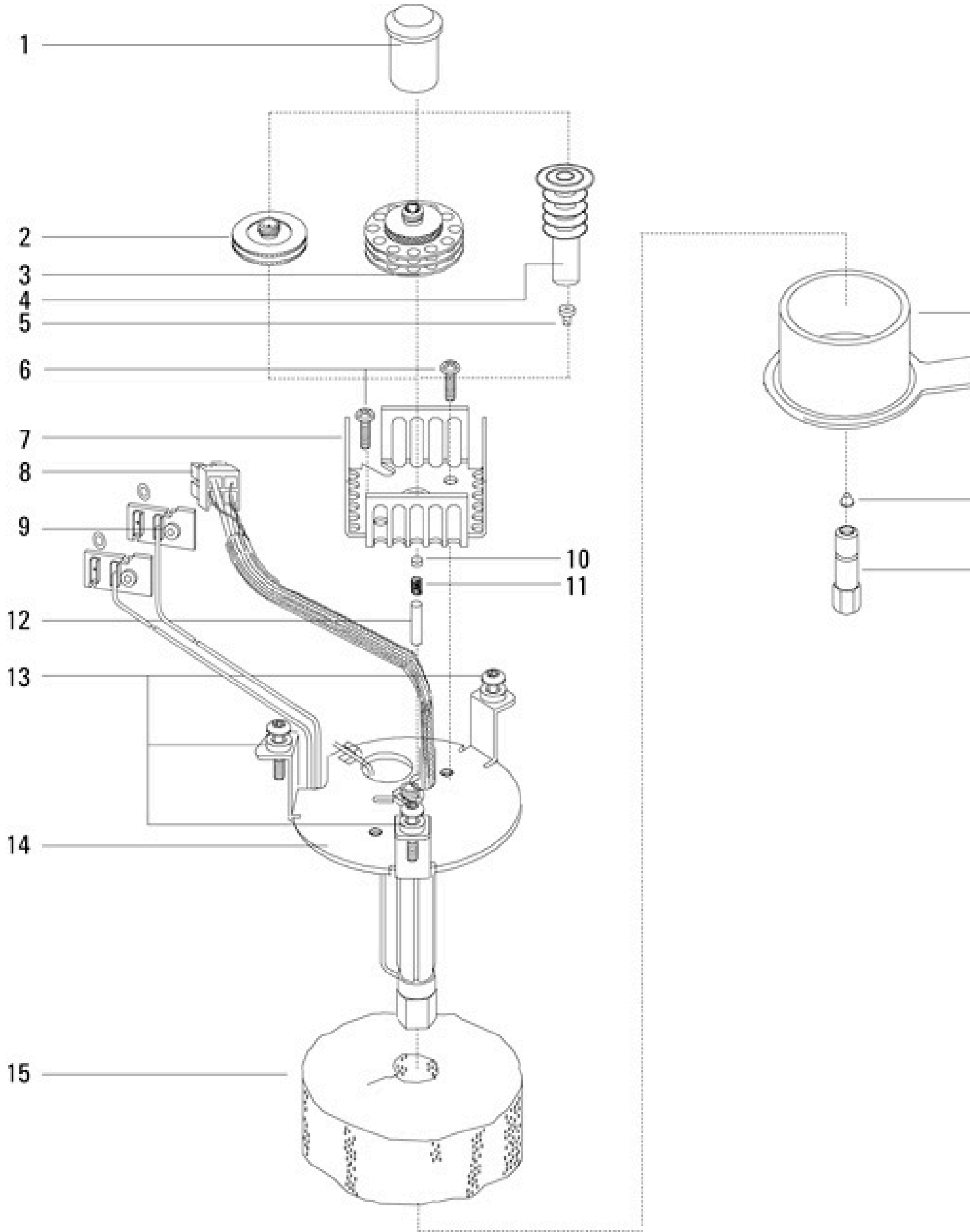
- G3454A Cool on- column inlet with EPC, Kit
- For cryoblast parts for G3467A and G3468A see Oven, liquid CO_2 or N_2 Cryogenic Cooling.

Description	Part number
Cool On-column Inlet Accessory without ship kit	G3454-60501
Cool On-column Inlet weldment assembly without EPC module	G3454-60502
Cool On-column Inlet EPC module	G3454-60554



Cool on-column inlet body

Item	Description	Part number
1	Needle guide top (optional)	19245-20670
2	Septum nut base assembly, for .250/.320-mm columns	19245-80521
3	Septum nut base, for .530 mm columns	G1545-80520
4	Manual cooling tower assembly (optional), for .200 mm columns	19320-80625
5	Duckbill for use with cooling tower, 10/pk	19245-40050
6	Screw, M4 × 8, Torx T-20 chromeplate	0515-2711
7	Heatsink fin	G1545-00010
8	Heater/Sensor assembly	G1545-60520
9	Screw, M3 x 16 mm	1390-1022
10	Septa	
11	Insert spring	19245-60760
12	Inserts (identify by number of rings on insert)	
13	Screw, M4 × 12 mm, T-20	0515-2496
14	Inlet weldment	G3454-80500
15	Inlet weldment insulation	G1545-20630
16	Cavity sleeve	19245-00060
17	Ferrules (identify by internal diameter)	
18	Column nut	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Consumables for the COC Inlet

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (***www.agilent.com/chem/supplies*** (***http://www.agilent.com/chem/supplies***)">***www.agilent.com/chem/supplies*** (***http://www.agilent.com/chem/supplies***)).

Recommended septum nut and inserts for injections onto 0.53-mm columns

Column type	Part number
Megabore insert; .530 mm – 0 rings	19245-20580
Aluminum-clad insert; .530 mm – 4 rings	19245-20780
Septum nut, .530 mm	G1545-80520
Needle support assembly, .530 mm, for 7683B injector	G2913-60977

Recommended parts for injections onto 0.25-mm and 0.32-mm columns

Column type	Part number
.320 mm wide bore insert; 5 silver rings	19245-20525
Capillary insert (glass columns) – 3 silver rings	19245-20550
.250 mm bore insert – 6 rings	19245-20515
Septum nut, .250/.320 mm	19245-80521
Syringe barrel, removable needle, 5 µL	5182-0836
Needle, .250 mm (3/pk)	5182-0833
Needle, .320 mm (3/pk)	5182-0831
Needle support assembly, .250/.320 mm, for 7683B injector	G2913-60978

Recommended parts for injections onto 0.2-mm columns

Description	Part number
Narrow bore insert; .200 mm – 1 silver ring	19245-20510
Cooling tower assembly	19230-80625
Syringe barrel, for fused silica needle, 10 µL	9301-0658

Replacement needles, fused silica, 0.18 mm (6/pk)	19091-63000
Replacement Teflon ferrule for fused silica syringe	0100-1389
Removable stainless steel needle syringe, 10 µL	5182-9633
Replacement stainless steel needles, 0.23 mm (3/pk)	5182-9645

Recommended septa for the COC inlet

Description	Part number
For 0.53- mm and 0.25/0.32- mm septum nuts	
5-mm solid septum for manual and automatic injection	5181-1261
5-mm long-life septum (50/pk)	5183-4762
5-mm advanced green septum (50/pk)	5183-4760
5-mm, high-temperature, low-bleed septum (50/pk)	5183-4758
5-mm through-hole septum for automatic injection (25/pk)	5181-1260
For the duckbill septum	
Duckbill septum for manual injection only (must use cooling tower with duckbill) (10/pk)	19245-40050

Nuts, ferrules, and hardware for capillary columns

Column id	Description	Typical use	Part number
.530 mm	Ferrule, Vespel/graphite, 0.8-mm id (10/pk)	0.45-mm and 0.53-mm capillary columns	5062-3512
	Ferrule, graphite, 1.0-mm id (10/pk)	0.53-mm capillary columns	5080-8773
	Column nut, finger- tight (for 0.53-mm columns)	Connect column to inlet or detector	5020-8293
.320 mm	Ferrule, Vespel/graphite, 0.5-mm id (10/pk)	0.32-mm capillary columns	5062-3514
	Ferrule, graphite, 0.5-mm id (10/pk)	0.1-mm, 0.2- mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853
	Column nut, finger- tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.250 mm	Ferrule, Vespel/graphite, 0.4-mm id (10/pk)	0.1-mm, 0.2- mm, and 0.25- mm capillary columns	5181-3323
	Ferrule, graphite, 0.5-mm id (10/pk)	0.1-mm, 0.2- mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853

	Column nut, finger- tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.100 and .200 mm	Ferrule, Vespel/graphite, 0.37-mm id (10/pk)	0.1-mm and 0.2-mm capillary columns	5062-3516
	Ferrule, Vespel/graphite, 0.4-mm id (10/pk)	0.1-mm, 0.2- mm, and 0.25- mm capillary columns	5181-3323
	Ferrule, graphite, 0.5-mm id (10/pk)	0.1-mm, 0.2- mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853
	Column nut, finger- tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
All	Ferrule, no-hole (10/pk)	Testing	5181-3308
	Capillary column blanking nut	Testing-use with any ferrule	5020-8294
	Column nut, universal (2/pk)	Connect column to inlet or detector	5181-8830
	Column cutter, ceramic wafer (4/pk)	Cutting capillary columns	5181-8836

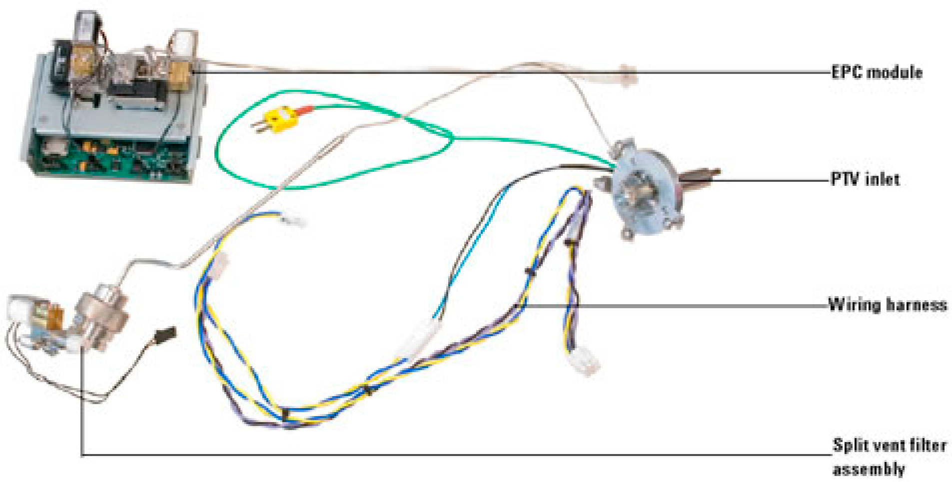
Programmed Temperature Vaporization Inlet (PTV)

Top level subassemblies for PTV inlet accessories:

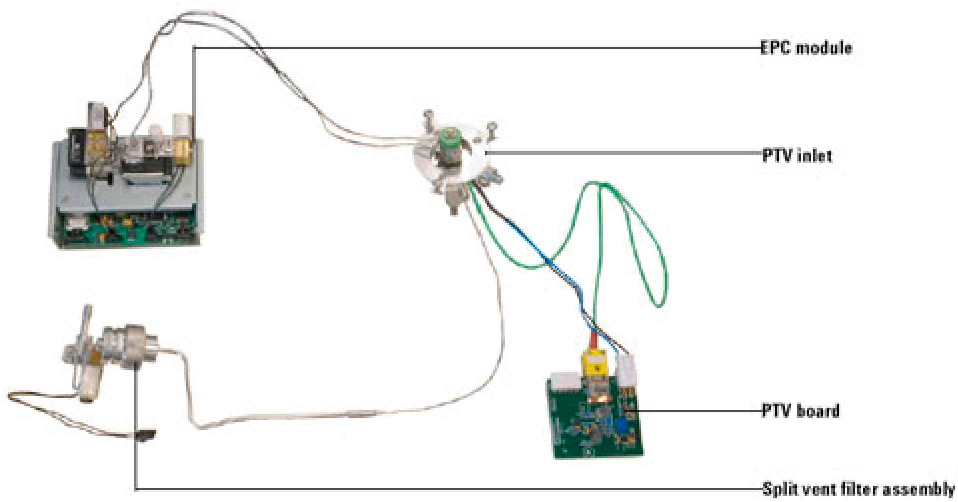
- G3500A Septumless head PTV, LCO2 Accessory with EPC, Kit
- G3501A Septum head PTV, LCO2 Accessory with EPC, Kit
- G3502A Septumless head PTV, LN2 Accessory with EPC, Kit
- G3503A Septum head PTV, LN2 Accessory with EPC, Kit

Description	Part number
Septumless head PTV inlet, LCO2 accessory without ship kit	G3500-65500
Septum head PTV inlet, LCO2 accessory without ship kit	G3501-65500
Septumless head PTV inlet, LN2 accessory without ship kit	G3502-65500
Septum head PTV inlet, LN2 accessory without ship kit	G3503-60500
PTV EPC assembly, 100 PSI	G3500-60500

Septumless head



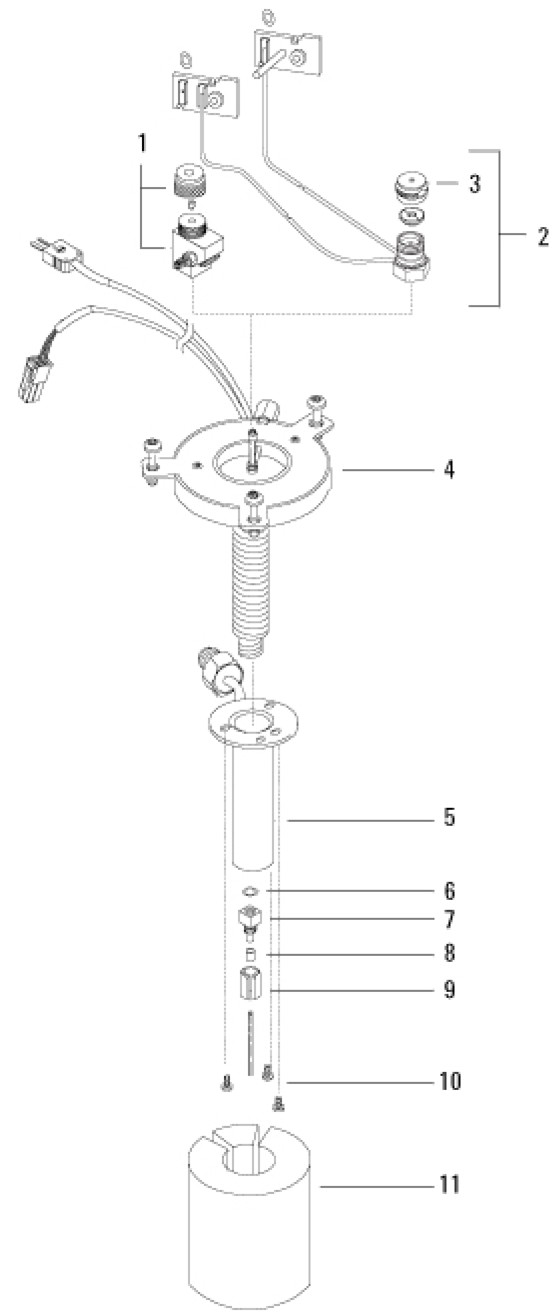
Septum head



PTV Inlet Body

Item	Description	Part number	Qty
NS	Septumless head weldment	G3500-80000	1
1	Septumless head	G2617-60507	1
2	Septum head*	G3500-80001	1
3	Septum nut*	18740-60835	1
4	PTV inlet assembly	G2617-60506	1
5	Cooling jacket		
	PTV, CO2 cooling jacket	G2617-60508	1
	PTV N2 cooling jacket	G2619-60501	1
NS	PTV inlet assembly with cooling jacket		
	PTV inlet with CO2 cooling jacket	G2617-60518	
	PTV inlet with LN2 cooling jacket	G2617-60517	
6	Silver seal (5/pk)	5182-9763	1
7	Graphpak inlet adapter		1
8	Ferrules for graphpak inlet		1
9	Split nut for inlet adapters	5062-3525	1
10	Screw, M3 × 3 mm		3
11	PTV insulation block	G2617-20510	1
NS	PTV cryo insulator	G2617-60510	1

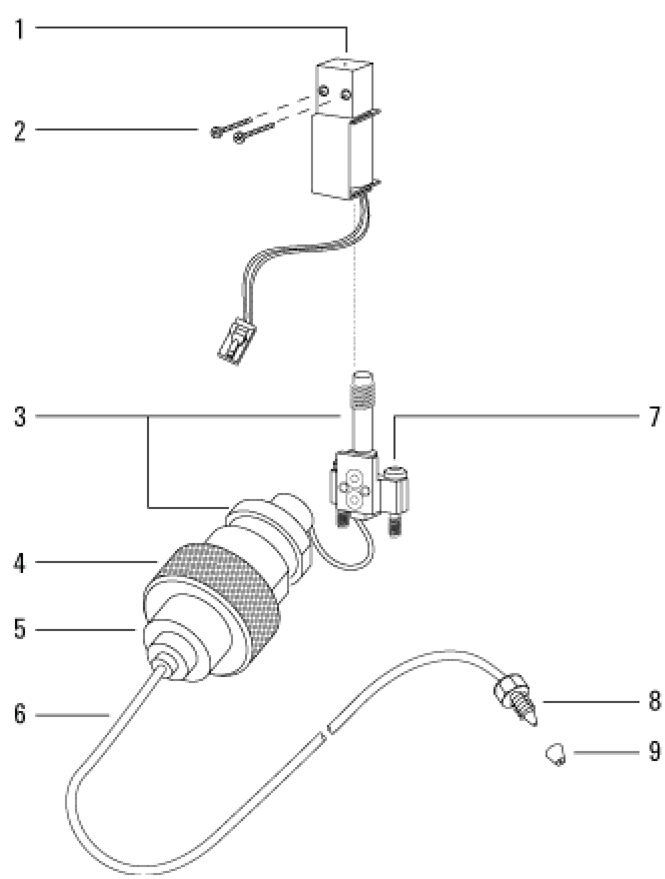
* See the Agilent chemical analysis consumables and accessories catalog for Merlin assemblies.



PTV Split vent

	Description	Part number	Qty
NS	Replacement filter kit	G1544-80530	1
1	Proportional valve, split vent	G3430-60527	1

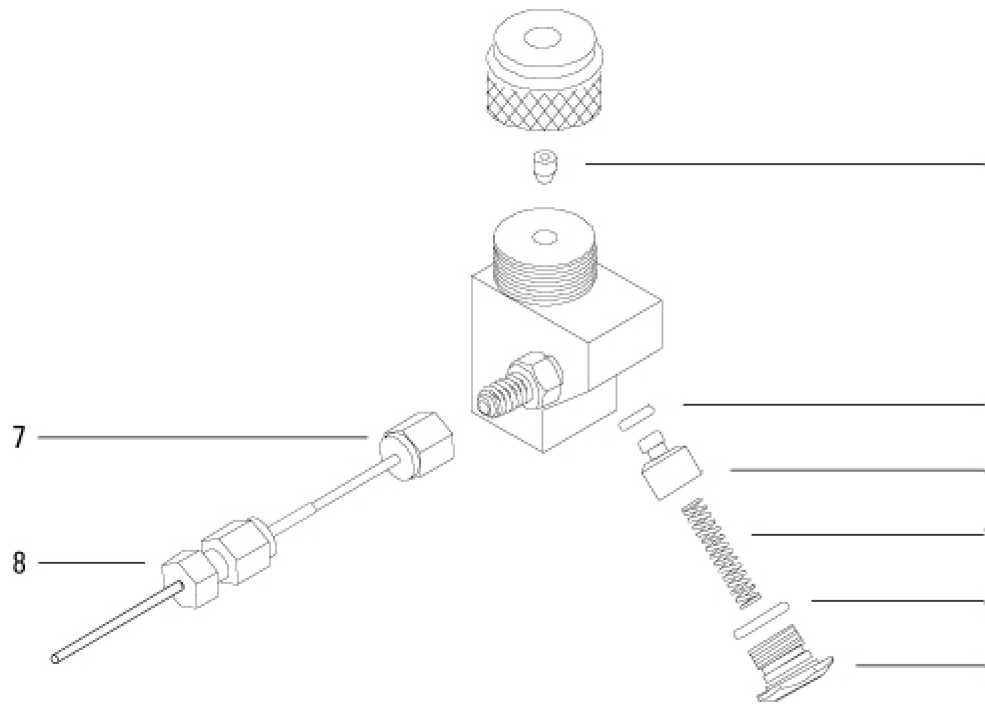
2	Screw, M3 x 16 mm, T-10	0515-1141	2
3	Flow block, split vent trap	G3452-60506	1
4	Trap nut	G1544-20650	1
5			
6	PTV front trap tubing assembly	G2617-80520	1
7	Screw, M4 x 12 mm, T-20	0515-2496	1
8	Nut, 1/16-inch SS	0100-0053	1
9	Ferrule, 1/16-inch SS	0100-1490	1
NS	Split vent trap (see consumables)		
NS	O-ring, 12/pk (2 for EPC module seal, 2 for valve seal)	5180-4181	4
NS	Trap retainer	G3452-00005	1



PTV Septumless head

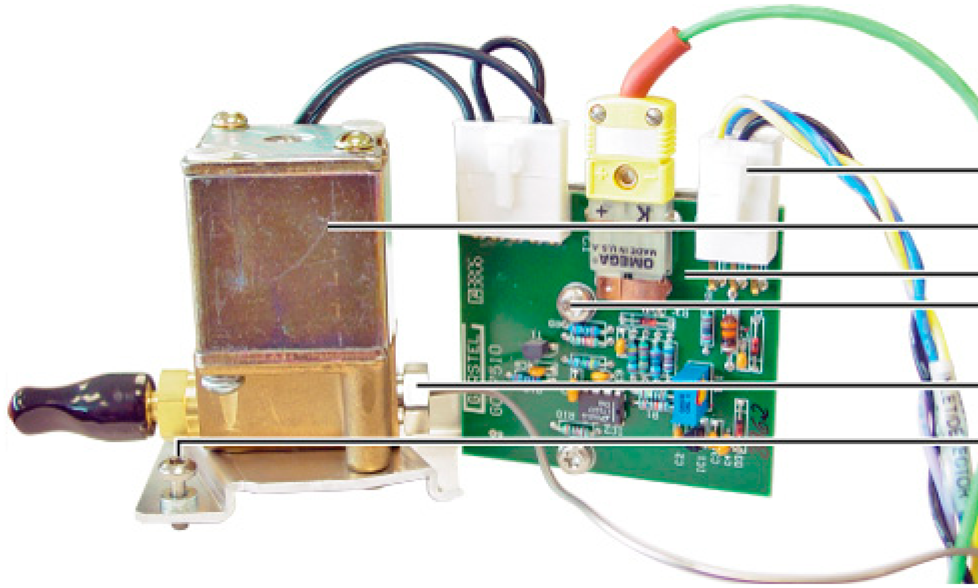
	Description	Part number	Qty
	Septumless head	G2617-60507	

1	Teflon ferrule (needle seal)	5182-9748	1
2	Kalrez seal	5182-9759	1
3	Valve body	5182-9757	1
4	Pressure spring	5182-9758	1
5	Viton seal	5182-9775	1
6	Sealing element	5182-9760	1
7	PTV column adapter tube	G2617-80550	1
8	PTV septumless head weldment	G3500-8000	1



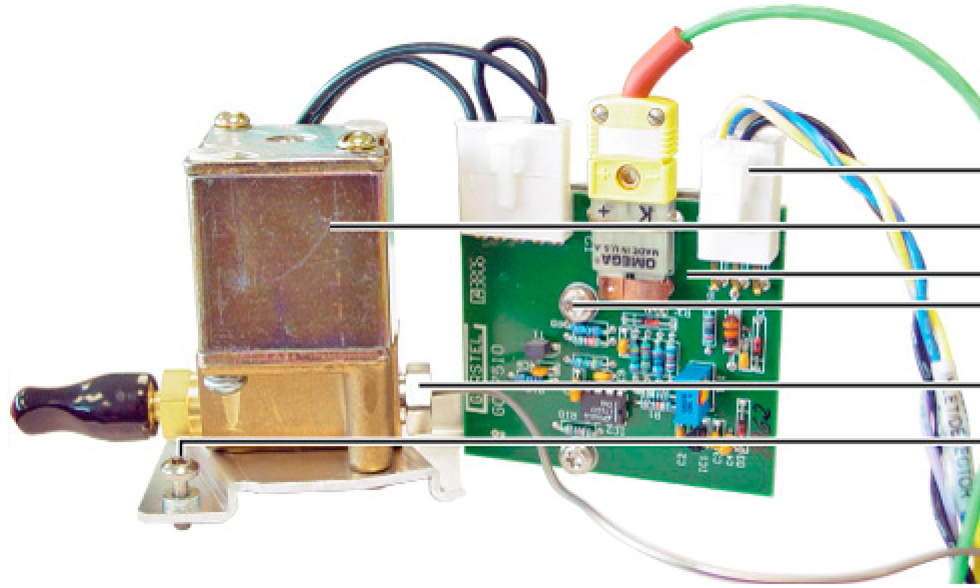
PTV Temperature controller

Item	Description	Part number	Qty
1	Cable, PTV thermocouple	G2617-60505	1
2	CO2 Cryo Valve Kit (includes supply connector)	G1530-67070	1
3	PTV Thermocouple interface board	G2617-60010	1
4	Screw, M4 x 6 mm, T-20 (attach board to bracket)	0515-2832	2
5	Bracket, PTV thermocouple board and LCO2 valve	G3430-00058	1
6	Screw, M4 x 12 mm, T-20 (attach bracket to carrier)	0515-2496	2



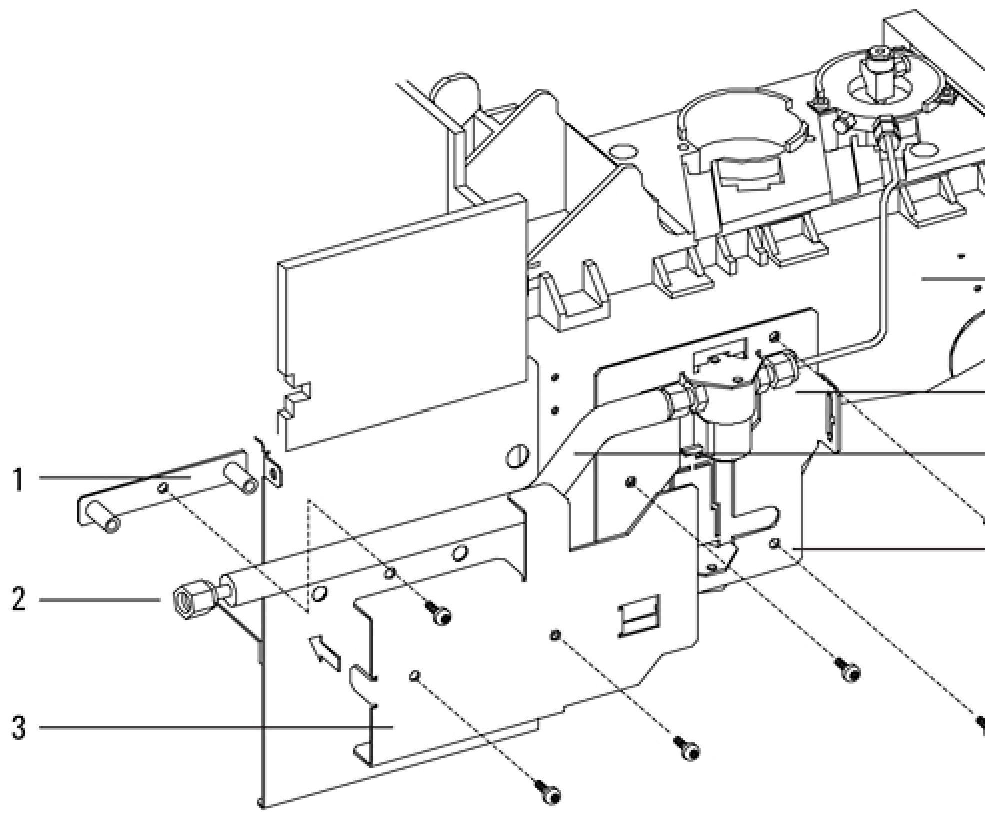
PTV CO2 cryo assembly

Item	Description	Part number	Qty
	7890 PTV LCO2 Cyro Assembly (recommended repair level)	G3500-60515	1
2	Valve, PTV LCO2 cryo	G1565-60545	1
5	Bracket, PTV thermocouple board and LCO2 valve	G3430-00058	1
6	Screw, M-32 x .375 inch (to attach valve to bracket)	2510-0102	2
	PTV CO2 brazement (valve to IP tube)	G2617-80510	1
NS	Cap, protective without flange	1401-0044	1
NS	1/8-inch male connector without O-ring	G1543-80025	1
NS	Gland seal CO_2	G1565-20590	1
NS	Teflon seal	G1565-20840	1



PTV N2 cryo assembly

Item	Description	Part number	Qty
1	PTV LN$_2$ nut plate	G2619-00040	1
NS	Screw, M4 x 12 mm, T-20 (attach nut plate)	0515-2496	1
3	PTV LN$_2$ insulation cover	G2619-00030	1
	Screw, M4 x 12 mm, T-20 (attach cover)	1390-1024	2
4	PTV LN$_2$ cell inlet tube	G2617-80550	1
5	7890 PTV LN2 Cryo Assembly (recommended valve repair level)	G3502-60510	1
2	PTV LN$_2$ supply tube (included in 5)	G2619-20520	
6	PTV inlet tube insulation (included in 5)	G2619-00010	1
7	Mounting bracket, LN2 cryo valve (included in 5)	G3502-00001	1
8	Screw, 8-32 x .312-inch (included in 5)	2510-0043	2
NS	PTV jumper cable (included in 5)	G2619-60502	1
NS	Nut, 1/4-inch tubing, stainless steel	0100-0055	1
NS	Connector	0100-0112	1
NS	Connector, male	0100-0208	1
NS	1/4-inch ferrule set, stainless steel	0100-1827	1



Consumables for the PTV Inlet

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (***www.agilent.com/chem/supplies*** (***http://www.agilent.com/chem/supplies***)">***www.agilent.com/ chem/supplies*** (***http://www.agilent.com/chem/supplies***)).

PTV liners and ferrules

Description	Part number
Single baffle, 2-mm id, 180-µL, deactivated, glass wool	5183-2038
Single baffle, 2-mm id, 200-µL, deactivated	5183-2036
Multi-baffle, 1.5-mm id, 150-µL, deactivated	5183-2037
Fritted glass, 1.5-mm id, 150-µL, deactivated	5183-2041
Graphpak 3D ferrules for liner (5/pk)	5182-9749
Installation tool for 3D ferrules	G2617-80540

Other consumables and parts for the PTV inlet

Description	Part number
Syringe, 5-µL, 23-gauge fixed-needle	9301-0892
Syringe, 10-µL, 23-gauge fixed-needle	9301-0713
Syringe, 50-µL, 23-gauge fixed-needle, for large volume injections	5183-0318
Syringe, 100-µL, 23-gauge fixed-needle, for large volume injections	5183-2058
Split Vent Trap PM Kit, Single Cartridge, 2 O-rings	5188-6495

Septumless head

Description	Part number
Septumless head	G2617-60507
Teflon ferrules (needle seal) (10/pk)	5182-9748
Septumless head rebuild kit (includes Viton seal, Kalrez seal, and pressure spring)	5182-9747
Carrier gas tube for septumless head	G2617-80550
Ferrule, 1/16-inch Teflon, for septumless head carrier gas tube	0100-1375

Septum head

Description	Part number
Merlin Microseal septum (high-pressure)	5182-3444
11-mm septa, red (50/pk)	5181-1263

Septum head

Description	Part number
Silver seal (5/pk)	5182-9763

Graphpak 2M inlet adapter, 0.20-mm id1		5182-9754
Graphpak 2M inlet adapter, 0.25- to 0.33-mm id*		5182-9761
Graphpak 2M inlet adapter, 0.53-mm id*		5182-9762
Ferrules for Graphpak 2M inlet, 0.20-mm id	(10/pk)	5182-9756
Ferrules for Graphpak 2M inlet, 0.25-mm id	(10/pk)	5182-9768
Ferrules for Graphpak 2M inlet, 0.32-mm id	(10/pk)	5182-9769
Ferrules for Graphpak 2M inlet, 0.53-mm id	(10/pk)	5182-9770
3-D Graphpak ferrules (5/pk)		5182-9749
Split nut for Graphpak adapter		5062-3525

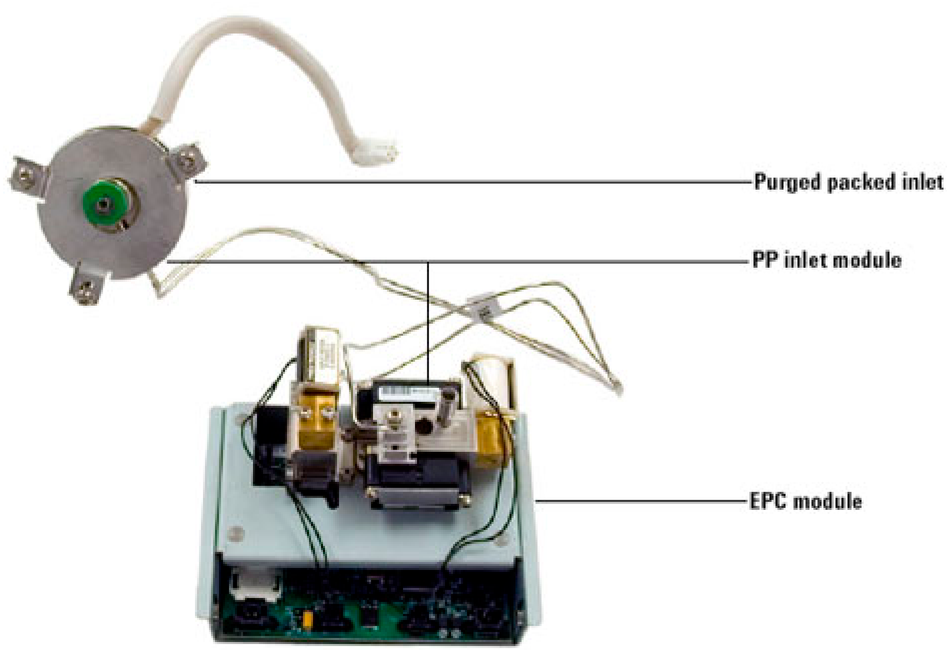
1Includes (1) adapter, (1) silver seal, and (1) split column nut.

Purged Packed Inlet (PP)

Top level subassemblies for Purged Packed inlet accessories:

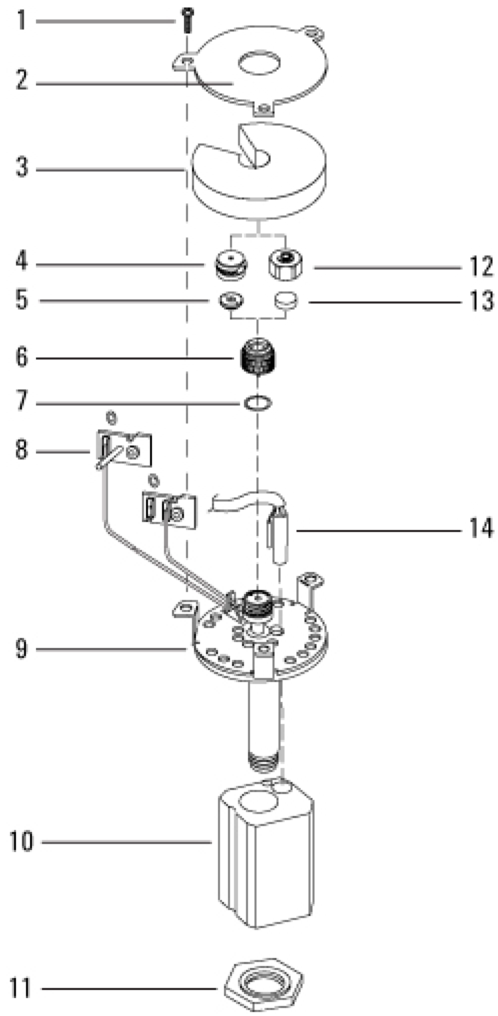
- G3451A Purged- packed with EPC, Kit

Description	Part number
Purged-packed Inlet Accessory without ship kit	G3451-65520
Purged packed inlet weldment assembly without EPC module	G3451-80506
Purged packed inlet EPC module	G3451-60551



7890A Purged Packed Inlet Upper Body

Item	Description	Part number	Qty
1	Screw, Torx T-20, M4 x 12 mm	1390-1023	3
2	Top cover plate	G1543-00085	1
3	Top insulation	G1543-00100	1
4	Nut, Merlin Microseal	5182-3445	
5	Septum, Merlin Microseal	5182-8815	
6	Top insert weldment	19243-80570	1
7	Viton O-ring (12/pk)	5080-8898	1
8	Screw, Torx T-10, M3 x 16 mm	G1946-20168	2
9	Inlet weldment	G3451-80501	1
10	Thermal block	G1543-20765	1
11	Bottom nut	G1543-20580	1
12	Septum nut	18740-60835	1
13	Septum, 11 mm, low bleed (50/pk)	5182-0739	-
14	Heater/Sensor assembly	G1543-61540	1
NS	Top gasket insulation	G1543-00155	1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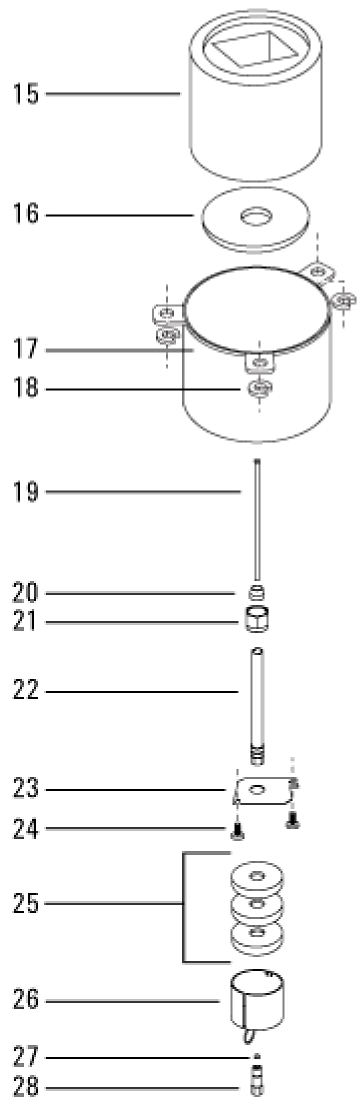
Purged Packed Inlet

Item	Description	Part number	Qty
15	PP insulation	G3432-00004	1
16	PP bottom insulation	G3432-00003	1
17	PP insulation cup	G3431-00005	1
18	C-clip	0515-1799	3
19	Glass liner (25/pk)	5080-8732	1
20	Vespel ferrule (10/pk)	5080-8774	1
21	Tubing nut (1/4-inch brass), 10/pk	5180-4105	1
22	Column adapter		1
23	Bottom plate for oven	G1543-00060	1
24	Screw, T-20, M4 x 12mm	0515-2711	2
25	Nutwarmer insulation	19234-60715	3
26	Nutwarmer cup	19234-60700	1
27	Ferrules (see consumables)		
28	Column nut (capillary, universal, 2/pk)	5180-8830	1



Consumables and Parts for the Purged Packed Inlet

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (***www.agilent.com/chem/supplies*** (***http://www.agilent.com/chem/supplies***)">***www.agilent.com/chem/supplies*** (***http://www.agilent.com/chem/supplies***)).

Purged packed inlet parts

Description	Part number
Inlet kit, contains septa, O-rings, and inserts	5181-8837

Preventative maintenance kit	5188-6498

Purged packed liners and column adapters

Description	Part number
Glass liner, plain (25/pk)	5080-8732
Glass liner, deactivated (5/pk)	5181-3382
0.53-mm column adapter with liner	19244-80540
1/8-inch column adapter with liner	19243-80530
1/8-inch column adapter, no liner	19243-80510
1/4-inch column adapter with liner	19243-80540
1/4-inch column adapter, no liner	19243-80520

Recommended septa and O-rings

Description	Part number
11-mm solid septum, low-bleed, red (50/pk)	5181-1263
11-mm septum with partial through- hole, low-bleed, red (50/pk)	5181-3383
11-mm septum, low-bleed, gray (50/pk)	5080-8896
Merlin Microseal septum (30 psi)	5181-8815
11-mm high-temperature silicone septum (350 °C and higher) (50/pk)	5182-0739
Viton O-ring (Top insert weldment) (12/pk)	5080-8898

Septum retainers

Description	Part number
Standard septum nut	18740-60835
Headspace retainer nut	18740-60830
Merlin Microseal retainer	5181-8816

Nuts and ferrules for packed columns

Description	Typical use	Part number
1/8-inch id Swagelok stainless steel nut, front ferrule, back ferrule (20 each/pk)	1/8-inch column	5080-8751
1/8-inch id Swagelok brass nut, front ferrule, back ferrule (20 each/pk)	1/8-inch column	5080-8750
1/8-inch id Vespel/ graphite ferrule (10/pk)	1/8-inch column	0100-1332
1/8-inch id brass tubing nut (10/pk)	1/8-inch column	5180-4103
1/4-inch id Swagelok stainless steel nut, front ferrule, back ferrule (20 each/pk)	1/4-inch column	5080-8753
1/4-inch id Swagelok brass nut, front ferrule, back ferrule (20 each/pk)	1/4-inch column	5080-8752
1/4-inch id Vespel/ graphite ferrule (10/pk)	Inlet/detector liner/adapters 1/4-inch column	5080-8774
1/4-inch id brass tubing nut (10/pk)	1/4-inch column	5180-4105

Nuts, ferrules, and hardware for capillary columns

Column id	Description	Typical use	Part number
.530 mm	Ferrule, Vespel/graphite, 0.8-mm id (10/pk)	0.45-mm and 0.53-mm capillary columns	5062-3512
	Ferrule, graphite, 1.0-mm id (10/pk)	0.53-mm capillary columns	5080-8773
	Column nut, finger- tight (for 0.53-mm columns)	Connect column to inlet or detector	5020-8293
.320 mm	Ferrule, Vespel/graphite, 0.5-mm id (10/pk)	0.32-mm capillary columns	5062-3514
	Ferrule, graphite, 0.5-mm id (10/pk)	0.1-mm, 0.2- mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853
	Column nut, finger- tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.250 mm	Ferrule, Vespel/graphite, 0.4-mm id (10/pk)	0.1-mm, 0.2- mm, and 0.25- mm capillary columns	5181-3323

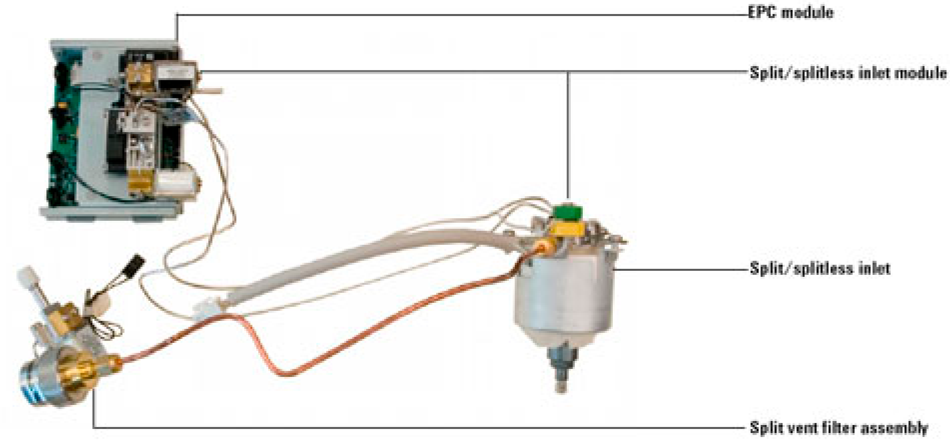
	Ferrule, graphite, 0.5-mm id (10/pk)	0.1-mm, 0.2- mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853
	Column nut, finger- tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.100 and .200 mm	Ferrule, Vespel/graphite, 0.37-mm id (10/pk)	0.1-mm and 0.2-mm capillary columns	5062-3516
	Ferrule, Vespel/graphite, 0.4-mm id (10/pk)	0.1-mm, 0.2- mm, and 0.25- mm capillary columns	5181-3323
	Ferrule, graphite, 0.5-mm id (10/pk)	0.1-mm, 0.2- mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853
	Column nut, finger- tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
All	Ferrule, no-hole (10/pk)	Testing	5181-3308
	Capillary column blanking nut	Testing-use with any ferrule	5020-8294
	Column nut, universal (2/pk)	Connect column to inlet or detector	5181-8830
	Column cutter, ceramic wafer (4/pk)	Cutting capillary columns	5181-8836

Split/Splitless Inlet (SSL)

Top level subassemblies for SSL inlet accessories:

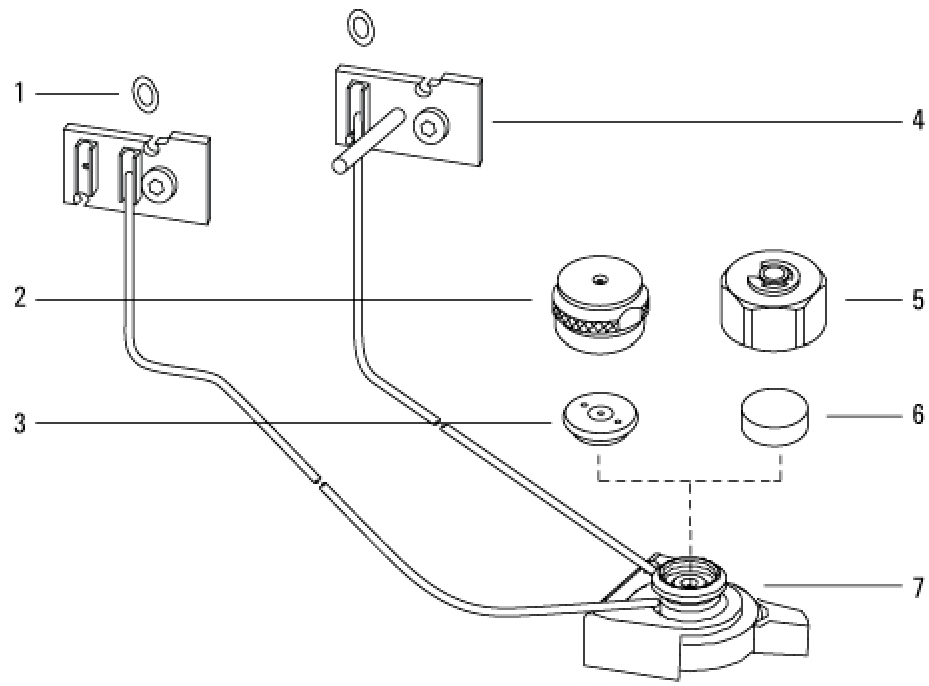
- G3452A 100 psi split/splitless with EPC, Kit
- G3460A 150 psi split/splitless inlet with EPC,Kit

Description	Part number
SSL Inlet Accessory 0-100 PSIG without ship kit	G3452-60500
SSL Inlet Accessory 0-150 PSIG without ship kit	G3452-60509
SSL Weldment Assembly without EPC module	G3452-60512
SSL inlet body with heater/sensor and insulation	G3452-67000
SSL EPC module, 100 PSI	G3452-60552
SSL EPC module, 150 PSI	G3452-60510

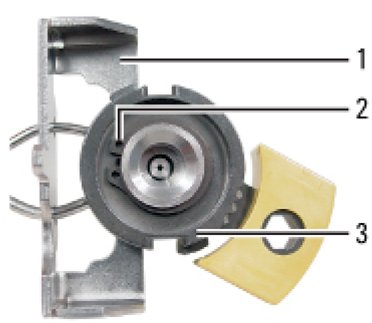


Split/Splitless Inlet

Item	Description	Part number	Qt
1	O-ring, 12/pk (2 for EPC module seal, 2 for valve seal)	5180-4181	4
2	Nut, Merlin Microseal	5182-3445	2
3	Septum, Merlin Microseal	5182-8815	
4	Screw, captive, M3	G1946-20168	2
5	Septum nut, standard	18740-60835	1
6	Septum, standard		1
7	Top insert assembly, standard	G3452-60730	1
NS	Top SSL insert weldment assembly, headspace	G3452-60100	
NS	Top insert, AC gang fitting weldment	G3430-60011	
NS	Top insert assembly, valve	G3480-67585	



Item	Description	Part number	Qty
1	Tubing assembly	G3430-60011	1
2	Split ring	0510-1306	1
3	Turn-top	G3430-40035	1

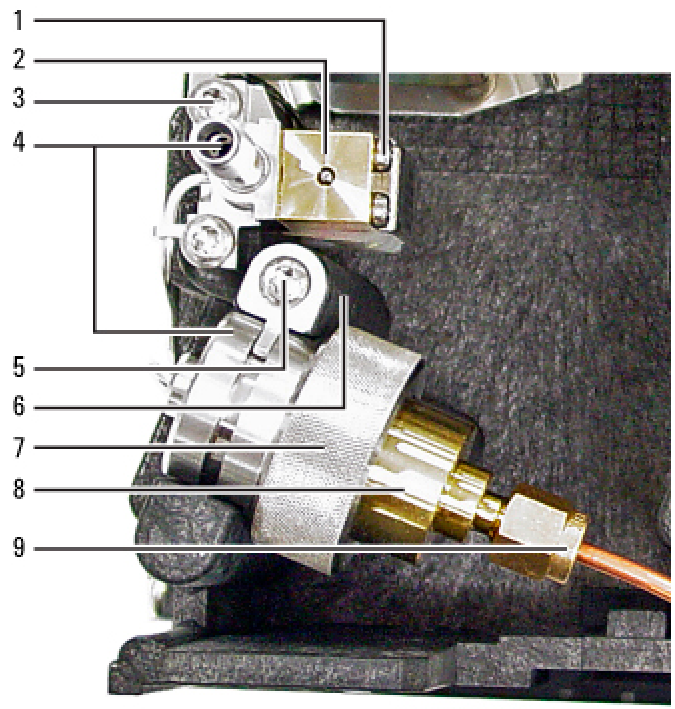


Bottom view

SSL Split vent trap

Item	Description	Part number	Qt
1	Screw, M3 x 16 mm T-10 to attach valve	0515-1141	2

2	Proportional valve, split vent	G3430-60527	
3	Screw, captive, M4 x 20 mm, T-20	1390-1024	2
4	Flow block, split vent trap	G3452-60506	1
NS	O-ring, 12/pk (2 for EPC module seal, 2 for valve seal)	5180-4181	2
5	Screw, M4 × 12 mm, T-20	0515-2496	1
6	Trap retainer	G3452-00005	1
NS	Split vent trap (see consumables)		
7	Retaining nut for split vent trap	G1544-20590	1
8	Can, front, split vent, brass	G1544-20675	1
9	Vent line tube assembly	G3430-60526	1
	1/8-inch copper tubing with length 325 mm or 12.8 in		



Split Splitless Inlet Body

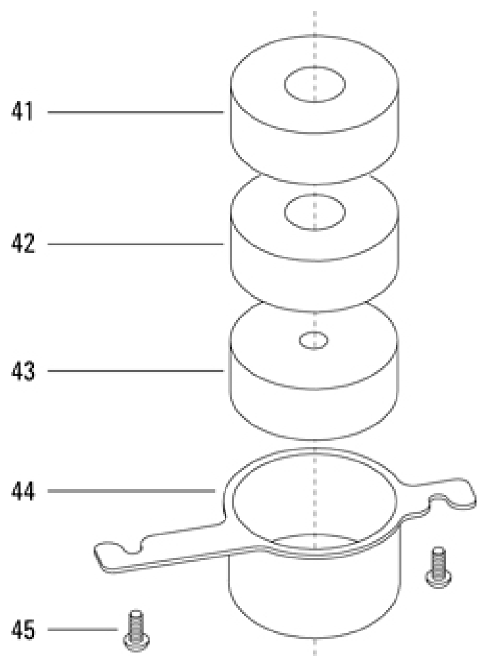
Item	Description	Part number	Qt
21	Screw, M4 x 12 mm, Torx T-20 (captive) C-clip	1390-1023 0515-1799	3 3
22	Inlet weldment	G3452-80570	1
23	Heater/Sensor assembly	G1530-61950	1
24	Screw, M5 x 10 mm	0515-4788	1

25	Heater block	G3452-20500	1
26	Insulation block	G3452-00002	1
27	Insulation bottom	G3432-00003	1
28	SSL insulation cover	G3431-00005	1
30	Retaining nut for heater block	G1544-20590	1
31	Gold seal kit, includes washer	5188-5367	1
32	Reducing nut	18740-20800	1
33	Ferrule		
34	Column nut		
36	Insulation top	G3431-00010	1


21

Split Splitless Inlet Warmer

Item	Description	Part number	Qt
41	Insulation, top	19243-00068	1
42	Insulation, middle	19243-00067	1
43	Insulation, bottom	19243-00069	1
44	Bottom insulation cover	19243-00070	1
45	Screw, M4 x 12 mm, Torx T-20, chromeplated	0515-2711	2



Consumables and Parts for the Split/Splitless Inlet

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (***www.agilent.com/chem/supplies*** (***http://www.agilent.com/chem/supplies***)).

Split, splitless, direct, and direct connect inlet liners

Mode	Description	Deactivated	Part number
Split	Low-pressure drop, glass wool, single taper, 870 µL	Yes	5183-4647
Split	Glass wool, 990 µL	No	19251-60540
Split-Manual only	Empty pin and cup, 800 µL	No	18740-80190
Split-Manual only	Packed pin and cup, 800 µL	No	18740-60840
Splitless	Single taper, glass wool, 900 µL	Yes	5062-3587
Splitless	Single taper, no glass wool, 900 µL	Yes	5181-3316
Splitless	Dual taper, no glass wool, 800 µL	Yes	5181-3315
Splitless-Direct inject	2-mm id, quartz, 250 µL	No	18740-80220
Splitless-Direct inject	2-mm id, 250 µL	Yes	5181-8818
Direct inject - Headspace or purge and trap	1.5-mm id, 140 µL	No	18740-80200
Direct column connect	Single taper, splitless 4-mm id	Yes	G1544-80730
Direct column connect	Dual taper, splitless 4-mm id	Yes	G1544-80700

Description	Part number
Septum retainer nut	18740-60835
Strain relief septum nut for headspace	6410090050
11-mm septum, high-temperature, low-bleed, 50/pk	5183-4757
11-mm septum, prepierced, long life, 50/pk	5183-4761
Merlin Microseal septum (high-pressure)	5182-3444
Merlin Microseal septum (30 psi)	5181-8815
Nonstick fluorocarbon liner O-ring (for temperatures up to 350 °C), 10/pk	5188-5365
Graphite O-ring for split liner (for temperatures above 350 °C), 10/pk	5180-4168
Graphite O-ring for splitless liner (for temperatures above 350 °C), 10/pk	5180-4173
Split Vent Trap PM Kit, Single Cartridge, 2 O-rings	5188-6495
Retaining nut	G1544-20590
Gold-plated seal (standard application)	5188-5367
Gold-plated seal with cross (high split flows) (includes SS washer)	5182-9652
Stainless steel washer (0.375-inch od), 12/pk	5061-5869
Reducing nut	18740-20800
Column nut, blanking plug	5020-8294
Preventative maintenance kit, split	5188-6496

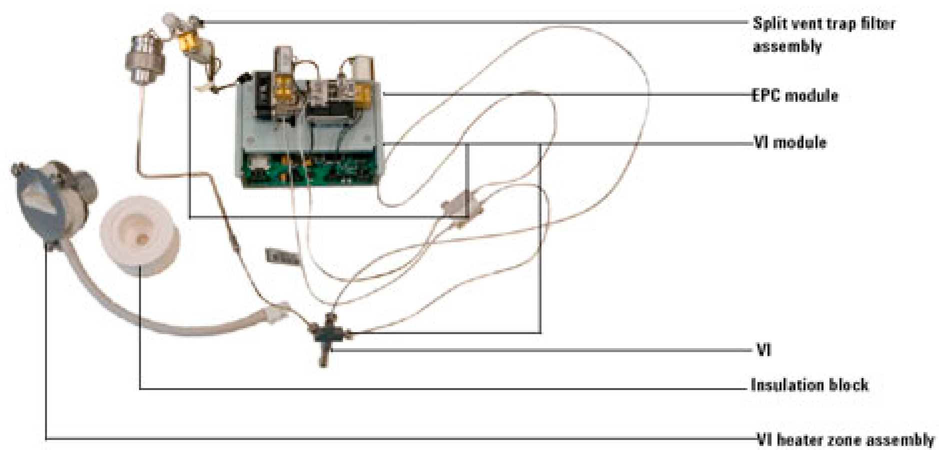
Preventative maintenance kit, splitless	5188-6497

Volatiles Interface (VI)

Top level subassemblies for VI inlet accessories:

- G3504A 100 psi Volatiles Interface with EPC, Kit

Description	Part no.
VI Inlet Accessory 0-100 PSIG without ship kit	G3504-65500
VI Weldment Assembly without EPC module	G3504-60506
VI EPC module, 100 PSI	G3504-60501

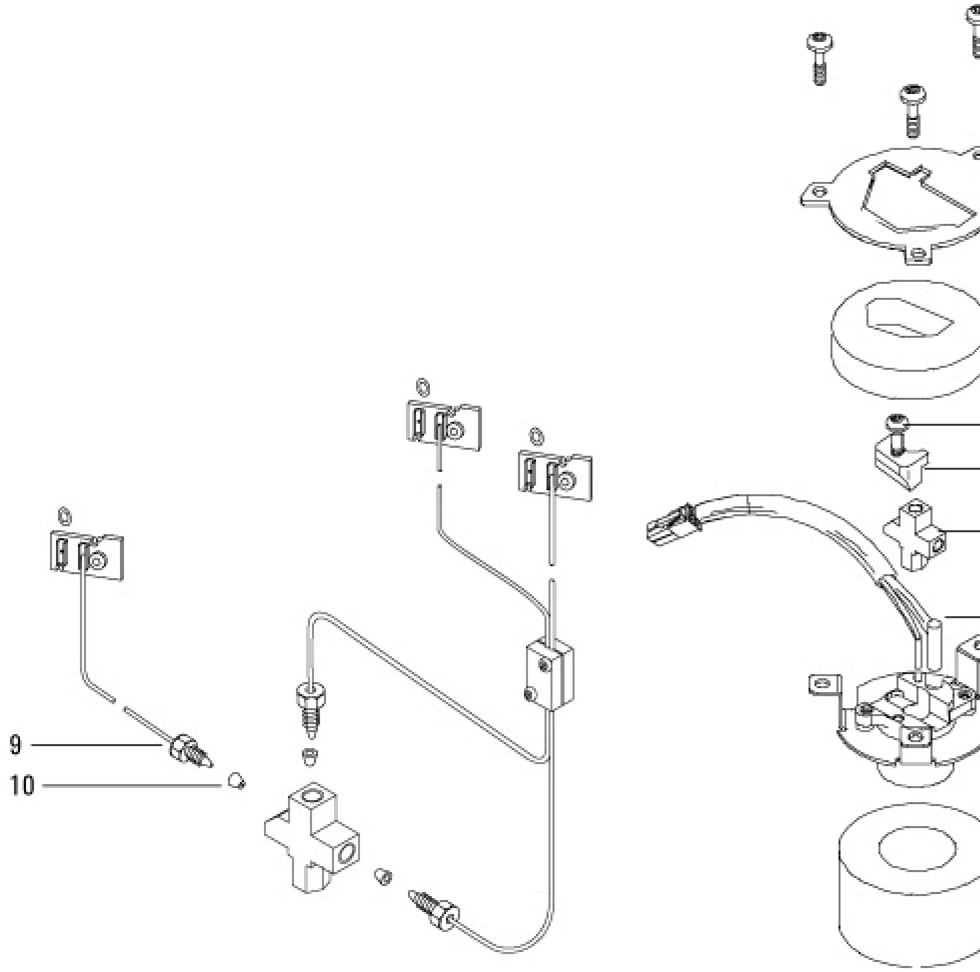


Volatiles Interface (VI)

Item	Description	Part number	Qty
1	VI top cover	G2319-00020	1
2	Top insulation	G2319-20580	1
3	Screw, M4 x 12 mm	1390-1023	4
4	Clamping plate	G2319-20540	1
5	Volatiles interface	G2319-60505	1
6	VI heater/sensor assembly	G2319-60503	1

7	Heater block assembly	G2319-60507	1
8	VI insulation, heater block	G2319-20530	1
9	Pneumatic gang fitting assembly	G2319-60501	1
	Contains:		
	Gen. make-up restrictor	19243-60540	1
	O-ring	0905-1014	1
	Torx screw	1390-1024	2
	Replacement filter kit	G1544-80530	—
	or		
13	Nut, male, 1/16-inch Swagelok	0100-0929	3
NS	Ferrule, 1/16-inch (10/pk)	0100-1333	
NS	Blanking nut, 1/16 inch, SS	01080-83202	
NS	Male nut, 1/16 inch	0100-0929	
NS	Filter trap assembly	G2319-80530	1
NS	Transfer line nut	19258-20830	1
NS	Transfer line ferrule	19258-20870	1

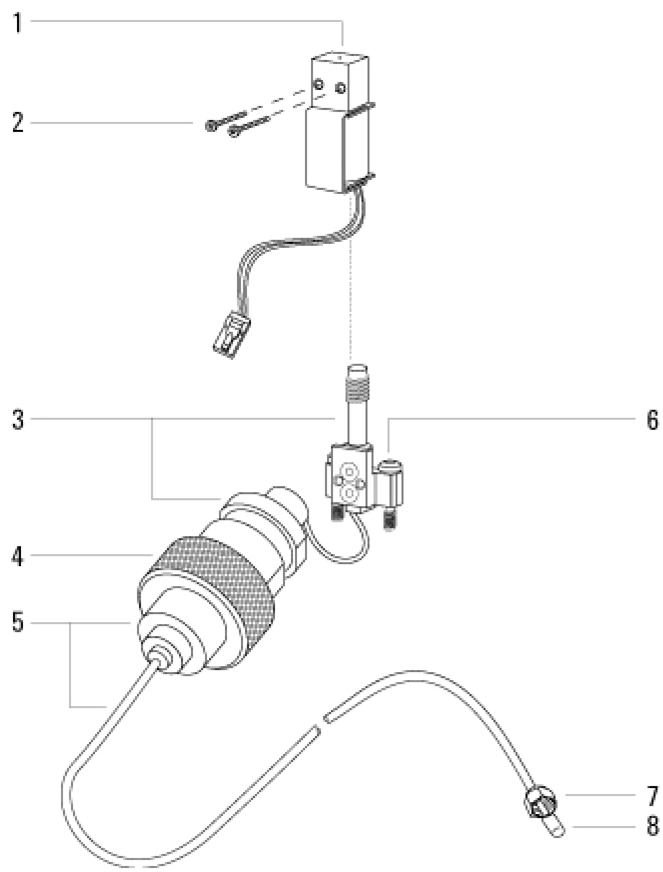
* Also refer to the Agilent chemical analysis consumables and accessories catalog.



7890A Volatiles Interface Trap

Item	Description	Part number	Qty
1	T08PC Valve Chemraz 0.01	G3430-60527	1
2	Screw, M3 x 16 mm, T-10, to attach valve	0515-1141	2
NS	O-ring, 12/pk for valve seal	5180-4181	2
3	Flow block, split vent trap	G3452-60506	1
NS	Screw, M4 × 12 mm, T-20	0515-2496	1
NS	Trap retainer	G3452-00005	1
4	Trap nut	G1544-20650	1
5	VI front trap assembly	G2913-80530	1
NS	Split Vent Trap (see consumables)		

6	Screw, captive, M4 x 20 mm, T-20	1390-1024	2
7	Nut, 1/16-inch	19258-20830	1
8	Ferrule, SilTite 1/16-inch	G2855-20553	1



Consumables and Parts for the VI

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (***www.agilent.com/chem/supplies*** (***http://www.agilent.com/chem/supplies***)">***www.agilent.com/chem/supplies*** (***http://www.agilent.com/chem/supplies***)).

Parts for the VI

Description	Part number
Clamping plate	G2319-20540

Volatiles interface	G2319-60505
Long column nut (65 mm)	G3504-20504
Nut, for transfer, pressure sensing, or split vent line	19258-20830
Ferrule, for transfer, pressure sensing, or split vent line	19258-20870
Split Vent Trap PM Kit, Single Cartridge, 2 O-rings	5188-6495

Nuts, ferrules, and hardware for capillary columns

Column id	Description	Typical use	Part number
.530 mm	Ferrule, Vespel/graphite, 0.8-mm id (10/pk)	0.45-mm and 0.53-mm capillary columns	5062-3512
	Ferrule, graphite, 1.0-mm id (10/pk)	0.53-mm capillary columns	5080-8773
	Column nut, finger- tight (for 0.53-mm columns)	Connect column to inlet or detector	5020-8293
.320 mm	Ferrule, Vespel/graphite, 0.5-mm id (10/pk)	0.32-mm capillary columns	5062-3514
	Ferrule, graphite, 0.5-mm id (10/pk)	0.1-mm, 0.2- mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853
	Column nut, finger- tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.250 mm	Ferrule, Vespel/graphite, 0.4-mm id (10/pk)	0.1-mm, 0.2- mm, and 0.25- mm capillary columns	5181-3323
	Ferrule, graphite, 0.5-mm id (10/pk)	0.1-mm, 0.2- mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853
	Column nut, finger- tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.100 and .200 mm	Ferrule, Vespel/graphite, 0.37-mm id (10/pk)	0.1-mm and 0.2-mm capillary columns	5062-3516
	Ferrule, Vespel/graphite, 0.4-mm id (10/pk)	0.1-mm, 0.2- mm, and 0.25- mm capillary columns	5181-3323
	Ferrule, graphite, 0.5-mm id (10/pk)	0.1-mm, 0.2- mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853
	Column nut, finger- tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
All	Ferrule, no-hole (10/pk)	Testing	5181-3308
	Capillary column blanking nut	Testing-use with any ferrule	5020-8294
	Column nut, universal (2/pk)	Connect column to inlet or detector	5181-8830

	Column cutter, ceramic wafer (4/pk)	Cutting capillary columns	5181-8836

Detectors

This section contains an illustrated parts breakdown for each of the following 7890 GC detectors and related components.

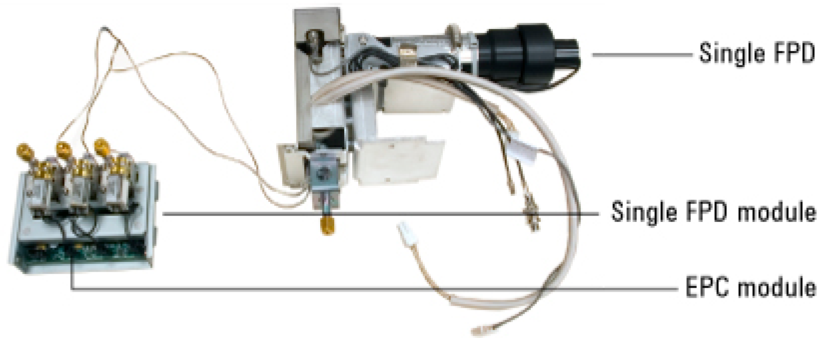
- Flame Ionization Detector (FID)
- Nitrogen Phosphorus Detector (NPD)
- Thermal Conductivity Detector (TCD)
- Microcell Electron Capture Detector (uECD)
- Flame Photometric Detector (FPD)

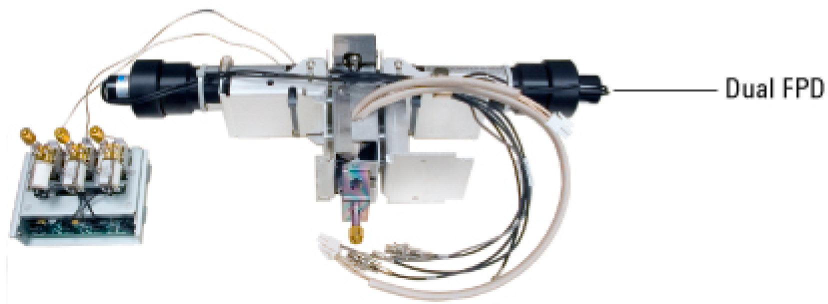
Flame Photometric Detector (FPD)

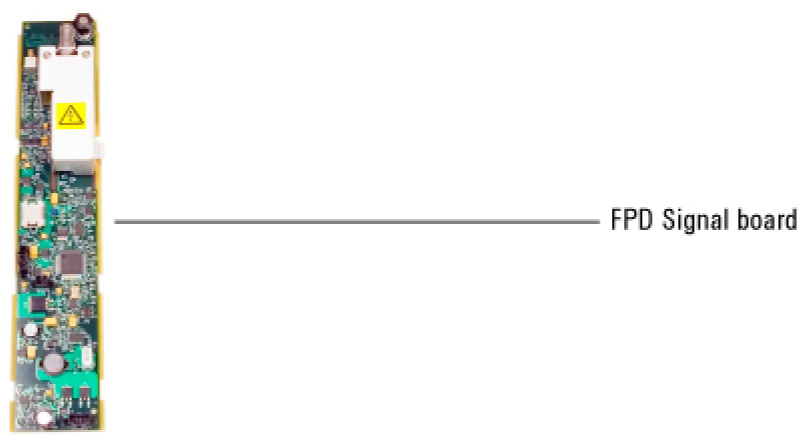
Top level subassemblies for FPD detector accessories:

- G3435A Single FPD with EPC, Kit
- G3436A Dual FPD with EPC, Kit

Description	Part number
FPD Detector Module, Single, without ship kit	G3435-60500
FPD Detector Module, Dual, without ship kit	G3436-60500
FPD EPC module	G3435-60535
FPD Signal board (1 for single FPD, 2 for dual FPD)	G3435-60010



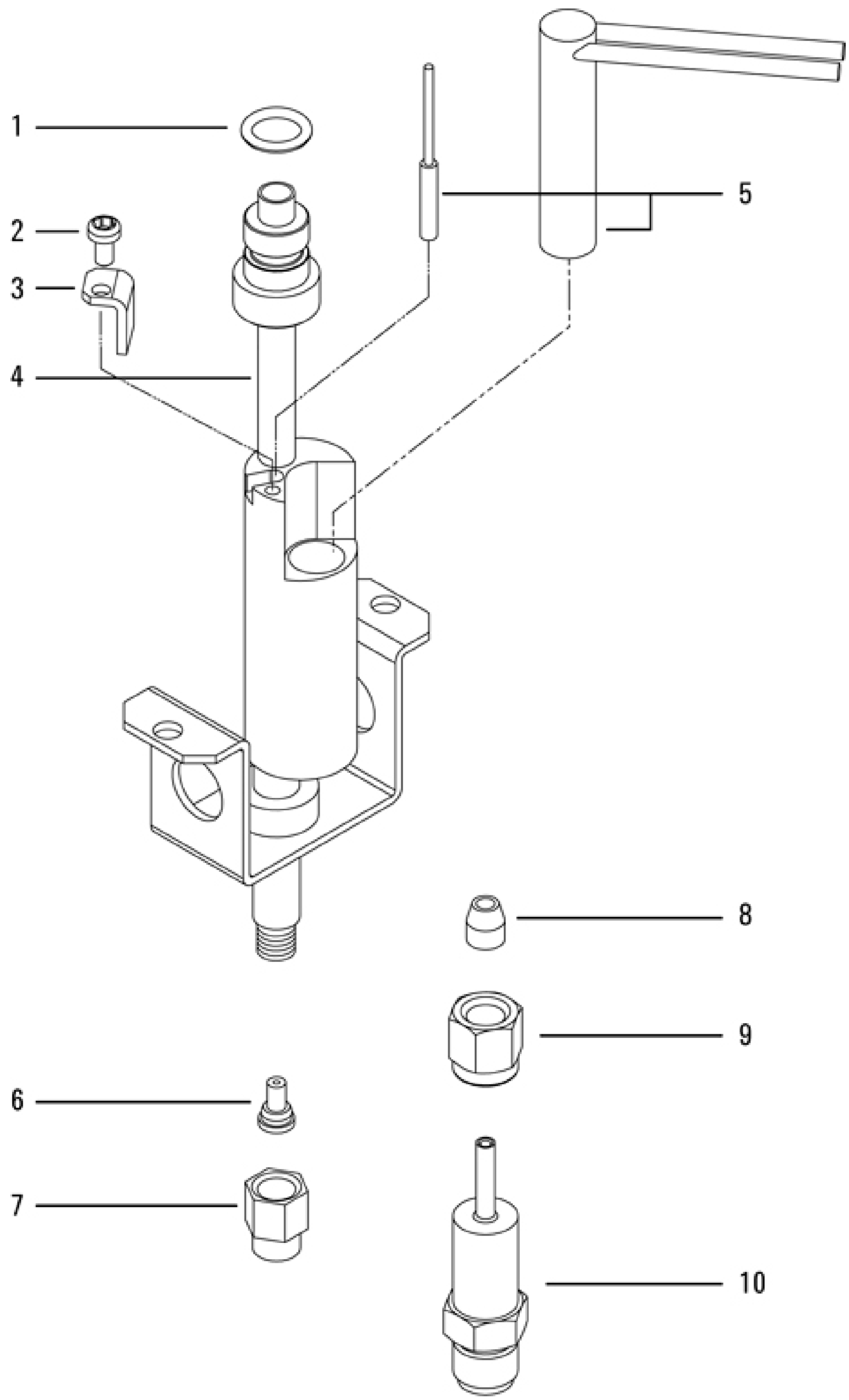




FPD inert transfer line parts

Item	Description	Part number
1	O-ring, FPD jet seal, white	0905-1608
2	Screw, M3 x 12 mm, T-10	0515-1084
3	Retaining clip	19256-00340
4	Inert transfer line	G3435-60555
5	Heater/Sensor assembly	G1535-60620
6	Capillary adapter seat	19256-21140

7	Capillary adapter nut	19256-21150
8	1/8-inch ferrule	0100-0332
9	1/8-inch nut	5180-4103
10	1/4-inch packed adapter	G1532-20710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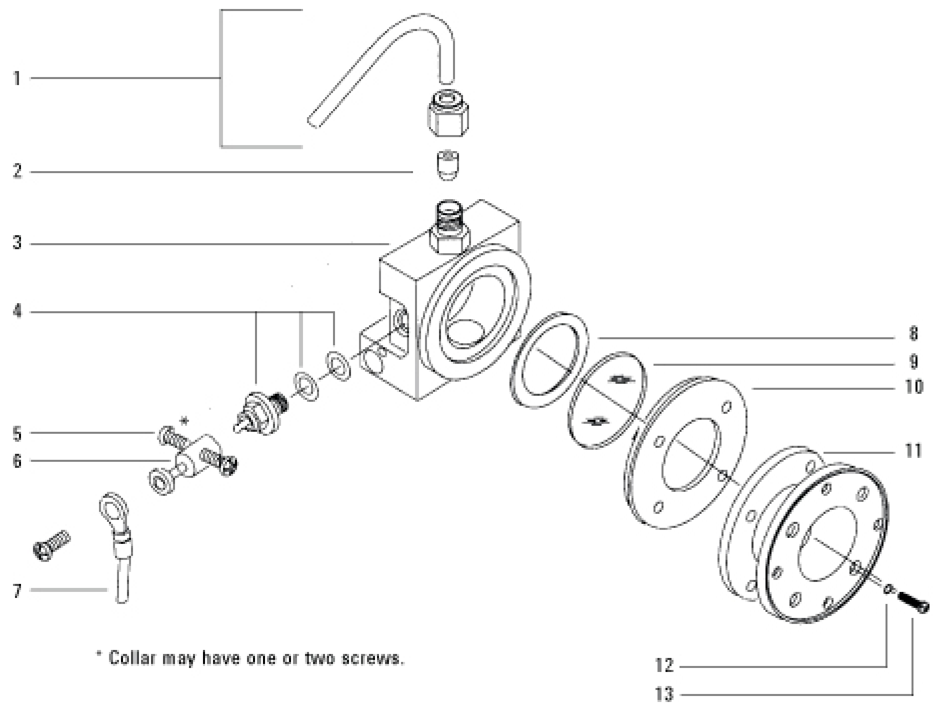
FPD ignitor and heat shield assembly parts

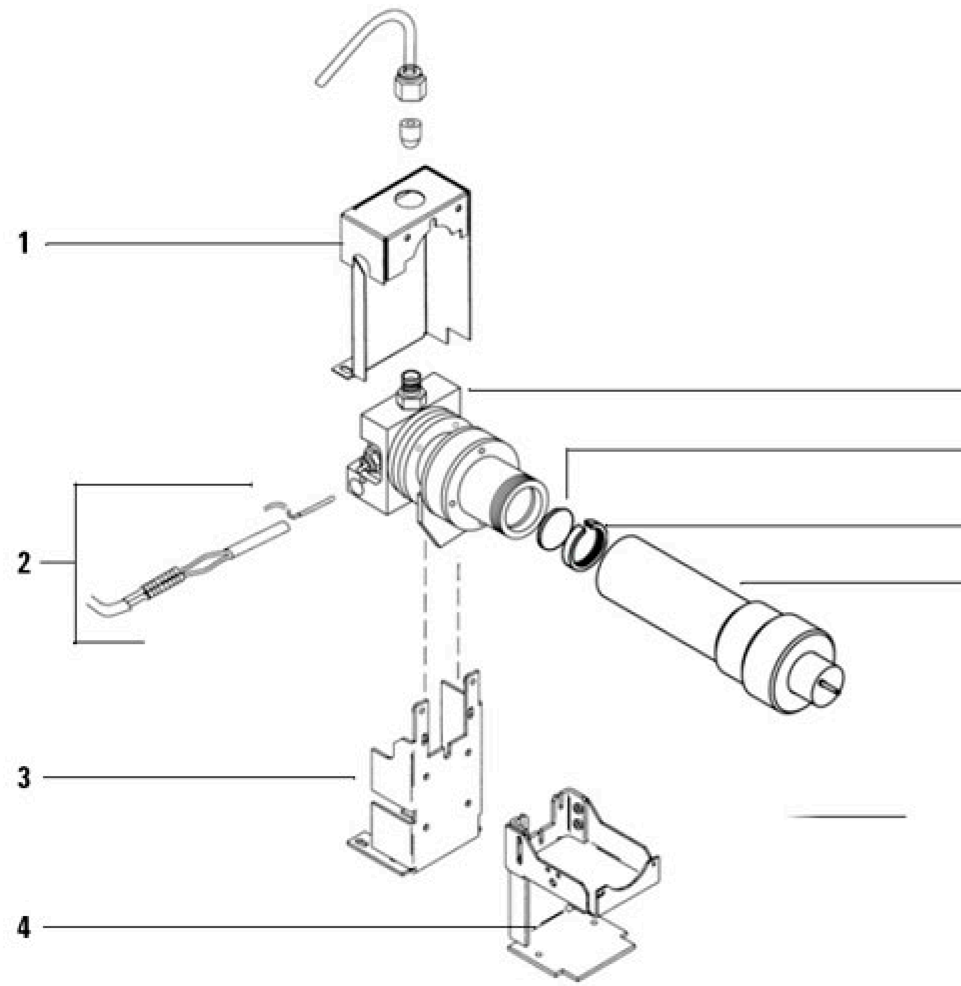
Item	Description	Part number
1	FPD tube assembly Aluminum Stainless Steel	 19256-60700 19256-20705
2	Vespel ferrule, 1/4-inch id	0100-1061
3	Emissions block assembly FPD, single FPD, dual (not shown)	 19256-80560 19256-80600
4	Ignitor replacement kit A. O-ring B. Spacer C. Glow plug	19256-60800
5	Screw, M3 x 66 mm, T-10	0515-0680
6	Collar	19256-20690
7	Ignitor cable assembly	G3435-60600
8	Heat shield gasket, white	19256-80045
9	First heat shield window	19256-80030
10	Heat shield disk	19256-20580
11	Stainless steel coupling	19256-20550
12	Lock washer (4 required)	2190-0584
13	Screw, M3 × 12, T-10 (4 required)	0515-1084



7890A PMT and bracket assemblies

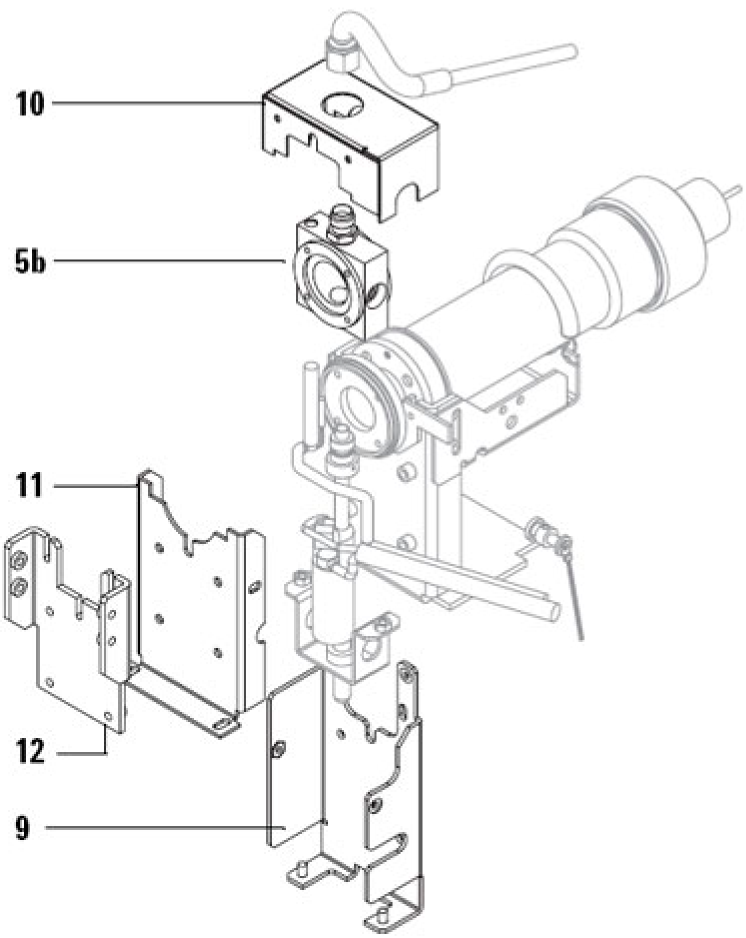
Single FPD

Item	Description	Part number
1	Chimney back cover	G1535-80520
2	Heater/Sensor assembly	G1535-60610
3	Transfer line support bracket, single	19256-00320
4	Bracket/Support	G1535-00010
5	Emissions block assembly, single	19256-60650
6	Filters:	
	Sulfur	1000-1437
	Phosphorus	19256-80010
7	Filter spacer (used only with sulfur filter)	19256-20910
8	PMT housing assembly	19256-60510



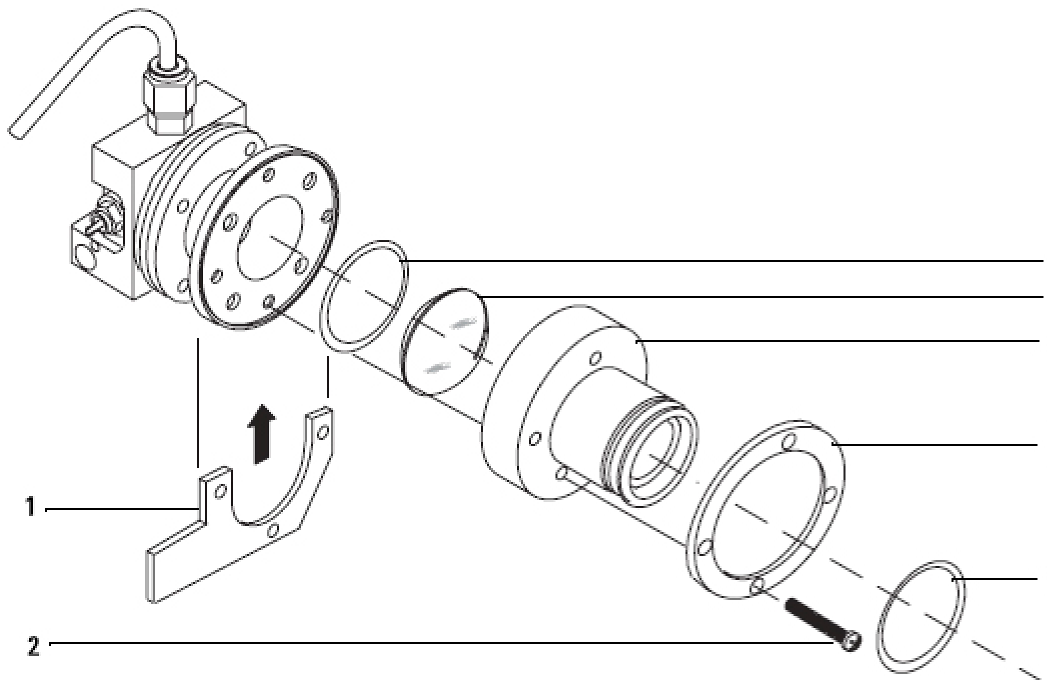
Dual FPD

Item	Description	Part number
11	Dual cover assembly	G1535-80530
12	Emissions block assembly, dual	19256-60690
13	Dual FPD chimney back	19256-00330
14	Dual main bracket	G1535-00040
15	Dual FPD chimney front	G1535-00030



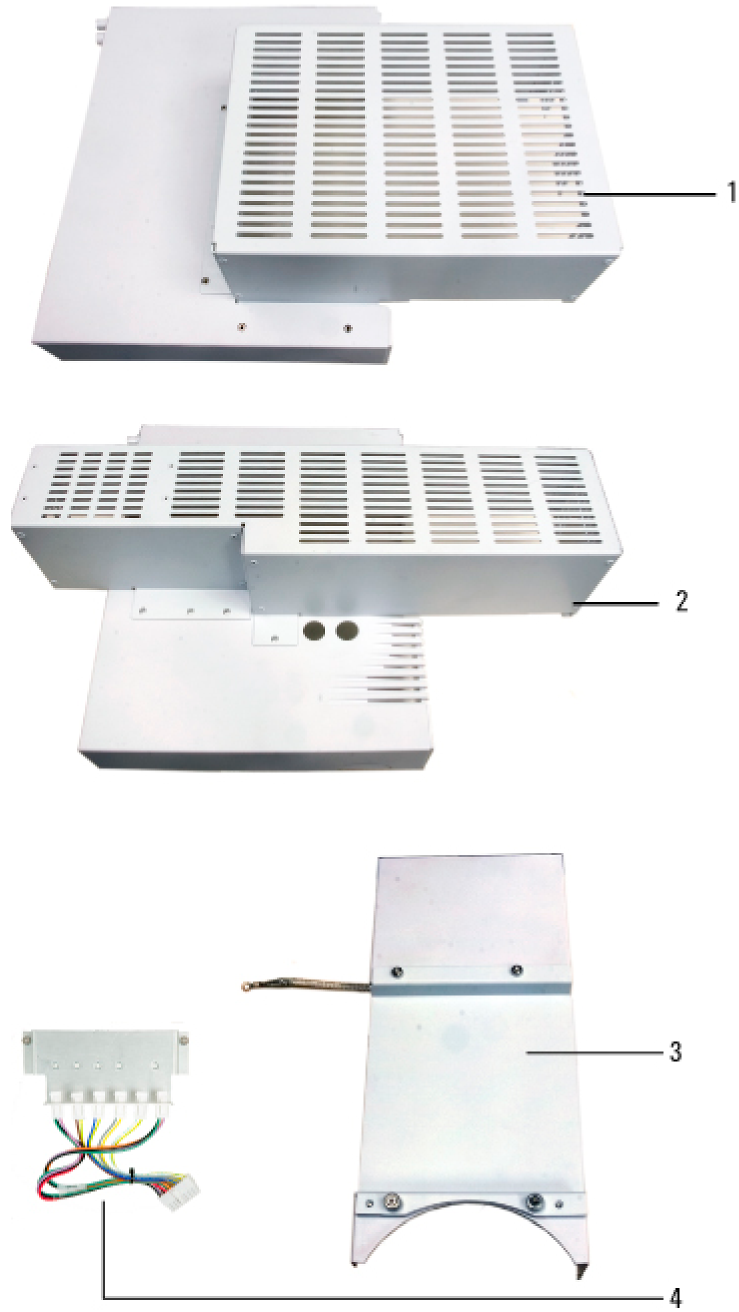
FPD lens assembly

Item	Description	Part number
1	Clamp	19256-00090
2	Screw, M3 × 25 (4 required)	0515-0683
3	Silicone O-ring, 0.926-inch id (orange)	0905-0955
4	Convex lens	1000-1438
5	Lens housing	19256-20900
6	Flange ring	19256-00200
7	O-ring, Viton, 1.239-inch id (brown)	0905-1100



FPD Covers

Item	Description	Part number
1	Single FPD top cover	G1535-80555
2	Dual FPD top cover	G1535-80560
3	Electronics top cover	G3435-60503
	with ground strap	19256-60730
4	Auxiliary heater and valve control assembly	
	Aux zone/valve box harness	G1530-60730



Consumables for the FPD

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (***www.agilent.com/chem/supplies*** (***http://www.agilent.com/chem/supplies***)">***www.agilent.com/chem/supplies*** (***http://www.agilent.com/chem/supplies***)).

FPD supplies

Description	Part number/quantity
Sulfur filter	1000-1437
Sulfur filter spacer	19256-20910
Phosphorus filter	19256-80010
Exit tube assembly, aluminum	19256-60700
Exit tube assembly, stainless steel	19256-20705
Vespel ferrule, 1/4-inch id	0100-1061
Ignitor replacement kit	19256-60800
· O-ring	
· Spacer	
· Glow plug	
Screw, M3 × 66 mm, T-10	0515-0680
Collar	19256-20690
Capillary adapter nut	19256-21150
Capillary adapter seat	19256-21140
1/4-inch packed adapter	G1532-20710
Column measuring tool	19256-80640
Spring to secure photomultiplier tube	1460-1160
1/8-inch packed adapter nut	0100-0057
1/8-inch Vespel ferrule for packed adapter	0100-1332
PM kit, FPD single	G2647-60510
PM kit, FPD dual	G2648-60510

Nuts, ferrules, and hardware for capillary columns

Column id	Description	Typical use	Part number
.530 mm	Ferrule, Vespel/graphite, 0.8-mm id (10/pk)	0.45-mm and 0.53-mm capillary columns	5062-3512
	Ferrule, graphite, 1.0-mm id (10/pk)	0.53-mm capillary columns	5080-8773
	Column nut, finger- tight (for 0.53-mm columns)	Connect column to inlet or detector	5020-8293
.320 mm	Ferrule, Vespel/graphite, 0.5-mm id (10/pk)	0.32-mm capillary columns	5062-3514

	Ferrule, graphite, 0.5-mm id (10/pk)	0.1-mm, 0.2- mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853
	Column nut, finger- tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.250 mm	Ferrule, Vespel/graphite, 0.4-mm id (10/pk)	0.1-mm, 0.2- mm, and 0.25- mm capillary columns	5181-3323
	Ferrule, graphite, 0.5-mm id (10/pk)	0.1-mm, 0.2- mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853
	Column nut, finger- tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.100 and .200 mm	Ferrule, Vespel/graphite, 0.37-mm id (10/pk)	0.1-mm and 0.2-mm capillary columns	5062-3516
	Ferrule, Vespel/graphite, 0.4-mm id (10/pk)	0.1-mm, 0.2- mm, and 0.25- mm capillary columns	5181-3323
	Ferrule, graphite, 0.5-mm id (10/pk)	0.1-mm, 0.2- mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853
	Column nut, finger- tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
All	Ferrule, no-hole (10/pk)	Testing	5181-3308
	Capillary column blanking nut	Testing-use with any ferrule	5020-8294
	Column nut, universal (2/pk)	Connect column to inlet or detector	5181-8830
	Column cutter, ceramic wafer (4/pk)	Cutting capillary columns	5181-8836

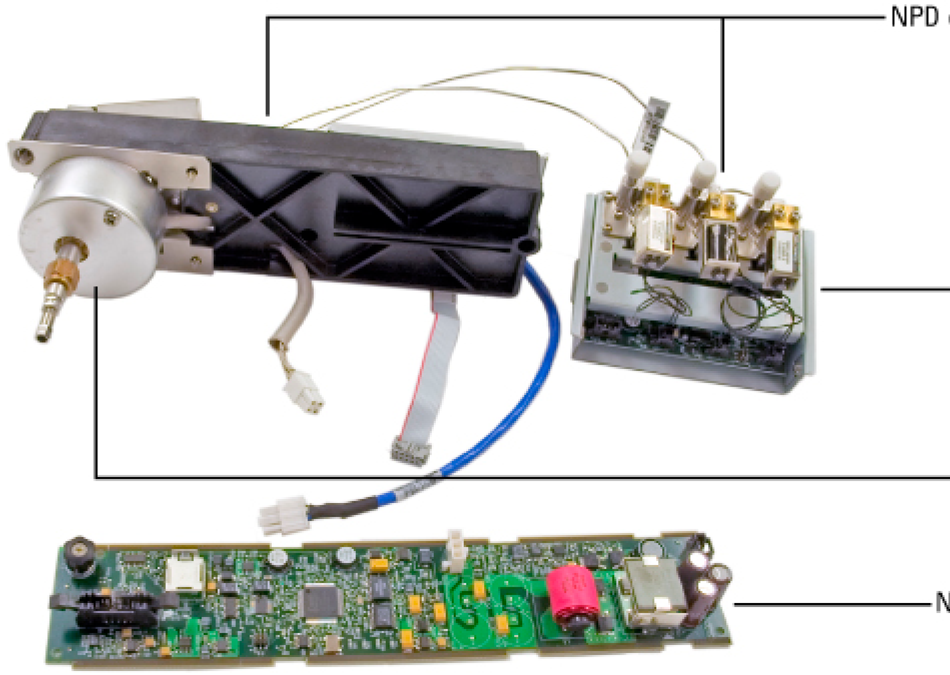
Nitrogen Phosphorous Detector (NPD)

Top level subassemblies for NPD detector accessories:

- G3495A NPD with EPC, Kit adaptable to either packed or capillary columns.
- G3496A Capillary NPD with EPC, Kit

Description	Part number
NPD Detector Module, adaptable, without ship kit	G3434-60506
NPD Detector Module, capillary, without ship kit	G3434-60501
NPD Adaptable Weldment Assembly with pallet, electrometer, and base	G3434-80508

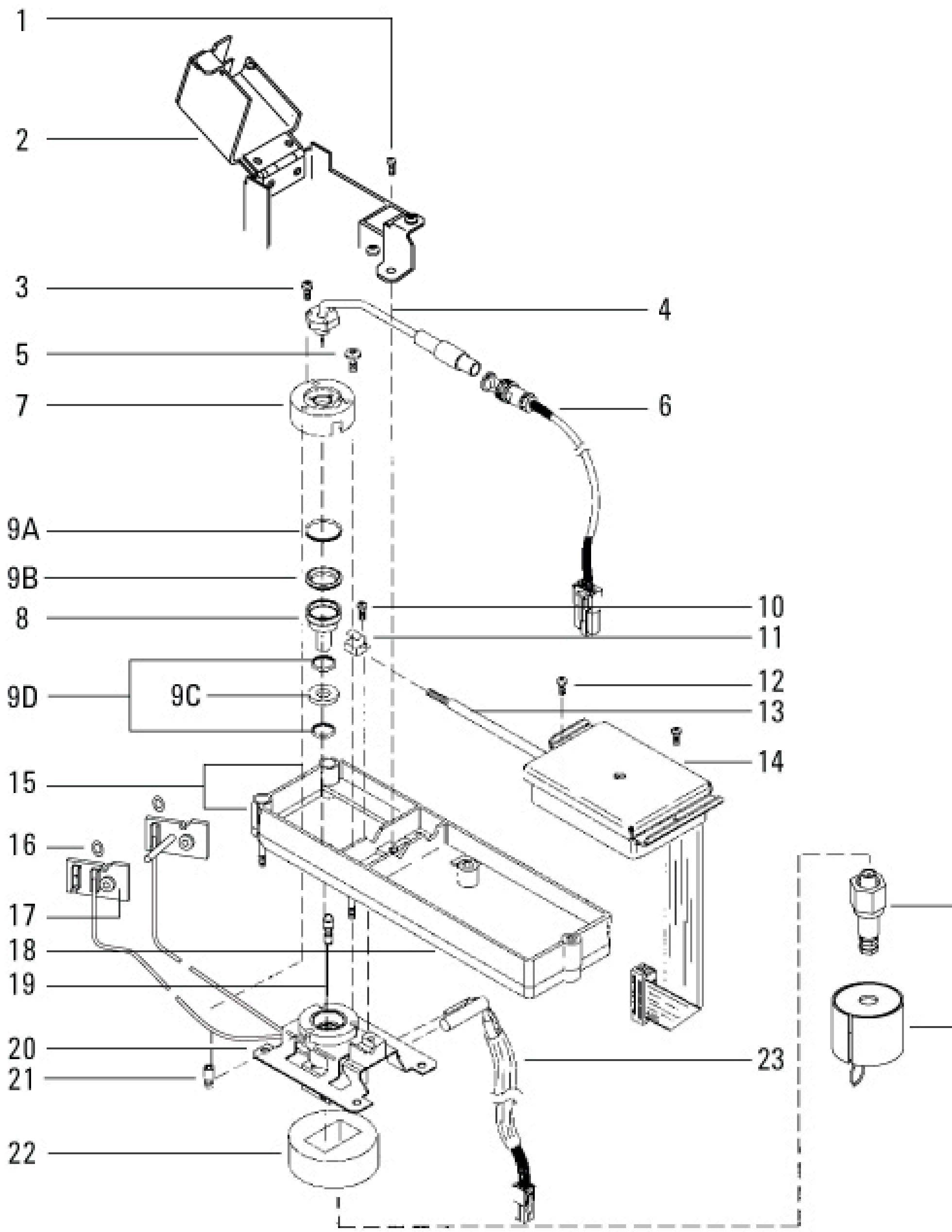
NPD Capillary Weldment Assembly with pallet, electrometer, and base	G3434-80507
NPD EPC Module	G3434-60502
NPD Signal Board	G3434-60021



Nitrogen Phosphorus Detector (NPD)

Item	Description	Part number	Qty
1	Screw, M4 × 10 mm, Torx T-20	0515-2495	1
2	Hinged cover assembly	G1534-80521	1
3	Screw, M3 × 8 mm, Torx T-10	0515-0655	3
4	NPD bead assembly	See consumables	1
5	Screw, M4, Torx T-20	0515-2495	3
6	Power cable assembly	G3434-60600	1
7	Lid weldment	G1534-80510	1
8	Collector funnel, standard	G1534-20530	1
NS	- Collector funnel, small id (Note 1)	G1534-20660	
9	NPD ceramic replacement kit	5182-9722	–
10	Screw, M4 × 10 mm	0515-2495	1
11	J-clamp	1400-0015	1
12	Screw, M4 × 10 mm	0515-2495	2
13	NPD interconnect assembly	G1534-60610	1
NS	Spring, interconnect	1460-2142	1
14	NPD electrometer	G3434-60010	1
15	Pallet captive screws	1390-1024	4
16	O-ring, size 2-006, fluorocarbon, 12/pk	5180-4181	3
17	Screw, captive, M3, T-10	G1946-20168	1
18	Mounting pallet	G1531-40020	1
19	Jets	See consumables	1
20	Base weldment with jet		1
	- Capillary column NPD	G3434-80505	
	- Packed column NPD	G3434-80506	
21	Lid stop/standoff	G1534-20590	3
NS	Insulation cap (Packed version only)	G1531-00130	1
22	NPD Insultation cup kit	G3434-00004	1
23	Heater/sensor assembly	G1530-61950	1
24	Column adapters for packed NPD	See consumables	
25	Cup insulation kit	19234-60720	1
NS	Flow measurement adapter	G1534-60640	–
NS	NPD ceramic insulator kit	5182-9722	–
	– Metal C-rings, top and bottom		
	– Ceramic insulators, upper and lower		

Noe 1: Optional collector funnel with smaller ID is used to reduce peak tailing in phosphorus compounds. If you use this part, you cannot measure column flow or detector flows.



Consumables for the NPD

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (***www.agilent.com/chem/supplies*** (***http://www.agilent.com/chem/supplies***)">***www.agilent.com/chem/supplies*** (***http://www.agilent.com/chem/supplies***)).

Before selecting a jet, see "Selecting an NPD jet" .

NPD parts

Description	Part number
Collector	G1534-20530
Screw, M3 × 0.5 × 8 mm	0515-0655
NPD white ceramic bead assembly	G1534-60570
NPD black ceramic bead assembly	5183-2007
Screw, M4 × 10 mm	0515-2495
J-clamp	1400-0015
NPD ceramic insulator kit	5182-9722
· Metal O-rings, top and bottom	
· Ceramic insulators, upper and lower	
Insulation cup	19234-60720
NPD chemical sample kit solution of 0.65 ppm azobenzene, 1000 ppm octadecane, 1 ppm malathion in isooctane, 3 ampoules	18789-60060
NPD lid standoff	G1534-20590

Column adapters, for adaptable NPD only

Description	Part number
FID/NPD capillary column adapter	19244-80610
1/8-inch packed column adapter	19231-80520
1/4-inch packed column adapter	19231-80530
1/4-inch packed glass column adapter	G1532-20710
1/4-inch column nut, 10/pk	5180-4105
1/4-inch Vespel/graphite ferrule, 10/pk	5080-8774

Jets for capillary version

Jet type	Part number	Jet tip id	Length
Capillary with extended jet (recommended)	G1534-80580	0.29 mm (0.011 inch)	51.5 mm
Capillary	G1531-80560	0.29 mm (0.011 inch)	43 mm

High-temperature	G1531-80620	0.47 mm (0.018 inch)	43 mm

Jets for adaptable or packed version

Jet type	Part number	Jet tip id	Length
Capillary with extended jet (recommended)	G1534-80590	0.29 mm (0.11 inch)	70.5 mm
Capillary	19244-80560	0.29 mm (0.011 inch)	61.5 mm
Capillary, high- temperature	19244-80620	0.47 mm (0.018 inch)	61.5 mm
Packed	18710-20119	0.46 mm (0.018 inch)	63.6 mm

Nuts, ferrules, and hardware for capillary columns

Column id	Description	Typical use	Part number
.530 mm	Ferrule, Vespel/graphite, 0.8-mm id (10/pk)	0.45-mm and 0.53-mm capillary columns	5062-3512
	Ferrule, graphite, 1.0-mm id (10/pk)	0.53-mm capillary columns	5080-8773
	Column nut, finger- tight (for 0.53-mm columns)	Connect column to inlet or detector	5020-8293
.320 mm	Ferrule, Vespel/graphite, 0.5-mm id (10/pk)	0.32-mm capillary columns	5062-3514
	Ferrule, graphite, 0.5-mm id (10/pk)	0.1-mm, 0.2- mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853
	Column nut, finger- tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.250 mm	Ferrule, Vespel/graphite, 0.4-mm id (10/pk)	0.1-mm, 0.2- mm, and 0.25- mm capillary columns	5181-3323
	Ferrule, graphite, 0.5-mm id (10/pk)	0.1-mm, 0.2- mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853
	Column nut, finger- tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.100 and .200 mm	Ferrule, Vespel/graphite, 0.37-mm id (10/pk)	0.1-mm and 0.2-mm capillary columns	5062-3516
	Ferrule, Vespel/graphite, 0.4-mm id (10/pk)	0.1-mm, 0.2- mm, and 0.25- mm capillary columns	5181-3323

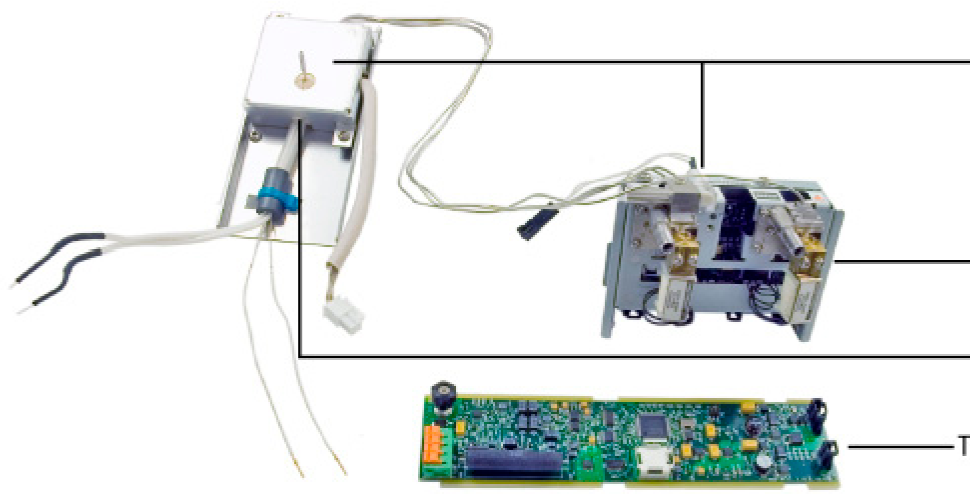
	Ferrule, graphite, 0.5-mm id (10/pk)	0.1-mm, 0.2- mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853
	Column nut, finger- tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
All	Ferrule, no-hole (10/pk)	Testing	5181-3308
	Capillary column blanking nut	Testing-use with any ferrule	5020-8294
	Column nut, universal (2/pk)	Connect column to inlet or detector	5181-8830
	Column cutter, ceramic wafer (4/pk)	Cutting capillary columns	5181-8836

Thermal Conductivity Detector (TCD)

Top level subassemblies for TCD detector accessories:

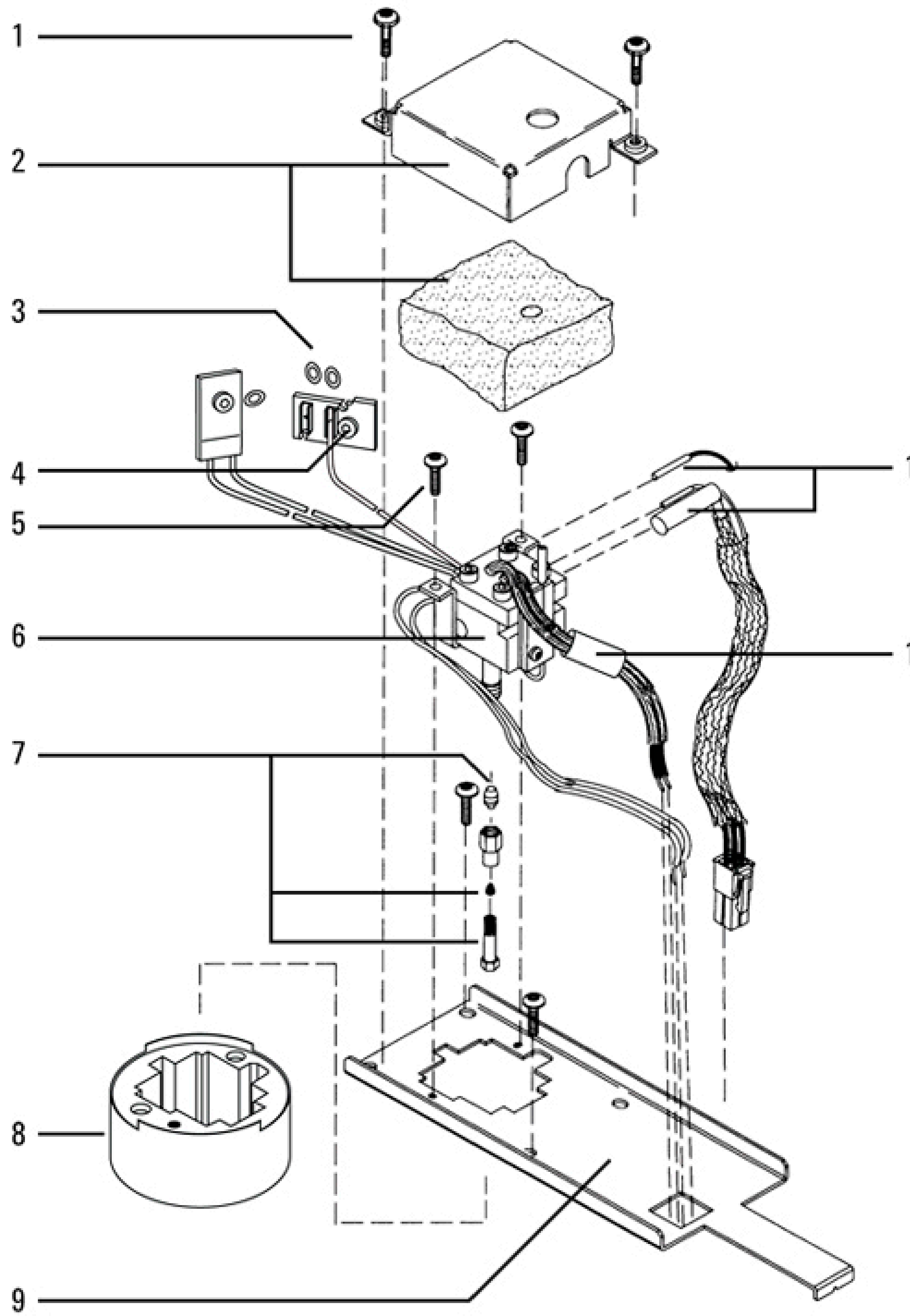
- G3432A TCD Accessory with EPC, Kit
- G3437A TCD mounted on left- hand side of GC,Kit
- 19232C TCD to FID adapter kit

Description	Part no.
TCD Detector Module without ship kit	G3432-60500
TCD 3rd Detector Module without ship kit	G3432-60507
TCD Replacement cell with delta sensor	G3432-67685
TCD EPC Module (without switching valve)	G3432-60532
TCD Signal Board	G3432-60010



Thermal Conductivity Detector (TCD)

Item	Description	Part number	Qty
1	Screw, M4 × 12 mm, T-20	0515-2496	2
2	Thermal cover and insulation assembly	G1532-00027	1
3	O-ring, 12/pk (2 for EPC module seal, 4 for valve seals)	5180-4181	6
4	Screw, captive, M3, T-10	G1946-20168	2
5	Screw, M4 × 10 mm, Torx T-20	0515-2711	2
6	TCD Block assembly without Delta PRT	G3432-60504	1
7	Column adapters, ferrules, and nut		
8	TCD Insulation Cup Kit	G3432-00004	1
9	TCD mounting pallet	G3432-00002	1
10	Heater/Sensor assembly	G1530-61950	1
11	Cylindrical EMI suppressor, ferrite	9170-1730	1
NS	ΔPRT	G1532-60660	1
NS	Screw, M4 × 12 mm, T-20 (attach detector to oven top)	0515-2496	2
NS	TCD seal insulation	G1532-00080	1
NS	Screw, M4 x 40 mm, T-20	0515-4793	1
NS	TCD vent restrictor kit	G1532-60700	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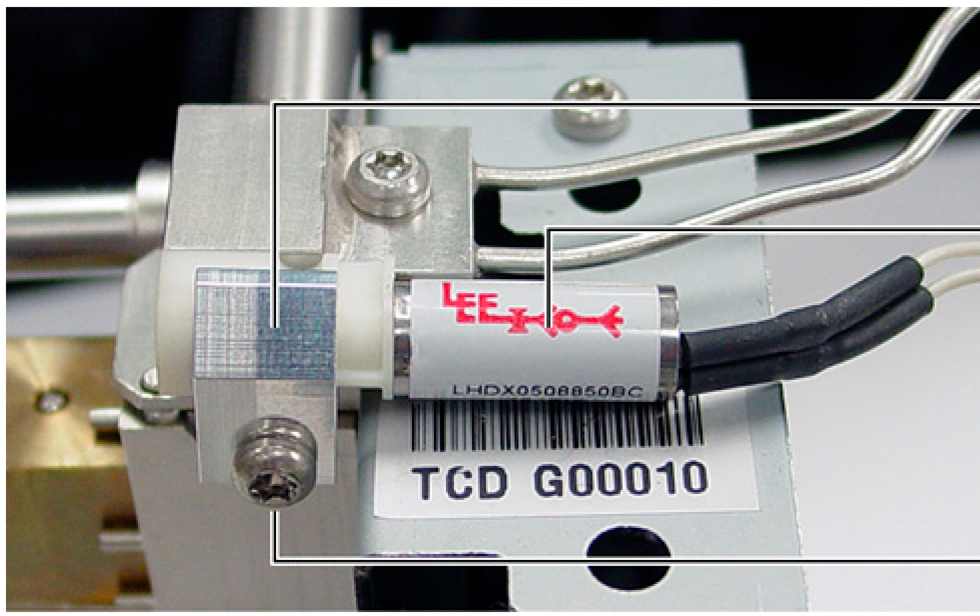
Reference gas switching valve

This valve is located on the EPC module.

Item	Description	Part number	Qty.
1	Clamp, switching valve	G3432-20523	1
2	TCD Switching valve	G1532-60550	1
3	Screw, M3 x 12 mm T-10	0515-1084	1
4	Cable, switching valve	G1532-60550	1



Consumables for the TCD

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (***www.agilent.com/chem/supplies*** (***http://www.agilent.com/chem/supplies***)">***www.agilent.com/chem/supplies*** (***http://www.agilent.com/chem/supplies***)).

Standard parts for attaching columns to the TCD

Column	Description	Unit	Part number
Capillary	Nut, 1/8-inch id, brass Swagelok	10/pk	5180-4103
	Back ferrule, for 0.1-mm to 0.53-mm capillary columns	10/pk	5182-3477
	Front ferrule, 0.53-mm capillary columns	10/pk	5182-9673

	Front ferrule, 0.32-mm capillary columns	10/pk	5182-9676
	Front ferrule, 0.1-mm, 0.2- mm, and 0.25-mm capillary columns	10/pk	5182-9677
	1/8-inch Swagelok plug		5180-4124
1/4-inch packed	1/4-inch packed column adapter		G1532-20710
	1/8-inch id Vespel/graphite ferrule	10/pk	0100-1332
	Nut, 1/8-inch id, brass	10/pk	5180-4103
	Ferrule, Vespel, 1/4-inch	10/pk	5080-8774
	1/4-inch id tubing nut, brass	10/pk	5180-4105
	1/8-inch Swagelok plug		5180-4124
1/8-inch packed	Ferrule, 1/8-inch Vespel/graphite	10/pk	0100-1332
	Nut, 1/8-inch id, brass	10/pk	5180-4103
	1/8-inch Swagelok plug		5180-4124

Optional TCD capillary column adapter hardware

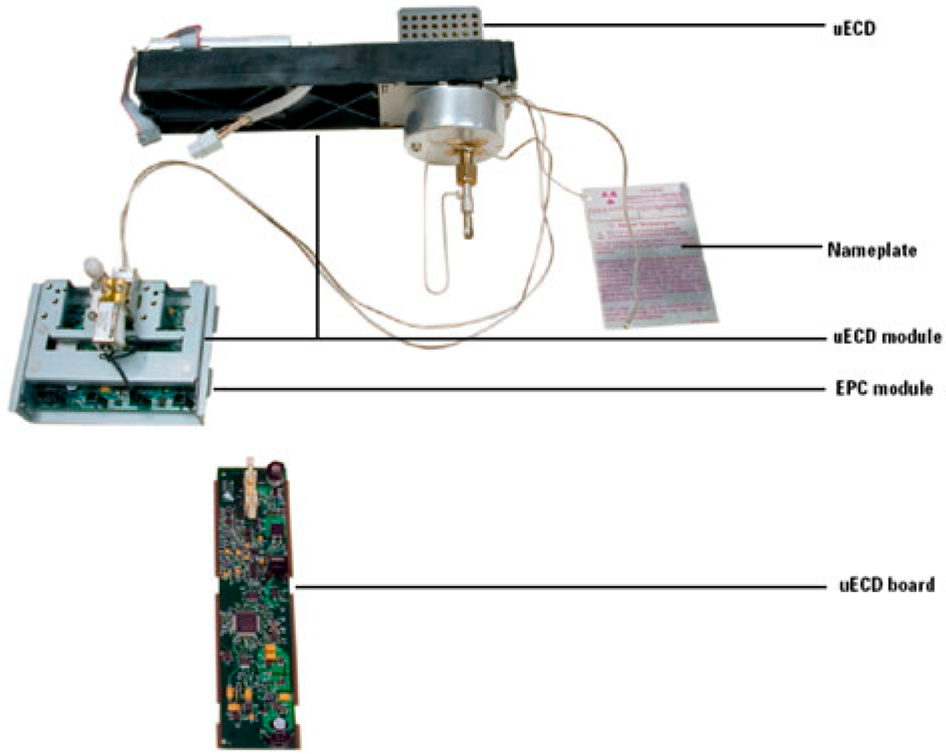
Description	Unit	Part number
Capillary adapter		G1532-80540
Ferrule, Vespel, 1/8-inch	10/pk	0100-1332
Nut, brass, 1/8-inch	10/pk	5180-4103

Microcell Electron Capture Detector (uECD)

Top level subassemblies for µECD detector accessories:

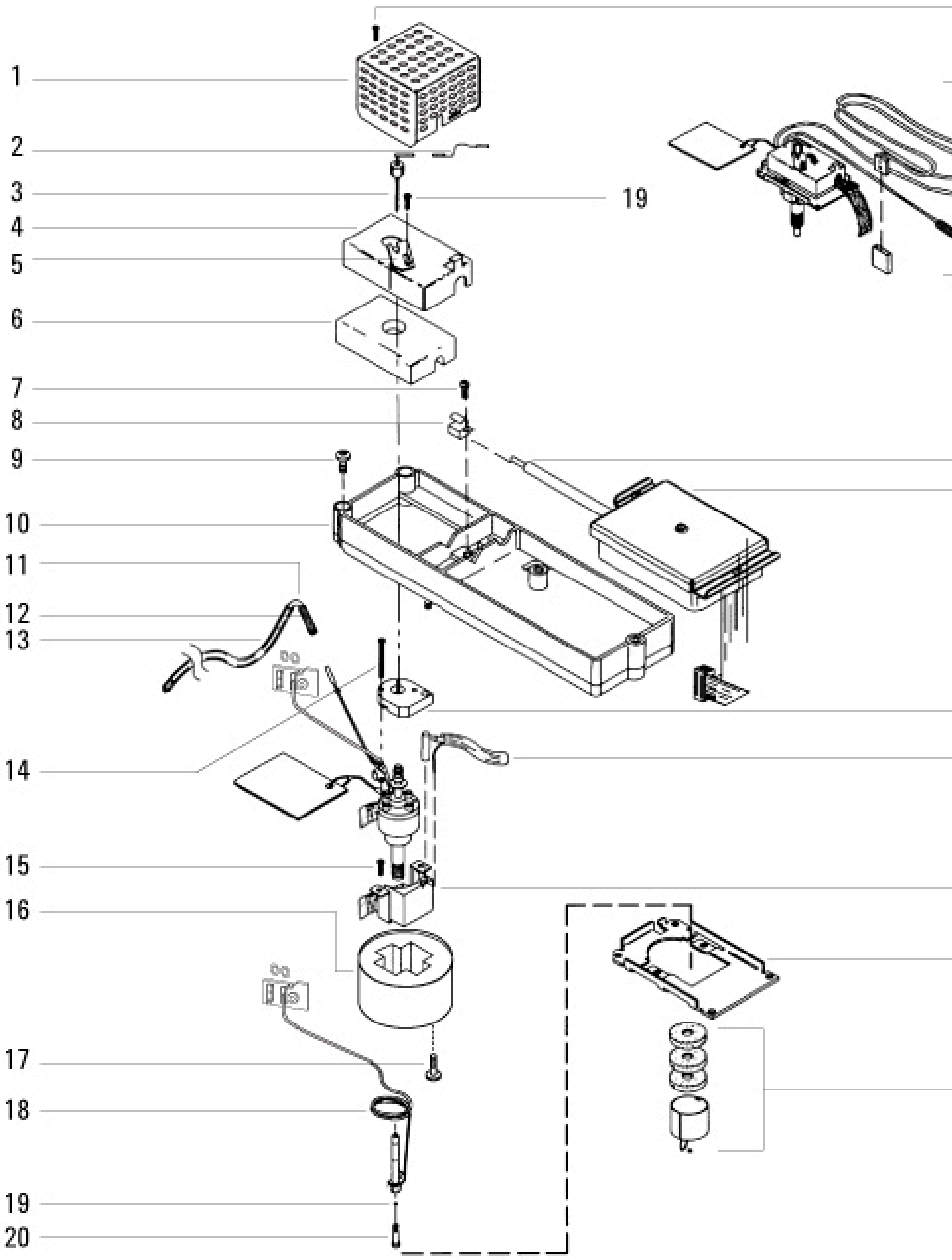
- G2397AD µECD with EPC Accessory
- G2398AD µECD with EPC Accessory for Japan

Description	Part number
µECD EPC module	G3431-60531
µECD Signal board	G3431-60020


uECD
Nameplate
uECD module
EPC module
uECD board

Microcell Electron Capture Detector (uECD)

Item	Description	Part number	Qty
1	uECD top cover	G2397-00011	1
2	uECD signal wire assembly	19233-60635	1
3	Anode/Ferrule/Nut assembly (specific license required)	G2397-60540	1
4	uECD thermal cover	G1533-00030	1
5	Thermal cover clip	19233-00095	1
6	uECD top insulation	G1533-00020	1
7	Screw, M4 × 10 mm, Torx T-20	0515-2495	1
8	Clamp, interconnect	19231-00040	1
9	Captive screw, detector pallet, M4 × 20 mm	1390-1024	4
10	FID pallet	G1531-40020	1
13	Tubing, Tygon, 30 inch	0890-0934	1
14	Screw, M4 × 45 mm, Torx T-20	0515-2484	2
15	Screw, M4 × 12 mm, Torx T-20	0515-2496	
16	ECD Insulation cup kit	G3433-00004	1
17	Screw, M4 x 40mm T-20	0515-4793	1
18	uECD make-up gas adapter weldment assembly:	G3433-63000	1
	– Fused silica indented mixing liner	G2397-20540	
	– End cap	19233-20755	
19	Ferrules, capillary columns		
20	Capillary column nut		
21	Replacement ECD Cell (general license)	G2397-60610	1
	Replacement ECD Cell (JP Labelled)	G2397-60615	
	Replacement ECD Cell (JP General)	G2398-60615	
22	uECD interconnect assembly	G1533-60510	1
NS	Screw, M4 × 10 mm, Torx T-20 to attach electrometer	0515-2495	2
23	uECD electometer without interconnect	G3433-60010	1
24	Upper heated block	G1533-20525	1
25	Heater/Sensor assembly	G1533-60625	1
26	Lower heated block	19233-20515	1
27	uECD mounting plate	G3433-60501	1
28	Nut warmer insulation and cup assembly	19234-60720	1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Consumables for the uECD

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (***www.agilent.com/chem/supplies*** (***http://www.agilent.com/chem/supplies***)">***www.agilent.com/chem/supplies*** (***http://www.agilent.com/chem/supplies***)).

uECD consumables and parts

Description	Part number
Fused silica indented mixing liner	G2397-20540
Makeup gas adapter	G3433-63000
ECD wipe test kit	18713-60050
Nut warmer insulation and cup assembly	19234-60720
Nut, 1/4-inch Swagelok adapter (10/pk)	5180-4105
Ferrule, graphitized Vespel, 1/4-inch (10/pk)	5080-8774
Capillary column blanking nut	5020-8294

Nuts, ferrules, and hardware for capillary columns

Column id	Description	Typical use	Part number
.530 mm	Ferrule, Vespel/graphite, 0.8-mm id (10/pk)	0.45-mm and 0.53-mm capillary columns	5062-3512
	Ferrule, graphite, 1.0-mm id (10/pk)	0.53-mm capillary columns	5080-8773
	Column nut, finger- tight (for 0.53-mm columns)	Connect column to inlet or detector	5020-8293
.320 mm	Ferrule, Vespel/graphite, 0.5-mm id (10/pk)	0.32-mm capillary columns	5062-3514
	Ferrule, graphite, 0.5-mm id (10/pk)	0.1-mm, 0.2- mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853
	Column nut, finger- tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.250 mm	Ferrule, Vespel/graphite, 0.4-mm id (10/pk)	0.1-mm, 0.2- mm, and 0.25- mm capillary columns	5181-3323
	Ferrule, graphite, 0.5-mm id (10/pk)	0.1-mm, 0.2- mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853
	Column nut, finger- tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.100 and .200 mm	Ferrule, Vespel/graphite, 0.37-mm id (10/pk)	0.1-mm and 0.2-mm capillary columns	5062-3516

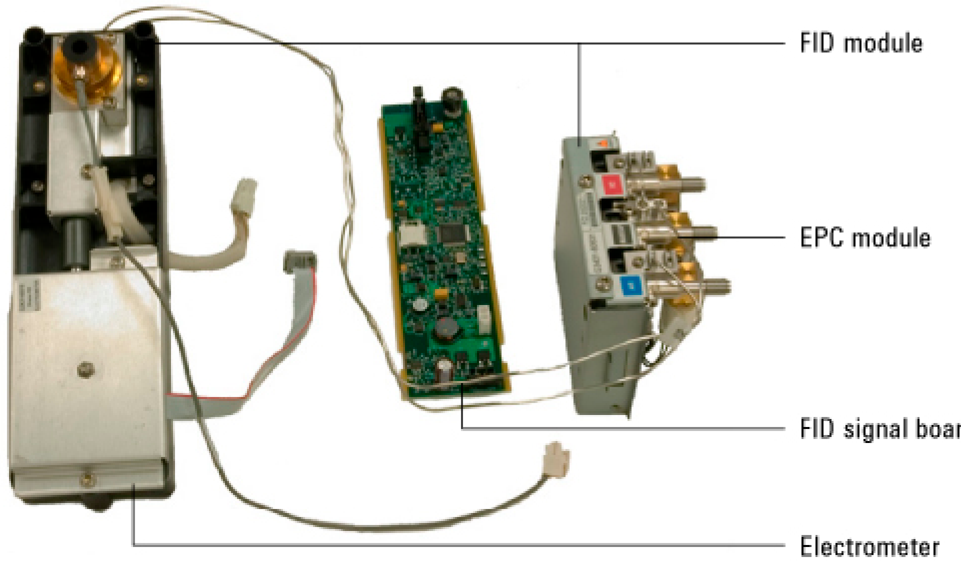
	Ferrule, Vespel/graphite, 0.4-mm id (10/pk)	0.1-mm, 0.2- mm, and 0.25- mm capillary columns	5181-3323
	Ferrule, graphite, 0.5-mm id (10/pk)	0.1-mm, 0.2- mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853
	Column nut, finger- tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
All	Ferrule, no-hole (10/pk)	Testing	5181-3308
	Capillary column blanking nut	Testing-use with any ferrule	5020-8294
	Column nut, universal (2/pk)	Connect column to inlet or detector	5181-8830
	Column cutter, ceramic wafer (4/pk)	Cutting capillary columns	5181-8836

Flame Ionization Detector (FID)

Top level subassemblies for FID detector accessories:

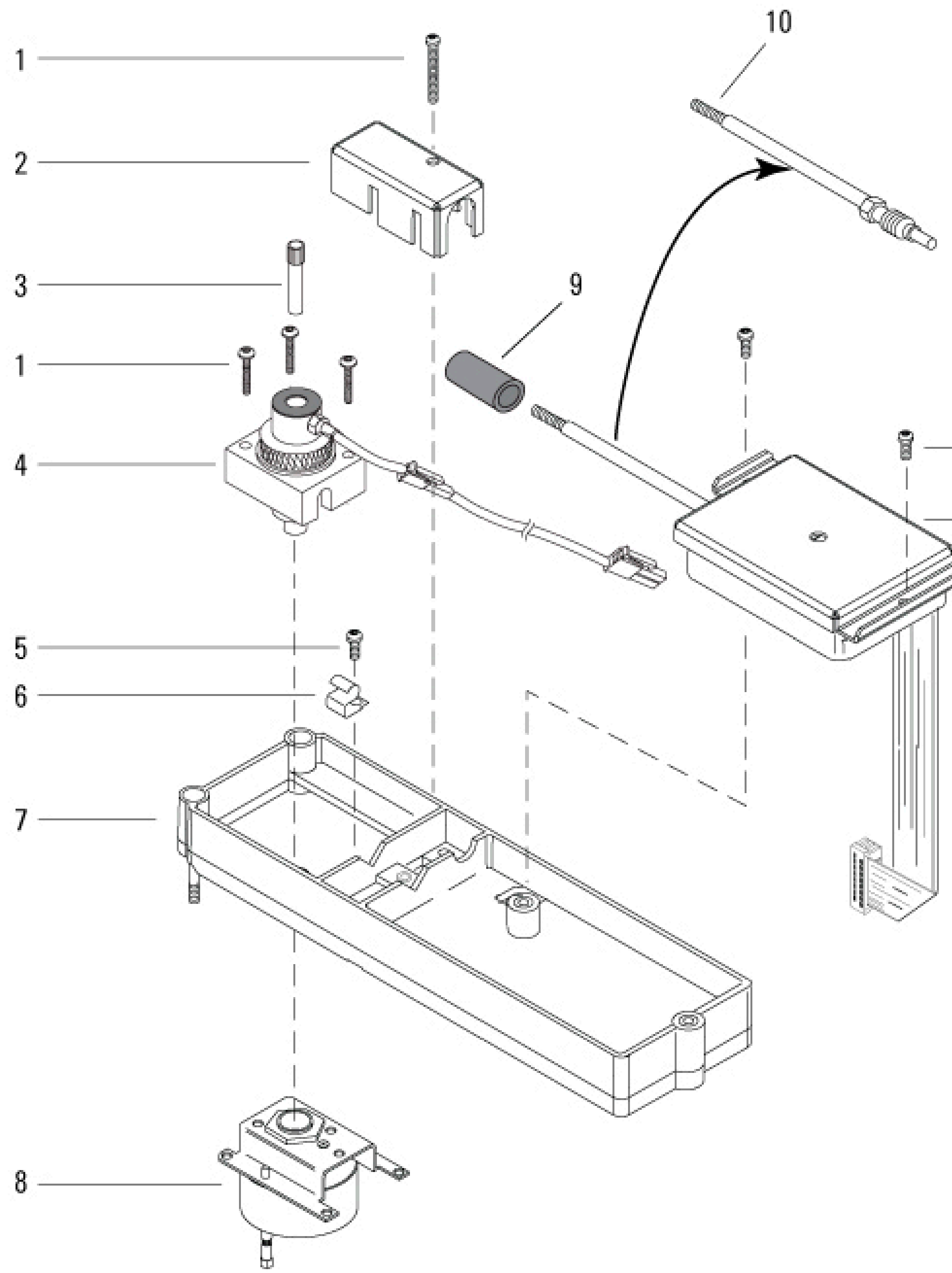
- G3461A FID with EPC, Kit adaptable to either packed or capillary columns.
- G3462A Capillary FID with EPC, Kit

Description	Part number
FID Detector Module, adaptable without ship kit	G3431-60506
FID Detector Module, capillary without ship kit	G3431-60500
FID Packed Weldment Assembly with pallet, electrometer, and base	G3431-80508
FID Capillary Weldment Assembly with pallet, electrometer, and base	G3431-80506
FID EPC Module	G3431-60531
FID Signal Board	G3431-60020



FID detector body

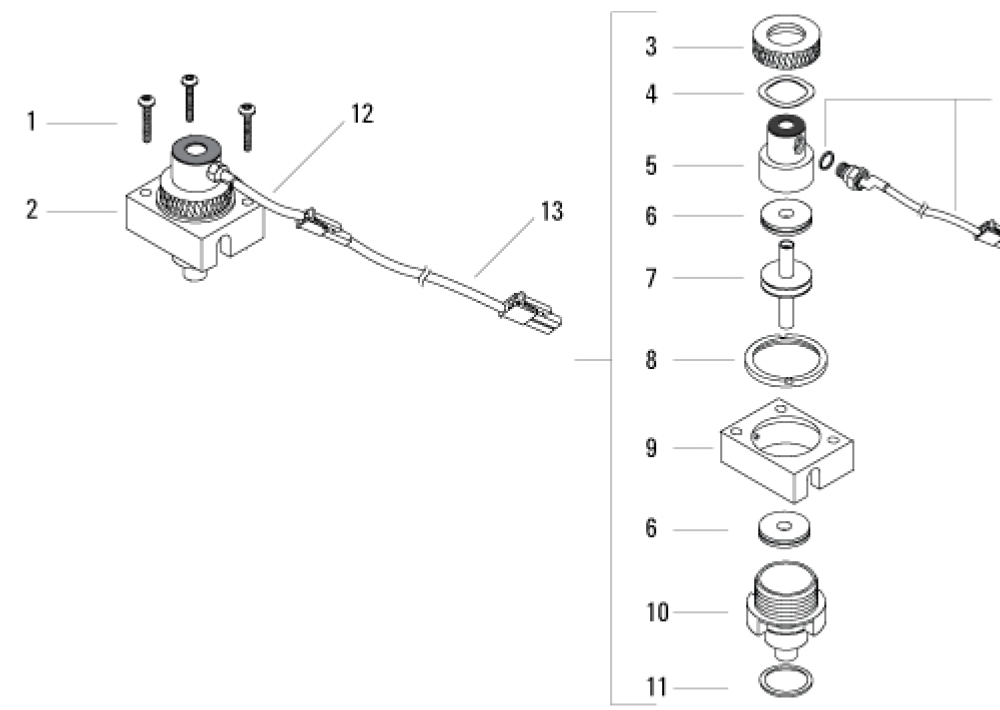
Item	Description	Part number	Qty
1	Screw, M4 × 25 mm, Torx T-20	0515-2712	4
2	FID interconnect cover	G1531-00220	1
3	PTFE chimney (optional)	19231-21050	1
4	Collector assembly	G1531-60690	1
5	Screw, M4 × 10 mm, Torx T-20	0515-2495	3
6	Interconnect J-clamp	19231-00040	1
7	Mounting pallet, FID	G1531-40020	1
8	***FID Base Assembly*** (472)		
9	Cylindrical EMI suppressor, ferrite	9170-1730	1
10	Spring, electrometer interconnect	1460-2142	1
11	FID interconnect assembly	G1531-60715	1
12	FID electrometer	G3431-60010	1



FID Collector Assembly

Item	Description	Part number	Qty
1	Screw, M4 × 25 mm, Torx T-20	0515-2712	3
2	Collector assembly	G1531-60690	1
3	Collector nut	19231-20940	1

Item	Description	Part number	Qty
4	Spring washer	3050-1246	1
5	Ignitor castle	19231-20910	1
	or optional Hastelloy component	19231-21060	1
6	Upper/lower collector insulator	G1531-20700	2
7	Collector body	G1531-20690	1
8	Spanner nut (collector)	19231-20980	1
9	Collector mount	G1531-20550	1
10	Collector housing	G1531-20740	1
11	Silicone gaskets, 0.890-inch od/0.709-inch id, 12/pk	5180-4165	1
12	Ignitor (glow plug) assembly	19231-60680	1
13	Ignitor cable assembly	G3431-60680	1



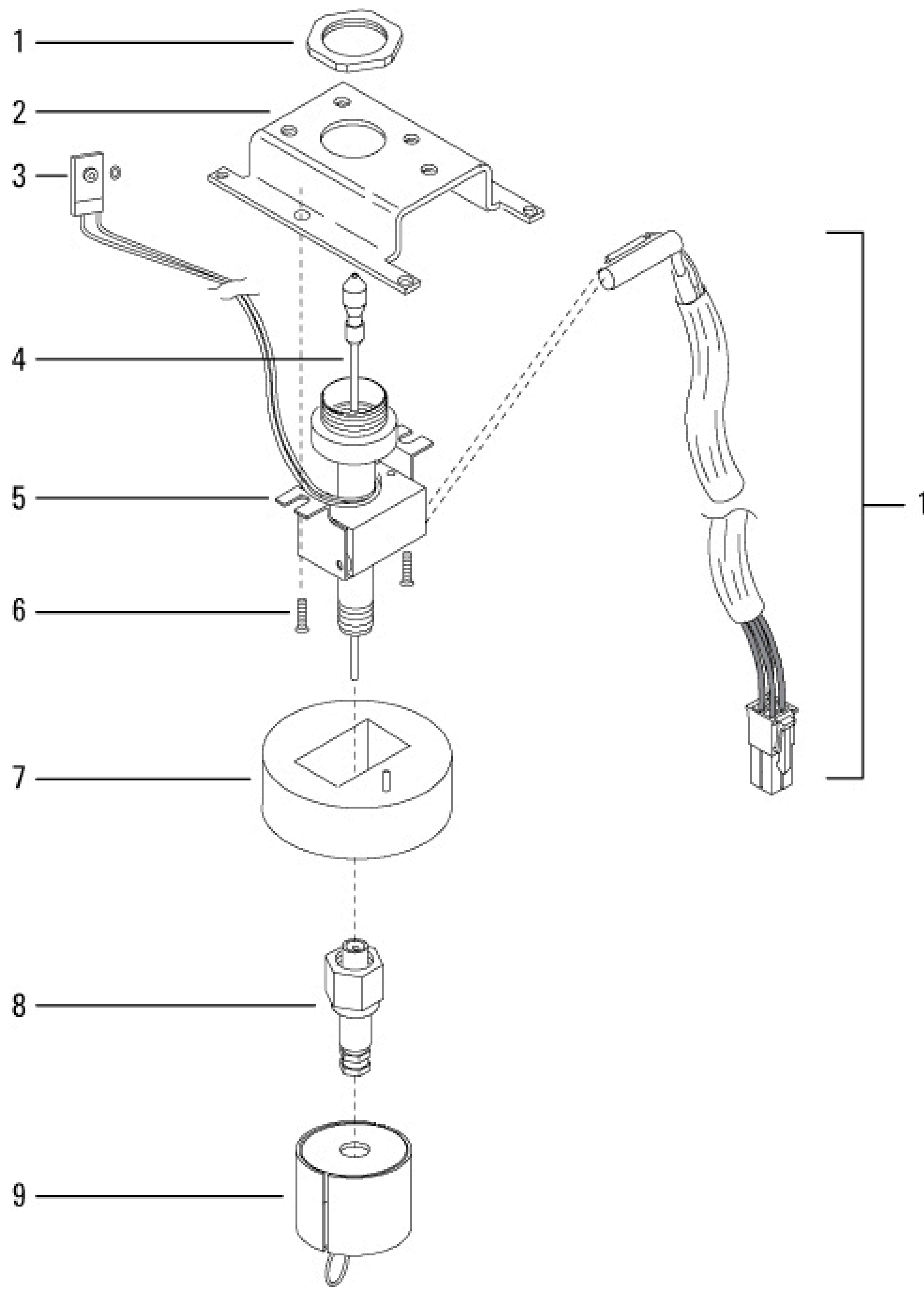
FID Base Assembly

Item	Description	Part number	Qty
1	Base spanner nut	19231-20990	1
2	Thermal strap	G1531-00105	1
3	Screw, captive, M3, T-10	G1946-20168	3
	O-ring, size 2-006, fluorocarbon, 12/pk	5180-4181	3
4	Jets: see consumables		1

Item	Description	Part number	Qty
5	Adaptable FID, base weldment with jet	G3431-80509	–
	Capillary column FID, base weldment with jet	G3431-80507	
6	Screw, M4 × 25 mm, Torx T-20	0515-2712	2
7	FID block insulation	G1531-60700	1
8	Adaptable FID column adapters:		1
	– FID/NPD capillary column	19244-80610	–
	– FID/NPD 1/8-inch packed column	19231-80520	–
	– FID/NPD 1/4-inch packed column	19231-80530	–
9	Nut warmer insulation and cup assembly (9 & 10)	19234-60720	1
10	Heater/sensor assembly	G1530-61950	1

G3431- 80509 includes jet G1531- 80560

G3431-80507 includes jet 19244-80560



Consumables for the FID

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (*www.agilent.com/chem/supplies* (*http://www.agilent.com/chem/supplies*)).

FID PM kits

Description	Part no.
Maintenance kit, FID rebuiding	G1531-67001
Maintenance kit, FID cleaning	G1531-67000

FID adapters and chimney

Description	Part no.
Screw, M4 × 25 mm, Torx T-20	0515-2712 (3/pkg)
PTFE chimney (optional)	19231-21050
Collector assembly	G1531-60690
FID/NPD capillary column adapter	19244-80610
FID/NPD 1/8-inch packed column adapter	19231-80520
FID/NPD 1/4-inch packed column adapter	19231-80530
Insulation (3/pk).	19234-60715
Insulation cup assembly	19234-60700
Nut, 1/4-inch, brass, for packed column adapters (10/pk)	5180-4105
Ferrule, Vespel, 1/4-inch, for packed column adapters (10/pk)	5080-8774

Jets for capillary adaptable fittings

Jet type	Part number	Jet tip id	Length
Capillary	**19244-80560**	0.29 mm (0.011 inch)	61.5 mm
Capillary, high- temperature (use with simulated distillation)	**19244-80620**	0.47 mm (0.018 inch)	61.5 mm
Packed	**18710-20119**	0.46 mm (0.018 inch)	63.6 mm
Packed, wide-bore (use with high-bleed applications)	**18789-80070**	0.76 mm (0.030 inch)	63.6 mm

Jets for capillary optimized fittings

Jet type	Part number	Jet tip ID	Length
Capillary	**G1531-80560**	0.29 mm (0.011 inch)	48 mm
High-temperature (use with simulated distillation)	**G1531-80620**	0.47 mm (0.018 inch)	48-mm

7890A EPC modules

This is a quick reference to the EPC- related part numbers. For a full description of the modules, see the EPC modules section in this document.

Valves require 2 O- rings each (5180- 4181, 12/pk).

Inlet modules

EPC modules

Description	Part number	O-rings	Slot
COC	G3454-60554	3	1 or 2
PP	G3451-60551	3	1 or 2
PTV	G3500-60500	3	1 or 2
S/SL 100 PSI	G3452-60552	3	1 or 2
S/SL 150 PSI	G3452-60510	3	1 or 2
VI	G3504-60501	4	1 or 2

Proportional valves

Description	Carrier	Septum purge	Split vent
COC	G3431-60508	G3431-60509	
PP	G3431-60508	G3431-60509	
PTV	G3431-60508	G3431-60509	G3430-60527
S/SL 100 PSI	G3431-60508	G3431-60509	G3430-60527
S/SL 150 PSI	G3431-60508	G3431-60509	G3430-60527
VI	G3431-60508	G3431-60509	G3430-60527

Detector modules

EPC modules

Description	Part number	Slot
uECD	G3433-60533	3 or 4
FID	G3431-60531	3 or 4

FPD	G3435-60535	3 or 4
NPD	G3434-60502	3 or 4
TCD	G3432-60532	3 or 4 or AUX Det 2

Proportional valves

Description	Air	Makeup	Hydrogen	Reference
uECD		G3431-60508		
FID	G3431-60508	G3431-60509	G3431-60509	
FPD	G3431-60508	G3431-60508	G3431-60508	
NPD	G3431-60508	G3431-60509	G3431-60509	
TCD		G3431-60508		G3431-60508

PCM modules

EPC module

Description	Part number	O-rings	Slot
PCM	G3476-60501	3	1, 2, 5, or 6

Proportional valves

Description	Carrier	AUX
PCM	G3431-60508	G3430-60528

Auxiliary pressure controllers

EPC module

Description	Part number	Slot
AUX	G3470-60501	5 or 6 or AUX

Proportional valves

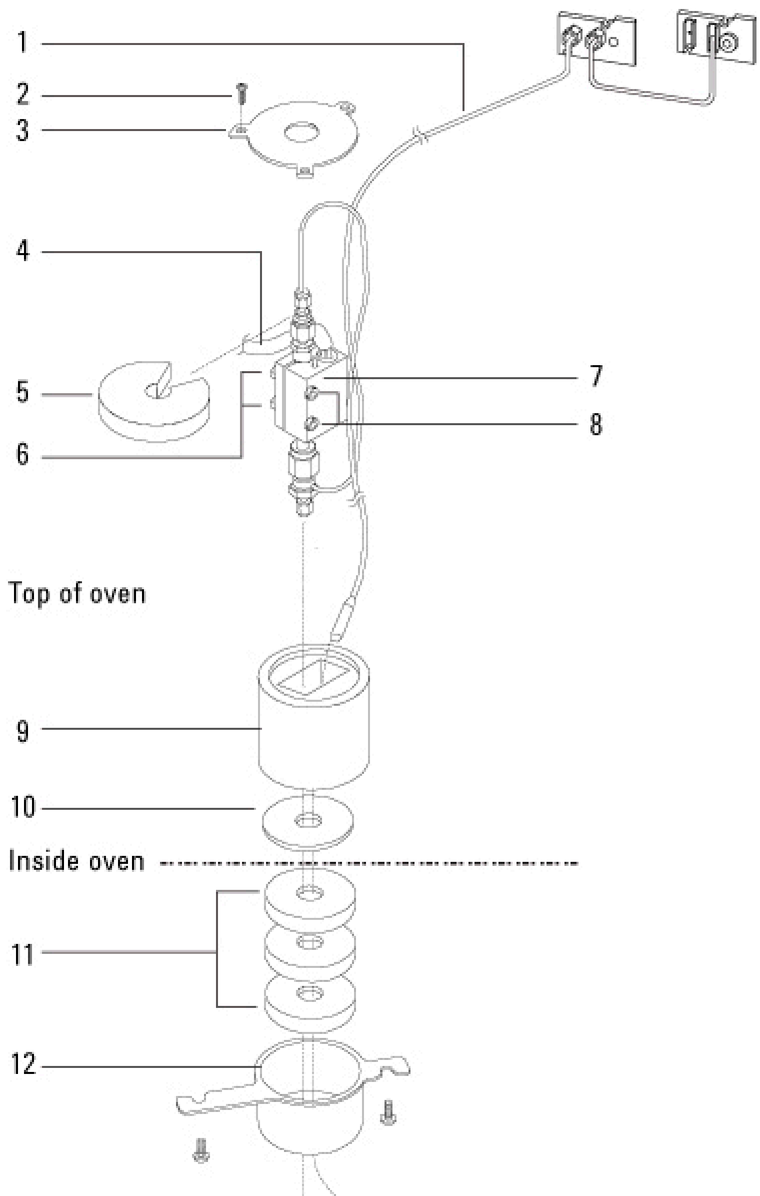
Description	Air	Makeup	Hydrogen
AUX	G3431-60508	G3431-60508	G3431-60508

Nickel catalyst accessory

Top level subassemblies for FID detector accessories:

- G3478A Nickel Catalyst Kit
- G3440- 60512 Nickel Catalyst Kit without ship kit

Item	Description	Part number	Qty
	Nickel catalyst assembly (items 2 through 8)	G3440-63002	1
1	Nickel catalyst hydrogen mix weldment	G1580-80500	1
NS	Screw,		
2	Screw, M4 x 12 mm, captive	0515-2711	3
3	Top cover plate	G1543-00085	1
4	Heater/sensor assembly	G1580-61160	1
5	Top insulation	G1543-00100	1
6	Nut, hex, with lockwasher	0535-0043	2
7	Heater block	08900-20835	1
8	Screw, socket M4 × 20 mm	0515-0038	2
9	PP base insulation	G1543-00030	1
10	PP bottom insulation	G1543-00070	1
11	Nutwarmer insulation	19234-60715	3
12	Nutwarmer cup	19234-60700	1

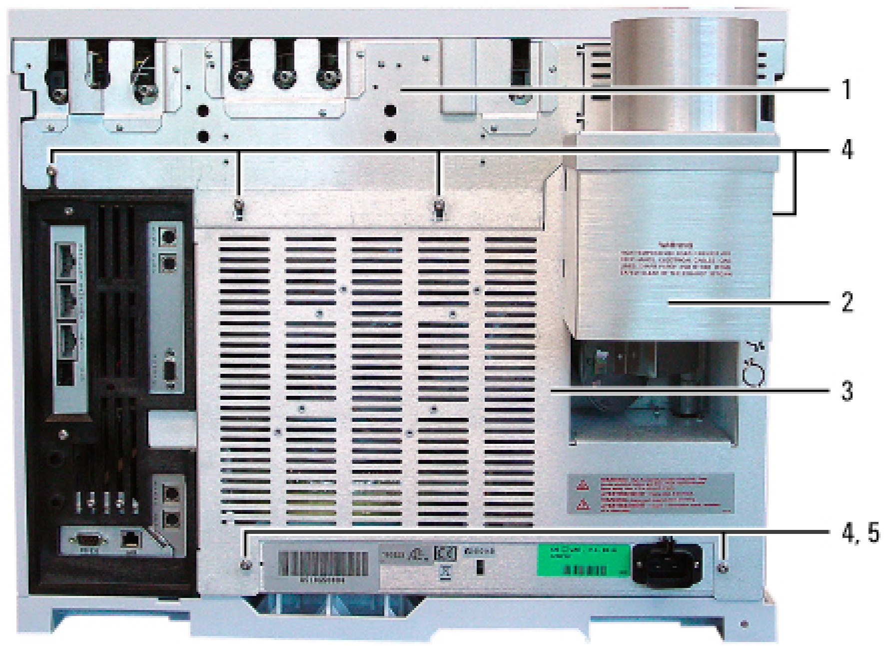


7890A Covers

Back covers

Item	Description	Part number	Qty
1	Cover, back upper	G3430-00090	1

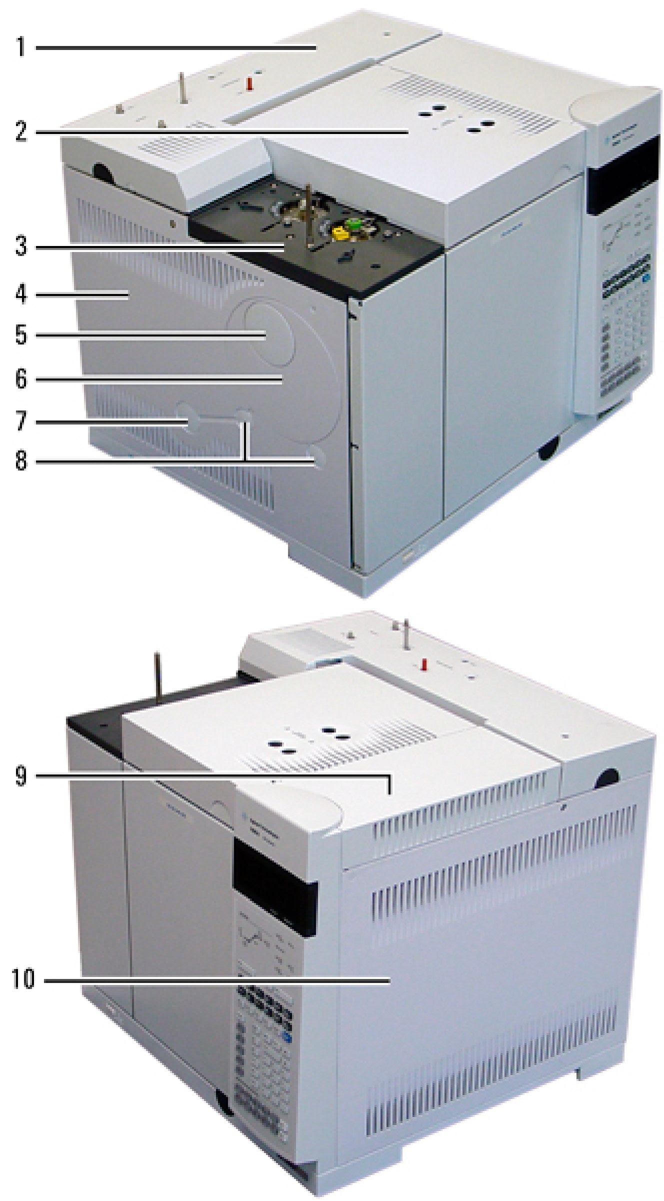
2	Oven exhaust deflector (optional)	G1530-80650	1
3	Cover, back lower	G3430-00023	1
4	Screw, M4 × 12 mm, T-20	0515-2496	6
5	Lock washer, No. 8, 0.168 in.	2190-0409	2



7890A Plastic covers

Item	Description	Part number	Qty
1	Pneumatics cover	G3430-60546	1
2	Detector cover	G3430-40007	1
3	Inlet cover (7 screws to attach to inlet carrier)	G3430-60540	1
4	Cover, left side with plugs	G3430-60541	1
5	3-inch hole plug	5040-4641	1
6	Rotating insert	G3430-40024	1
7	1 1/2-inch hole plug	5040-4643	1
8	1-inch hole plug	5040-4642	2
NS	Button, replacement for pneumatics cover	future	
NS	Detector cover, single FPD	G3435-80500	

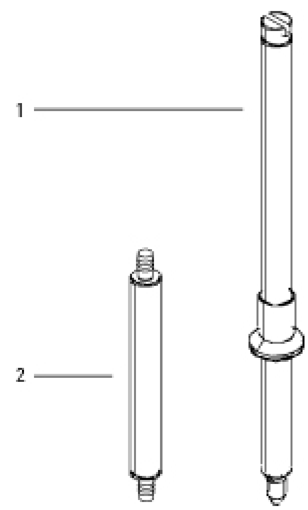
NS	Detector cover, dual FPD	G3435-80501	
NS	Detector cover, headspace	G3430-60017	
NS	Screw, Captive M4 × 12 mm, T-20	1390-1023	5
NS	Screw, M4 × 12 mm, T-20	0515-2496	3
NS	Screw, M4, T-20	1390-1024	1



	Description	Part no.	Qty.
9	Electronics top cover (1 screw to attach)	G3430-60543	1
19	Cover, right side (1 screw to attach)	G3430-60542	1
NS	Screw, Captive M4 × 12 mm, T-20	1390-1023	2
NS	Electronics top cover for FPD	G3435-60503	

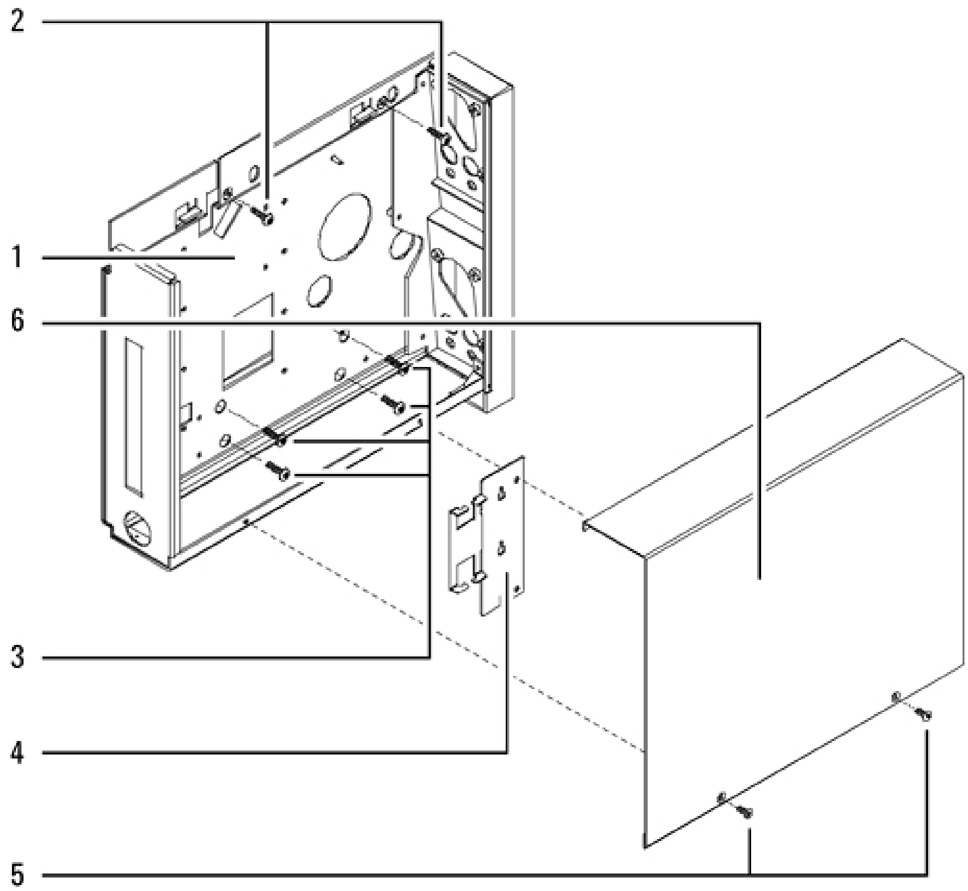
Auto-injector mounting and parking posts

Item	Description	Part number	Qty
1	Injector mounting post	G4513-20562	2
2	Parking post, dual purpose	05890-61525	2



7890A TCD side carrier

	Description	Part no.	Q
1	Pneumatic carrier assembly	G1530-60950	1
2	Screw, M4 × 25 mm, Torx T-20	05152712	2
3	Screw, M4 × 12 mm, Torx T-20	05152496	4
4	Chemical trap bracket	0589000810	1
5	Screw, M4 ×10 mm, Torx T-20, flathead	05152725	2
6	Flow side cover	G153001240	1



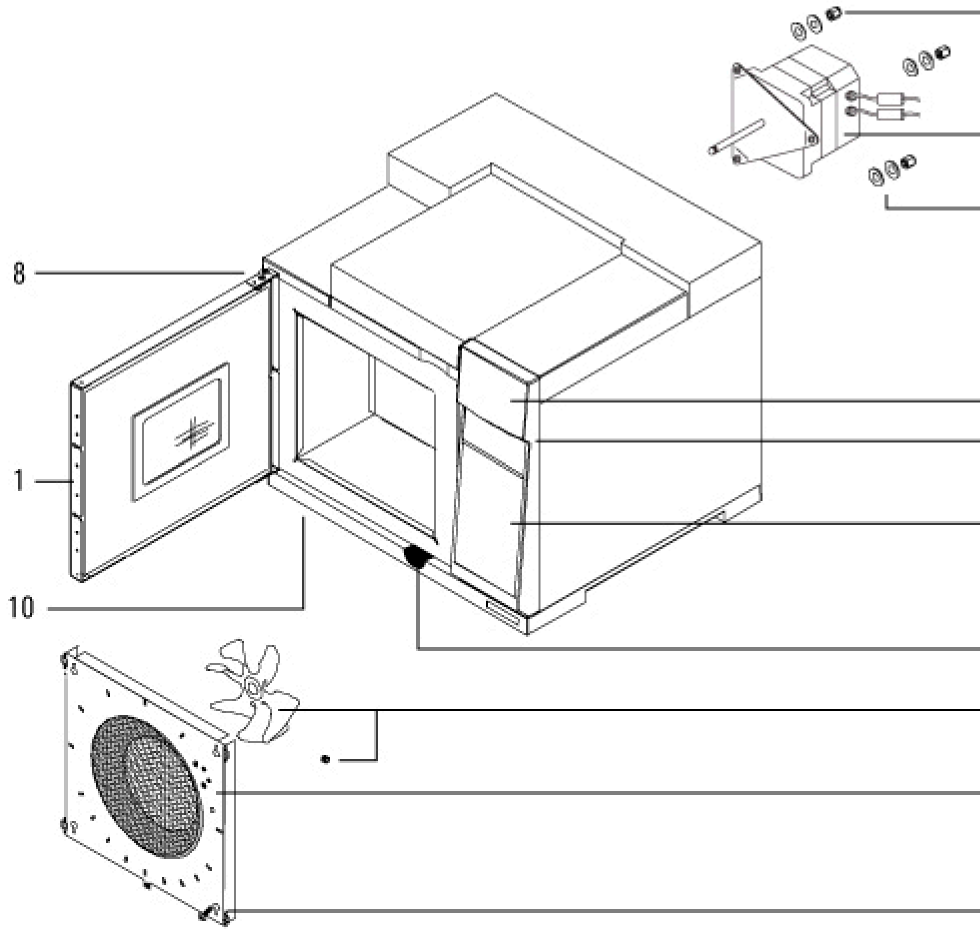
7890A Oven

This section contains illustrated parts breakdowns for the following 7890A GC components:

- Oven
- Oven flapper assembly
- CO_2 cryogenic cooling
- Liquid nitrogen cryogenic cooling

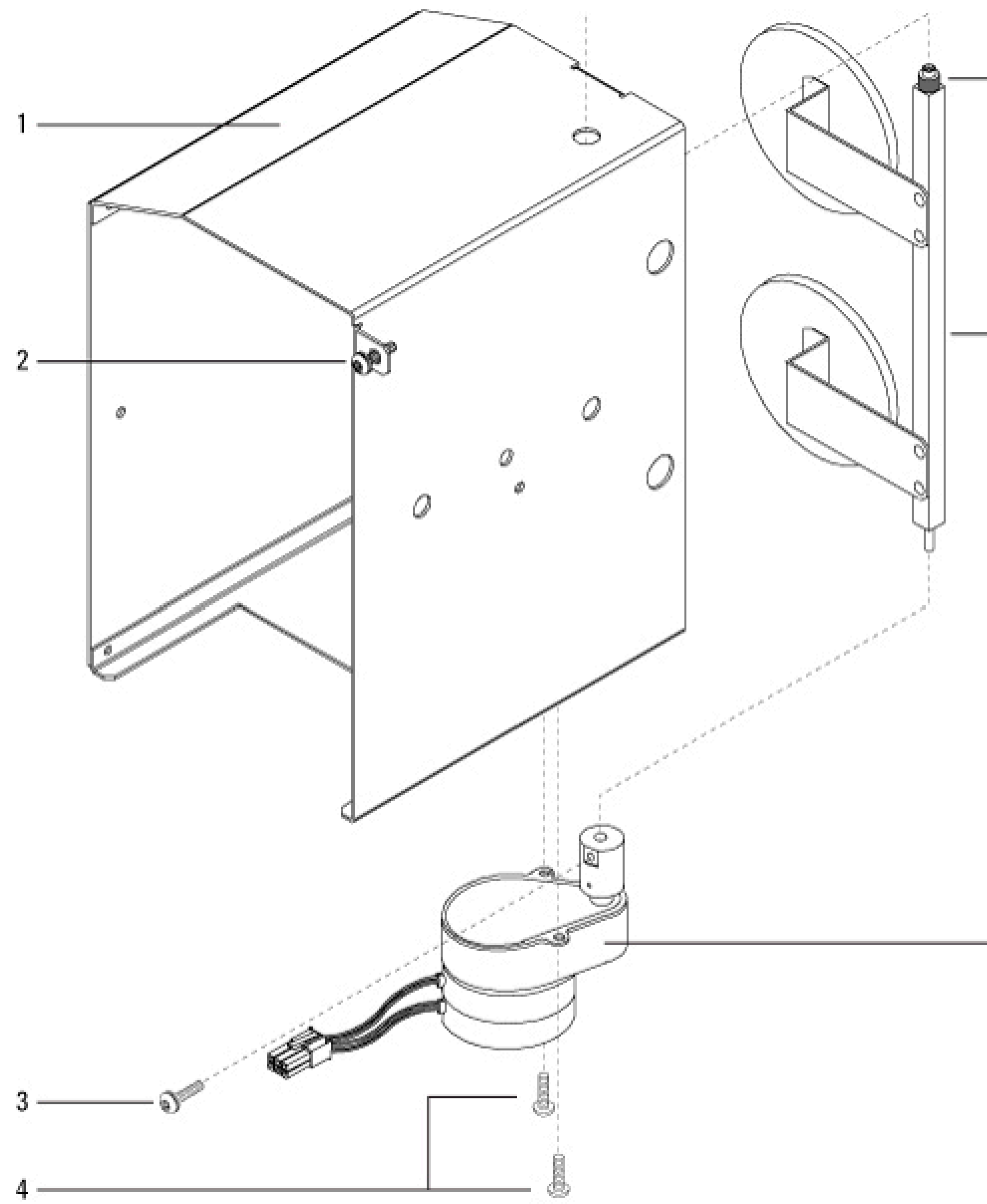
7890A Oven assembly

Item	Description	Part number	Qty
1	Oven door	G3430-60502	1
7	Button, oven door	G3430-80513	1
2	Fan blade, stainless steel, and set screw	05890-80270	1
3	Oven heater shroud assemblies:		1
	–120V USA power	G1530-61610	
	–200V Japan power	G1530-61620	
	–220V Single phase power, Europe, and –208V USA power, single phase	G1530-61630	
	–220V Single phase power, Hong Kong	G1530-61630	
	–220V Single phase power, China	G1530-61630	
	–220V China power, slow ramp	G1530-61230	
	–220V Israel power	G1530-61630	
	–230V Single phase power, Switzerland, 10 amp	G1530-61670	
	–230V Denmark power, 10 amp	G1530-61670	
	–230V Denmark/Switzerland power, 16 amp	G1530-61650	
	–230V Continental Europe power	G1530-61650	
	–240V Australia power	G1530-61640	
	–240V South Africa/India power	G1530-61640	
	–240V Great Britain/Ireland power	G1530-61640	
	–240V USA power	G1530-61640	
	–240V Australia power, slow ramp	G1530-61640	
4	Screw, M4, Torx T-20, chrome plated	0515-2711	4
5	Hex nut	0535-0043	3
6	Washer	2190-0712	6
7	Oven door button	G3430-80513	1
8	Door hinge		1
9	Motor, oven fan	G3430-60504	1
10	On/Off switch	G3430-40023	1
11	Keyboard bezel assembly	G3430-60511	1
12	Keyboard display 4 × 20 UF	G1530-80000	1
13	Keyboard window bezel	G1530-61320	1



7890A Oven flapper assembly

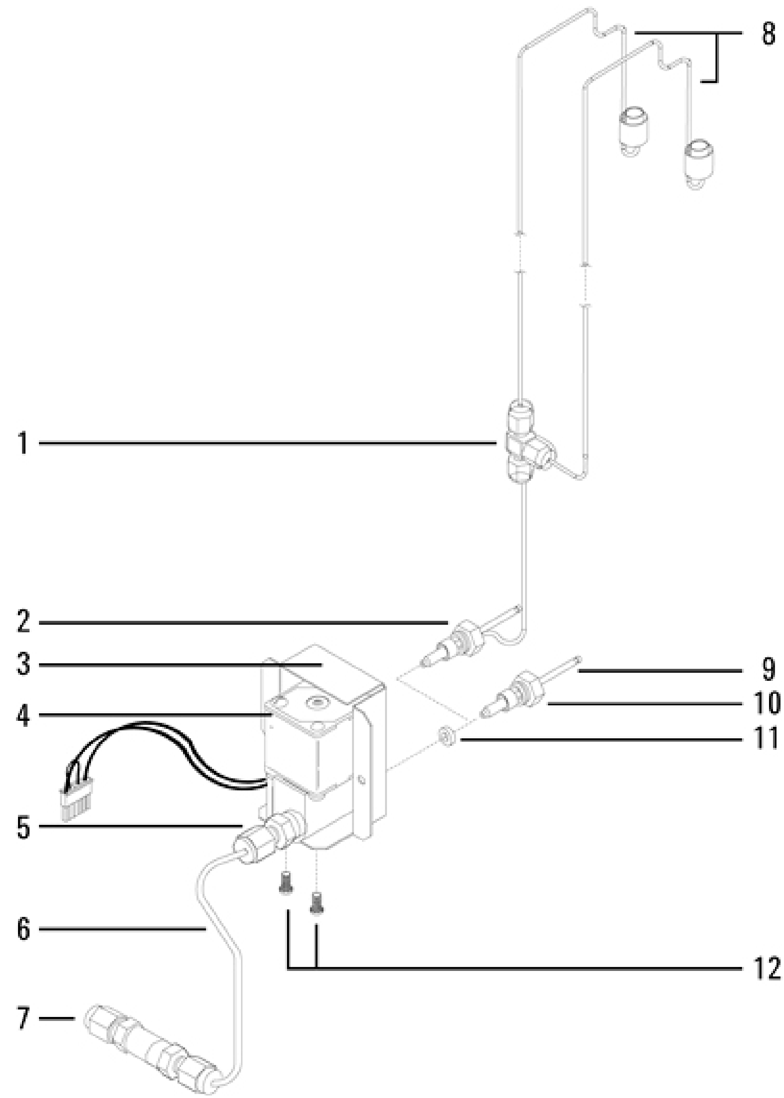
Item	Description	Part number	Qty
NS	Oven exhaust duct and flapper assembly (includes 3 captured screws 1390-1023)	G3430-60008	1
1	Dual duct assembly	G3430-81001	1
6	Flapper shaft assembly	G3430--81002	1
5	Flapper bushing	G1530-20550	1
7	Stepper motor assembly	G1530-60945	1
3	Screw, Torx T-20, M4 x 12 mm (to attach motor to shaft)	0515-2496	1
4	Screw, Torx T-10, M3 × 8 mm (to attach motor to duct)	0515-0655	2
2	Screw, Torx T-10, M3 × 8 mm (to attach duct to oven)	1390-1023	3



7890A CO2 cryogenic cooling

Item	Description	Part number	Qty
1	Tee, brass	0100-0090	1
2	CO_2 blast brazement (Cryoblast)	G1535-80550	1
3	Cryo bracket	G1565-00010	1
4	CO_2 cryo valve	G1565-60545	1

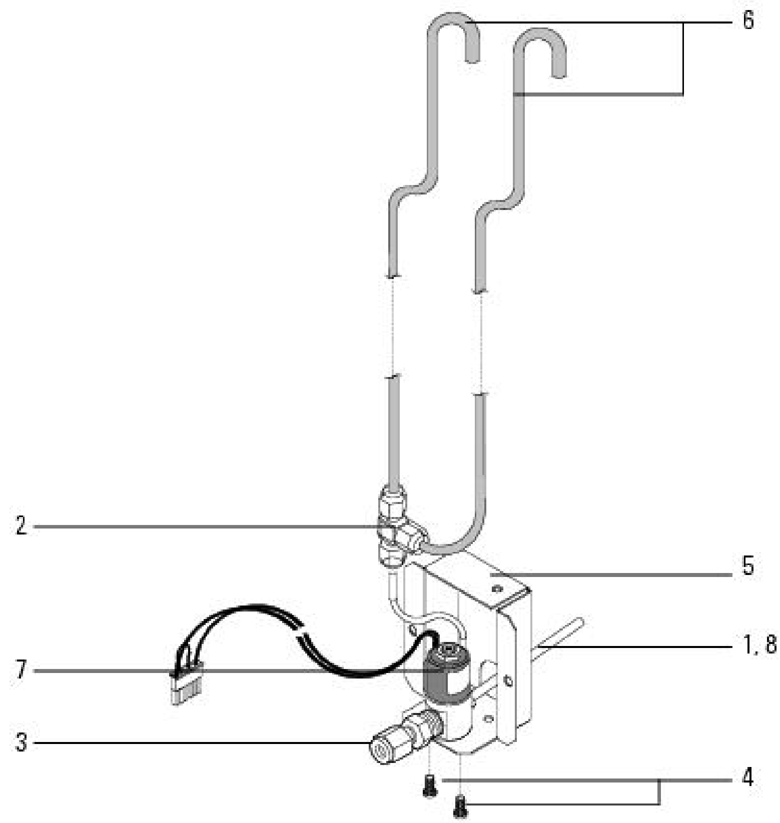
5	1/8-inch male connector without O-ring	G1543-80025	1
6	CO_2 inlet tube	G1565-20600	1
7	CO_2 cryo inline filter	3150-0602	1
8	Cryoblast restrictor weldment	G1565-80590	1
9	CO_2 weldment (oven cryo)	G1565-80505	1
10	Clamp screw	G1565-20560	1
11	Gland seal, CO_2	G1565-20590	1
12	Screw, 8-32, .312-inch	2510-0043	2
NS	Screw Torx T-20, M4 × 12 mm	0515-2496	2
NS	Teflon seal	G1565-20840	1
NS	CO_2 cryogenic kit	G1565-65510	–
NS	CO_2 cryo blast kit	G1565-65520	–
NS	CO_2 cryo valve/dual blast assembly	G1565-65521	-*



7890A Liquid nitrogen cryogenic cooling

Item	Description	Part nunmer	Qty
1	N_2 blast brazement	G1566-80535	1
2	Tee, brass	0100-0090	1
3	Connector, male	0100-0208	1
4	Screw, 8-32, .312-inch	2510-0043	2
5	Cryo bracket	G1565-00010	1
6	N_2 restrictor tube	G1566-20575	2
7	N_2 cryo valve	G1566-60557	1

8	Liquid N_2 nozzle	19310-20500	1
NS	Screw Torx T-20, M4 × 12 mm	0515-2496	2
NS	Tape, industrial	0460-0016	
NS	N_2 cryo blast	G1566-65507	
NS	N_2 cryo valve/dual blast assembly	G1566-65508	
NS	N_2 cryogenic kit	G1566-65517	



7890A Valves

Top level subassemblies for Valve accessories:

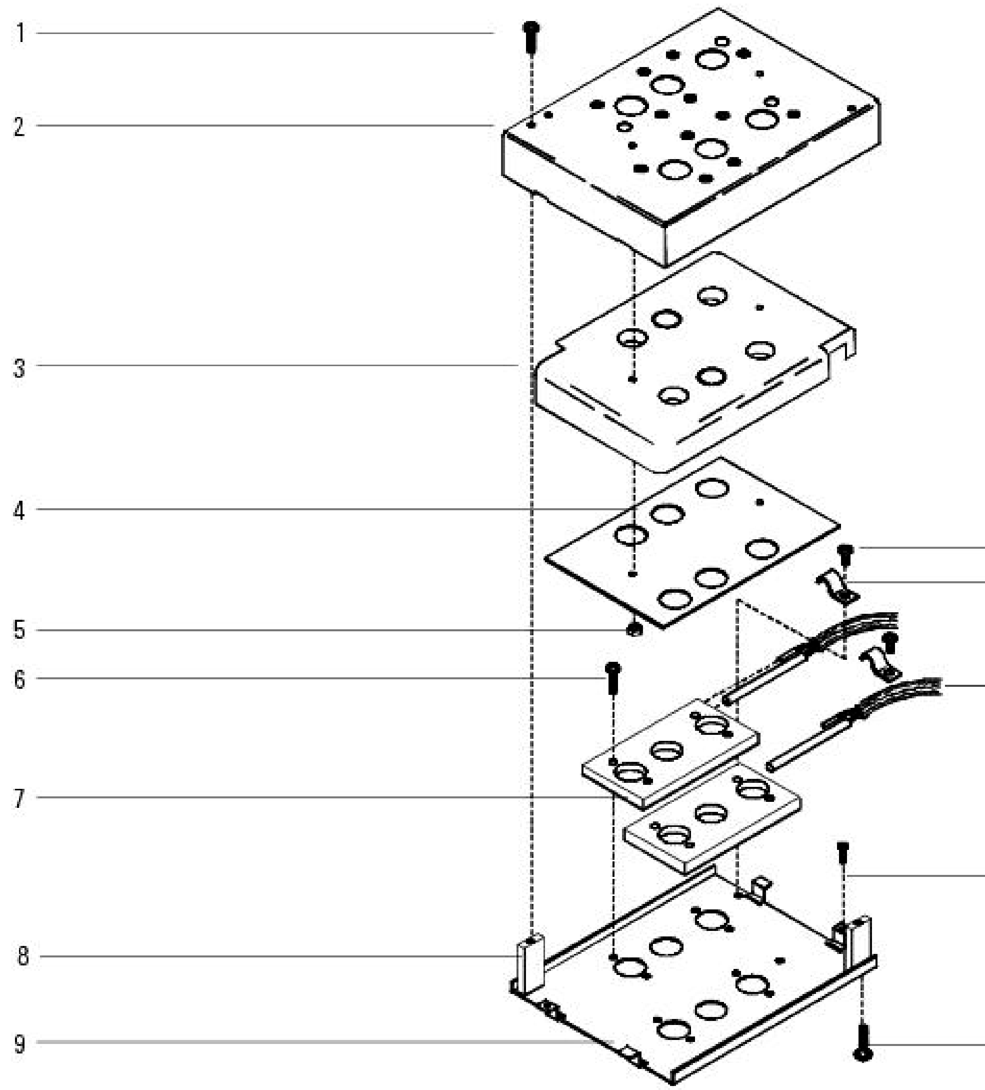
- G1580A Valve box for one valve, Option 751
- G1581A Valve box for two valves, Option 752

This section contains illustrated parts breakdowns for the following 7890 GC valves and related components. In general, the valve parts are the same for both 6890 and 7890A GCs.

- Valve Box Assembly
- Valve Driver Assembly
- Valve Actuator Assembly
- Valco W- series Minivalve

7890A Valve box assembly

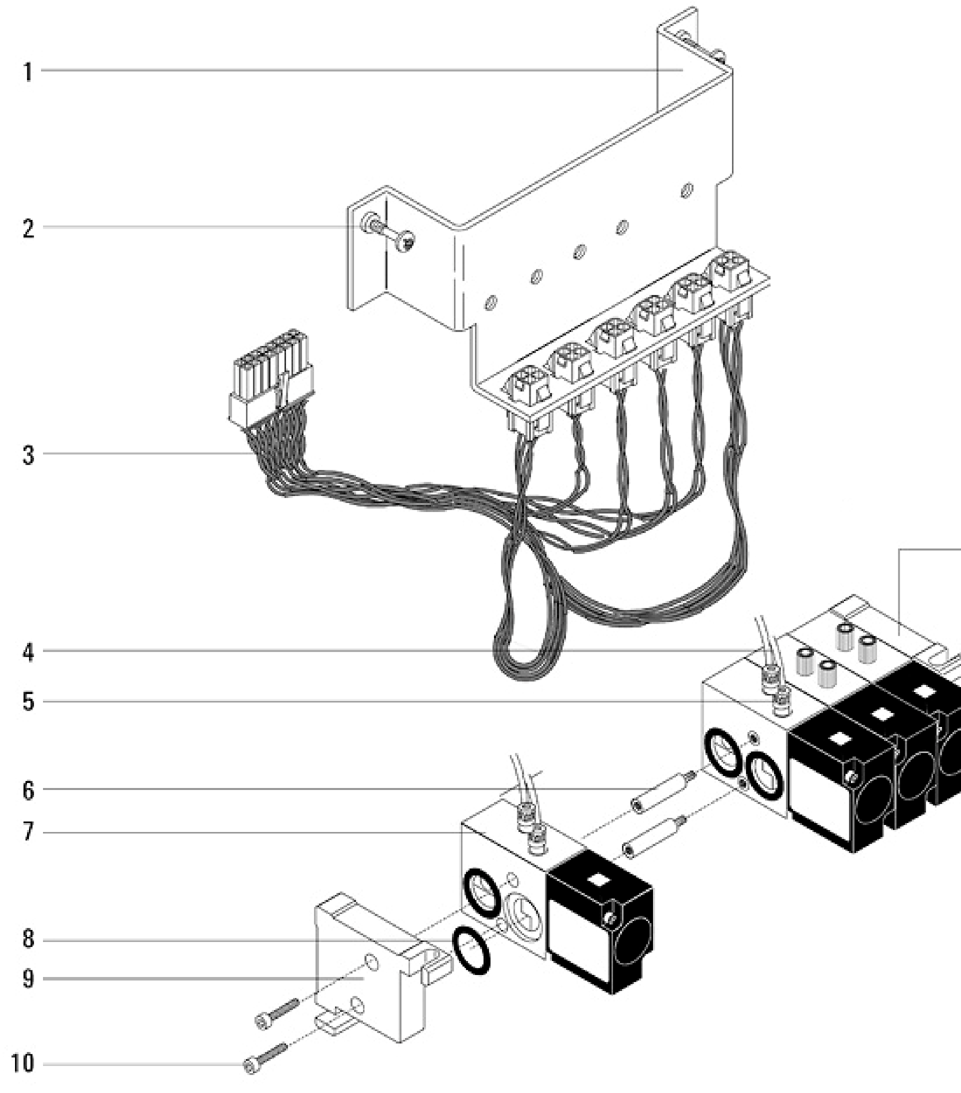
Item	Description	Part number	Qty
1	Screw, M4 × 8 mm, Torx T-20, chromeplated	0515-2711	6
2	Valve box cover	G1580-00030	1
3	Valve box insulation, top	G1580-00050	1
4	Insulation retainer plate	G1580-00040	1
5	Hex nut, insulation plate	0535-0025	2
6	Screw, M3 × 30 mm, Torx T-10, chromeplated	0515-2525	4
7	Heater block	G1580-20520	1 or 2
8	Standoff, valve box	G1580-20500	2
9	Valve box bottom plate	G1580-00010	1
10	Screw, M3 × 8 mm, Torx T-10, chromeplated	0515-2726	2
11	Heater/Sensor harness cable clamp	1400-0015	2
12	Heater/Sensor assembly	G1580-61140	2
NS	Cable-tie strap	1400-0249	4
NS	Aluminum tube (split/splitless inlet only)	18900-20320	1
NS	In-line filter (sample in line)	0101-0532	1



7890A Valve driver assembly

Item	Description	Part number	Qty
1	Valve driver bracket	G1580-00070	1
2	Captured screw, M4 × 12 mm, Torx T-20	1390-1023	2
3	Valve driver wiring harness	G1530-60660	1
4	Pneumatic tubing, 1/8-inch OD, Teflon	0890-0746	8
5	Adapter fitting, 10-32 × 1/16-inch hose barb	0100-1205	8
6	Standoff (included with valves)		8

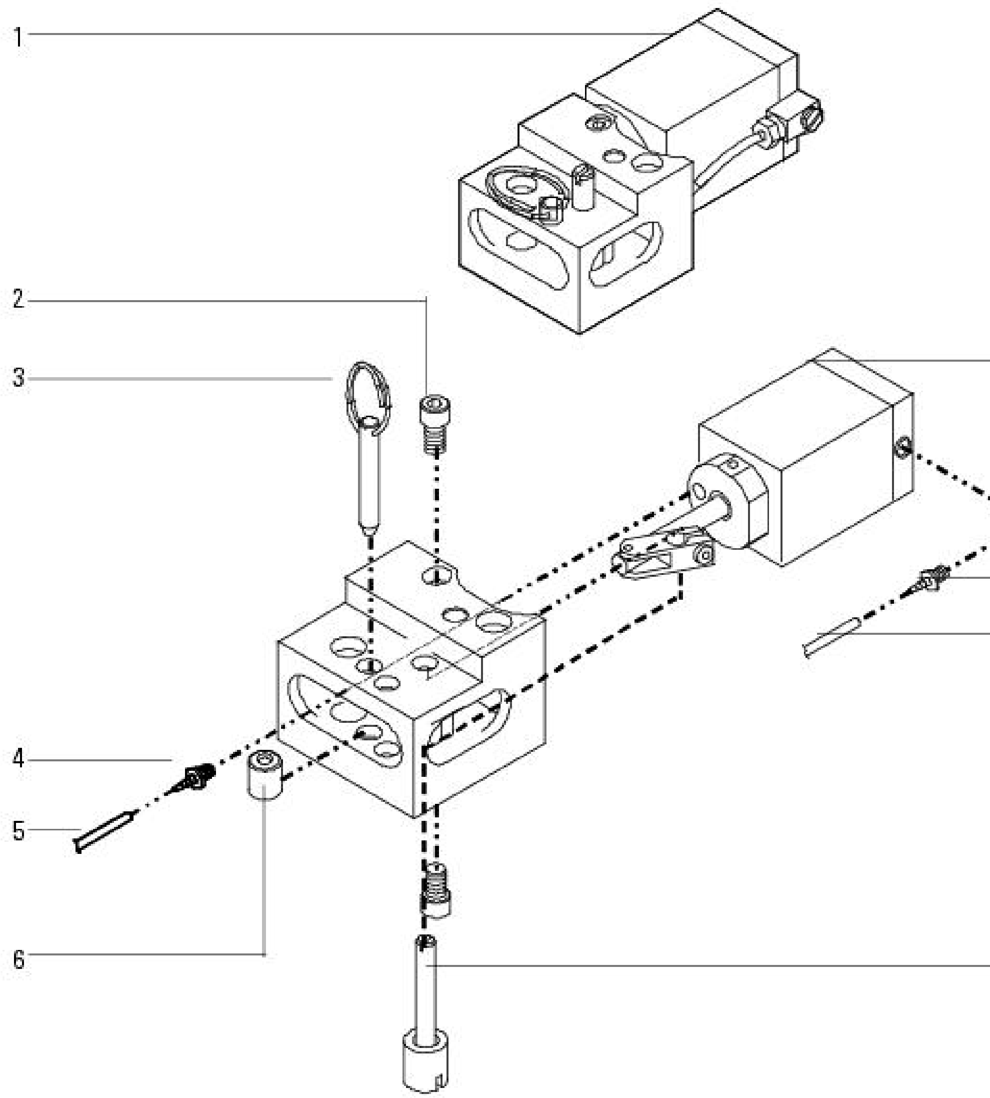
7	4-way Solenoid valves	G1580-61095	4
8	O-ring (with valves and end plate kit)		10
9	Solenoid valve end plate kit	05890-61097	1
10	Screw, socket head	0515-1214	2
11	Elbow fitting, 1/4-inch, male	0100-1632	2
12	Exhaust tubing, 1/4-inch od, 120 inch	0890-1489	1
NS	Heater cable assembly	G1530-60790	1



7890A Valve actuator assembly (1 of 2)

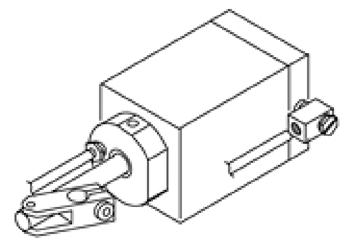
	Description	Part number	Qty
1	Valve actuator assembly	19325-60660	1
2	Modified screw	19325-80030	2
3	Quick-release pin	1480-0632	1

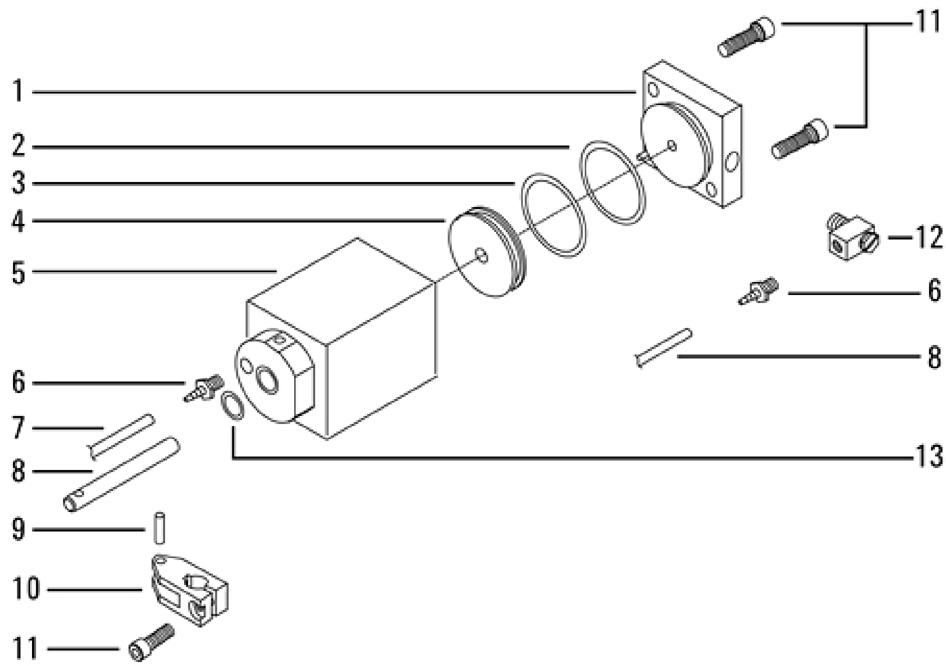
4	1/8-inch hose fitting, 10-32 × 1/16-inch id, hose barb	0100-1205	2
5	Teflon tubing 1/8-inch od, order by the inch; 42 inches per actuator	0890-0746	
6	36° Actuator limiter	18900-21000	1
7	End cap	19325-20680	1
8	Elbow fitting, 10-32	0100-1220	1
9	Coupler/Shaft assembly	G1580-60640	1
NS	Hex key, 3 mm	8710-0911	



7890A Valve actuator assembly (2 of 2)

Item	Description	Part number	Qty
1	Cylinder end cap	19325-20680	1
2	O-ring, 1.176-inch id	0905-1405	1
3	O-ring, 1.046-inch id	0905-0463	1
4	Piston	19325-20640	2
5	Actuator cylinder	19325-20630	1
6	Hose fitting	0100-1205	2
7	Teflon tubing, 1/8-inch x 42 inch	0890-0746	1
8	Piston rod	19325-20650	1
9	Dowel pin	1480-0017	1
10	Link	19325-80010	1
11	Screw, socket head, M4 x 8 mm	0515-0153	3
12	Elbow fitting	0100-1220	1

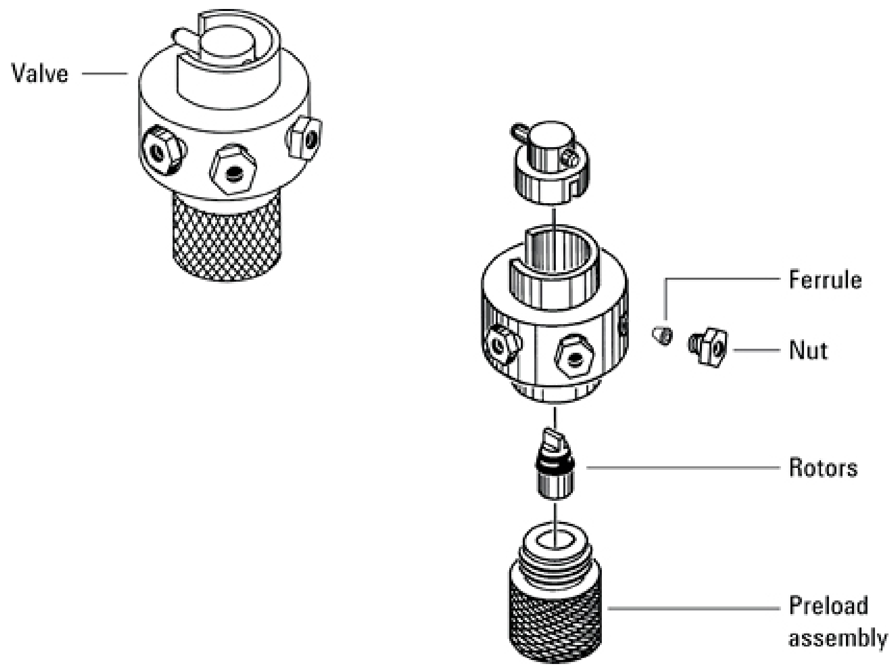




7890A Valco W-series minivalve

Item	Description	Part number
1	Valve	
	Gas sampling valves	
	– 6-port valve (225 °C max)	5062-9508
	– 6-port valve (350 °C max)	0101-0584
	– 6-port valve (Hastelloy, 225 °C max)	5062-9509
	– 10-port valve (225 °C max)	5062-9510
	– 10-port valve (350 °C max)	0101-0585
	– 10-port valve (Hastelloy, 225 °C max)	5062-9511

	Liquid sampling valves	
	– 4-port valve (internal sample injector) (0.2 µl, 1000 psi, Option 850)	0101-0636
	– 4-port valve (internal sample injector) (0.5 µl, 1000 psi, Option 852)	0101-0637
	– 4-port valve (internal sample injector) (1.0 µl, 1000 psi, Option 854)	0101-0638
	– 4-port valve (internal sample injector) (0.5 µl, 5000 psi, Option 856)	0101-0639
2	Ferrule	0100-1022
3	Nut	0100-0791
4	Rotors:	
	General purpose valve rotors	
	– 6-port valve (225 °C max)	5181-7459
	– 10-port valve (225 °C max)	5181-7460
	– 6-port valve (350 °C max)	1535-4952
	– 10-port valve (350 °C max)	1535-4954
	Standard pressure liquid sample valve rotors	
	– 0.2 µl 4-port (1000 psig max)	5062-3563
	– 0.5 µl 4-port (1000 psig max)	5062-3562
	– 1.0 µl 4-port (1000 psig max)	5062-3559



7890A Electrical

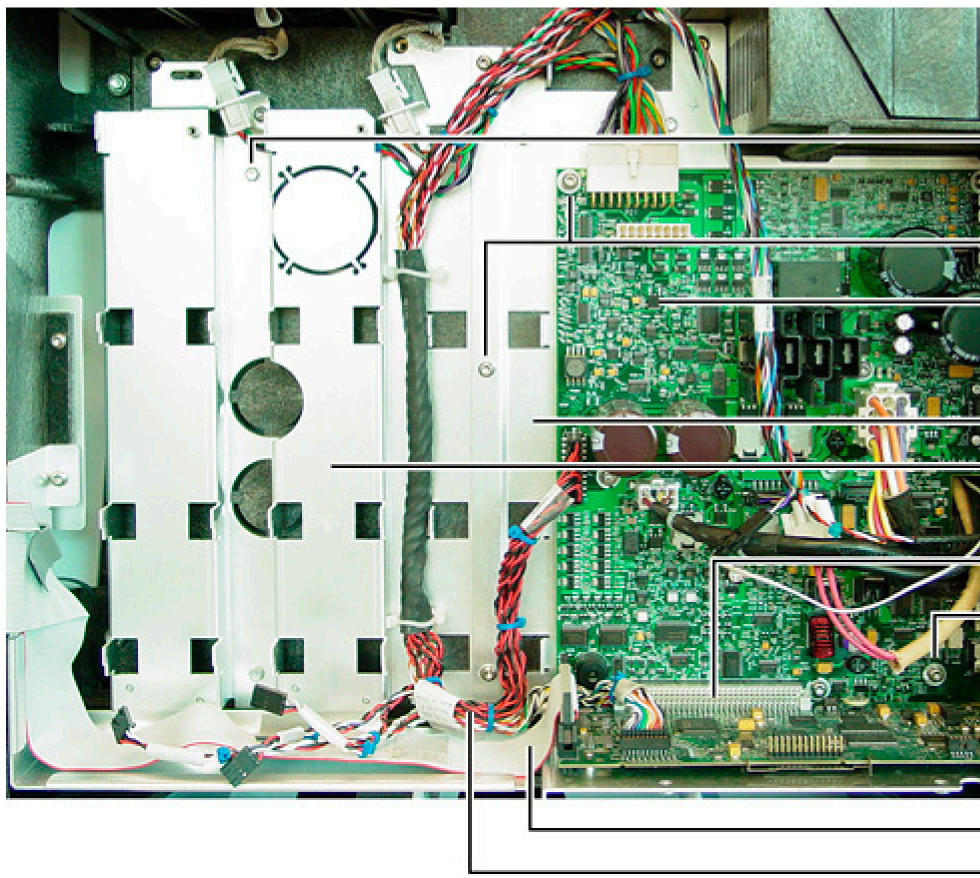
This section contains illustrated parts breakdowns for the following 7890 GC electrical components.

- AC Power Cords
- AC Power Board
- Analog and Power Board
- Analog Input Board (G1556A Accessory)
- Chassis Fans

Electronics carrier

	Description	Part number	Qty
NS	ALS controller board	G3430-60529	1
NS	Fuse, ALS controller PCA, 7A 125V	2110-0961	1
NS	Screw, T-20, M4 × 12 mm (attach ALS board to carrier)	0515-2496	2

1	Analog & Power board	G3430-60150	1
2	Logic board	G3430-60100	1
3	Harness, 4-wire communication buss	G3430-60513	1
4	Harness, keyboard and display	G3430-60514	1
5	Backplane for Analog and power board	G3430-00086	1
6	Backplane for Detector signal boards	G3430-00085	1
7	Grounding screw, M4 × 25 mm, T-20 (for #1)	0515-2712	1
NS	Grounding screw, M4 x 12 mm, T-20 (for #6)	0515-2496	1
8	Screw, M4 × 6 mm	0515-2832	10
9	Screw, self-tapping, 1/4-inch nut	0515-4897	3

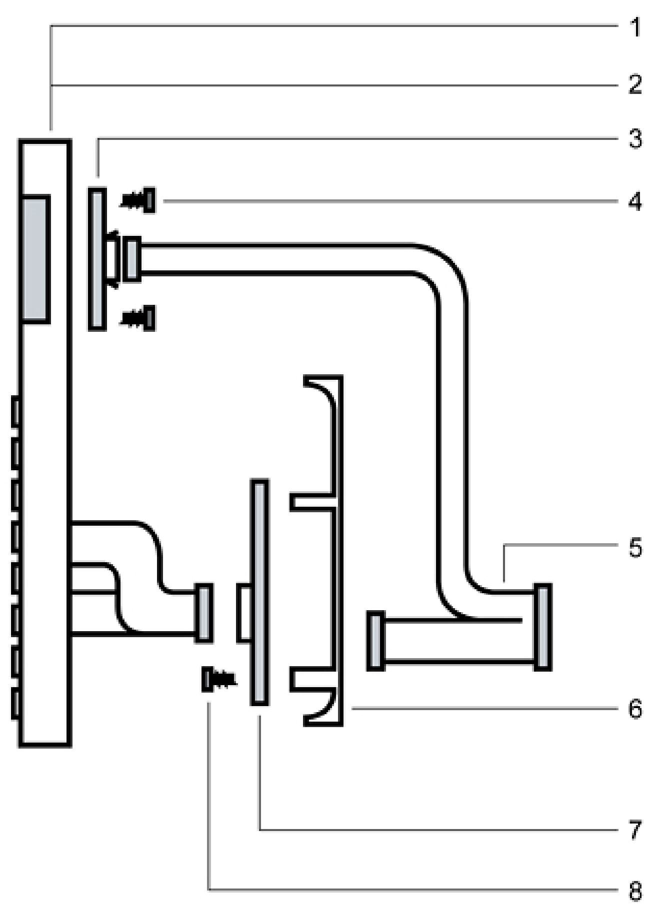


Keyboard and Display

Item	Description	Part number	Qty
1	Keyboard/display assembly with display and harness	G3430-60555	1
2	Replacement keyboard assembly without display	G3430-67500	1

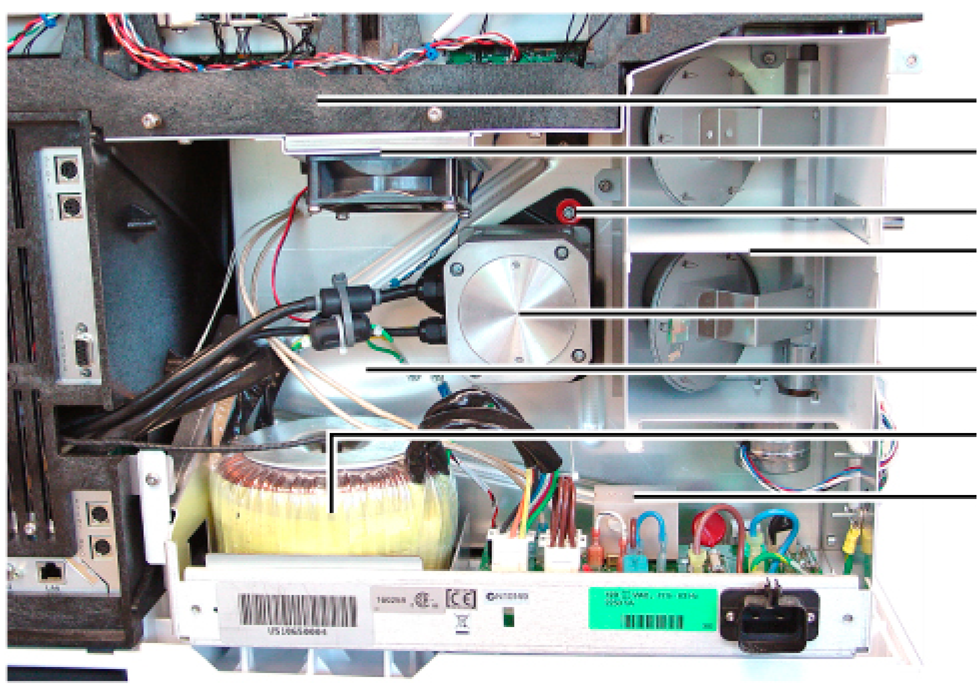
3	Display	G3430-80033	1
4	Self-tapping screws	0624-1076	4
5	Keyboard/display harness	G3430-60514	1
6	Bracket	G3430-00098	1
7	Interconnect board	G3430-60003	1
8	Screw, M4 x 12 mm, T-20	1390-1023	1
NS	Screw, self-tapping, 1/4-inch (connect left and bottom sides of assembly to electronics carrier)	0515-4897	3
NS	Screw, M4 x 12 mm, T-20 (connects top right corner of assembly to electronics carrier)	0515-2496	1

Much of the keyboard/display is concealed by its plastic shell, so that a conventional exploded view is not very helpful. Use the schematic diagram below to identify parts.



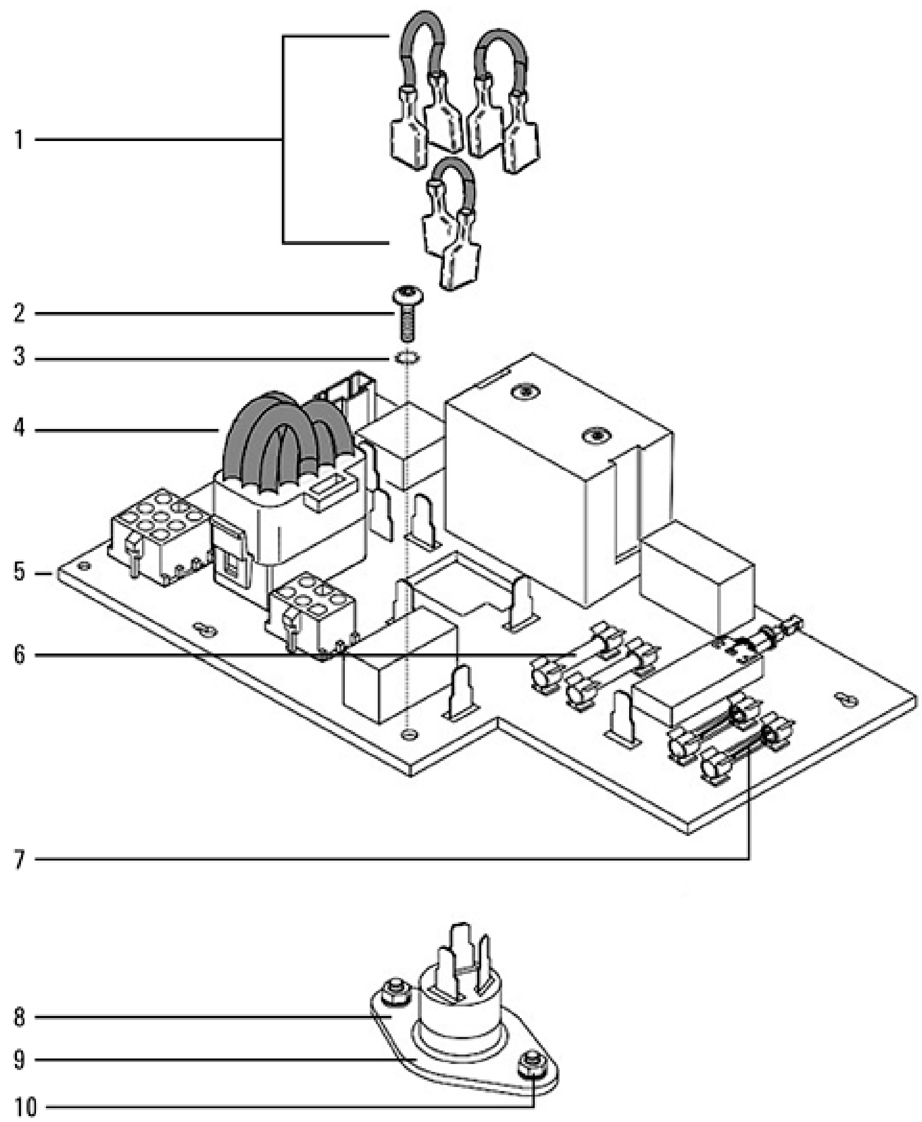
AC power

Item	Description	Part number	Qty
1	EPC pneumatics carrier assembly with fan	G3430-80503	1
NS	Screw, T-20, M4 × 12 mm (attach carrier to oven)	0515-2496	3
2	Fan, pneumatics carrier	G3430-60006	1
NS	Screw, M4 X 30 mm, T-20	0515-0669	4
3	Washer, steel to attach motor	2190-0712	6
3	Nut with lock washer, M4 to attach motor	0535-0043	3
4	Oven flapper assembly	G3430-60008	1
5	Motor, oven fan, DC	G3430-60504	1
6	Nut with lock washer, M4 X 3.2 mm for grounding straps (7 mm nut driver)	0535-0043	2
7	Transformer kit with large washers	G3430-60975	1
NS	Screw, M8 x 100 mm (7/32 hex wrench)	0515-4962	1
NS	Washer, lock	2190-0669	1
8	AC power board	G3430-60050	1
NS	Screw, M4, T-20	1390-1024	1



AC circuit board components

Item	Description	Part number	Qty
1	Triac jumper (part of 5)		3
2	Screw, M4	1390-1024	1
3	Washer		1
4	AC configuration plug		1
	– USA and Canada 120V	G1530-60690	
	– Japan 200V	G1530-60700	
	– Continental Europe, 220V single phase power	G1530-60710	
	– Hong Kong, 220V, single phase	G1530-60710	
	– China 220V	G1530-60710	
	– China 220V, 10 amp slow ramp	G1530-60710	
	– Israel 220V	G1530-60710	
	– Switzerland/Denmark, 230V, 16A	G1530-60720	
	– Switzerland power cable, 230V, 10A	G1530-60720	
	– Denmark, 230V, 10A	G1530-60720	
	– Continental Europe, 230V	G1530-60720	
	– Australia, 240V	G1530-60730	
	– South Africa/India, 240V	G1530-60730	
	– United Kingdom/Ireland, 240V	G1530-60730	
	– USA and Canada, 240V	G1530-60730	
	– Australia 240V, slow ramp	G1530-60730	
5	AC board	G3430-60050	1
6	Ceramic fuse, type x, 20A/250V	2110-0098	2
7	Glass fuse, type F, 8A/250V	2110-0036	2
8	Triac	1884-0355	1
9	Pad (under triac)	1205-1164	1
10	Hex nut	0535-0031	2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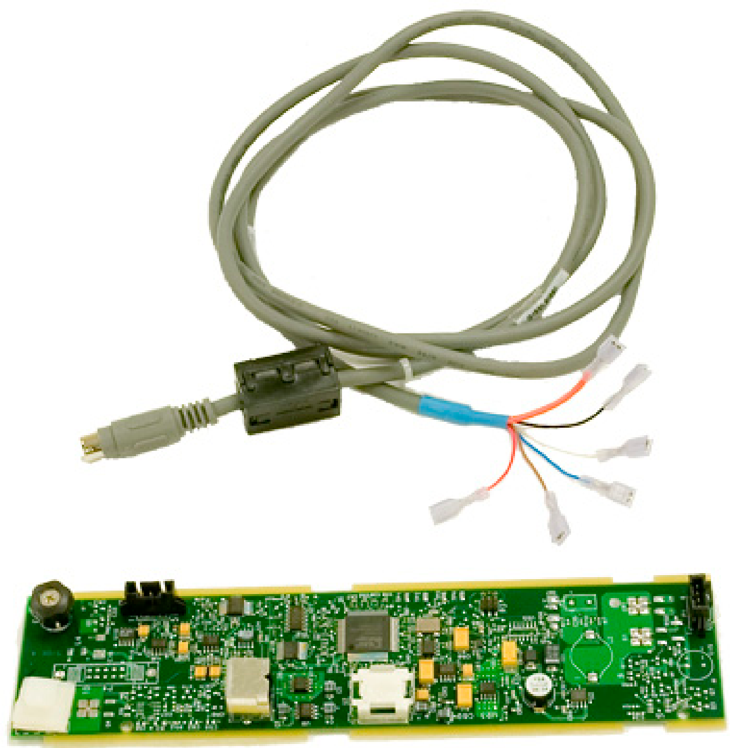
Power cords

The 7890A uses detachable power cords.

Countries	VAC	Description	Part nu
Australia, New Zealand	**240?**	C13, 10 amp	8120-13
Americas	120	10 amp	8120-13
Europe	**220? 230?**	C13, 10 amp	8120-16
US/Canada/Taiwan/Thailand	**120?**	C13, 13 amp	8120-19
Switzerland	**230?**	C13, 10 amp	8120-21
Denmark, Greenland	**230?**	C13, 10 amp	8120-39
India/S Africa	**240?**	C13, 10 amp	8120-42
Japan	**200?**	10 amp	8120-47
Israel	**220?**	C13, 10 amp	8120-51
Taiwan/South America		C19, 20A	8120-63
Argentina			8120-68
US	120 208 240	C19, 20 amp	8120-68
Japan	**200?**	C19, 20 amp	8120-69
Chile		C13, 10 amp	8120-69
Australia	**240?**	C19, 16 amp	8120-86
Great Britain/Hong Kong/Singapore/Myanmar	**220? 240?**	C19, 13 amp	8120-86
Europe	**220? 230?**	C19, 16 amp	8120-86
Swizerland, Denmark	**230?**	C19, 16 amp	8120-86
Great Britain/Hong Kong/Singapore/Myanmar	**220? 240?**	C13, 10 amp	8120-87
China	**220?**	C19, 15 amp, Fast	8121-00
US	**120? 208?** 240	C19, 15 amp	8121-00
Israel	**220?**	C19, 16 amp	8121-01
Argentina		C19, 20 amp	8121-06
India, South Africa	**240?**	C19, 15 Amp	8121-07
China	**220?**	C13, 10 amp	8121-07
Korea		C19, 16 amp	8121-12
Korea		C13, 10 amp	8121-12
Thailand	220	15 A, 1.8M, C19	8121-13

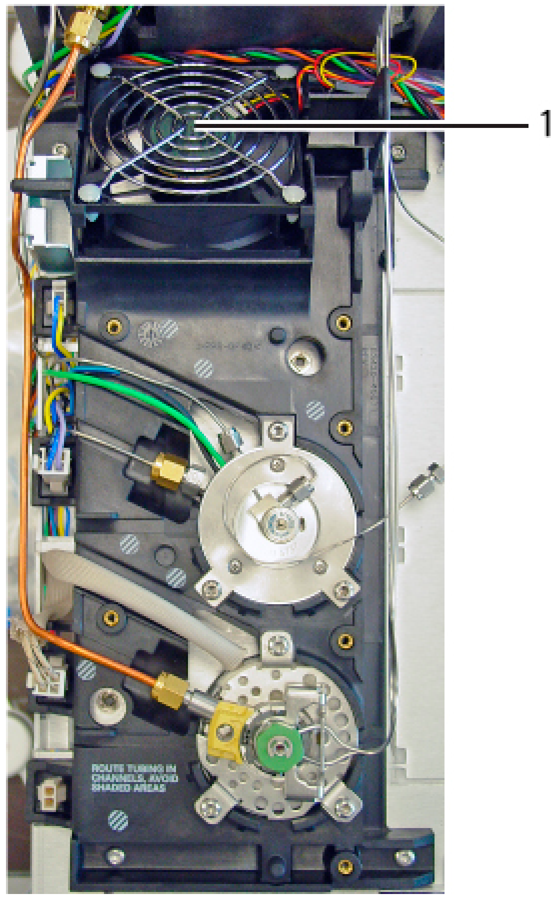
7890A Analog input board (G1556A accessory)

Item	Description	Part number	Qty
1	Analog input board	G3456-60010	1
2	General purpose analog output cable assembly	G1530-60560	1



7890A Chassis fans

Item	Description	Part number	Qty
1	Pneumatics area fan	G3430-60006	1
2	Inlet fan assembly	G3430-60560	1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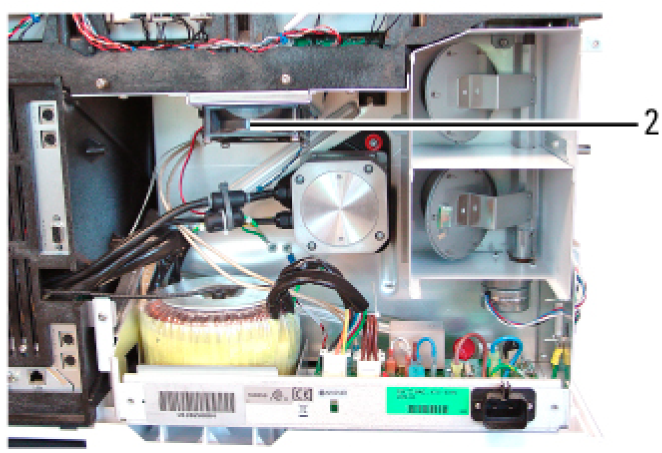
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Reference lists

EPC modules

Printed circuit boards

Accessories and options

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