Agilent Technologies

Chemical Analysis Group

5890 Gas Chromatograph

5890 Series II Site Prep Info

Document A15282

Site Prep/Installation Manual

HP 5890 Series II and HP 5890 Series II Plus

HP part number 05890-90281

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Warranty

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

Hewlett-Packard makes no warranty of any kind with regard to this material, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Hewlett-Packard shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Safety Information

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

Safety Symbols

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

WARNING

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

CAUTION

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

Important User Information for In Vitro Diagnostic Applications

This is a multipurpose product that may be used for qualitative or quantitative analyses in many applications. If used in conjunction with proven procedures (methodology) by qualified operator, one of these applications may be In Vitro Diagnostic Procedures.

Generalized instrument performance characteristics and instructions are included in this manual. Specific In Vitro Diagnostic procedures and methodology remain the choice and the responsibility of the user, and are not included.

Sound Emission Certification for Federal Republic of Germany

If Test and Measurement Equipment is operated with unscreened cables and/or used for measurements in open set-ups, users have to assure that under these operating conditions the Radio Interference Limits are still met at the border of their premises.

The following information is provided to comply with the requirements of the German Sound Emission Directive dated January 18, 1991

Sound pressure Lp < 70db(A)

During normal operation

At the operator position

According to ISO 7779 (Type Test)

When operating the HP 5890 Series II with cryo valve option, the sound pressure ≈ 78 db(A) during cryo valve operation for short burst pulses.

Schallemission

Werden Meß- und Testgeräte mit ungeschirmten Kabeln und/oder in offenen Meßaufbauten verwendet, so ist vom Betreiber sicherzustellen, daß die Funk-Entströbedingungen unter Betriebsbedingungen an seiner Grundstücksgrenze eingehalten werden.

Diese Information steht im Zusammenhang mit den Anforderungen der Maschinenlärminformation sverordnung vom 18 Januar 1991.

Schalldruckpegel LP < 70 dB(A)

Am Arbeitsplatz

Normaler Betrieb

Nach DIN 45635 T. 19 (Typprüfung)

Bei Betrieb des HP 5890 Serie II mit Cryo Ventil Option treten beim Oeffnen des Ventils impulsfoermig Schalldrucke Lp bis ca. 78 dB(A) auf.

Little Falls Site
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Contents

1

Site Preparation

Site Preparation

Introduction

This section discusses the site preparation for the HP 5890 SERIES II (hereafter referred to as HP 5890). The following topics are discussed:

- Environmental considerations
- Power considerations
- Gas considerations

You will need various supplies to prepare an area for the HP 5890. Hewlett•Packard's analytical supplies catalog describes the supplies available from Hewlett•Packard.You can obtain a copy from your local sales office.

Environmental considerations

This instrument operates in the 0° to 55°C temperature range and the 5% to 95% relative humidity range. We recommend an environment comfortable for the operators (reasonably constant temperature and humidity) for optimum performance and instrument lifetime.

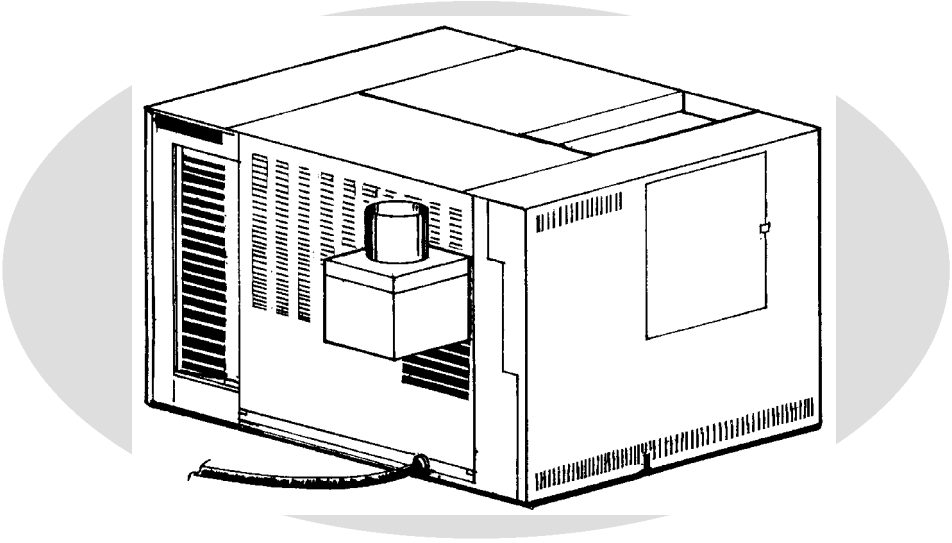
Corrosive substances, whether gas, liquid, or solid, may affect materials and components used in the HP 5890 and should be avoided.

Space considerations

The HP 5890 requires a clear surface about 56 cm (22 in.) deep by 71 cm (28 in.) wide, capable of supporting at least 41 kg (90 lbs). Another 25 cm (10 in.) must be allowed behind the instrument to dissipate oven exhaust air (up to 400°C).

The HP 5890 is about 50 cm (20 in.) high. The area above the instrument should be clear. Shelves or other overhanging obstructions limit access to the top of the instrument and interfere with cooling.

If space is limited, the Oven Exhaust Deflector may improve oven cooling. It diverts exhaust air up and away from the instrument. It may be connected to a 4•inchexhaust duct system, routed to a fume hood, or vented outside the building with 4•inchdiameter furnace duct.



Oven exhaust deflector

Other instruments used with the HP 5890, such as detectors, integrators, and samplers, may require additional bench space. See those manuals for details.

Power considerations

Line voltage

Your gas chromatograph operates from one of these voltage supplies, depending on the power option ordered. These options and the power cords furnished are described on the next page.

- 120 VAC single phase (+5, -10%), 48 to 66 Hz, 2200 VA max. (requires a 20 amp dedicated line)
- 200 VAC split phase (+5, -10%), 48 to 66 Hz, 2200 VA max. (requires a 15 amp dedicated line)
- 220/240 VAC single phase (+5, -10%), 48 to 66 Hz, 2200 VA max. (requires a 15 amp dedicated line)
- 220/240 VAC split phase (+5, -10%), 48 to 66 Hz, 2200 VA max. (requires a 15 amp dedicated line)

Power line cord

To protect personnel, the instrument panels and cabinet are grounded through the three•conductorpower line cord in accordance with International Electrotechnical Commission (IEC) requirements.

The three•conductorpower line cord, when plugged into a properly grounded receptacle, provides power and grounds the instrument. A properly grounded receptacle has its ground contact connected to a suitable earth ground. Proper receptacle grounding should be verified.

The power options for the HP 5890, and the electrical power and the line cord termination for each, are shown here.

Option		Power and Cord
001 (Standard)		120 V single phase, 20A for USA.
002		220 V single phase with power cord for use in Europe and Peoples Republic of China.
003		220 V single phase with power cord for use in Hong Kong.
004		240 V single phase with power cord for use in Great Britain.
005		240 V single phase with power cord for use in Australia.
006		220 V split phase with power cord for use in Europe.
007		240 V split phase with power cord for use in USA.
008		200 V split phase with power cord for use in Japan.
031		220 V single phase with power cord for use in Denmark.
032		220 V single phase with power cord for use in Switzerland.
033		240 V single phase with power cord for use in South Africa.

Gas considerations

Gases for packed columns

The choice of carrier gas depends on the detector selected and what performance is required from it. These relationships are shown below. In general, makeup gases are not needed with packed columns.

Gas Recommendations for Packed Columns

Detector	Carrier Gas	Comments
Thermal conductivity (TCD)	Helium	General use.
	Hydrogen	Maximum sensitivity (see Note A).
	Nitrogen	Hydrogen detection (see Note B).
	Argon	Maximum hydrogen sensitivity (see Note B).
Flame ionization (FID)	Nitrogen	Maximum sensitivity.
	Helium	Acceptable alternate.
Nitrogen/ Phosphorus (NPD)	Helium	Optimum performance.
	Nitrogen	Acceptable alternate.
Electron capture (ECD)	Nitrogen	Maximum sensitivity.
	Argon/Methane	Maximum dynamic range.

Note A: Slightly greater sensitivity than helium, but may remove passivation from filaments causing high drift rates until passivation is completely reduced. Incompatible with some compounds.
Note B: For analysis of hydrogen or helium; greatly reduces sensitivity for other compounds (some peaks may invert).

Gases for capillary columns

Hydrogen is the recommended carrier gas for capillary analyses; helium is an acceptable alternate and nitrogen is least desirable.

These detectors are compatible with packed columns which use higher carrier gas flow rates than those used with capillary columns. A separate makeup gas system brings total flow into a detector up to the rate for optimum sensitivity with capillary columns. For each detector and carrier gas, there is a preferred choice for makeup gas.

Gas Recommendations for Capillary Columns

Detector	Carrier Gas	Preferred Makeup Gas	Second Choice/Notes
FID	Hydrogen	Nitrogen	Helium
	Helium	"	"
	Nitrogen	"	"
NPD	Hydrogen	Helium	
	Helium	"	
	Nitrogen	"	0 See comment below.
ECD	Hydrogen	Argon/Methane	Nitrogen
	Helium	"	"
	Nitrogen	Nitrogen	Argon/Methane
	Argon/Methane	Argon/Methane	Nitrogen
TCD	Hydrogen		
	Helium	Same as carrier	Same as carrier and
	Nitrogen	and reference gas	reference gas
	Argon		

When an NPD is used with an HP Series 530 µ capillary column, hydrogen carrier gas, and a packed column inlet (flow•controlled),both isothermal and temperature programmed analyses may be run. However, if a capillary inlet (pressure•controlled)is used, only isothermal analysis is recommended. Temperature programming changes the resistance of the column and the flow of hydrogen into the detector. NPD sensitivity is very sensitive to hydrogen flow.

Gas purity

Some gas suppliers furnish **instrument** or **chromatographic** purity grades (the names vary with the supplier) specifically intended for chromatographic use. Use these when available.

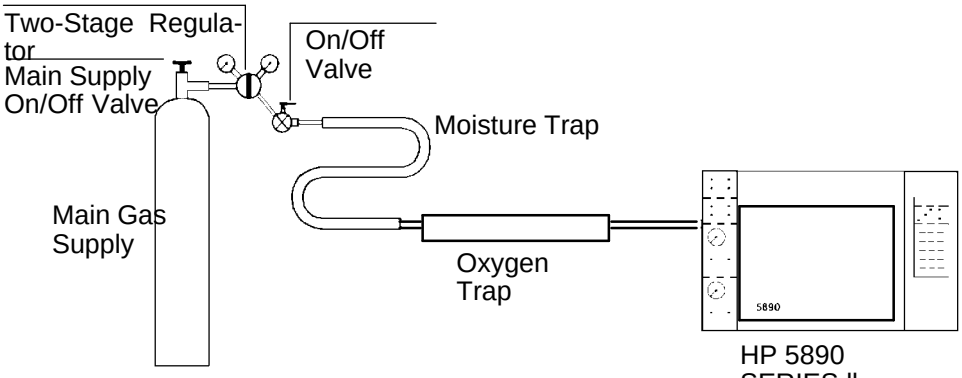
Gas Purity Recommendations

Carrier Gases and Capillary Makeup Gases	
Helium	99.9995%
Nitrogen	”
Hydrogen	”
Argon/Methane	Best available

Note: For ECD use, gases must be 99.9995% pure.

Detector Support Gases	
Hydrogen	99.9995%
Air (dry)	Best available

Assembling the gas plumbing



General Plumbing Diagram

Follow this general plumbing diagram to prepare gas supply plumbing. Note that:

- Two•stage(rather than single stage) regulators are strongly recommended to eliminate pressure surges.
- On/off valves are not essential but are very useful. They are usually mounted on the outlet fitting of the two•stageregulators.
- FID and NPD detectors should have their own air supply. Detector operation may be affected by pressure pulses in air lines shared with other devices (valve actuators, samplers).
- Flow•and pressure•controllingdevices require at least 138 kPa (20 psi) pressure differential across them to operate properly. Source pressures and capacities must be more than ample to ensure this.
- If auxiliary flow panel(s) are **not** to be installed in the instrument, we recommend pressure gauges in gas supply lines just prior to their connection to instrument inlet fittings. This measures supply pressure at the instrument rather than pressure at the source (which may be different due to long or narrow supply lines).

Supply tubing

Caution Do not use methylene chloride or any other halogenated solvent for tubing that will be used with an electron capture detector. They will cause elevated baselines and detector noise until they are completely flushed out of the system.

Copper tubing usually contains oils and other manufacturing lubricants which must be removed before use. A methylene chloride rinse followed by a methanol rinse is suitable except when an electron capture detector will be used.

The choice of tubing diameter depends upon the distance between the supply source and the chromatograph and the total demand expected for the particular gas. When the supply is close to the instrument, 1/8•inch tubing is adequate.

For long distances, or when multiple instruments are to be supplied from the same source, or if high demand is anticipated (air for an FID), use larger diameter supply lines to reduce pressure drop.

Be generous when cutting lengths of tubing for local supply lines; a relatively long coil of flexible tubing between the supply and the instrument permits moving the instrument to reach rear cover panels.

Cylinder fitting type and size

Consult your local gas supplier for type and size of cylinder valves. They are described by CGA (Compressed Gas Association) numbers. Use these numbers to select compatible pressure regulators.

Two-stage pressure regulators

Two stages of pressure regulation are needed to reduce the very high source pressure to the pressures used by the instrument. The two stages may be combined in a single regulator with a fairly short tubing run to the instrument, or one stage may be at the source with the second stage close to the instrument. In either case, use good quality regulators with stainless steel diaphragms. See the Hewlett•Packard's analytical supplies catalo*g* for further information.

Molecular sieve moisture trap

A type A molecular sieve moisture trap is supplied with ECDs. Install it between the carrier gas source regulator and inlet supply fitting on the instrument.

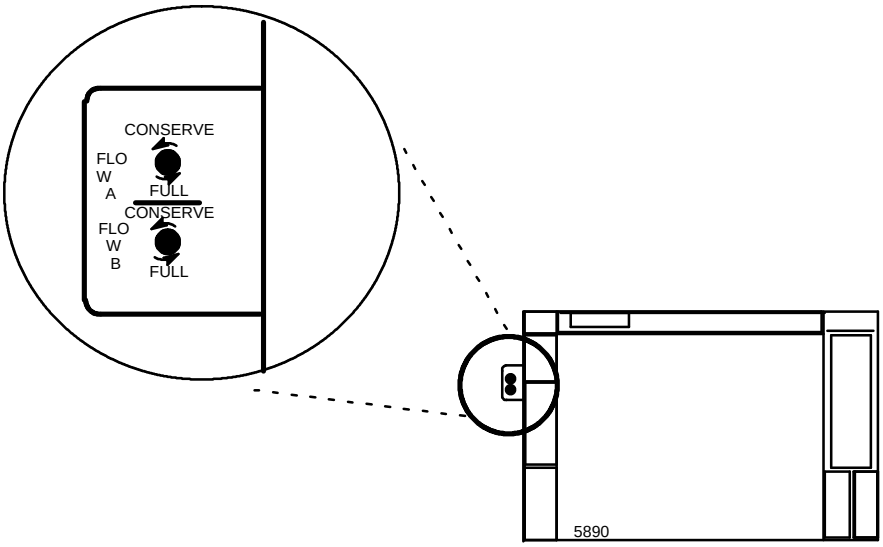
Moisture in the carrier gas can damage columns. We recommend moisture traps for all carrier gases, regardless of the detector, and also for detector support gases (makeup, hydrogen, air).

Oxygen trap

Trace amounts of oxygen can damage columns, particularly capillary columns. Oxygen also degrades the performance of ECDs. An oxygen trap may be connected between the molecular sieve drier and inlet supply fittings to the instrument.

Carrier gas miser

A carrier gas miser reduces the use of carrier gas during off•hours.It reduces two channels of carrier gas flow to a low purging rate during off•hours,without disturbing the pressure regulator or flow controller settings.



Carrier Gas Miser

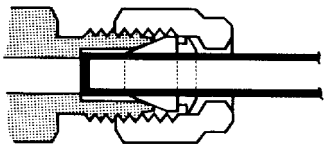
Making pipe thread connections

Avoid pipe thread connections if possible. If they must be used, seal them with Teflon tape. Do not use **pipe dope** to seal the threads; these mixtures contain volatile materials that will contaminate the tubing.

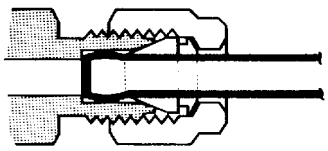
Teflon tape is available in two grades. The less expensive **hardware store** grade contains a small amount of volatile material. In most cases this does no harm, but it will interfere strongly (noise, elevated baseline, reduced sensitivity and linearity) with electron capture detectors. An instrument grade (the name may vary) has had these volatiles removed. The better grade tape is recommended for all chromatographic fittings.

Making swage-type connections

Assemble fitting, bottom tubing



Hand-tighten, then wrench-tighten



Swage-Type Fittings

Assemble the fittings as shown. Push the tubing into the fitting as far as it will go, then tighten the fitting by hand (no wrench). Use a wrench to tighten further (3/4 • turn for 1/8 • inch tubing, 1 • 1/4 • turn for 1/4 • inch tubing).

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Installation

Installation

Introduction

This section reviews installation for the HP 5890 SERIES II (hereafter referred to as HP 5890). The following topics are discussed:

- Inspection of shipped materials
- Instrument cooling
- Connecting supply gases
- Connecting cryogenic cooling
- Power considerations
- Signal cables

Shipment checklist

Retain shipping containers and material until contents are checked for completeness and instrument performance is verified.

Items received should be checked against packing lists. If there are discrepancies, contact your local Hewlett•Packardoffice immediately.

Site preparation

If not already done, refer to *Site Preparation* in this manual for information concerning proper site preparation.

Cooling considerations

Cooling: The instrument is cooled convectively: ambient air enters through vents in side panels and from beneath the instrument. Warmed air exits through slots in top, rear, and side panels. Since ventilation slots in instrument top, side, and rear cover panels provide instrument cooling, materials that might obstruct air flow must not be placed beneath or on top of the instrument.

Caution For proper cooling and general safety, always operate the instrument with cover panels properly installed.

Oven Exhaust: Heated air (up to 450°C) from the column oven exits through a vent in the rear. Allow at least 25 cm (10 inches) clearance behind the instrument to dissipate the heated air. Also, place nothing behind the instrument that might be damaged by the heated air exhaust.

WARNING Temperature•sensitiveitems (gas cylinders, chemicals, regulators, etc.) should not be located in the path of the heated exhaust. Also, exercise care in working at the rear of the instrument during cool•downcycles to prevent possible burns.

Connecting supply gases

Supply gases are connected either at the main front flow panel, or at auxiliary flow panel(s) mounted behind the door on the left side panel. All inlet supply fittings are 1/8•inchfemale swage•type.

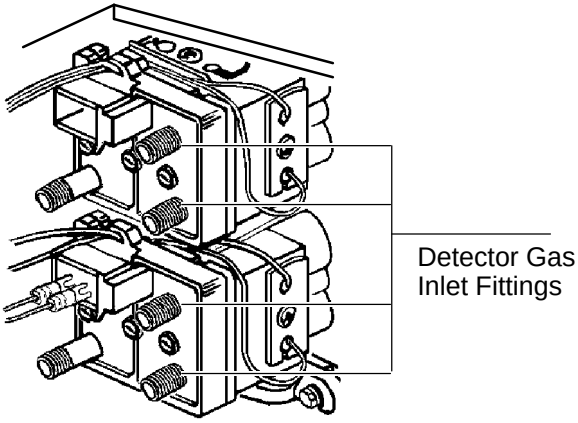
WARNING H_2 is flammable and is an explosion hazard. If H_2 is being connected, observe safety precautions: be sure the supply is off until all connections are made. Be sure unconnected fittings are capped or plugged.

The main flow panel

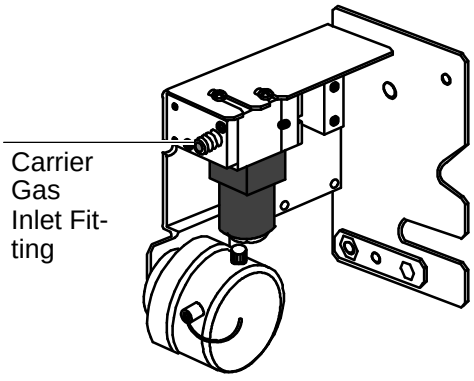
In general, each carrier gas supply is connected to one of the following devices at the rear of the main flow panel:

- Carrier gas is connected to the mass flow controller for an inlet.
- Capillary makeup gas is connected to the flow manifold block for a detector.
- Detector support gases (H_2 and air for FIDs, NPDs and FPDs; reference gas for a TCD) are also connected to the flow manifold block for each particular detector.

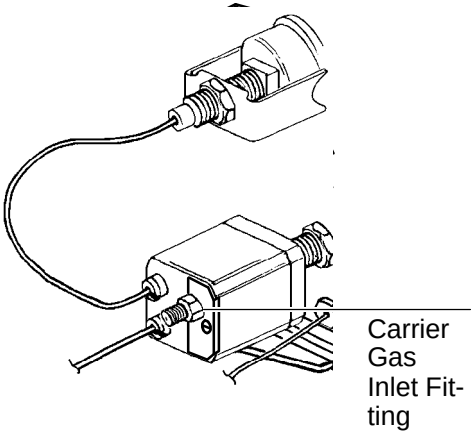
Detector Flow Manifold Blocks:



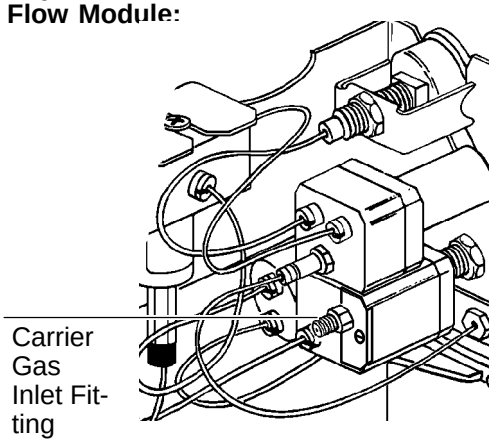
Programmable Cool On-Column Capillary Inlet Flow Module:



Packed Column Inlet Flow Module:



Split/Splitless Capillary Inlet Flow Module:

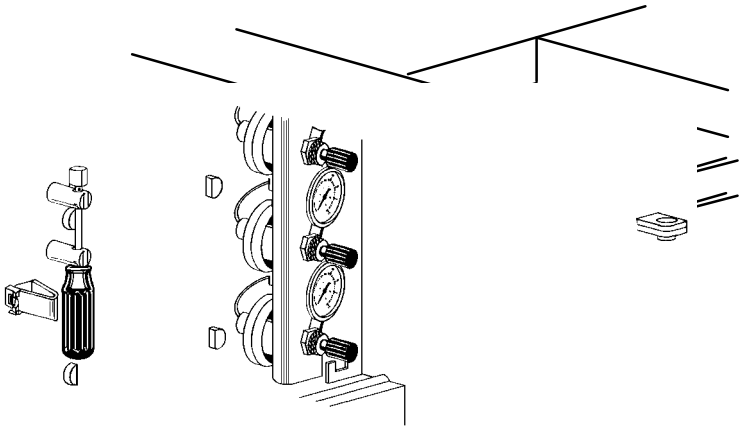


Rear Views, Main Flow Panel (Typical)

Auxiliary flow panels

For auxiliary flow panel(s), follow instructions included with the panel to connect supply tubing between each pressure regulator and the appropriate mass flow controller or flow manifold block, and to connect gas supplies to the pressure regulators.

If **no** supply gas is to be connected **directly** to an inlet mass flow controller or detector flow manifold block, proceed to *Setting initial supply pressures and leak testing* in this section.



Auxiliary Flow Panel

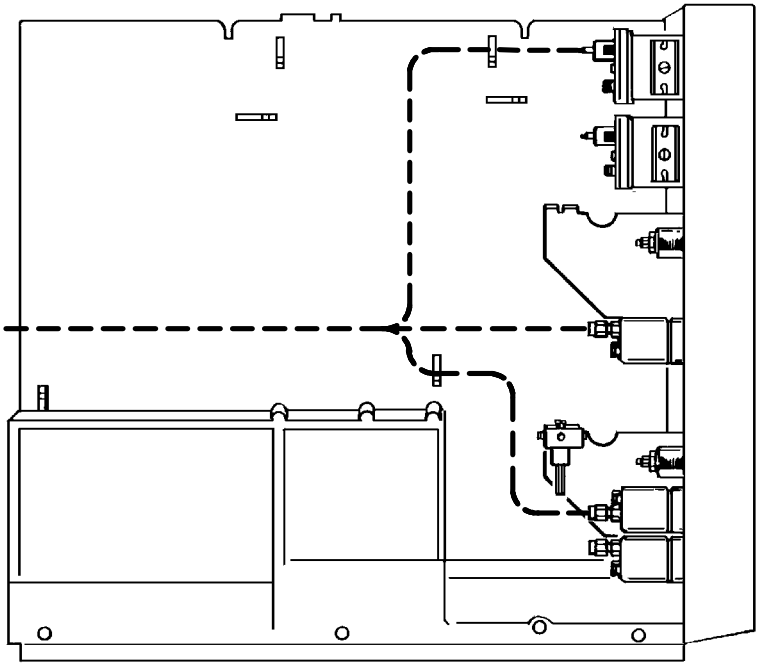
After locating the appropriate panel, and before connecting the gas supply tubes and fittings:

1. Make sure gas supplies to be connected are turned off at their sources.
2. Remove the left side panel by removing two screws along its bottom edge, then slide the panel toward the rear of the instrument and lift.

3. For each gas supply to be connected, route its tubing to the appropriate mass flow controller or flow manifold block. Route tubing along the oven wall using slots provided to secure tubing to the wall.

   If you do not have a packed inlet, continue with gas supply tube connections in this section.

4. The flow controller for packed inlets contains a flow restrictor for flow ranges from 0 to 20 ml/min. The instrument ship kit contains an alternative flow restrictor for flow ranges from 0 to 110 ml/min. If your analysis requires flows greater than 20 ml/min, change the restrictor using the instructions starting on the next page. You may also obtain higher flow rates by increasing the supply pressure. See the *Setting inlet system flow rates* section in Chapter 4 of the Operating Manual.



Paths For Routing Gas Supply Tubing

Changing the flow restrictor

You need the following tools to complete this task: a 7/16•inchopen end wrench, a short flathead screwdriver, a pair of tweezers, and the flow restrictor that fits the flow range you need for your analysis.

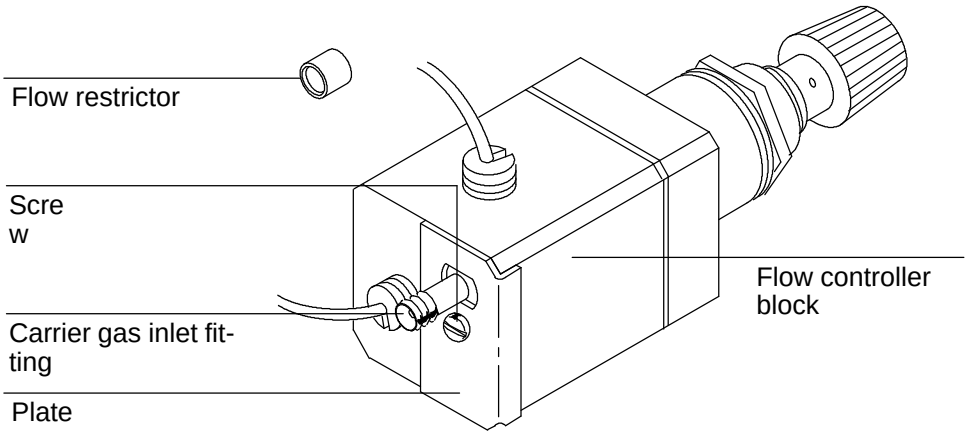
If the gas lines are already connected to the instrument, turn off the carrier gas source and remove the gas line from the carrier gas inlet fitting with a 7/16•inchopen end wrench.

1. Select the flow restrictor you need for your analysis from the table. These restrictors are used in packed and purged•packedinlet systems (standard flow controller part number 19362•60565). There is a spare restrictor in the ship kit (part number 19362•60535) with a flow range of 0 to 110 ml/min.

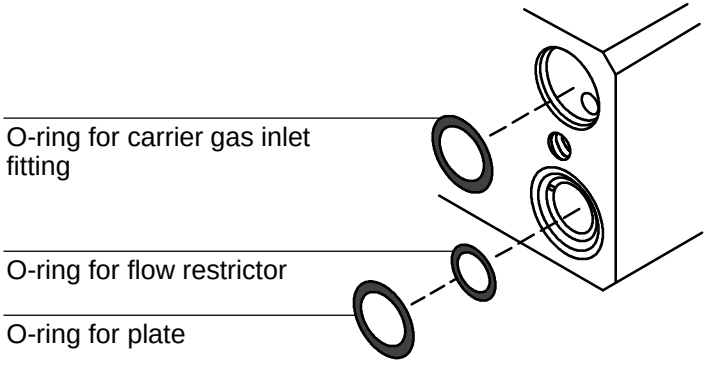
Part number	Flow range (ml/min)	Supply pressure*	Colored dot code
19362-60515	0 to 20	50	red & purple
19362-60525	0 to 60	50	blue & purple
19362-60535	0 to 110	50	green & purple
19362-60545	0 to 400	50	black & purple
19362-60555	0 to 750	50	yellow & purple

*Note: Based on Helium gas

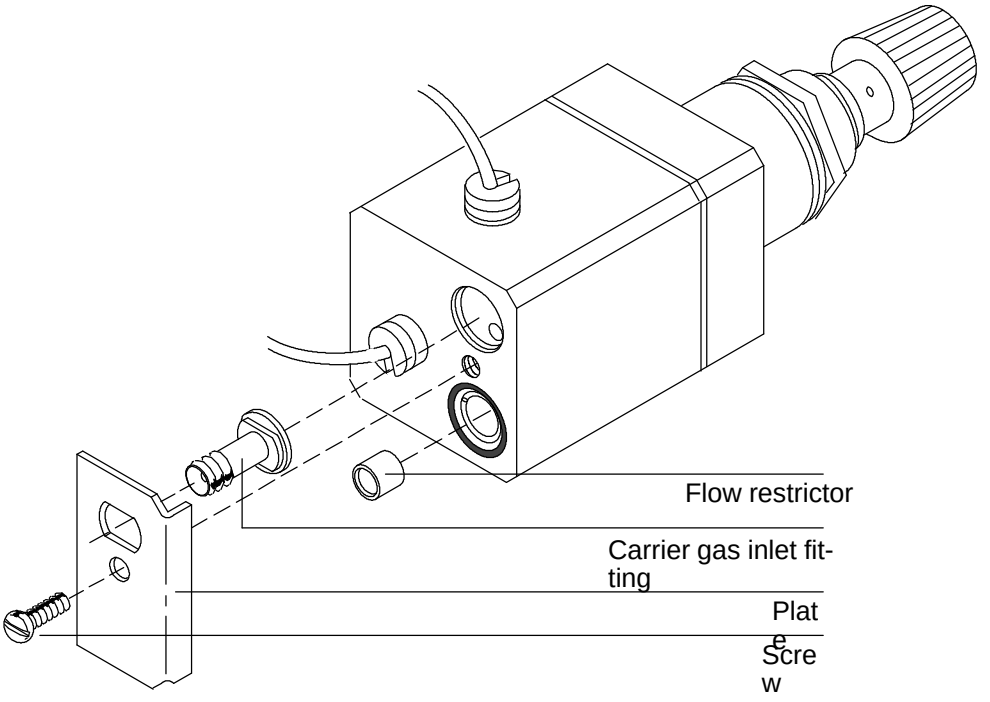
2. Remove the screw that holds down the plate on the flow controller. Both the flow restrictor and brass carrier gas inlet fitting are held onto the block by this plate. Set the screw, plate, carrier gas inlet fitting aside. You will replace them in step 5.



3. Remove the flow restrictor from the flow controller with a pair of tweezers.
4. Insert the alternate flow restrictor. Be sure the three O•ringsare in place.



5. Replace the brass carrier gas inlet fitting and plate to the flow controller block.
6. Replace the screw that holds the plate onto the flow controller block. To prevent leaks, be sure it is tight.

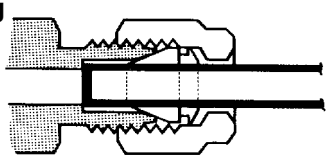


7. Replace the carrier gas connector and turn on the gas to a pressure of 50 to 60 psi. Leak test your work.

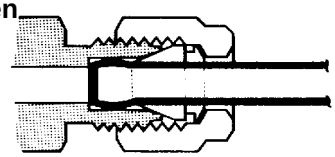
Gas supply tube connections

Assemble the fittings as shown. Push the tubing into the fitting as far as it will go, then tighten the fitting by hand (no wrench). Use a wrench to tighten further (3/4 turn for 1/8 inch tubing, 1 1/4 turn for 1/4 inch tubing).

Assemble fitting, bottom tubing



Hand-tighten, then wrench-tighten

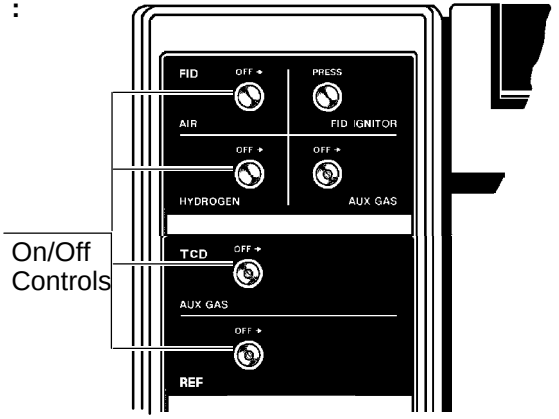


- **For a carrier gas**, its tube is connected at the fitting on the appropriate mass flow controller labeled IN.
- **For a capillary makeup gas**, its tube is connected at the fitting on the appropriate flow manifold block labeled FID—AUX for an FID or NPD, or TCD—AUX for a TCD or ECD.
- **For H_2 and air for an FID or NPD**, their tubes are connected at fittings on the appropriate flow manifold block labeled, respectively, FID—HYD and FID—AIR.
- **For TCD reference gas**, its tube is connected at the fitting on the appropriate flow manifold block labeled TCD—REF.

Once all connections are made, proceed to *Setting initial supply pressures and leak testing.*

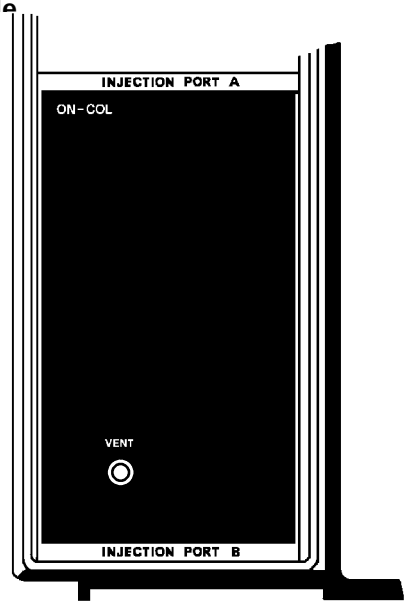
Setting initial supply pressures and leak testing

Detectors :

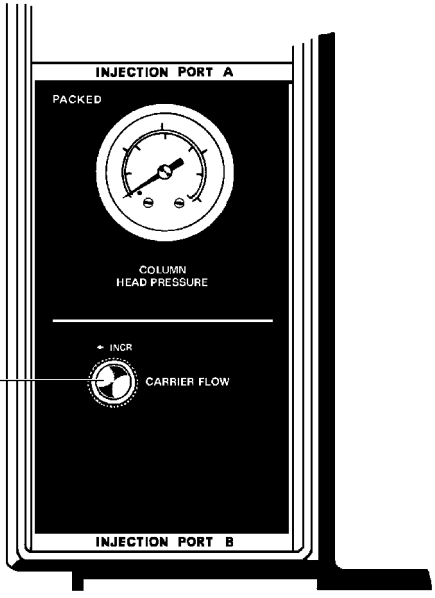


On/Off Controls

Programmable Cool On-column Capillary Inl

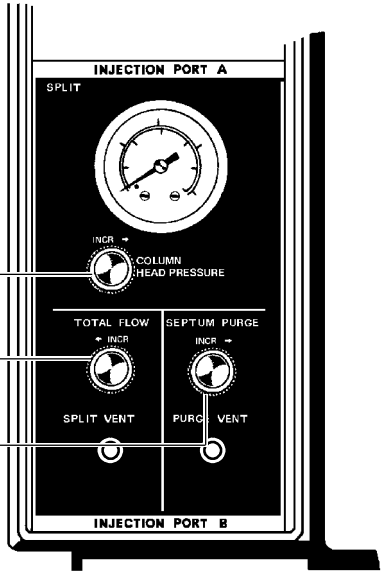


Packed Columr Inlet:



Mass Fl Controll

Split/Splitless Capilla Flow M



Colur Head sure

Mass Contı

Septı Purge

HP 5890 Flow Controls (Typical)

After supply gases are connected, the system may be pressurized, and all installed fittings then checked for leaks.

1. At the HP 5890 flow panel, do the following:
   a. Close all detector on/off valves (fully **clockwise**). Do the same for capillary makeup gas.
   b. **Gently** close all mass flow controllers by turning them **clockwise** only until they **bottom**, then **no further**.
2. Perform the following at the source for each gas supply:
   a. Turn on the gas supply at its source.
   b. Use the following guidelines in setting supply pressures:

      Note: Suggested pressure values are defined **at the instrument**. If supply tubing is long or narrow, or if multiple devices are supplied from the same source, pressure at the supply itself may not represent pressure at the HP 5890.

      - **For any gas** supplied to the HP 5890 through a **local** pressure regulator (e.g., regulators on Accessory 19246A auxiliary flow panels), set supply pressure at least 69 kPa (10 psi) greater than the highest pressure to be set at the **local** regulator.
      - **For carrier gases**, set supply pressure into the appropriate mass flow controller to 345 kPa (50 psi) for column head pressures up to 207 kPa (30 psi). For greater column head pressures, set pressure into the mass flow controller to at least 138 kPa (20 psi) greater than the desired head pressure.
      - **For capillary makeup gas**, set supply pressure to the appropriate AUX on/off valve (detector flow manifold block) to 276 kPa (40 psi).

- **For TCD reference gas**, set supply pressure to the appropriate REF on/off valve to 276 kPa (40 psi).
- **For an FID or NPD** , set H_2 and air supply pressures to the appropriate HYDROGEN and AIR on/off valves (detector flow manifold block) to 103 kPa (15 psi) and 276 kPa (40 psi), respectively.

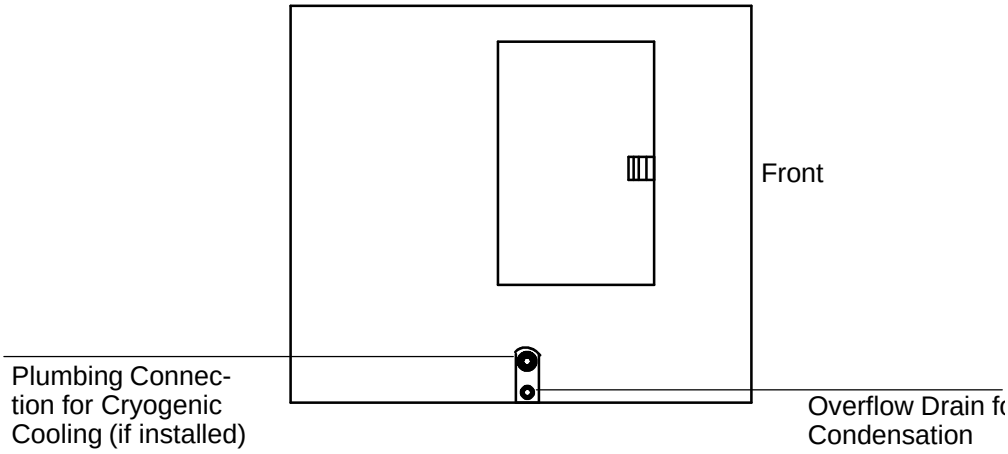
Note that optimum FID operation requires setting H_2 and air flow rates (determined by supply pressures) based specifically upon carrier gas flow rate (+ capillary makeup gas flow rate for capillary applications). The pressures given here are adequate for leak•testing, but are not necessarily correct for all FID applications.

3. Beginning where each regulator connects to the cylinder, and ending at installed fittings in the HP 5890, check each connection for leakage using a suitable leak•detectionfluid.
4. Tighten and recheck any leaking fittings.
5. When all installed fittings are verified to be leak•free,replace the side panel, making sure all gas•supplytubing is routed through the exit slot at the rear of the instrument, and continue with installation.

Connecting cryogenic coolant

The connection to the cryogenic inlet valve (if installed) is made through an access slot in the lower edge of the left side panel. A drain for condensation fluid is located below the slot.

Remove the left side panel by removing two screws along the bottom edge; then slide the panel toward the rear of the instrument and lift.



Left Side View

The appropriate coolant must be used, based upon the cryogenic option installed•either liquid CO_2 coolant or liquid N_2 coolant. To switch from one coolant to the other, replacement of the entire valve assembly is required•Accessory 19239A for liquid CO_2, or Accessory 19239B for liquid N_2.

For liquid carbon dioxide coolant• Connect a length of 1/8•inch stainless steel tubing to the brass fitting on the side of the inlet valve. Use two wrenches•one to support the fitting on the valve, the other to tighten the fitting on the tubing.

The CO_2 tank must be equipped with an internal eductor (dip) tube to ensure delivery of liquid rather than gas. Connect the tubing to the exit fitting on the tank. Do not use a regulator as vaporization (and all cooling) would occur in the regulator instead of the oven.

Tubing between tank and inlet valve does not require insulation.

For liquid nitrogen coolant• Connect 1/4•inchcopper tubing to the cryogenic inlet valve. Use two wrenches•one to support the fitting on the valve and the other to tighten the fitting on the tubing.

Connection between the valve and liquid N_2 supply must be insulated and as short as possible so liquid, rather than gas, is supplied to the inlet valve. Foam tubing used for refrigeration and air•conditioninglines is suitable insulation. Insulation should cover as much as possible.

Caution

Liquid N_2 cylinders are equipped with a safety relief valve to prevent excess pressure. Release pressure is set by the supplier. The pressure setting should be in the range 138 to 207 kPa (20 to 30 psi) for proper operation. Lower pressures may cause inadequate cooling; high pressures may cause uncontrolled cooling, damaging oven and contents.

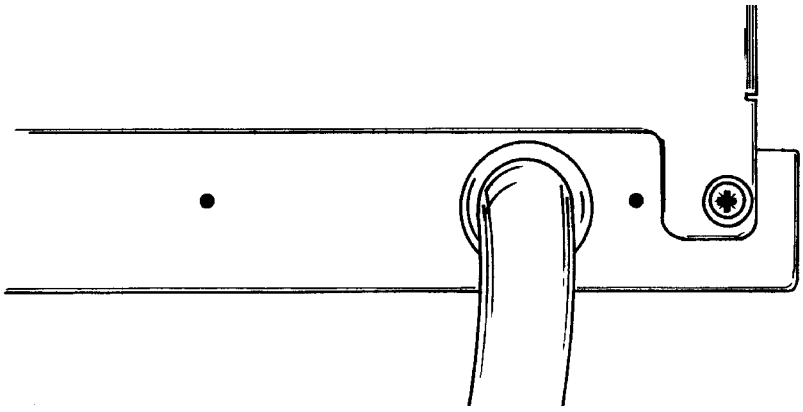
Connect tubing to the liquid N_2 supply using a suitable adapter.

Gas supply checklist

To connect lines to the appropriate gas supply(ies), you should have completed the following steps:

1. Ensure all gas supplies are **off** prior to connection and that all unconnected fittings are capped.
2. Route gas supply tubing along the oven wall (using the wall slots provided) to the appropriate mass flow controller or flow manifold block.
3. Select the appropriate tube connections for gas supplies and make connections.
4. Pressurize the system.
5. Compensate for pressure differences between the source and the instrument.
6. Leak test each connection.
7. Install cryogenic cooling gas supply (if applicable).

Connecting power line cord



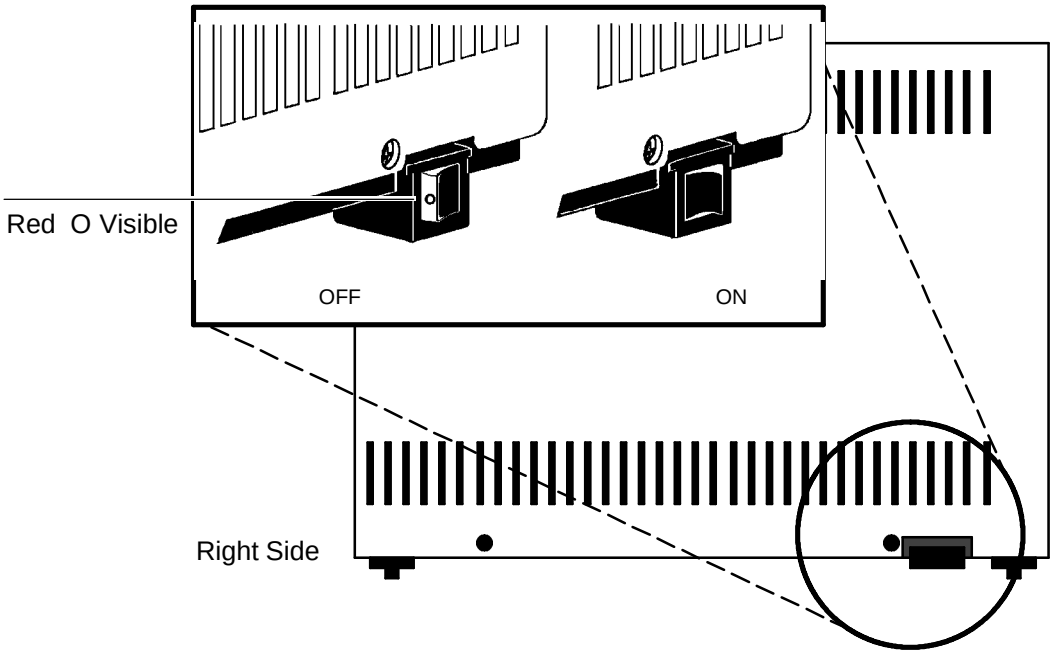
Source Line Voltage Label (Typical)

Voltage and grounding

The source voltage and load rating to be supplied is marked on a label attached at the rear of the instrument. Operating voltage is configured according to the original power option ordered.

To protect personnel, instrument panels and cabinet are grounded through the three•conductorpower line cord, in accordance with International Electrotechnical Commission (IEC) requirements.

The instrument must be operated from a receptacle having its ground contact connected to a suitable earth ground. Proper receptacle grounding should be verified before connecting the power line cord.

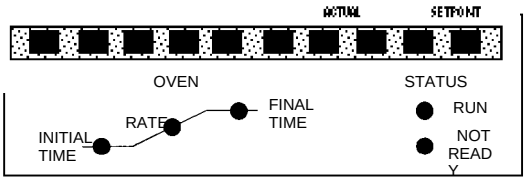


On/Off Positions For Main Power Line Switch

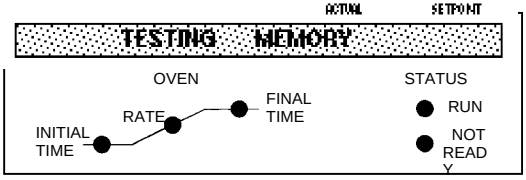
After placing the instrument where it is to be used, **verify** the **line** power switch is **off** (a red O painted on the forward part of the switch must be **visible**) **before** connecting the power line cord.

Turning power on

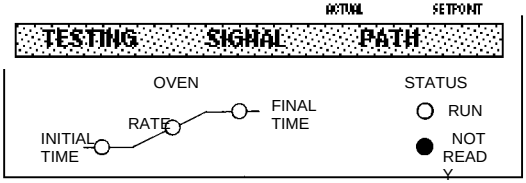
1. After making sure the main power switch is in its **off** position, connect the HP 5890 to power, switch the **line** power switch **on**, and observe the display area above the keyboard on the front panel.



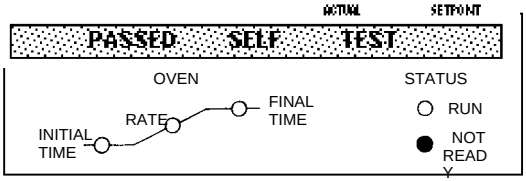
Test of display elements: all alpha-numeric and LED elements are lit.



HP 5890 memory test in progress.



HP 5890 Self-testing in progress. LEDs off, except possibly NOT READY.



Message indicating normal termination of diagnostic tests after power restoration. User setpoints remain in force.

LEDs off, except possibly NOT READY.

Normal Integrity Check At Power-on

2. Review the self•diagnosticelectronic performance verification: this requires about 30 seconds.

   Successful completion is indicated when the message PASSED SELF TEST is displayed.

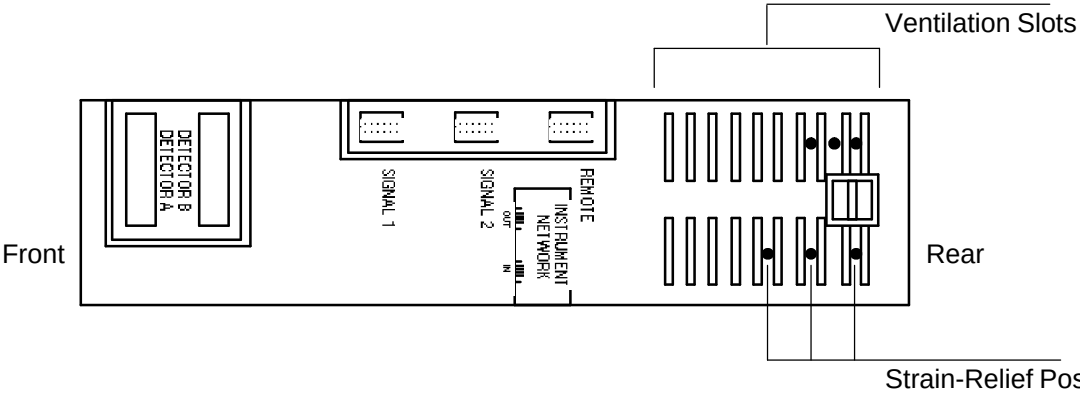
3. When PASSED SELF TEST is displayed, verify that the keyboard is active by pressing OVEN TEMP. The display should change immediately to one showing current oven status.

	ACTUAL	SETPOINT
OVEN TEMP	**34**	**OFF**

Example Display At First Power-on

Connecting signal output cables

The HP 5890 end of each type of signal cable terminates in a plug. Connection to the HP 5890 is made at receptacles found beneath the right instrument top cover. Open the right top panel (by lifting its rear edge) and proceed according to the cable(s) to be installed.



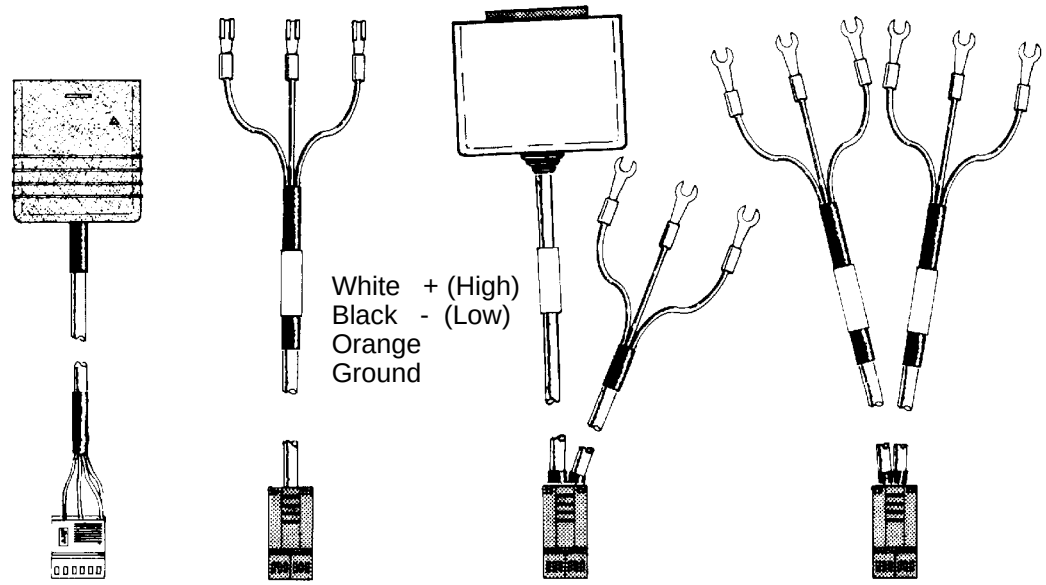
Locations For Signal Cable Connections

Note two sets of strain•reliefposts provided at the rear of the cable connection area; cables either should be coiled around or threaded through these posts before exiting at the rear of the instrument.

Caution Avoid routing cables near the oven exhaust vent or over the top of the instrument; high temperatures in these areas may cause damage.

Analog signal output cables

The following figure and table show cables available to connect an HP 5890 **analog** output channel (variable DC signals, +1 V or +1 mV maximum) to a recorder, integrator, and/or A/D converter for a computer system. If a second output channel is installed, a second cable is also required.



Available Analog Signal Output Cables

Note that the **general purpose** and **HP 3350Series LAS** analog output cable assemblies consist of two independent cables, terminating together at a common, single, **female** plug at the HP 5890. One cable is labelled 1 mV, the other +1 V output. In general, the +1 V cable is connected to an integrating device or A/D converter, and the 1 mV cable is connected to a chart recording device.

Analog Signal Output Cables

Part No.	Typical Use	Length	Connector Type
35900-60610	to HP 3394/96A Integrator	2 m	Edge Connector: HP 3394/96A Integrator, 1 V input
05890-60760	to HP 3390/92/93A Integrator	2 m	Edge Connector: HP 3390/92A Integrator, 1 V input
05890-60790	to HP 3350 Series Lab Automation Systems	2 m	Edge Connector: HP 18652A A/D Converter, 1 V input
05890-60780	to HP 3388A Integrator	2 m	**Push-On** Terminals: 1 V A/D inputs
05890-60800	General Purpose	2 m	Spade Lugs

Note: Information above pertains to the +1 V cable. The 1 mV cable terminates in spade lugs for cable Part No. 05890-60790 and -60800.

1. Insert the cable plug into the SIGNAL 1 or SIGNAL 2 male receptacle. The plug may be inserted in either of its two possible orientations.

Note: The SIGNAL 2 analog output receptacle does not function unless the Option 550/Accessory 19242A (Communications Interface Board) or Option 560/Accessory 19254A (RS•232•C Interface Board) is installed.

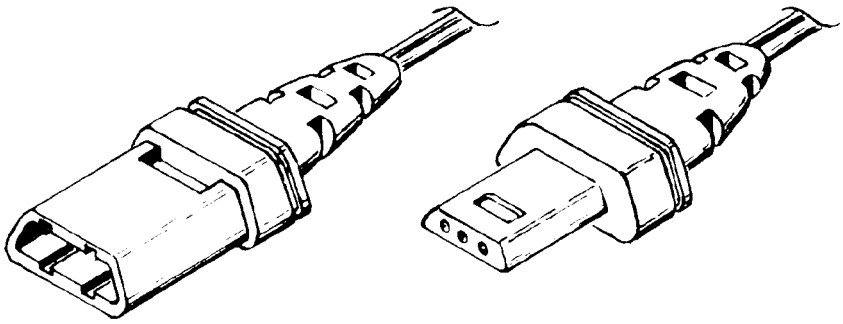
2. Connect lead cable(s) to the respective receiving device(s). If spade lug•terminatedwires must be connected directly, note the following with respect to color coding:

WHITE	+ (High)
BLACK	- (Low)
ORANGE	Ground

3. Lead the cable(s) out of the instrument at the rear of the signal cable area. Replace the top panel (unless additional cables are to be installed at this time).

Instrument network (INET) cable

With Option 550 or 570 installed, the HP 5890 may be made part of an **Instrument Network** (INET) system allowing automated operation of the chromatograph, an integrator, an automatic liquid sampler, valves, etc. The figure below shows the cable required to use this Option.



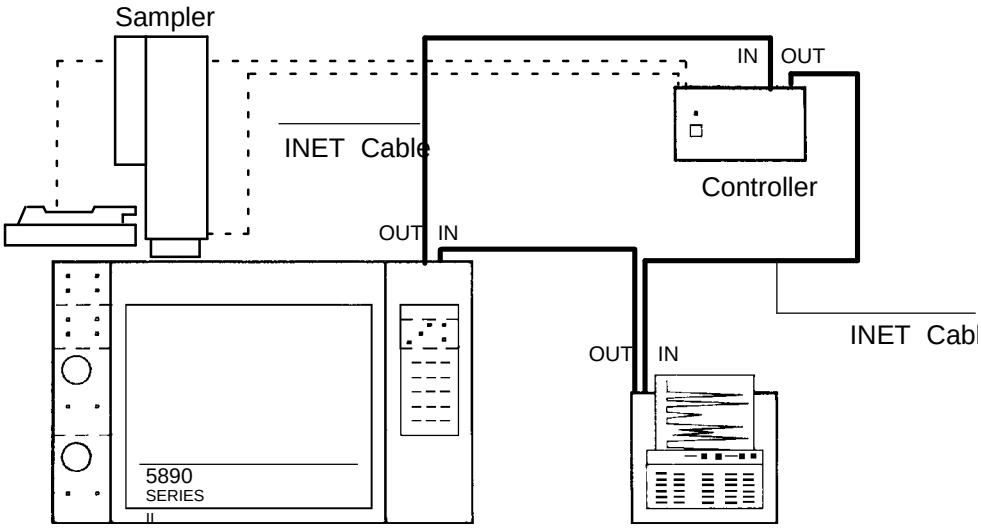
Inet Communications Cable

Note that two cables are always required to create a complete communications loop.

Available INET Communications Cables

Part No.	Length	Connector Type
82167D	5 m	HP-IL

Each device to be included in INET communications is connected in series with the next, forming a **loop**; thus, INET OUT on a given device must be connected to INET IN on the next. The loop must be continuous, and all devices must be **on** for the loop to function.



Typical Inet Loop System

To install the INET communications cable:

1. Locate INSTRUMENT NETWORK IN (male) and OUT (female) receptacles at the top of the HP 5890 (see the *Locations for Signal Cable Connections* figure in this section).
2. Locate INET IN/OUT receptacles on other devices to be included in the loop.
3. Install an INET cable between the OUT receptacle on the HP 5890 and the IN receptacle on the next device included in the loop.

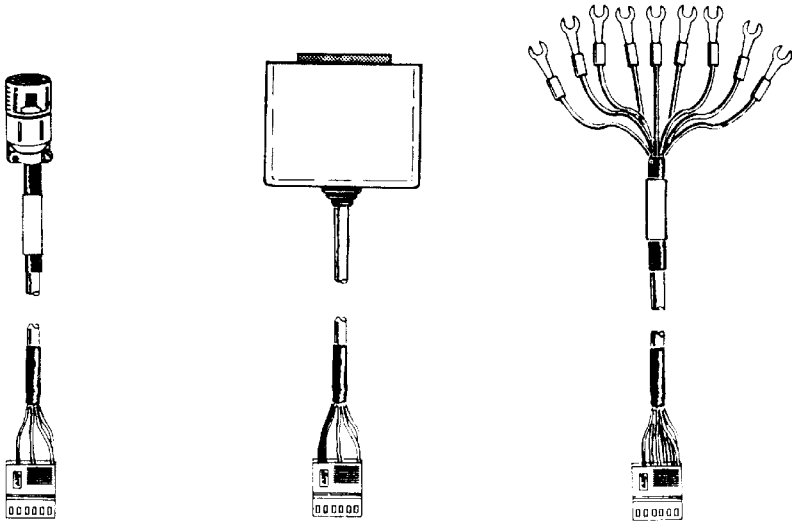
4. Install a second INET cable between the IN receptacle on the HP 5890, and the OUT receptacle on the previous device included in the loop.

For an INET system, communication among instruments on the loop should be made only via installed INET cables. If you have capability of installing a remote start/stop cable (see next section) between the HP 5890 and the INET controller, this should not be done at the same time INET cables are connected.

Remote start/HP 5890 ready cables

The REMOTE receptacle provides a function used primarily to start an integrator or data system when an HP 5890 run begins, and also provides **ready** information.

Pin No.	Color
1	Green
2	Brown
3	Blue
5	Gray
6	Violet
7	Orange
8	Black
9	Yellow
12	Red



05890-61050 or 05890-61060

05890-61070

05890-61080

Remote Start/HP 5890 Ready Cables

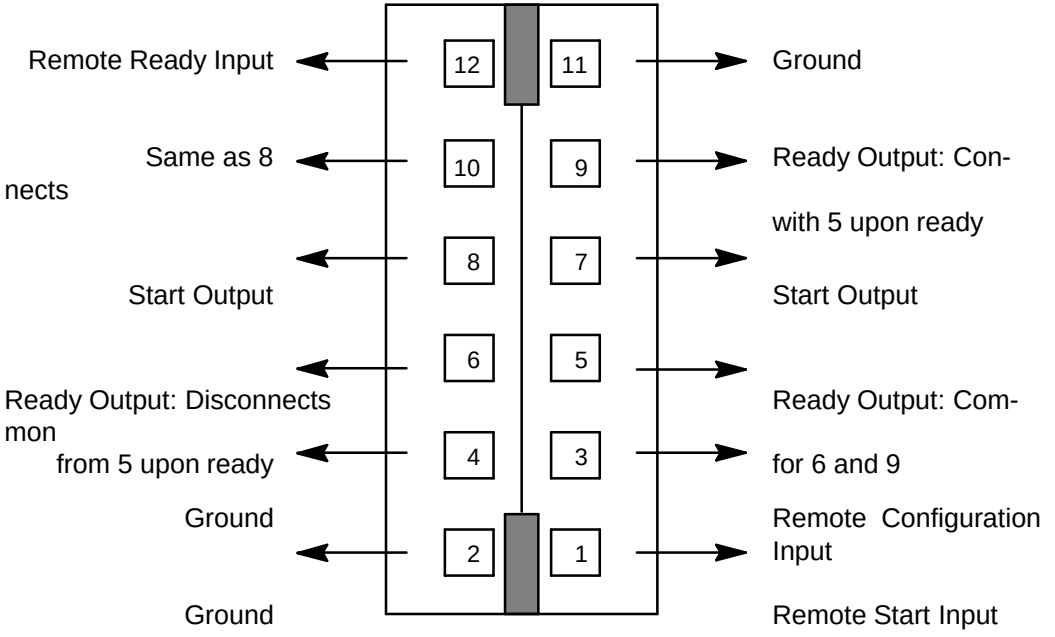
Available Remote Start/HP 5890 Ready Cables

Part No.	Use	Length
03394-60560	HP 3394/96A Integrator/Controller	2 m
05890-61060	HP 3392A Integrator/Controller	2 m
05890-61050	HP 3390A Integrator	2 m
05890-61070	HP 3350 Series LAS	2 m
05890-61080	General Purpose	2 m

Remote receptacle

The 12•pin REMOTE receptacle provides a variety of functions, depending upon connections made via the cable. The figure below and the table following identify the function at each pin.

View from the top and front of the HP 5890



Available Functions, Remote Receptacle J2

Available Functions, REMOTE **Receptacle**

Function	Description
Pin No. 1	
Remote Start In	**TTL** input: expects a pulsed relay closure (>5 msec duration) across Pin 1 and any Ground pin. • A closure initiates a run by starting the oven temperature program. • The run terminates at the HP 5890 by pressing STOP, or by completing the oven temperature program.
Pin No. 2	
Ground	Ground pin.
Pin No. 3	
Remote Configuration In	**TTL** input; expects a relay closure, or a jumper, across Pin 3 and any Ground pin. • If Pins 3 & 4 are open (unconnected): the HP 5890 START key **both** initiates a run by starting the oven temperature program, **and** pulses the **Start Out** relay (Pins 7 & 8; Pins 9 & 10). • If Pins 3 & 4 are closed (connected): the HP 5890 START key pulses the **Start Out** relay (Pins 7 [9] & 8 [10]), but **does not** start the oven temperature program. The run is initiated (temperature program started) via a closure across Pins 1 & 2 (Remote Start In), or INET (if used).
Pin No. 4	
Ground	Ground pin.

(continued on next page)

Available Functions, REMOTE **Receptacle**

Function	Description
Pin No. 5 & 6 or 5 & 9	
Ready Out	Two sides of a single-pole, double-throw relay; **ready** is signaled by the contacts opening (Pins 5 & 6), or by contacts closing (Pins 5 & 9). **Ready** occurs when the following conditions are met: • The HP 5890 is **not** in a run. • The oven is both on and at setpoint. • Oven EQUIB TIME has elapsed. • **All** heated zones that are on are at setpoint. • **All** detectors assigned to output channel(s) are on. • If INET is used, other devices on the loop signal **ready**. • No FAULT:s have occurred. Relay contacts are rated at 3 W, 0.25 A, 28 V dc maximum resistive load only; 1.2 msec bounce.
Pin No. 7, 8, and 10	
Start Out Identical to Pin 8	Two sides of a normally open relay. Contacts are pulsed closed for 50 msec to signal **start run** when **either** of the following occurs: • If Pins 3 & 4 (Remote Configuration In) are **not connected**, the relay is pulsed when START is pressed. • If Pins 3 & 4 (Remote Configuration In) are **connected**, the relay is pulsed when the oven temperature program starts. Relay contacts are rated at 10 W, 0.5 A, 200 V dc maximum resistive load only; 0.4 msec bounce.
Pin No. 11	
Ground	Ground pin.
Pin No. 12	
Remote Ready In	**TTL** input; expects a relay closure (connecting Pins 11 & 12) by an external device if the device is **not** ready. • If a **not ready** closure is read, the HP 5890 NOT READY LED is lit and a display is generated. The NOT READY condition is also reported to the INET system (if used). • The external device is assumed to be **ready** when the closure is removed (disconnecting Pins 11 & 12).

The variety of functions available makes custom•designedoperating systems possible. Some examples include:

- A simple push•buttonswitch installed across Pins 1 & 2 permits starting the HP 5890 from a remote location. In performing manual injections, for example, it is quite convenient to have remote **start** capability located in the inlet area to minimize time delays between starting the HP 5890 and injecting sample.

  Alternatively, an integrator or chart recorder having suitable remote start output capability can be connected across Pins 1 & 2 to permit the remote device to start the HP 5890.

- It is also convenient to have a connected integrator or chart recorder start automatically when an analysis is initiated at the HP 5890. If the integrating or recording device can be started remotely by a contact closure, Pins 7 & 8 (or 7 & 10) may be used for this purpose.

  - Note that Pins 7 & 8 (or 7 & 10) are **always** momentarily connected to each other when START at the HP 5890 is pressed.

  - Note also that when START is pressed, behavior of the oven temperature program depends upon the condition at Pins 3 & 4:

    If 3 & 4 **are not** connected, the oven temperature begins immediately.

    If Pins 3 & 4 **are** connected, the oven temperature program does not begin until Pins 1 & 2 are connected.

  Pins 3 & 4, if connected, permits the HP 5890 START key to start a remote device **without** simultaneously starting its own oven temperature program.

  For example, this permits setting up a system for automated operation using an integrator, an automatic sampler, and a controller for the sampler. With Pins 3 & 4 **connected**, when START is pressed at the HP 5890, Pins 7 & 8 (or 7 & 10) are connected momentarily to signal the sampler controller to operate the sampler.

At injection, the sampler controller simultaneously must signal the integrator to begin integrating data, and must start the HP 5890 oven temperature program (via Pins 1 & 2).

- Where the HP 5890 is to be started from a remote device, it is convenient to have indication as to whether or not the HP 5890 is **ready**. This is available via Pins 5 & 6, which remain connected until HP 5890 **readiness** occurs, or via Pins 5 & 9 which remain disconnected until HP 5890 **readiness** occurs.

  Choice of which pair of Pins to use depends upon requirements of the remote device.

- Conversely, Pins 11 & 12 permit a remote device to report **its** readiness to the HP 5890: if Pins 11 & 12 are **connected**, the remote device is assumed **not** ready. At the HP 5890, the NOT READY LED will be lit, EXT DEVICE NOT READY is displayed by pressing CLEAR, and **not ready** is reported to the INET system (if used).

  An example of where this function might be required is where, in automated operation, an integrating or computing device requires time to process and report data for a just•terminatedrun before the next run can begin.

- Note that there is no remote **stop** function; the HP 5890 stops the current run either when STOP is pressed, or upon completing its oven temperature program. A connected integrating or recording device must be stopped separately, either manually or through its own timed events table.

RS-232 and HPIB/RS-232 cables

For RS•232(Option 560) and HPIB/RS•232 (Option 580) cable installation information, refer to the appropriate document included with each option.

HP-IB/RS-232 interface board information

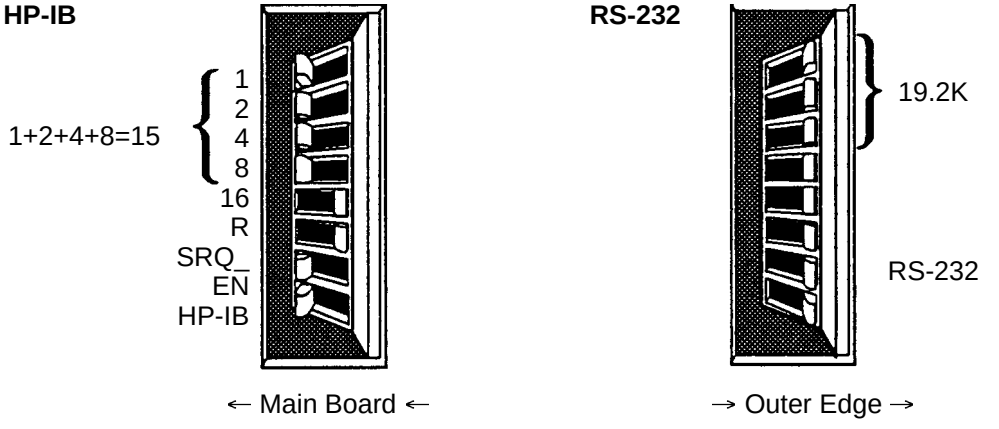
Remove the top right cover and the right side panel from the instrument.

Locate the eight•toggleS1 Switch on the HP•IB/RS•232nterface board. Notice that each of the eight toggles can be positioned toward the main board or the outer edge of the interface board.

The bottom toggle determines either an RS•232or an HP•IB configuration. When the bottom toggle is set toward the outer edge, the board is considered for RS•232use. Set the bottom toggle for your desired configuration.

If you desire an HP•IBconfiguration (bottom toggle toward the main board), the five top toggles need to be set to determine the HP•IBaddress. Setting the toggles toward the main board activates the address indicated. For example, if the top toggle is set inward, it indicates a one; or if set outward, it indicates a zero. If the top four toggles were all set toward the main board's outer edge (and the fifth toggle positioned toward the interface board's outer edge), the resulting HP•IBaddress would be 1 + 2 + 4 + 8 or 15. Set the HP•IBaddress desired.

When using an HP•IBcofiguration, the seventh toggle should be set. Unless otherwise specified by the host computer's documentation, set the default SRQ•ENtoggle toward the main board (its enable position).



If you desire an RS•232configuration (the bottom toggle toward the board's outer edge), the top three toggles must be set to establish the baud rate. Use the table below to set the toggles (note that a toggle **on** means that it is set toward the board's outer edge).

toggle 1	OFF	ON	OFF	ON	OFF	ON	OFF	ON
toggle 2	OFF	OFF	ON	ON	OFF	OFF	ON	ON
toggle 3	OFF	OFF	OFF	OFF	ON	ON	ON	ON
Baud Rate	150	300	600	1.2K	2.4K	4.8K	9.6K	19.2K

Although the INET loop may be configured later for communication with various products, for the present, the provided HP•ILcable (HP Part No. 82167-60002) should be connected from the interface board's **out** connector to its **in** connector. This will loop information from its transmitter section back into its receiver section for the initial testing.

Install the instrument's side panel.

1. Plug the instrument's power cord into a power source. Turn the instrument's main power switch on.
2. As soon as the GC display reads TESTING SIGNAL PATH, press the CLEAR button. Continue to hold the CLEAR button in, until the User Tests Sel 0..7 message appears on the display.
3. Press the number 0 on the keypad. The response on the display will be the revision code for the RS•232/HP•IBinterface installed in your instrument.
4. Next, press the number 3 on the keypad. The message HPIL Loop Passed should appear when the INET portion of the interface is functioning and the HPIL cable is connected from **out** to **in**.

5. Test 4 will verify your selection of type of interface and either its address or its baud rate. Pressing the number 4 on the keypad will display a message RS-232 Baud = the selected rate or HP-IB Addr the selected address. If the display indicates an incorrect type of interface, address, or baud rate, turn off the instrument's power and reset the toggles of switch S1 on the interface board.

6. When the proper interface and baud rate or address is displayed, entering the number 7 on the keypad allows you to restart the system with all of the new parameters just entered.

The display will prompt you to press the ENTER key. When the ENTER key is pressed, the instrument will undergo its standard self•testand the new parameters will be configured into memory.

Tests 1, 2, 5, and 6 are used as diagnostic tools for troubleshooting.

Test 1•Short Memory Test displays TEST 0000. This rapidly cycles through memory pages incrementing the test number to determine if all 256 1K pages are accessible.

Test 2•Long Memory Test (about 15 minutes) initially displays Set Memory to 0's, then changes to Bank: 000, PASS: 000 during the test. The bank number will cycle through 0 ... 255, displaying the number of the current 1K segment under test. After all 256 segments are tested, the pass count is incremented and the test restarts.

Note that Test 4•HP•IB Addr or RS•232Baud must be run before Test 5 or 6 to set the current selection into the interface chip.

Test 5•HP•IB Communication Test displays characters received on the HP•IBbus. It also sends HP5890A HP•IB/RS•232User Tests <CRLF>. It transmits and receives at a rate of about 3 characters per second. Timeouts may be a problem.

Test 6•RS•232 Communication Test transmits HP5890A HP•IB/RS•232 User Tests < CRLF > at a rate of 3 characters per second. It displays characters received (at any speed) from the RS•232line.

If an INET loop is to be used, install the loop cables. If an INET is not being used, leave the INET cable between an **in** and **out** in place.

Connect the appropriate HP•IBor RS•232cable to the connector board.

Replace all of the instrument's panels and covers.

Analog input board information

Input Voltage	-10mV to + 1V between + and - inputs
Input Noise	10 μV peak to peak
Input Common Mode Range	+/- 5V DC (measured + or - to Gnd)
Common Mode Rejection Ratio	80 db
Scaling	1 HP 5890 display count + 16.2 μV input At Range 6 → 1 mV input to board will produce a 1 mV output

Post-install checklist

☐ Are the instrument supply gasses connected?

☐ Have all the supply gas fittings been leak tested?

☐ Have the signal output cables been connected?

☐ Has the instrument power cord been connected?

Refer to the *HP 5890 SERIES II Operating Manual* for column installation and operating information.