Clarus 500 GC Installation Guide

Release History

Part Number	Release	Publication Date
09936590	B	August 2002

Any comments about the documentation for this product should be addressed to:

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Shelton
Connecticut 06484-4794
U.S.A.

Or emailed to: AI.UserAssistance@perkinelmer.com

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Introduction 1

About This Manual

This quick installation guide is divided into following chapters:

Chapter 1 Introduction

This chapter contains a brief introduction on the instrument, the conventions and warnings used in the manual.

Chapter 2 Safety Practices

Important safety information for the Clarus 500 GC is provided in this chapter.

Chapter 3 Preparing Your Laboratory

The preparation of your laboratory needed for the Clarus 500 GC laboratory requirements for the instrument are reviewed in this chapter.

Chapter 4 Installing the Clarus 500 GC

Information on connecting the Clarus 500 GC is provided.

Chapter 5 Connecting the Gases and Electrical Supply

Information on connecting the gases and electrical supply to the system is provided.

Chapter 6 Connecting the Accessories

Information on installing accessories such as the EICD, NPD Bead Assembly, recorder, integrator and the printer is provided.

Chapter 7 PPC Restrictor Information

PPC restrictor information is provided in this chapter.

Conventions Used in this Manual

Normal text is used to provide information and instructions.

Bold text refers to button or tab page that is displayed on the touch screen.

All eight digit numbers are PerkinElmer part numbers unless stated otherwise.

Notes, cautions and warnings

Three terms, in the following standard formats, are also used to highlight special circumstances and warnings.

NOTE: *A note indicates additional, significant information that is provided with some procedures.*

CAUTION	*We use the term CAUTION to inform you about situations that could result in **serious damage to the instrument** or other equipment. Details about these circumstances are in a box like this one.*

WARNING

*We use the term WARNING to inform you about situations that could result in **personal injury** to yourself or other persons. Details about these circumstances are in a box like this one.*

Customer Service

PerkinElmer Instruments
710 Bridgeport Avenue
Shelton, CT 06484-4794 U.S.A

Tel: 1 (800) 762-4000 or (203) 762-4000
Internet: http://www.perkinelmer.com

Electromagnetic Compatibility (EMC)

United States (FCC)

This product is classified as a digital device used exclusively as industrial, commercial, or medical test equipment. It is exempt from the technical standards specified in Part 15 of the FCC Rules and Regulations, based on Section 15.103 (c).

European Union

All information concerning EMC standards will be in the Declaration of Conformity and these standards will change as the European Union adds new requirements.

European Union Industrial Environment

The 230 V/50 Hz. Clarus GC has been manufactured for use in the European Union and is intended for the industrial environment. The instrument is to be connected to a mains power network supplied from a high or medium-voltage transformer dedicated for the supply of an installation feeding a manufacturing or similar plant.

Industrial environments are characterized by the existence of one or more of the following conditions:

-industrial, scientific and medical (ISM) apparatus are present

-heavy inductive or capacitive loads are frequently switched

-currents and associated magnetic fields are high

These are the major contributors to the industrial electromagnetic environment and as such distinguish the industrial from other environments. The instrument is not intended for connection to a public mains network supplying residential, commercial and light-industrial locations.

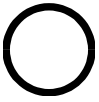
Susceptibility to RF Interference

With the exception of the Flame Ionization Detector (FID), a RF field strength of 10 V/m between 80 MHz. and 1000 MHz. with 80% modulation at 1 kHz. may cause a deflection on the chromatographic detector baseline that exceeds its normal pattern. This implies that if a transmitting device, such as a walkie-talkie carried by a security guard, is use near the detector, a spike or peak on the chromatographic baseline may occur. If you are concerned that such an event may occur, PerkinElmer recommends that walkie-talkie restriction notices be posted in the vicinity. Cell phones, beepers, and other similar devices operate in a much higher frequency range and do not cause interference.

Warning Signs on the Instrument

Alternating current.

Protective conductor terminal.



Off position of the main power source.

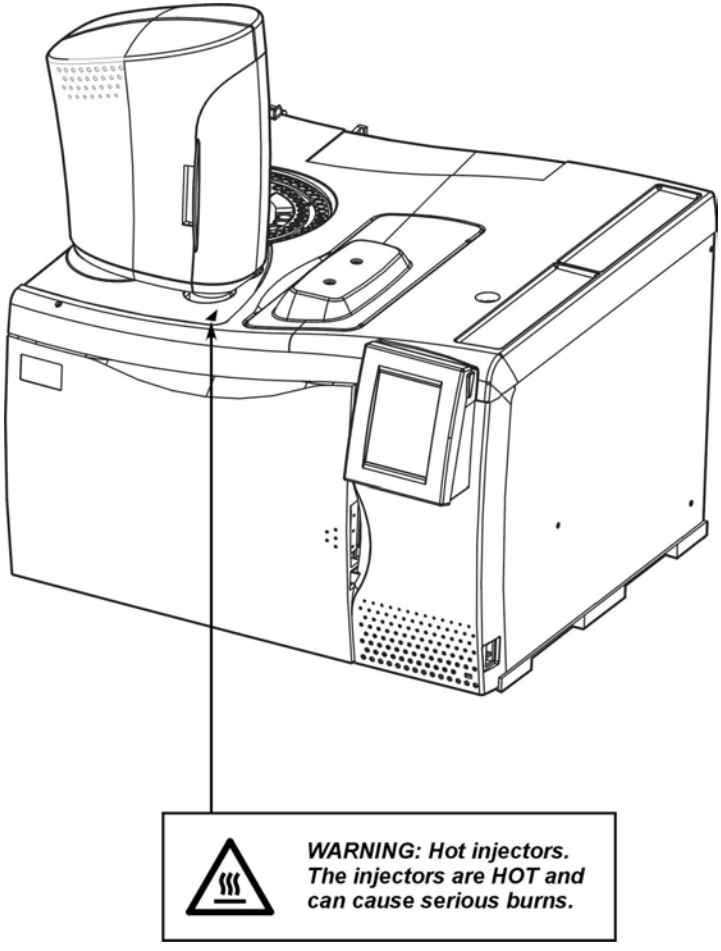
On position of the main power source.

Warning, hot surface

Warning, risk of electric shock.

Warning (refer to accompanying documents).

Label locations on instrument



Safety Practices 2

Chapter Overview

This chapter describes the general safety practices and precautions that must be observed when operating the Clarus 500 GC.

This advice is intended to supplement, not supersede, the normal safety codes in the user's country. It is also a supplement to the PerkinElmer standard Safety and Health Policy. The information provided does not cover every safety procedure that should be practiced. Ultimately, maintenance of a safe laboratory environment is the responsibility of the analyst and the analyst's organization.

Please consult all manuals supplied with the Clarus 500 GC and accessories before you start working with the instrument. Carefully read the safety information in this chapter and in the other manuals supplied. When setting up the instrument or performing analyses or maintenance procedures, strictly follow the instructions provided. The Clarus 500 GC should be used in accordance with the instructions provided in this manual. If used otherwise, the protection provided by the instrument may be impaired.

Generic Warnings

Before installing or operating the Clarus 500 GC, read the following information concerning hazards and potential hazards. You should ensure that anyone involved with installation and/or operation of the Clarus 500 GC is knowledgeable in both general safety practices for the laboratory and safety practices for the Clarus 500 GC. Get advice from your safety engineer, industrial hygienist, environmental engineer, or safety manager before you install or use this instrument.

Heated Zones

Heated zones should be treated with caution, for example, injector caps and detectors. Avoid physical contact with the injector caps. The detector cover may get hot, especially if flame ionization detectors are operated at high temperatures. As a general rule, allow heated zones to cool before attempting to work in the oven, injector, or detector areas.

CAUTION	***THERMAL RUNAWAY PROTECTION:*** *The Clarus 500 GC software shuts down the instrument if any heated zone exceeds 470 °C. Should this occur, the following error message is displayed*: **INSTRUMENT SHUTDOWN** *xxx THERM RUNAWAY where xxx is the heated zone* *Call your PerkinElmer Representative.* *Instrument shutdown also occurs if there is a PRT (Platinum Resistance Thermometer) or MPU (Micro Processor Unit) failure. In these cases the following error message is displayed:* *INSTRUMENT SHUTDOWN* *xxx PRT ERROR where xxx is the failed zone.* *Call your PerkinElmer Representative.*

Precautions

WARNING

Be sure that all instrument operators read and understand the precautions listed below. It is advisable to post a copy of the precautions near or on the instrument shelf.

The following precautions must be observed when using the Clarus 500 GC:

- Be sure that the power line voltage of the Clarus 500 GC corresponds to the voltage used in your laboratory.
- Never remove the side panels of the Clarus 500 GC without shutting down the instrument and disconnecting the instrument power cord from line power.
- Do not immerse the purge gas exit line in a liquid, as the liquid may be drawn back into the sample holder.
- Only high quality purge gases should be used with the Clarus 500 GC. Minimum purity of 99.995% is recommended. A high quality filter-dryer accessory is recommended for the removal of any moisture from the purge gases.

Environmental Conditions

Operating Conditions

CAUTION *The Clarus 500 GC is designed for indoor use only.*

CAUTION

Do not operate in a Cold Room or a refrigerated area. The Clarus 500 GC operates most efficiently under the following conditions:

- *Ambient temperature is 10 °C to 35 °C (50 °F to 95 °F). The GC will operate safely between 5 °C and 40 °C (41 °F and 104 °F).*
- *Ambient relative humidity is 20% to 80% non-condensing.*
- *Operating altitude is in the range of 0 to 2 000 m.*

WARNING

The Clarus 500 GC is not designed for operation in an explosive environment.

Installation Category

The Clarus 500 GC is able to withstand transient overvoltage according to Installation Category II as defined in IEC 1010-1.

Pollution Degree

The Clarus 500 GC will operate safely in environments that contain nonconductive foreign matter up to Pollution Degree 2 in IEC 1010-1.

Clarus 500 GC Touch Screen

For optimum performance, the Clarus 500 GC's touch screen may require periodic re-calibration. The interval between re-calibration may be affected by exposure to combined heat and humidity conditions (ambient conditions between 30 °C / 50% RH and 35 °C / 80% RH).

Storage Conditions

The Clarus 500 GC may be stored under the following conditions:

- ambient temperature is -20 °C to +60 °C (-4 to 140 °F)
- ambient relative humidity is 20 to 80%, non-condensing
- altitude is in the range 0 to 12 000 m.

General Laboratory Safety

Your laboratory should have all equipment ordinarily required for the safety of individuals working with chemicals (fire extinguishers, first-aid equipment, safety shower and eye-wash fountain, spill cleanup equipment, etc.).

Electrical Safety

The Clarus 500 GC contains high voltage. To prevent the risk of shock, unplug the line cord from the AC outlet and wait at least one minute before opening or removing any instrument panels.

The instrument has been designed to protect the operator from potential electrical hazards. This section describes some recommended electrical safety practices.

CAUTION *This unit contains protective circuitry. Contact PerkinElmer Service before performing any AC line tests.*

WARNING *Connect the GC to an AC line power outlet that has a protective ground connection. To ensure satisfactory and safe operation of the GC, it is essential that the protective ground conductor (the green/yellow lead) of the line power cord is connected to a true electrical ground. Any interruption of the protective ground conductor, inside or outside the GC, or disconnection of the protective ground terminal may impair the protection provided by the GC.*

WARNING ***Do not operate the GC with any covers or parts removed.***

WARNING

To avoid electrical shock, disconnect the power cord from the AC outlet before servicing. Servicing on the GC is to be performed only by a PerkinElmer service representative or similarly trained and authorized person.

WARNING

Do not attempt to make adjustments, replacements or repairs to this GC except as described in the user documentation.

WARNING

For protection against fire hazard, only replace fuses with the same type and rating. Servicing on the GC is to be performed only by a PerkinElmer service representative or similarly trained and authorized person.

CAUTION *To ensure adequate cooling of the instrument electronics, do not obstruct the gap at the base of the GC, and leave at least a 6-inch clearance between instruments.*

Ensure that the power cord is correctly wired and that the ground leads of all electrical units (for example, recorders, integrators) are connected together via the circuit ground to earth. Use only three-prong outlets with common earth ground connections.

Servicing of incoming AC line components in your laboratory should be performed only by a licensed electrician.

WARNING

Lethal voltages are present at certain areas within the instrument. Installation and internal maintenance of the instrument should only be performed by a PerkinElmer service engineer or similarly authorized and trained person. *When the instrument is connected to line power, opening the instrument covers is likely to expose live parts. Even when the power switch is off, high voltages can still be present. Capacitors inside the instrument may still be charged even if the instrument has been disconnected from all voltage sources.*

The instrument must be correctly connected to a suitable electrical supply. The supply must have a correctly installed protective conductor (earth ground) and must be installed or checked by a qualified electrician before connecting the instrument.

WARNING

Any interruption of the protective conductor (earth ground) inside or outside the instrument or disconnection of the protective conductor terminal is likely to make the instrument dangerous. Intentional interruption is prohibited.

When working with the instrument:

- Disconnect the instrument from all voltage sources before opening it for any adjustment, replacement, maintenance, or repair. If afterwards, the opened instrument must be operated for further adjustment, maintenance, or repair, this must only be done by a PerkinElmer Service engineer.
- Whenever it is possible that the instrument is no longer electrically safe for use, make the instrument inoperative and secure it against any unauthorized or unintentional operation. The electrical safety of the instrument is likely to be impaired if, for example, the instrument shows visible damage, has been subjected to prolonged storage under unfavorable conditions, or has been subjected to severe stress during transportation.

Moving the Clarus 500 GC

The Clarus 500 GC weighs 53.5 kg (118 lb). Improper lifting can cause injury to the back. If the instrument must be moved, we recommend that at least two people carefully lift the instrument in order to move it.

ECD Radioactive Hazards

WARNING

To assure that removable radioactive contamination on the external parts of the ECD remains at a safe level, the United States Nuclear Regulatory Commission requires that:

- *The ECD be wipe tested at least once every six months.*
- *A record of the results must be maintained for NRC inspection.*

United States Government Regulations for ECDs

NOTE*: To repair an Electron Capture Detector cell requires a specific license issued by the U.S. Nuclear Regulatory Commission (NRC) and/or in some states by the equivalent state agency. For further information on obtaining a license, contact the Customer Service Department at PerkinElmer, Shelton, Connecticut, or the NRC Material Branch, Office of Nuclear Materials, Safety and Safeguards, Washington, DC 20555.*

All USNRC regulations can be obtained through the internet at www.nrc.gov/reading-rm/

NOTE: *These instructions are for ECD cell purchasers who are not specifically licensed to handle radioactive materials.*

The Clarus 500 GC Electron Capture Detector model (P/N N610-0063) contains a maximum of 15 mCi of Nickel 63 (Ni 63), a radioactive material. Your possession and use of this detector is governed by 10 C.F.R. Section 31.5 which is reproduced in Appendix I. Under the provisions of that regulation you are deemed a "General Licensee."

Your possession and use of the detector cell may also be regulated by the state where you are located. The requirements of state regulatory agencies are substantially similar to those contained in NRC regulation 10 C.F.R. Section 31.5, but they may differ in some respects. It is suggested that you procure a copy of the regulations of your particular state. (Supplement 2 in Appendix I contains a list of the "Agreement States" which have been granted authority by the U.S. Nuclear Regulatory Commission to regulate the possession and use of radioactive material.)

It is required that you be familiar with regulation 10 C.F.R. Section 31.5 (Appendix 1 in the Hardware Guide 0993-6590). Following are summaries of its requirements.

Labels

Do not remove any of the labels attached to the ECD cell or any of the labels attached to your Clarus 500 Gas Chromatograph that refer to the ECD cell. Follow all instructions and abide by all precautions provided by the labels and in user instruction manuals referred to by the labels.

Leak Testing

You are obligated under U.S. federal and state regulations to make certain that the ECD cell is wipe-tested for leakage of radioactive materials at intervals of no longer than six months, and that the analysis of these wipe tests is conducted by a person specifically licensed to do so, either by the U.S. Nuclear Regulatory Commission or by an Agreement State. The analyses can be performed by the firm listed below:

National Leak Test Center
P.O. Box 486
North Tonawanda, New York 14120

ECD Cell Failure or Damage

If a leak test detects more than 0.005 μCi (microcurie) of removable radioactive material on the surface of an ECD cell, or if the cell itself is damaged in such a way as to indicate that it may no longer adequately shield the radioactive material inside, you must immediately suspend operation of your chromatograph until the cell has been repaired or disposed of by ***a person specifically licensed to do so***. Any such incident must be reported by you to the Regional Office, Inspection and Enforcement, U.S. Nuclear Regulatory Commission.

Reporting Radiation Incidents, Theft or Loss

Please read Regulation 10 C.F.R. Section 20.2201 and 20.2202. These describe your duties should the radioactive material (Ni 63) in the ECD cell be lost, stolen, or released, or should any person be exposed to radiation.

Other ECD Requirements

Regulation 10 C.F.R. Section 31.5 (see Appendix I) does not permit you to abandon the ECD cell or export it. It may not be transferred except to a person specifically licensed to receive it. Within thirty days of such a transfer, you must report to the Director of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, the name and address of the transferee. However, no report is needed to transfer a defective ECD cell to PerkinElmer in order to obtain a replacement.

You may transfer the ECD cell to another general licensee, like yourself, only when it remains at the same location to which it was shipped by PerkinElmer. Give the transferee a copy of these instructions and the regulations in Appendix I, and report to the commission as required in Regulation C.F.R. Section 31.5.

WARNING

NEVER DISMANTLE THE ECD CELL!!
You can remove the ECD cell from the GC for repair.

United Kingdom Regulations

In the U.K., registration is required under the Radioactive Substances Act of 1960, for anyone keeping or using radioactive materials. Application should be made to any one of the following governing bodies:

ENGLAND Department of the Environment
Queen Anne's Chambers
Tothill Street
London, SW1H 9J4

SCOTLAND Scottish Development Department
21 Hill Street
Edinburgh, EH2 3J4

WALES Welsh Office
Cathay's Park
Cardiff, CF1 3NG

NORTHERN IRELAND Ministry of Development
Parliament Building
Storemont
Belfast, Northern Ireland

Safe Handling of Gases

When using hydrogen, either as the combustion gas for a flame ionization detector or as a carrier gas, special care must be taken to avoid buildup of explosive hydrogen/air mixtures. Ensure that all hydrogen line couplings are leak-free and do not allow hydrogen to vent within the oven.

Ventilation

Adequate ventilation must be provided, particularly if a liquid nitrogen or carbon dioxide subambient accessory is in constant use. When analyzing hazardous compounds, such as pesticides, it may be necessary to arrange for venting of detector effluent into a fume hood.

Using Hydrogen

WARNING

Flame Ionization Detectors (FID) and Flame Photometric Detectors (FPD) use hydrogen as fuel. If the hydrogen is turned on without a column attached to the injector and detector fittings inside the oven, hydrogen could diffuse into the oven creating the possibility of an explosion. To avoid possible injury, ***DO NOT TURN ON THE HYDROGEN UNLESS A COLUMN IS ATTACHED AND ALL JOINTS HAVE BEEN LEAK TESTED.***

Before disconnecting a column, make certain that the hydrogen has been turned ***OFF.***

If two FIDs or FPDs are installed and only one has a column attached to it, make certain that you cap off the unused detector inlet fitting with a 1/8-inch stainless steel plug (P/N N930-0061).

WARNING

Contact the gas supplier for a material safety data sheet (MSDS) containing detailed information on the potential hazards associated with the gas. *Carefully use, store, and handle compressed gases in cylinders. Gas cylinders can be hazardous if they are mishandled.*

NOTE: *The permanent installation of gas supplies is the responsibility of the user and should conform to local safety and building codes.*

If liquid nitrogen is used, the gas cylinder must be fitted with an over-pressure regulator which will vent the cylinder as necessary to prevent it from becoming a safety hazard.

Consult the following references for more detailed information and additional guidelines about gas cyclinders.

- Compressed Gas Association (USA), "Safe Handling of Compressed Gases in Containers," pamphlet no. P-1, 1984.
- Compressed Gas Association (USA), "The Inert Gases – Argon, Nitrogen and Helium," pamphlet no. P-9, 1992.

Identification of Gas Cylinders

- Legibly mark cylinders to identify their contents. Use the chemical name or commercially accepted name for the gas.

Storing Gas Cylinders

Review the following precautions with the customer to ensure the safe use and storage of gas cylinders.

- Cylinders should be stored in accordance with the regulations and standards applicable to the customer’s locality, state, and country.

- When cylinders are stored indoors in storage rooms, the storage room should be well ventilated and dry. Ensure that the ventilation is adequate to prevent the formation of dangerous accumulations of gas. This is particularly important in small or confined areas.
- Do not store cylinders near elevators, gangways, or in locations where heavy moving objects may strike or fall against them.
- Use and store cylinders away from exits and exit routes.
- Locate cylinders away from heat sources, including heat lamps. Compressed gas cylinders should not be subjected to temperatures above 52 °C (126 °F).
- It is recommended that gas cylinders be stored and placed outside the laboratory and connected to the instrument through copper lines.

Handling of Gas Cylinders

- Do not allow ignition sources in the storage area and keep cylinders away from readily ignitable substances such as gasoline or waste, or combustibles in bulk, including oil.
- Store cylinders standing upright, fastened securely to an immovable bulkhead or permanent wall.
- When storing cylinders outdoors, they should be stored above ground on a suitable floor and protected against temperature extremes (including the direct rays of the sun).
- Arrange gas hoses where they will not be damaged or stepped on and where things will not be dropped on them.
- Take care not to kink or stress the gas lines. For safety, cylinders should be firmly clamped in position.
- If it becomes necessary to move the cylinders, do so with a suitable hand truck after insuring that the container cap is secured and the cylinder is properly fastened to the hand truck.
- Use only regulators, tubing and hose connectors approved by an appropriate regulatory agency.
- Do not refill cylinders.
- Check the condition of pipes, hoses and connectors regularly. Perform gas leak tests at all joints and seals of the gas system regularly, using an approved gas leak detection system.
- When the equipment is turned off, close all gas cylinder valves tightly at the cylinder. Bleed the remainder of the line before turning the exhaust vent off.

Hazardous Chemicals

Before using samples, you should be thoroughly familiar with all hazards and safe handling practices. Observe the manufacturer's recommendations for use, storage and disposal. These recommendations are normally provided in the Material Safety Data Sheets (MSDS) supplied with the solvents.

Be aware that the chemicals that you use in conjunction with the GC may be hazardous. **DO NOT** store, handle, or work with any chemicals or hazardous materials unless you have received appropriate safety training and have read and understood all related Material Safety Data Sheets (MSDS). MSDSs provide information on physical characteristics, precautions, first aid, spill clean up and disposal procedures. Familiarize yourself with the information and precautions contained in these documents before attempting to store, use or dispose of the reagents. Comply with all federal, state, and local laws related to chemical storage, handling, and disposal.

You must work under a suitable hood when handling and mixing certain chemicals. The room in which you work must have proper ventilation and a waste collection system. Always wear appropriate safety attire (full-length laboratory coat, protective glasses, gloves, etc.), as indicated on Material Safety Data Sheets.

WARNING

Some chemicals used with this GC may be hazardous or may become hazardous after completion of an analysis. The responsible body (for example, the Lab Manager) must take the necessary precautions to ensure that the GC operators and the surrounding workplace are not exposed to hazardous levels of toxic substances (chemical or biological) as defined in the applicable Material Safety Data Sheets (MSDS) or OSHA, ACGIH, or COSHH documents. Venting for fumes and disposal of waste must be in accordance with all national, state and local health and safety regulations and laws.

Definitions in Warning for Hazardous Chemicals

Responsible body. "Individual or group responsible for the use and maintenance of equipment, and for ensuring that operators are adequately trained." [per IEC 1010-1].

Operator. "Person operating equipment for its intended purpose." [per IEC 1010-1].

OSHA: Occupational Safety and Health Administration (United States)

ACGIH: American Conference of Governmental Industrial Hygienists

COSHH: Control of Substances Hazardous to Health (United Kingdom)

3 Preparing Your Laboratory

Chapter Overview

The items shown in the following checklist need to be considered when preparing the laboratory for the instrument.

- Environmental Conditions
- Exhaust Vent Requirements (if required)
- Laboratory Space Requirements
- Cooling Water Requirements (if required)
- Electrical Requirements
- Pneumatic Requirements (if required)

Preparing the Laboratory

The following sections describe the laboratory requirements in detail for the Clarus 500 GC.

Environmental Conditions

The laboratory in which the Clarus 500 GC is located must meet the following conditions:

- A corrosive-free environment.
- The instrument will operate with a laboratory temperature between 10 and 35 °C (50- 95 °F). For optimum instrument preformance, the room temperature should be controlled at 20° ± 2 °C.
- The environment should be relatively dust-free to avoid sample and instrument contamination problems.
- Free of excessive vibration.

The Clarus 500 GC has been designed for indoor use. Do not use the instrument in an area where explosion hazards may exist.

Exhaust Vent Requirements

Exhaust venting is important for the following reasons.

- It protects laboratory personnel from toxic vapors that may be produced by some samples.
- It helps to protect the instrument from corrosive vapors that may originate from the sample(s).
- It removes dissipated heat produced by the instrument and power supply.

WARNING

The use of Clarus 500 GC without adequate ventilation to outside air may constitute a health hazard.

NOTE: *Local electrical codes do not allow PerkinElmer Service Engineers to install the blower and vent assembly.*

The blower capacity depends on the duct length and number of elbows or bends used to install the system. If an excessively long duct system or a system with many bends is used, a stronger blower may be necessary to provide sufficient exhaust volume at the instrument.

Alternatively, smooth stainless-steel tubing should be used instead of flexible stainless steel tubing where flexibility is not required to reduce system friction loss or "drag." If smooth stainless steel is used, there must be a way to move the vent hood out of the way for servicing. A length of smooth stainless steel ducting has 20-30% less friction loss than a comparable length of flexible ducting. When smooth stainless steel tubing is used, elbows must be used to turn corners. These elbows should turn at a centerline radius of 150mm with a maximum bend angle of 45 degrees to reduce friction losses, and the number of elbows should be minimized.

Additional recommendations on the venting system include the following items.

- Make sure the duct casting is installed using fireproof construction. Route ducts away from sprinkler heads.
- The duct casing and venting system should be made of materials suitable for temperatures greater than 70 °C (158 °F). It should be installed to meet local building code requirements.
- Locate the blower as close to the discharge outlet as possible. All joints on the discharge side should be airtight, especially if toxic vapors are being carried.
- Equip the outlet end of the system with a back draft damper and take the necessary precautions to keep the exhaust outlet away from open windows or inlet vents. In addition, extend it above the roof of the building for proper dispersal of the exhaust.
- Equip the exhaust end of the system with an exhaust stack to improve the overall efficiency of the system.

- Make sure the length of the duct that enters into the blower is a straight length at least ten times the duct diameter. An elbow entrance into the blower inlet causes a loss in efficiency.
- Provide make-up air in the same quantity as is exhausted by the system. An "airtight" lab will cause an efficiency loss in the exhaust system.
- Ensure that the system is drawing properly by using an air flow meter.
- Equip the blower with a pilot light located near the instrument to indicate to the operator when the blower is on.

Clarus 500 GC Requirements

Laboratory Space Requirements:

Size	
GC:	66 cm (26 in.) wide x 40 cm (19 in.) high x 72 cm (28.5 in.) deep
Autosampler:	13 cm (5 in.) wide x 36 cm (14 in.) high x 24 cm (9.5 in.) deep
Weight	
GC:	49 kg (108 lb)
Autosampler:	4.5 kg (10 lb)
Physical Configuration:	Single unit for use on standard laboratory bench which can be interfaced to a computer.
Bench Space:	The laboratory bench should be sturdy enough to support the full weight of the GC as well as additional equipment (i.e., computer). Expect the total weight of the GC and accessory equipment to be at least 91 kg (200 lb). Allow a minimum clearance of 10.2 cm (4 in.) on each side, 15.2 cm (6 in.) at the rear of the GC, and 137.2 cm (54 in.) at the top of the GC. If this is not possible, install the GC on a bench that has wheels.
Peripherals, Printers, etc.	Allow at least 61 cm (24 in.) on either side of the GC to accommodate additional equipment.

Environmental Requirements:

Pollution Degree:	This instrument will operate safely in environments that contain nonconductive foreign matter up to Pollution Degree 2 as defined in IEC 1010-1.
Laboratory Environment:	Install the GC in an indoor laboratory environment that is clean and is free of drafts, direct sunlight and vibration. The laboratory should be free of flammable, explosive, toxic, caustic, or corrosive vapors or gases and should be relatively free of dust. The ambient laboratory temperature should be between 10 °C and 35 °C (50 °F and 95 °F) with a relative humidity between 20% and 80% with no condensation. The GC will operate safely between 5 °C and 40 °C (41 °F and 104 °F).

Electrical Power Requirements:

Installation Category Statement:	This instrument is able to withstand transient over-voltage according to Installation Category II as defined in IEC 1010-1.
Power Consumption:	2 400 VA (volt-amps) for the GC. Add 100 VA for the computer and 108 VA for the printer.

Power Specification:	All electrical supplies must be smooth, clean, and free of line transients greater than 40 V peak to peak and must meet and remain within the following tolerances: 120 VAC ±10% @ 50/60 Hz ±1% 230 VAC ±10% @ 50/60 Hz ±1% Instruments and peripherals should not be connected to circuits with large inductive or large and frequent loads (i.e., large motors, discharge lamps, photocopy systems, radio transmitters, etc.).
Power Outlets:	A minimum of one dedicated 120 VAC outlet at 20 A or one 230 VAC outlet at 10 A (minimum) is required for the GC. Additional equipment, such as computers and printers, should be connected per their specifications.

Safety Requirements:

Gas Cylinders and Gas Delivery Lines:	All gas cylinders should be firmly clamped to a suitable surface. Care must be taken not to kink or overstress the gas delivery lines.
Hydrogen:	Ensure that all hydrogen lines and connections are leak-free. When using a hydrogen tank, install an in-line hydrogen snubber (P/N 0009-0038) between the tank regulator and the delivery tubing.
Ventilation:	Always provide adequate ventilation. When analyzing hazardous compounds, such as pesticides, it may be necessary to arrange for venting the detector effluent into a fume hood.

Gas Requirements:

All gases must have a minimum purity of 99.995%. Gases used with the mass spectrometer and ELCD detectors require a minimum purity of 99.999%. Gas cylinders should be located outside of the laboratory whenever possible and should always be stored and operated in the vertical position. Always use copper tubing that is free of grease, oil, and organic material for all gases delivered to the Clarus 500 GC.

Helium, Nitrogen, 8.5% H_2/91.5% Helium 95% Argon/5% Methane:	A number 1A (200 ft^3) gas cylinder should be used for all carrier gases. Filter all gases (except methane) through a moisture filter and/or hydrocarbon trap and de-oxo filter. Argon/methane should be filtered through a moisture filter and a de-oxo filter. Gas delivery pressure to the GC should be 60 – 90 psig (414-621 kPa).
Air:	A number 1A (200 ft^3) gas cylinder of compressed air or an air compressor can be used. All air should be filtered through a moisture filter. Do ***NOT*** use "Breathing Air." When using manual pneumatics, gas delivery pressure to the GC must not exceed 30 psi (207 kPa). If this is not possible, secondary regulation will be required. With PPC pneumatics, a delivery pressure range of 70 – 90 psig (483 - 621 kPa) is acceptable.
Hydrogen:	A number 2 (62 ft^3) gas cylinder or a hydrogen generator can be used. All hydrogen should be filtered through a moisture filter. When using manual pneumatics, gas delivery pressure to the GC must not exceed 30 psi (207 kPa). If this is not possible, secondary regulation will be required. With PPC pneumatics, a delivery pressure range of 60 – 90 (414-621 kPa) psig is acceptable.

Sample Preparation Requirements

Customer Responsibility

Pre-Installation Checklist

Model: _____ Date: _____

Customer: _____

SPO# _____

Installation Requirements	**OK**	**Needs Prior to Installation**
Lab Space Requirements Instrument		
Lab Space Requirements Peripherals		
Environmental Requirements		
Power Requirements		
Safety Requirements		
Gas Requirements		
Sample Preparation (Customer Responsibility)		
Computer Configuration		
Miscellaneous		

4 Installing the Clarus 500 GC

Install the Autosampler

This section describes how to install the autosampler tower, the autosampler tower cover, and the autosampler syringe. The autosampler tower and the tower cover are shipped together in one box. The autosampler tray is installed in the Clarus 500 GC at the factory.

Remove the Encoder Protector Block

The Clarus 500 GC autosampler has been shipped with an encoder protector block. This is a piece of antistatic polyethylene foam that protects the tower disk during shipment. Before you install the autosampler tower onto your Clarus 500 GC, you *must* remove the encoder protector block from the tower disk assembly.

To remove the encoder protector block:

1. Carefully remove the autosampler tower from the shipping box.

2. The piece of foam on top of the tower is the encoder protector block. Carefully slide the block straight out from the tower disk.

CAUTION *Do not twist the block off. This will damage the tower disk.*

Install the Autosampler Tower

Perform the following procedure to install the autosampler tower:

1. The autosampler tower mounting hardware is shipped already secured to the Clarus 500 GC top. Remove the three screws and flat washers securing the mounting hardware and use them to secure the tower base to the Clarus 500 GC.

2. Position the tower interface harness through the autosampler stop, which is part of the tower base. The harness should be fitted carefully into the hole in the autosampler base assembly (see Note below).

NOTE: *You may find it easier to feed the wires a few at a time. The two yellow tie wraps on this harness indicate the portion of the harness that needs to be fed to the tower. Only one yellow tie wrap should be visible at the autosampler stop.*

3. Install the autosampler tower on the top of the Clarus 500 GC as shown in Figure 1. The locating pin on the Clarus 500 GC fits into the slotted hole in the autosampler tower base.

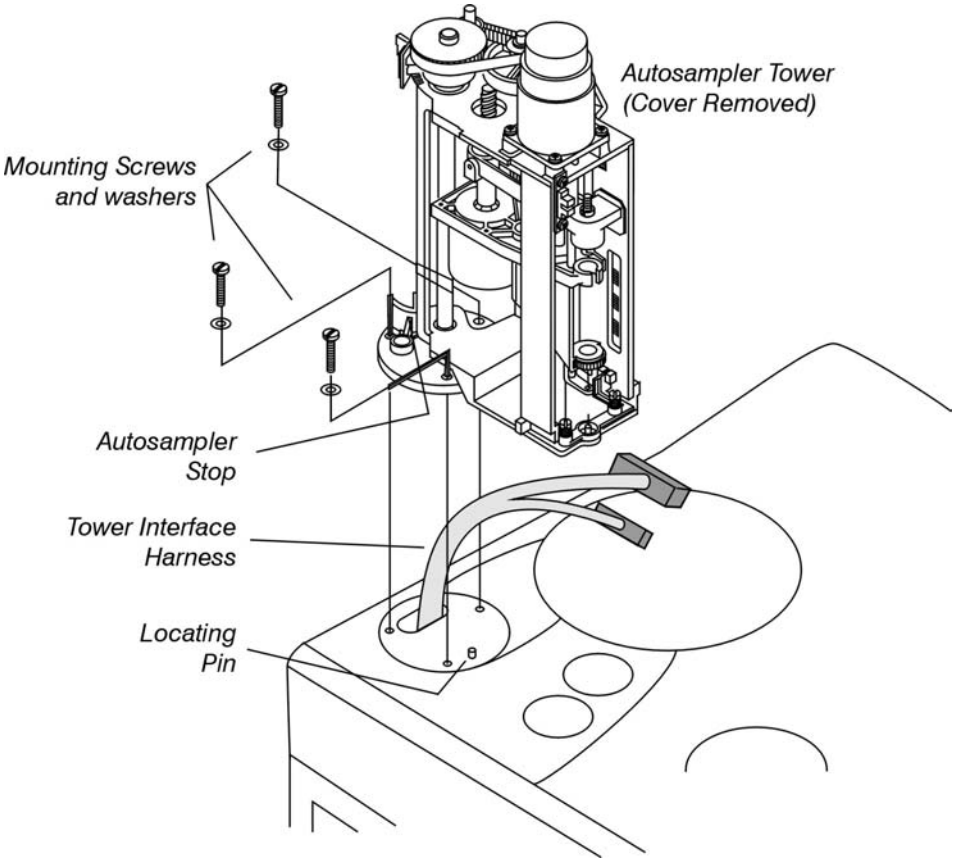


Figure 1. Installing the autosampler tower.

4. Connect the two harness connectors to the tower interface P.C. board. Plug the large connector into J2 and the small connector into J1 (see Figure 2).

These connectors are keyed and connect only one way.

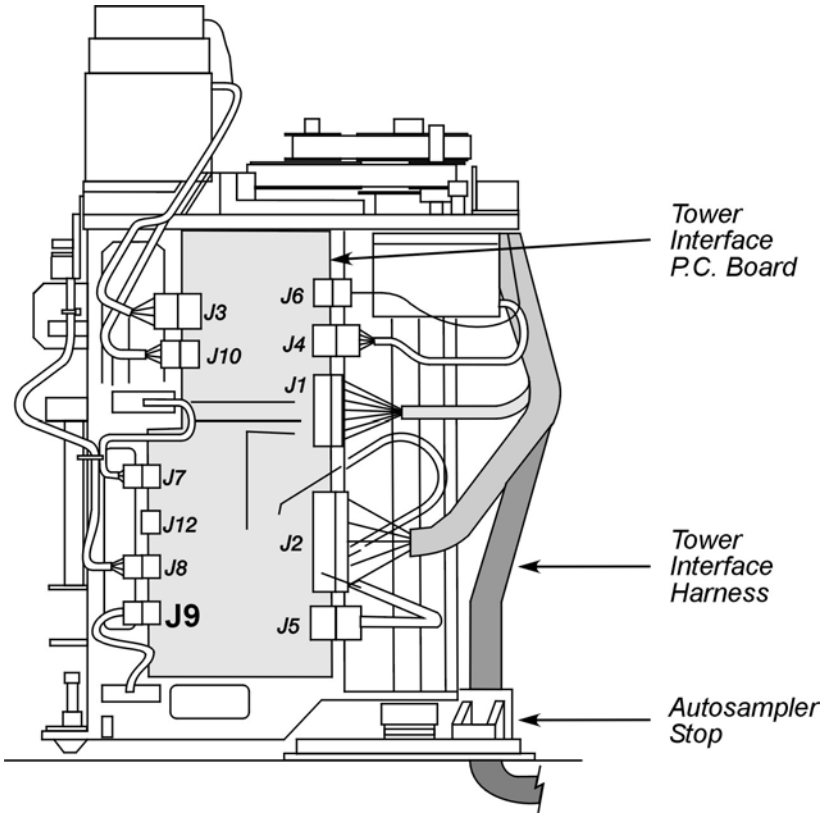


Figure 2. Connecting the tower interface harness to the tower interface p.c. board.

5. Manually rotate the autosampler tower so that the front of the tower (this is where the syringe will be installed) faces the rear of the Clarus 500 GC.

6. Secure the harness to the autosampler tower frame using the cable clamp attached to the harness. Attach the cable clamp and the harness ground wire to the underside of the casting as shown in Figure 3, using the screw provided. Make sure the harness is routed correctly before you tighten the screw, or you may have difficulty installing the autosampler tower cover.

NOTE: *There are two holes in the autosampler tower frame casting in the area to which the cable clamp should be secured. Secure the harness cable clamp and ground wire to the inner-most hole.*

7. The screw is already attached to the casting. Use a long Phillips screwdriver to remove the screw, then attach the cable clamp.

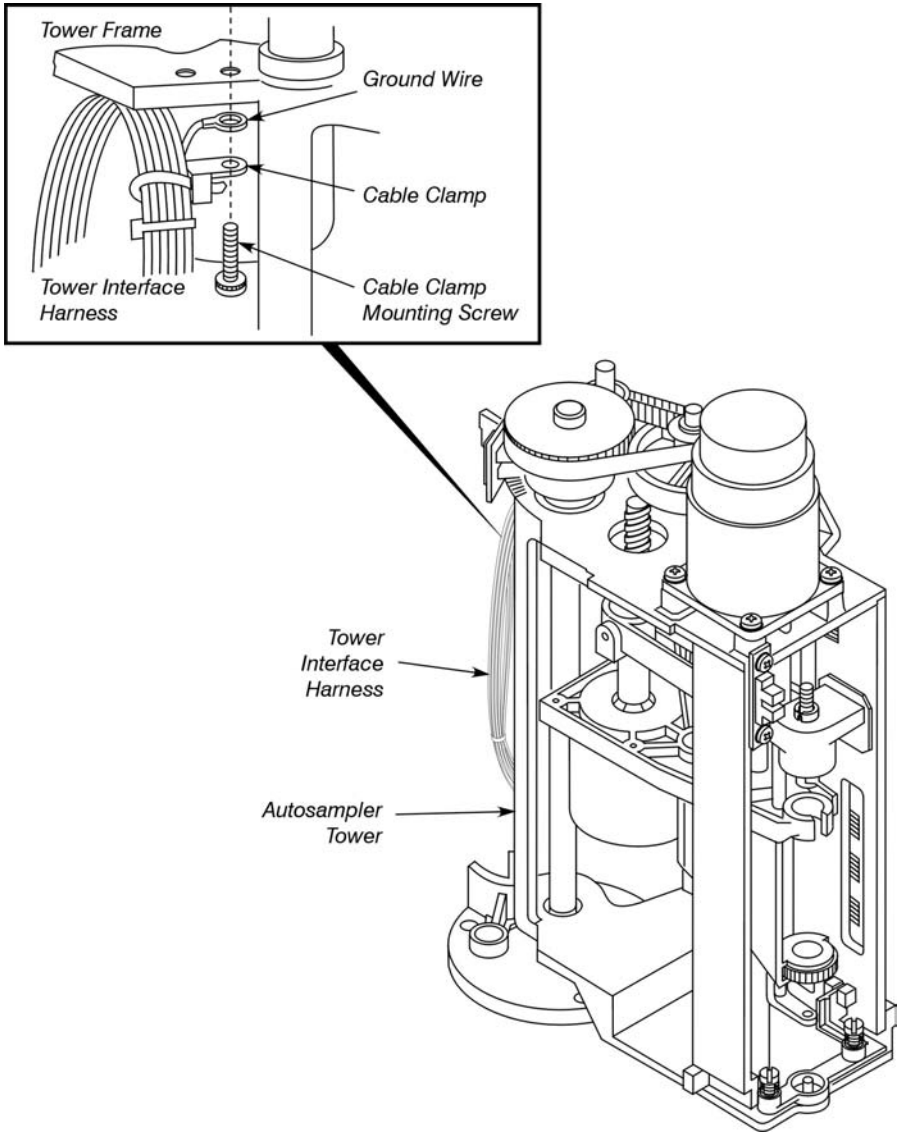


Figure 3. Securing the harness to the tower.

Install the Autosampler Tower Cover

Install the autosampler tower cover by referring to Figures 4 and 5 as you follow this procedure:

1. The tower is shipped with two 3/8-in. long screws installed on the bottom of the tower frame. Loosen but do not remove these screws.
2. Open the cover door and carefully lower the cover onto the tower, aligning the two guides inside the cover with the sides of the tower (see Figure 5).
3. Pull the sides of the cover away from the tower frame just enough to slide the cover tabs onto the two screws.
4. Tighten the two screws. Verify that the cover door opens and closes freely and that it locks when closed. If not, realign the cover until the door locks when closed.

NOTE: *If the door is hitting the door sensor, loosen the two screws that secure the door sensor bracket to the tower, then adjust the sensor up or down until the door no longer hits the sensor (see Figure 4).*

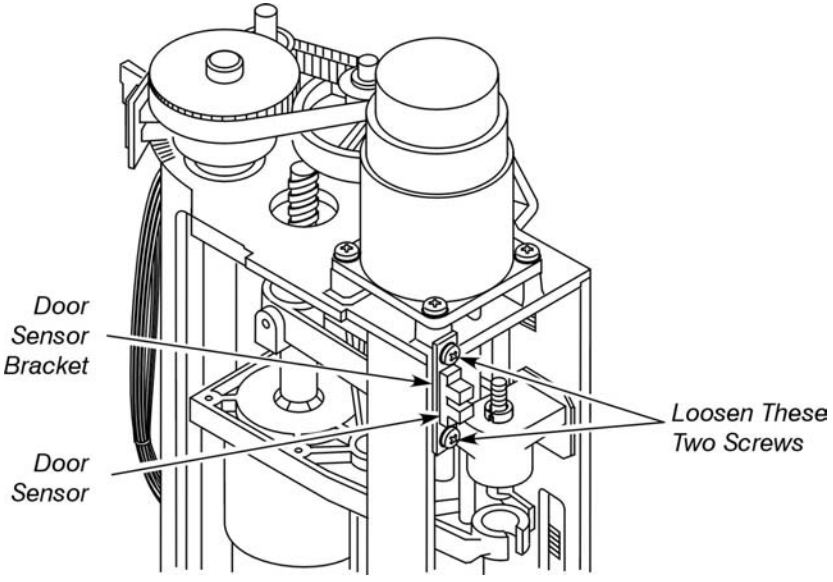


Figure 4. Adjusting the position of the tower door sensor.

Figure 5, on the following page, shows how to install the autosampler tower cover onto the tower.

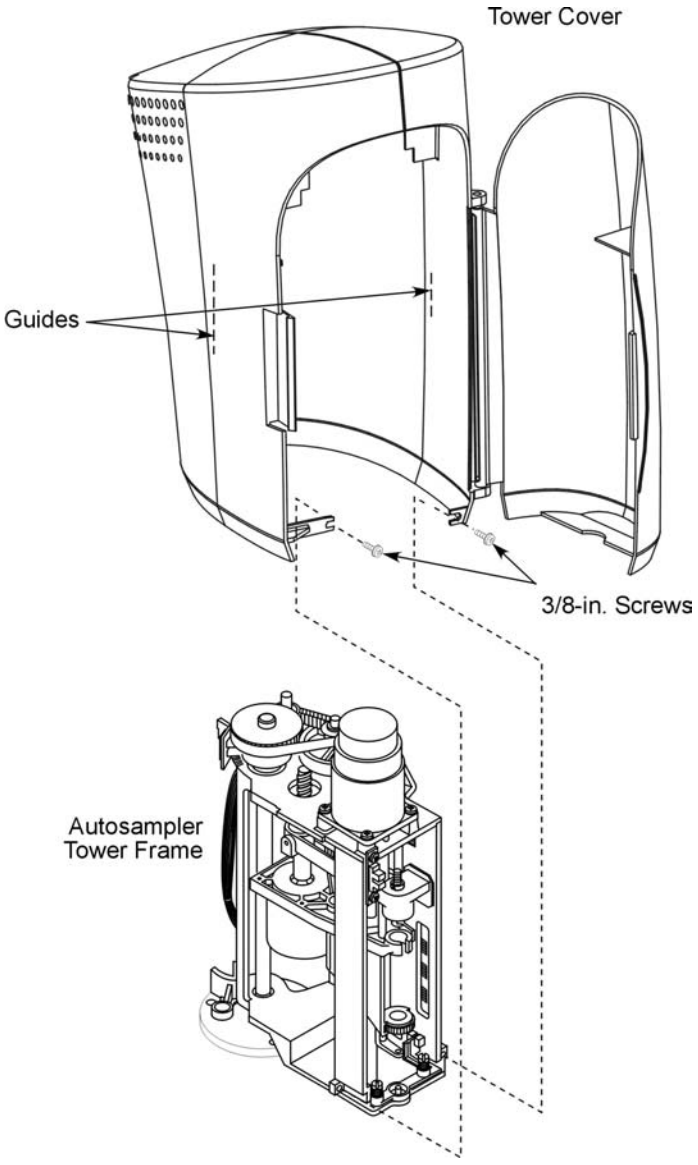


Figure 5. Installing the autosampler tower cover.

Install the Syringe Cover

To install the syringe, proceed as follows:

1. Before you install the syringe, move the autosampler tower so it faces the front of the instrument; this is called the “Park" position (see Figure 6).

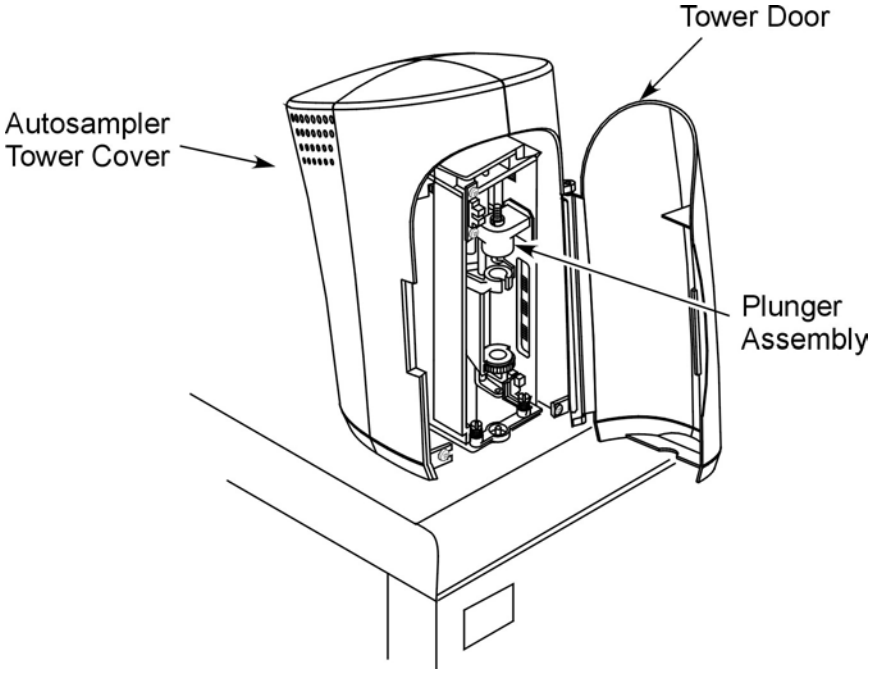


Figure 6. The autosampler tower in the “Park” position.

CAUTION	*Always handle the syringe with extreme care. Be careful not to bend the needle. Before installing the syringe, pull some solvent up into the barrel to moisten the mechanism.*

NOTE: *Use only syringes sold by PerkinElmer for the Clarus 500 GC. Syringe plungers are not interchangeable from one syringe to another.*

2. Lift and turn the plunger cap handle (located on top of the plunger assembly) until the pin locks it in the up position as shown in Figure 7.

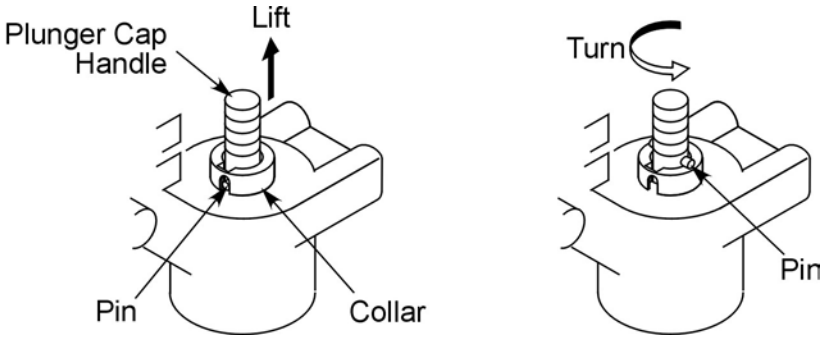


Figure 7. Lifting and turning the plunger cap handle.

3. Insert the syringe needle through the bottom of the carriage assembly and use your finger to carefully guide the needle through the hole in the needle guide (see Figure 8).

CAUTION	*Be careful not to bend the needle when inserting it into the hole in the needle guide.*

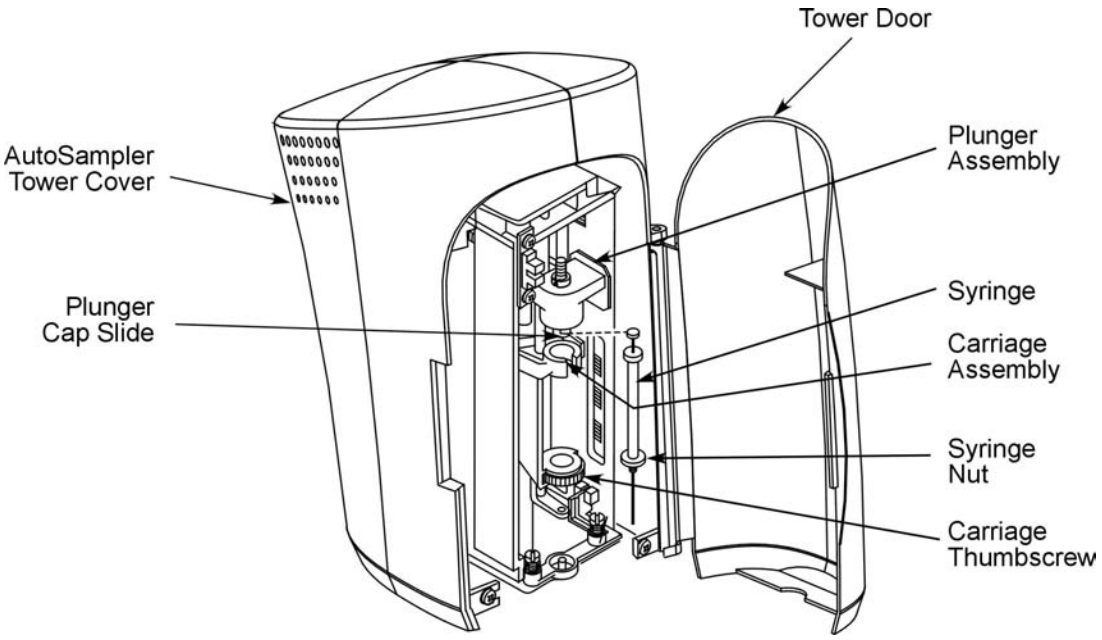


Figure 8. Installing the syringe.

4. Slide the top of the syringe plunger into the plunger cap slide, then lift and turn the plunger cap handle so the pin drops into place. This will lock the syringe plunger into place.
5. Hold the syringe nut with one thumb and, with your other thumb, turn the carriage thumbscrew counterclockwise to tighten it (see Figure 8). ***DO NOT OVERTIGHTEN THE THUMBSCREW***.
6. Carefully guide the needle into the needle locator in the center of the vial locator as you tighten the thumbscrew (see Figure 8).

Your autosampler is now installed.

Connecting the Gases and Electrical Supply 5

Connect the Gases

The following sections describe how to connect the gas cylinders to the Clarus 500 GC and how to check the connections for leaks. Use the fittings and copper tubing supplied in the installation kit (P/N 0332-8000).

Gas Cylinder Connections

Use the following procedure to make the gas cylinder connections:

1. Using a large adjustable wrench (at least 1¼ in.), attach a dual-stage regulator, or two single-stage regulators in series, to each gas cylinder. The regulator outlet fitting must be a 1/8-in. Swagelok type.

CAUTION	*The following applies to manual pneumatics configurations only:* *1. Dual-stage regulation is required with the Clarus 500 GC. It permits steady gas delivery at high or low flows and provides precise control of gas pressure throughout the discharge of virtually the entire contents of a compressed gas cylinder. It is not necessary for PPC units.* *2. If your Clarus 500 GC is equipped with a TCD and you are operating more than one GC from the same carrier gas tank, and/or operating the TCD at high sensitivity, install an additional single-stage regulator (0 – 90 psig) before you install the gas to the TCD.* *3. If your Clarus 500 GC is equipped with an ECD, you can control the flow of make-up gas by installing an additional 30-psig single-stage regulator before the ECD needle valve.* *4. If your Clarus 500 GC is equipped with a NPD, we recommend installing a toggle valve in the hydrogen line that enters the Clarus 500 GC. This allows you to turn off the hydrogen when the NPD is not in use without changing the regulator setting on the Clarus 500 GC.* *If your Clarus 500 GC is equipped with a FPD, we recommend installing a toggle valve in the air line that enters the Clarus 500 GC. This allows you to turn off the air when the FPD is not in use without changing the regulator setting on the Clarus 500 GC.*

2. Connect a 1/4-in. to 1/8-in. adapter to the regulator outlet fitting on all your gas cylinders except the hydrogen cylinder.
3. Insert a hydrogen snubber (P/N 0009-0038) in the hydrogen cylinder regulator outlet fitting as shown in Figure 9. Use a 1/4-in. to 1/8-in. reducer (P/N 0990-3212) between the snubber and the regulator.

NOTE: *PerkinElmer offers a fixed 30-psig stainless steel diaphragm regulator (P/N N610-1473) for use with manual pneumatics configurations. This provides a second stage of regulation between the tank and the needle valves on the manual pneumatics version Clarus 500 GC.*

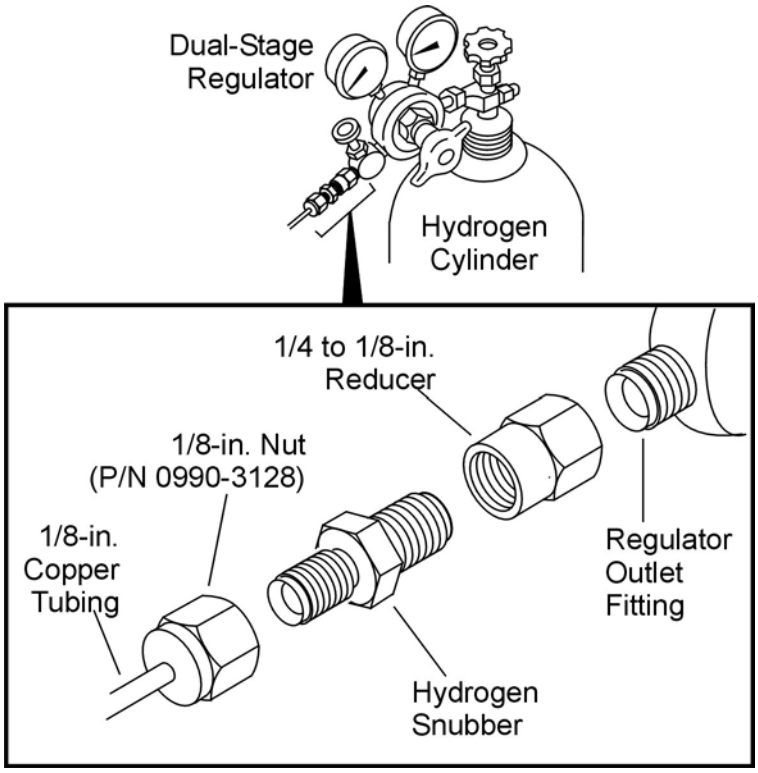


Figure 9. Connecting a hydrogen snubber.

4. Cut a length of 1/8-in. copper tubing long enough to connect a line filter to each gas supply line or gas cylinder.

5. Place a 1/8-in. nut, a 1/8-in. rear ferrule, and a 1/8-in. front ferrule over each end of the copper tubing as shown in Figure 10.

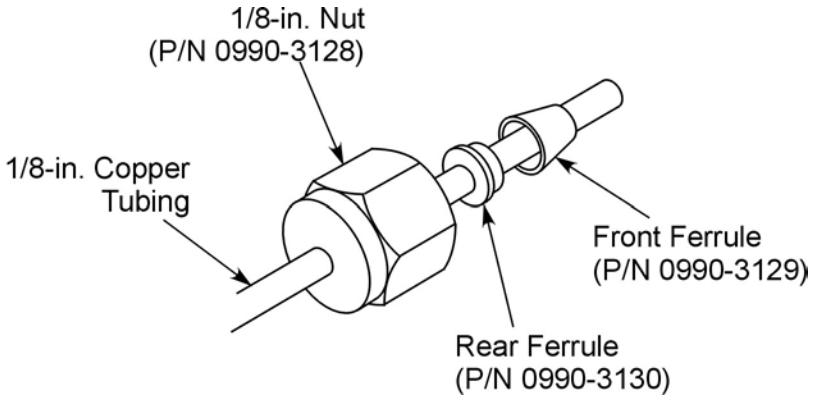


Figure 10. Components of a 1/8-in. tubing connection.

6. Insert one end of the tubing with the nut and ferrules into the end fitting of a suitable line filter (see Table 1), and insert the other end into the regulator outlet fitting or the end fitting of the hydrogen snubber.
7. Insert the tubing into the fitting so that the tubing bottoms firmly, then tighten the nut ½-turn past finger-tight.
8. Cut a piece of 1/8-in. copper tubing long enough to connect the filter to the Clarus 500 GC. To allow for future instrument movement, cut the tubing 2 – 3 ft longer than necessary.

Table 1. Recommended Filters

Detectors	Carrier Gas	Combustion Gas	
		H_2	Air
FID NPD FPD	Hydrocarbon Trap (N930-1192) + Oxygen Filter (N930-1179) if capillary column is used	Moisture Filter (i.e., Molecular Sieve) (N930-1193)	Moisture Filter (i.e., Molecular Sieve) (N930-1193)
TCD**	Hydrocarbon Trap (N930-1192) + Oxygen Filter (N930-1179) if capillary column is used		
ECD**	Moisture Filter (i.e., Molecular Sieve) (N930-1193) + Oxygen Filter (N930-1179)		
PID	Hydrocarbon Trap (N930-1192) + Oxygen Filter (N930-1179) if capillary column is used		
ElCD#	Hydrocarbon Trap (N930-1192) + Oxygen Filter (N930-1179) if capillary column is used	Molecular Sieve (N930-1193) + Charcoal (N930-1192)	

* There is a combination filter system that contains an Oxygen Filter, Oxygen Indicator, and a Moisture Trap. Its Part No. is N930-6002.

**Install a tee fitting on the carrier gas line for the TCD reference line or for the make-up line for the ECD.

99.999%-purity helium and hydrogen must be used with the ElCD.
Stainless-steel diaphragm regulators must be used with the ElCD (hydrogen regulator P/N 0990-7128, helium regulator P/N 0990-7127).

Clarus 500 GC Gas Connections

Perform the following procedure to connect the gases to the Clarus 500 GC:

CAUTION	*Do **NOT** connect any gases to the manual pneumatics bulkhead if there is a PPC module installed for any channel. In this case, the manual pneumatics bulkhead is NOT connected on the inside of the Clarus 500 GC. Therefore, if a gas line is connected to the manual pneumatics bulkhead, the gas would flow into the Clarus 500 GC itself. This must especially be avoided with the hydrogen gas.*

1. Make a tubing strain relief by forming an approximate 3-in. diameter loop in the tubing so that it is approximately 3 in. from the end of the tubing closest to the Clarus 500 GC as shown in Figure 11. Make this strain relief on all gas lines.

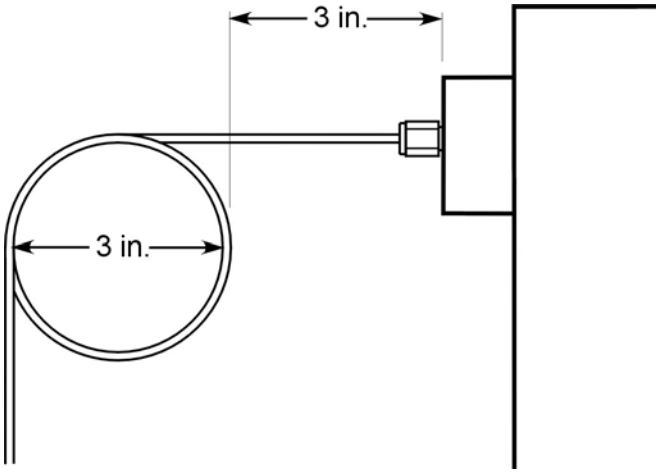


Figure 11. Tubing strain-relief loop.

2. Insert a 1/8-in. nut, a 1/8-in. rear ferrule, and a 1/8-in. front ferrule over the end of each piece of copper tubing as shown in Figure 10.

3. Insert the tubing into the proper fitting on the Clarus 500 GC bulkhead for the gas that you are connecting. Be sure the tubing bottoms out firmly in the fitting, then tighten the nut ½-turn past finger-tight.

Figure 12 shows the manual pneumatics bulkhead and PPC bulkheads on the back of the Clarus 500 GC. M/U = make-up gas, CARR. = carrier gas, and HYD and H2 = hydrogen gas.

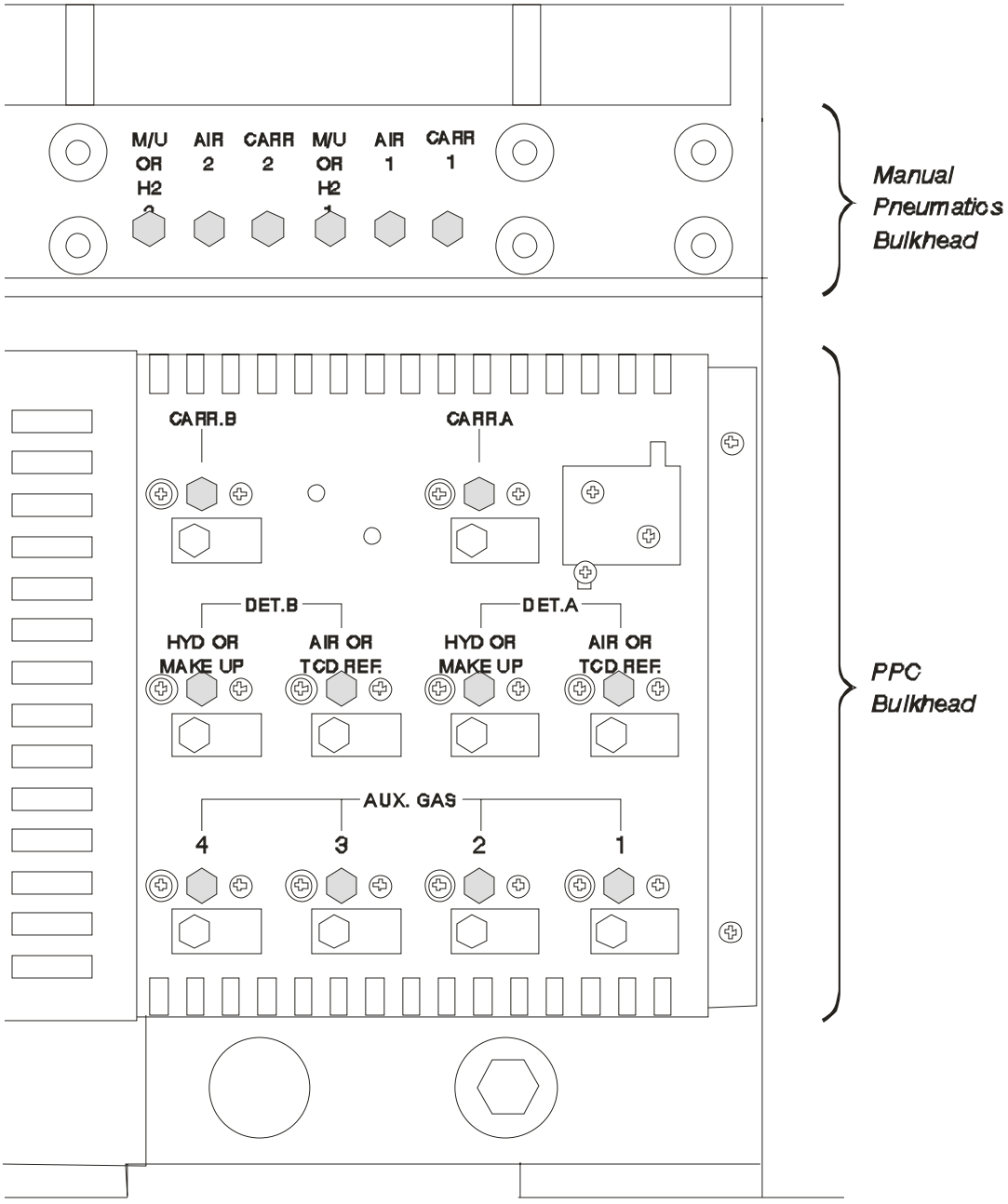


Figure 12. Location of the Clarus 500 GC bulkheads on the rear panel.

Leak Test the Gas Connections

After connecting the gases to the Clarus 500 GC, check all connections for possible leaks by following this procedure:

1. Set the regulator on the carrier gas cylinder between 60 and 90 psig.

2. Test the carrier gas connections by using either a gas leak-check solution of 50% isopropyl alcohol in water or an electronic leak detector. Check for leaks (indicated by bubbles) at each connection.

CAUTION	*Do **not** use a soap solution to check for gas leaks. It could contaminate the system.*

3. To check a hydrogen or air cylinder for leaks, set the regulator to 30 psig for manual pneumatics and for PPC systems between 60 and 90 psig for H_2 and between 70 and 90 psig for air; test the connections in the same manner that you tested the carrier gas connections.

Common Injector/Detector Gas Connections

Figures 13 through 21 shows how gases are connected to the Clarus 500 GC in several common injector/detector configurations. Note that the strain relief, which is required on all gas lines, is not shown in these figures.

WARNING

Position incoming gas lines away from the oven exhaust duct so that the hot exhaust will not blow directly on the gas lines.

CAUTION

Thoroughly purge the incoming gas lines before measuring and adjusting the gases. This is especially important when using hydrogen gas.

NOTE: *For Clarus 500 GC's that have a combination of both PPC and manual pneumatics, set the detector gas delivery pressure between 60 and 90 psig and install the fixed 30-psig stainless steel diaphragm regulator (P/N N610-1473), behind the Clarus 500 GC for the manual pneumatics detector gases.*

The manual pneumatics bulkhead always contains Swagelok nuts in all six locations whether or not there is an injector or a detector connected to this bulkhead. The PPC modules will be installed only if your Clarus 500 GC has been configured with PPC for an injector and/or detector.

The Clarus 500 GC can be configured as any of the following:

- All zones (injector/detector) as PPC.
- All zones as manual pneumatics.

- A combination of PPC and manual pneumatics.
  For example, the injectors could be controlled by PPC and the detectors could be controlled by manual pneumatics.

The following nine figures show the connections for the injectors and detectors to either the PPC or the manual pneumatics bulkheads. The connections for a PPC system are indicated by solid lines and the connections for manual pneumatics are indicated by dashed lines.

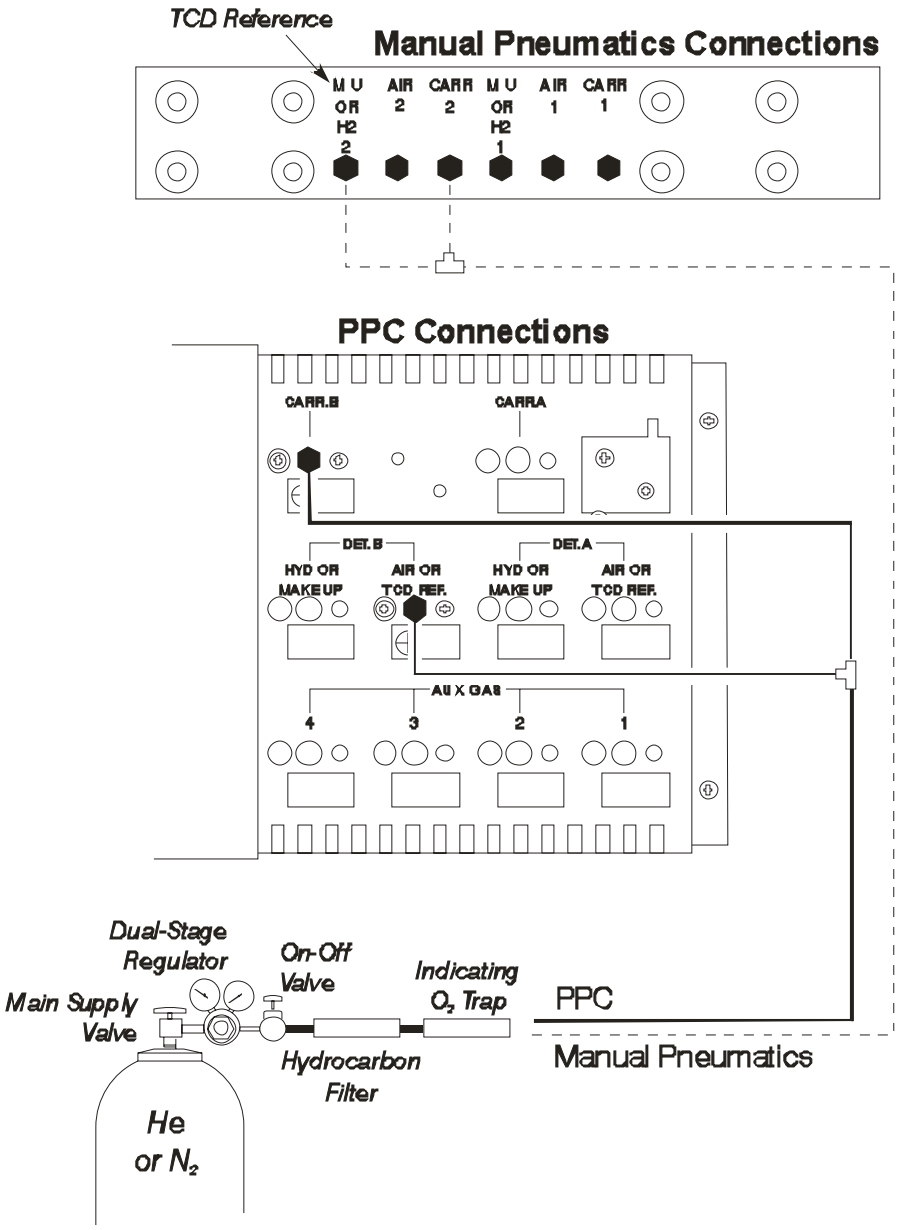


Figure 13. TCD in Channel B (rear channel) with one packed injector.

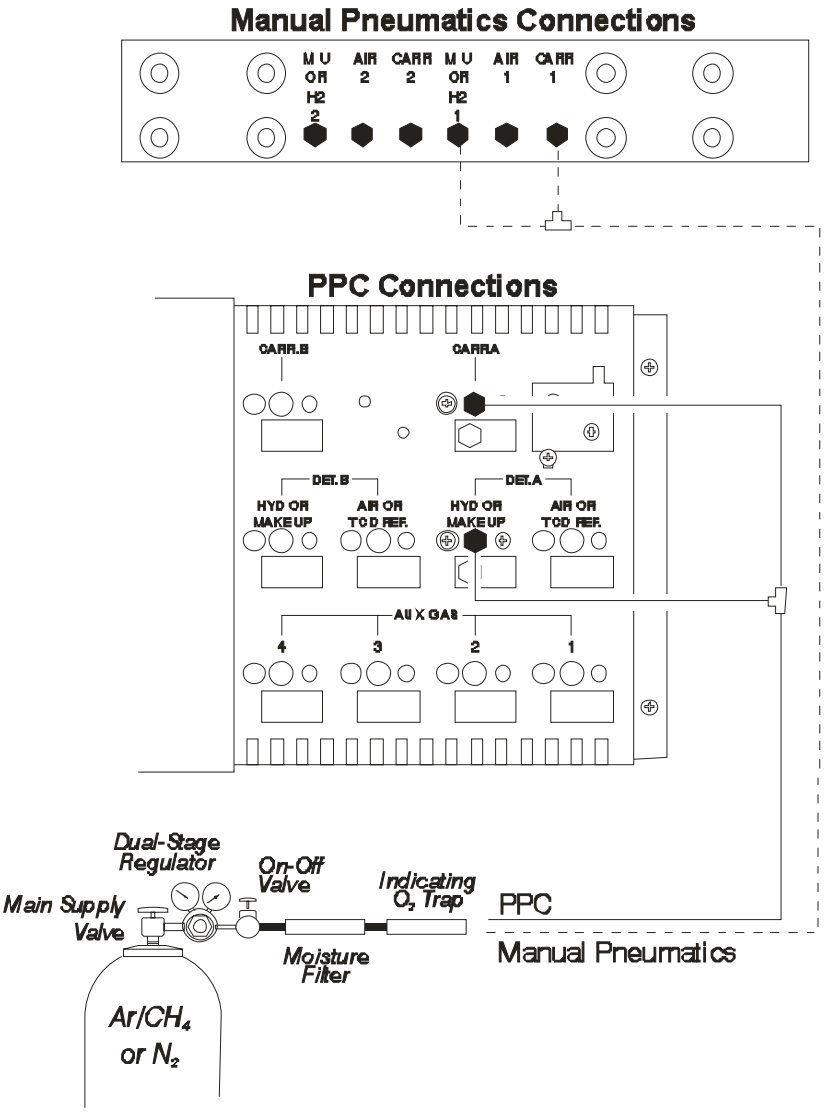


Figure 14. ECD in Channel A (front channel) using argon/methane or nitrogen as the carrier gas, with one injector.

NOTE: *If you are using the ECD with a capillary column at low flows (5 mL/min or less), you can plumb the injector with helium and the make-up line with argon/methane or nitrogen. Helium is the preferred carrier for capillary columns.*

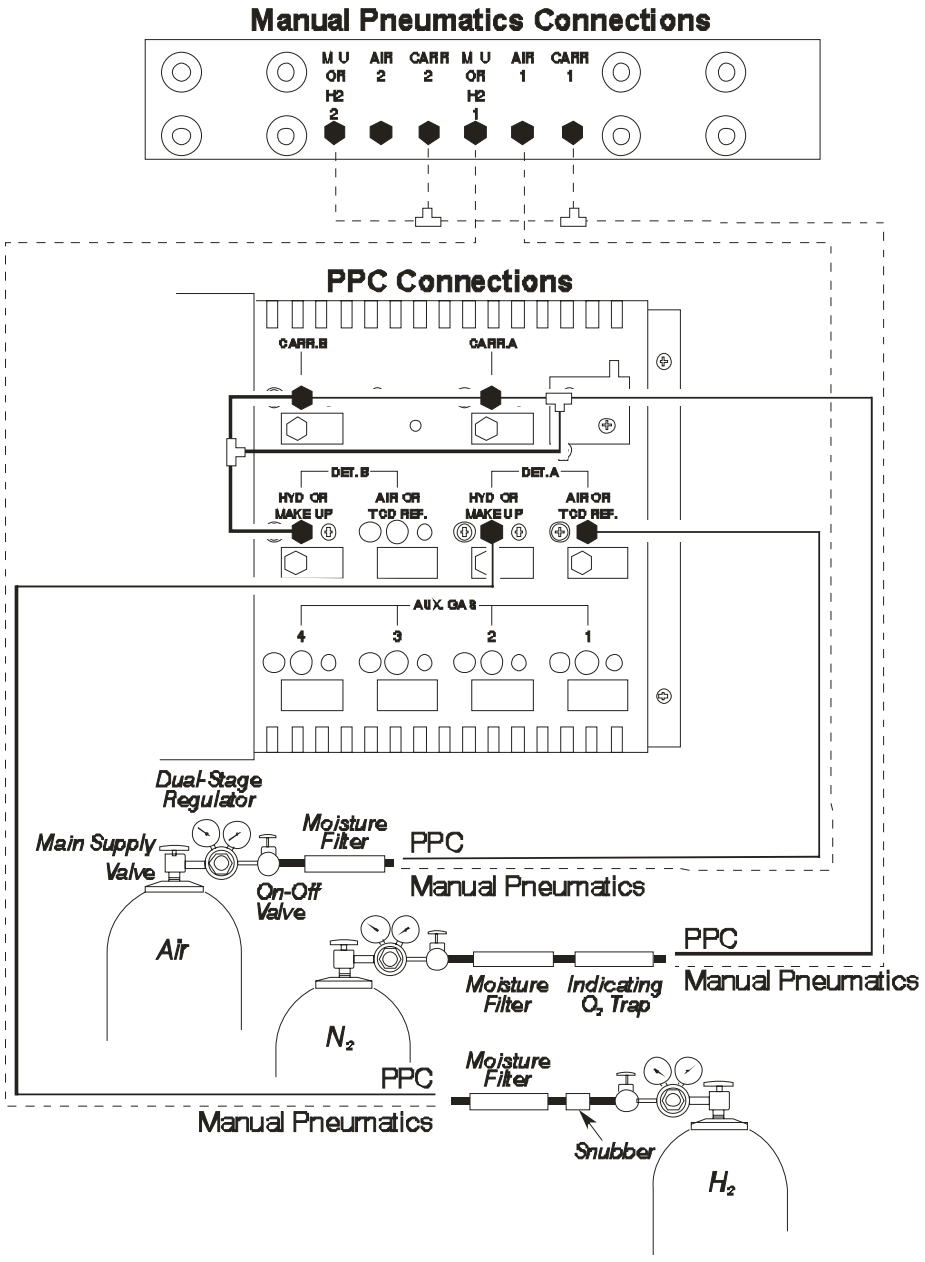


Figure 15. FID, NPD, or FPD in Channel A and ECD in Channel B using nitrogen as the carrier gas, with two injectors.

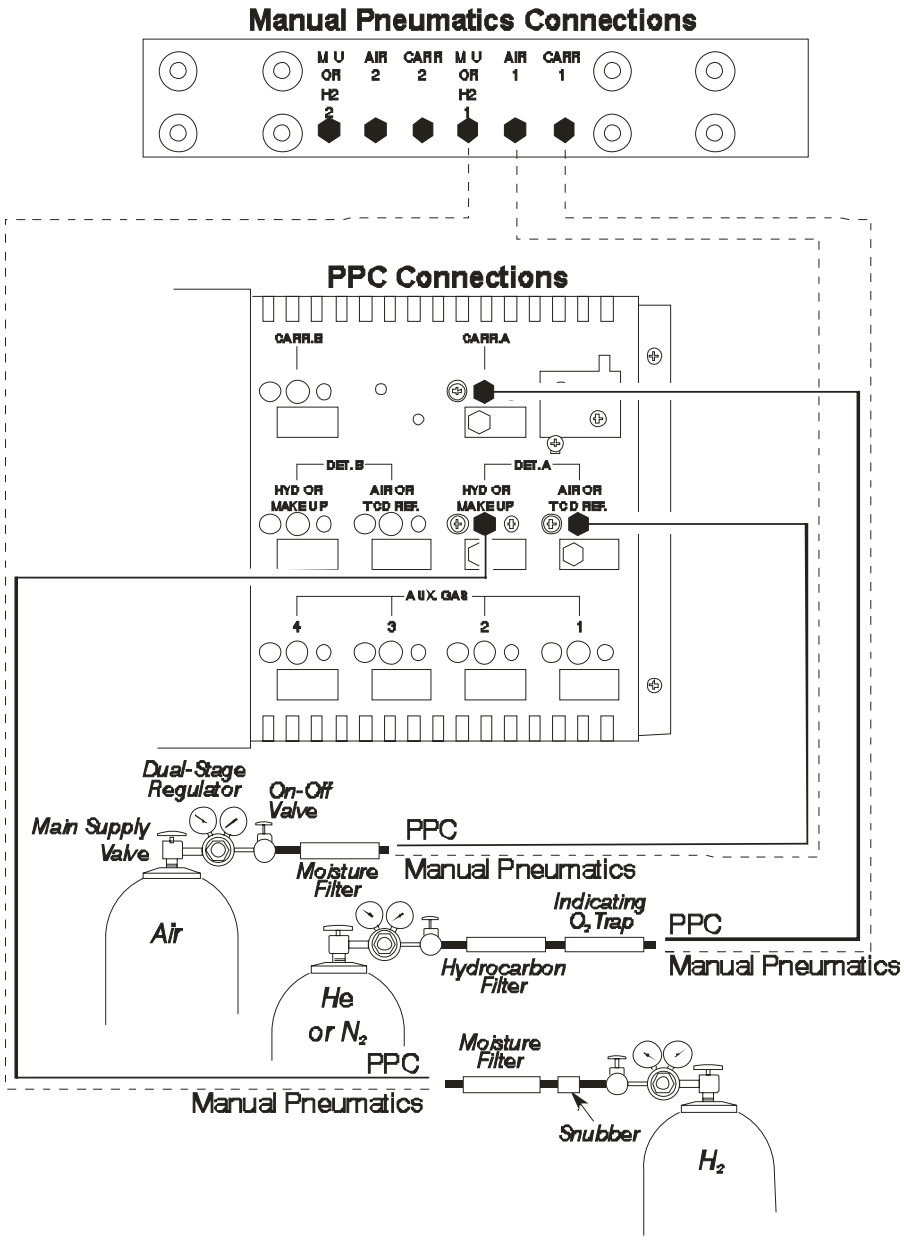


Figure 16. FID, NPD, or FPD in Channel A using helium or nitrogen as the carrier gas, with one injector.

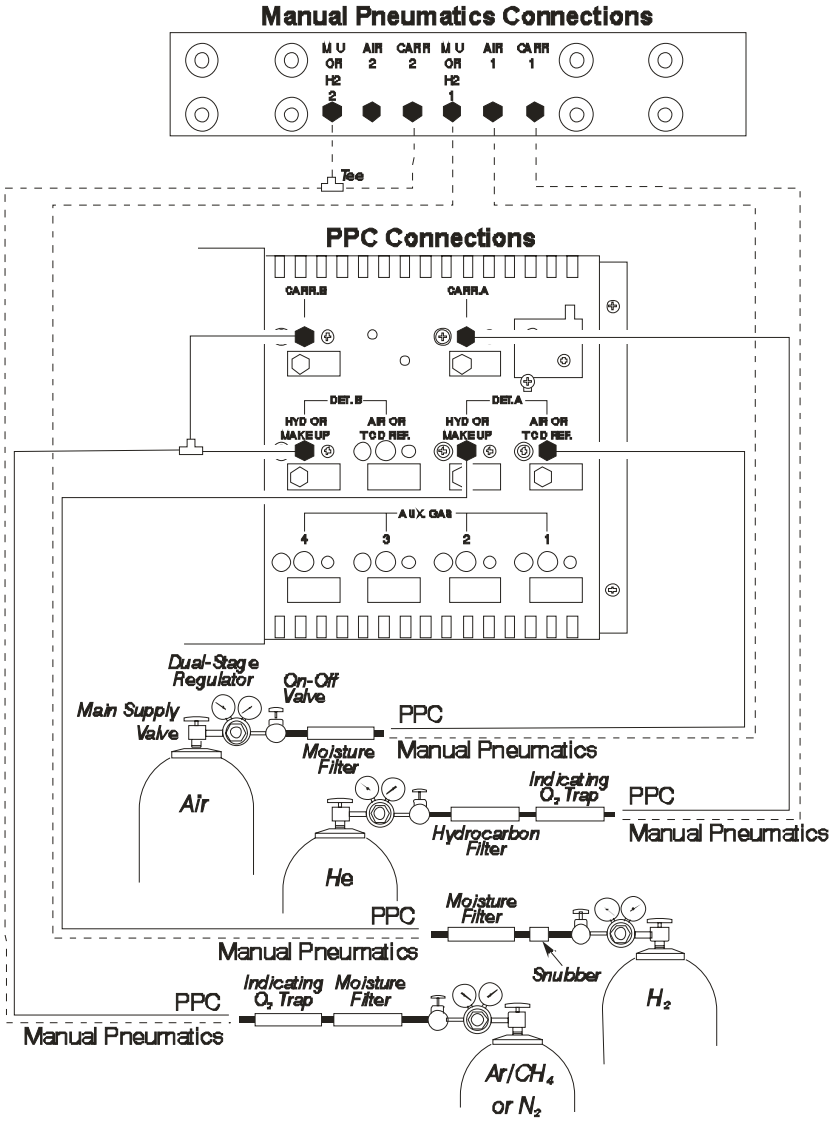


Figure 17. FID, NPD, or FPD in Channel A using helium carrier gas, ECD in Channel B using argon/methane or nitrogen carrier gas, with two injectors.

NOTE: *If you are using the ECD with a capillary column at low flows (5 mL/min or less), you can plumb the injector with helium and the make-up line with argon/methane or nitrogen. Helium is the preferred carrier gas for capillary columns. The FID, NPD, and FPD do not require make-up gas.*

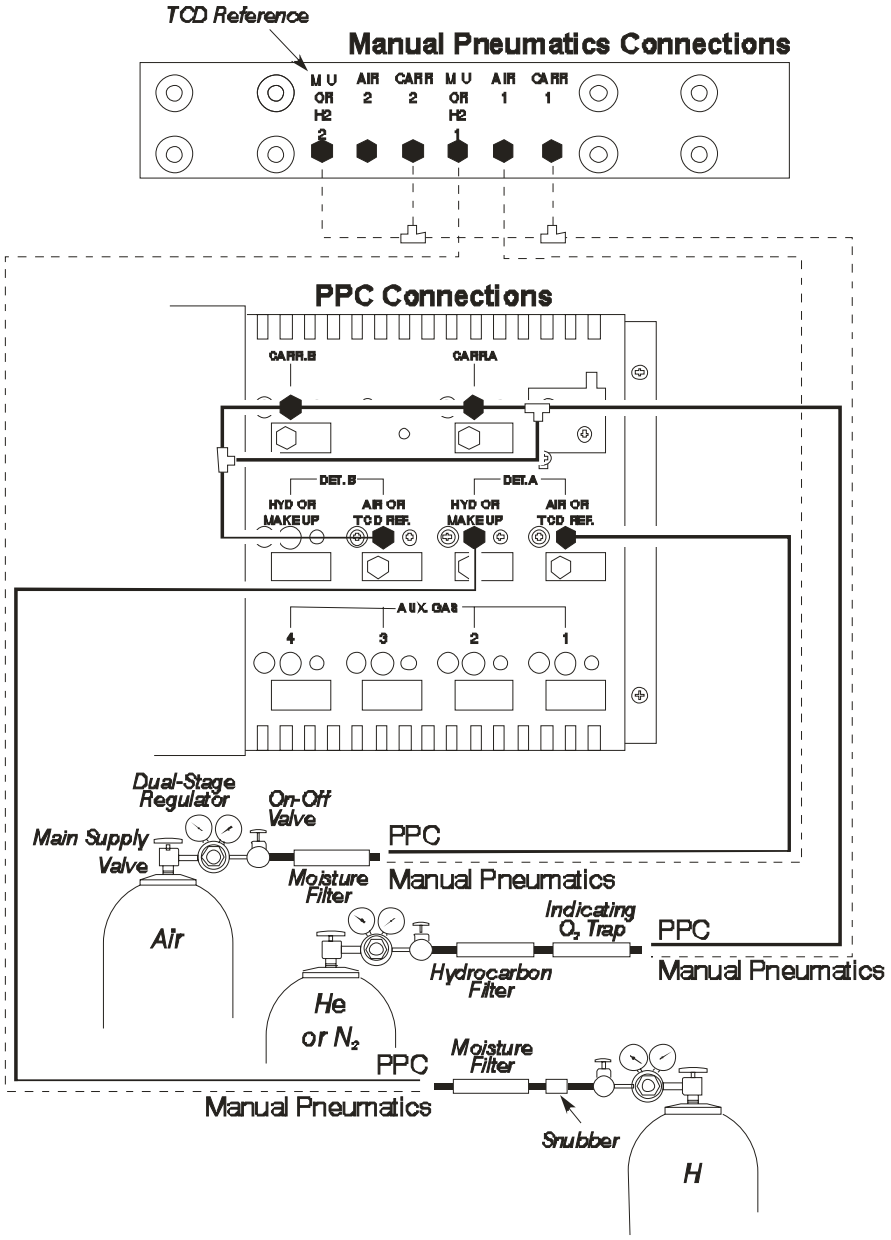


Figure 18. FID, NPD, or FPD in Channel A, TCD in Channel B, with two packed injectors.

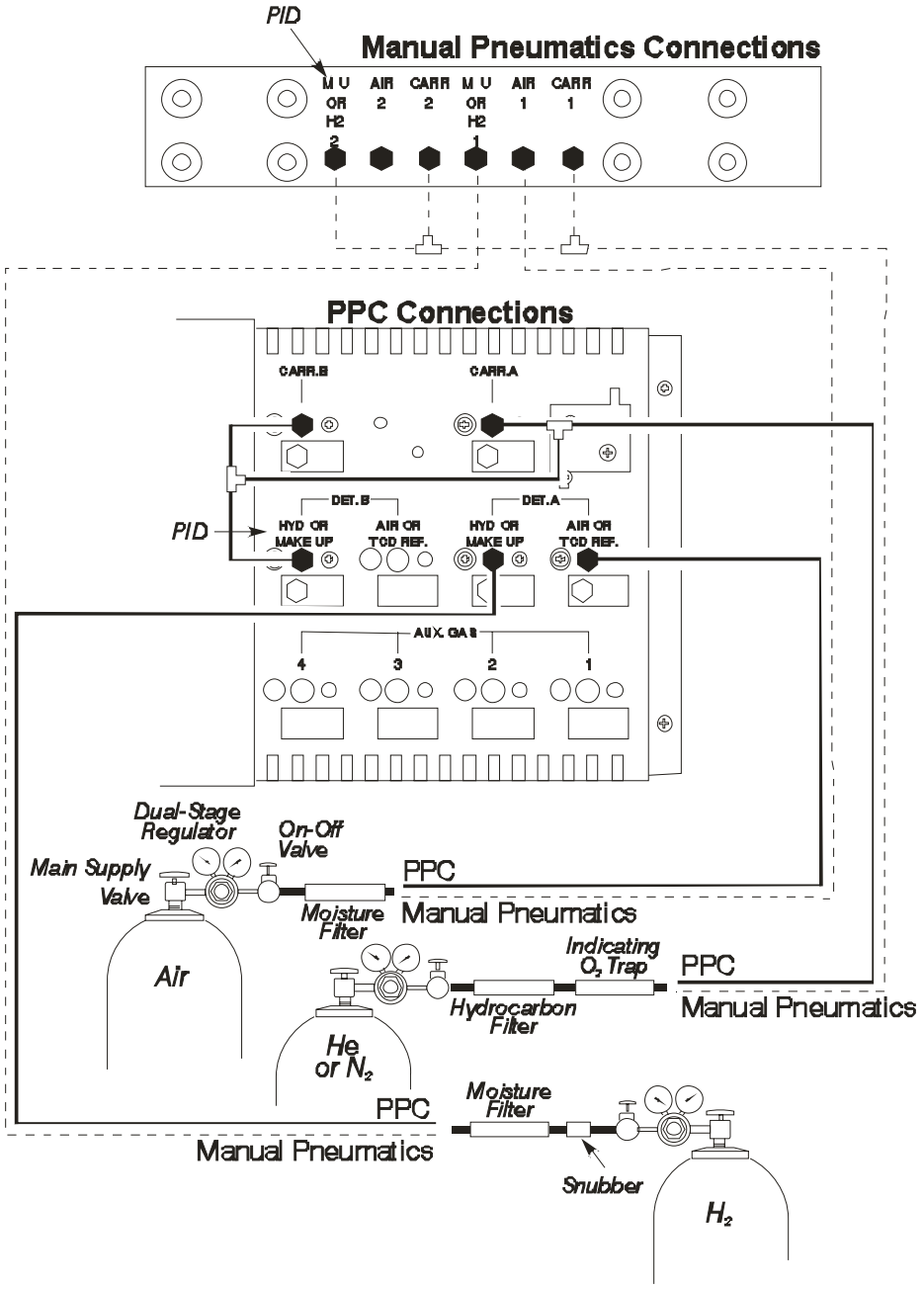


Figure 19. FID, NPD, or FPD in Channel A, PID in Channel B, with two packed injectors.

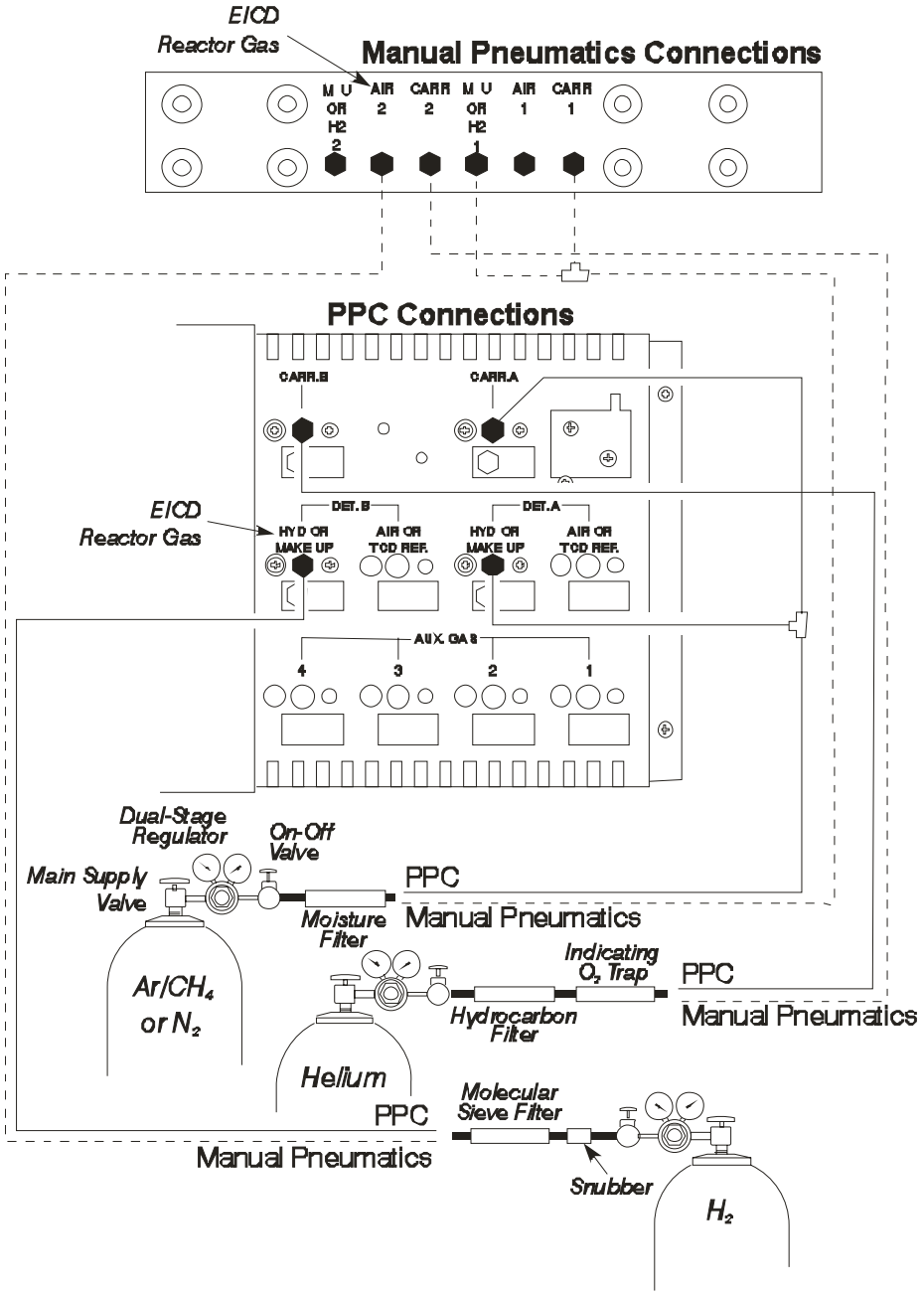


Figure 20. ECD in Channel A, ElCD in Channel B, with two packed injectors.

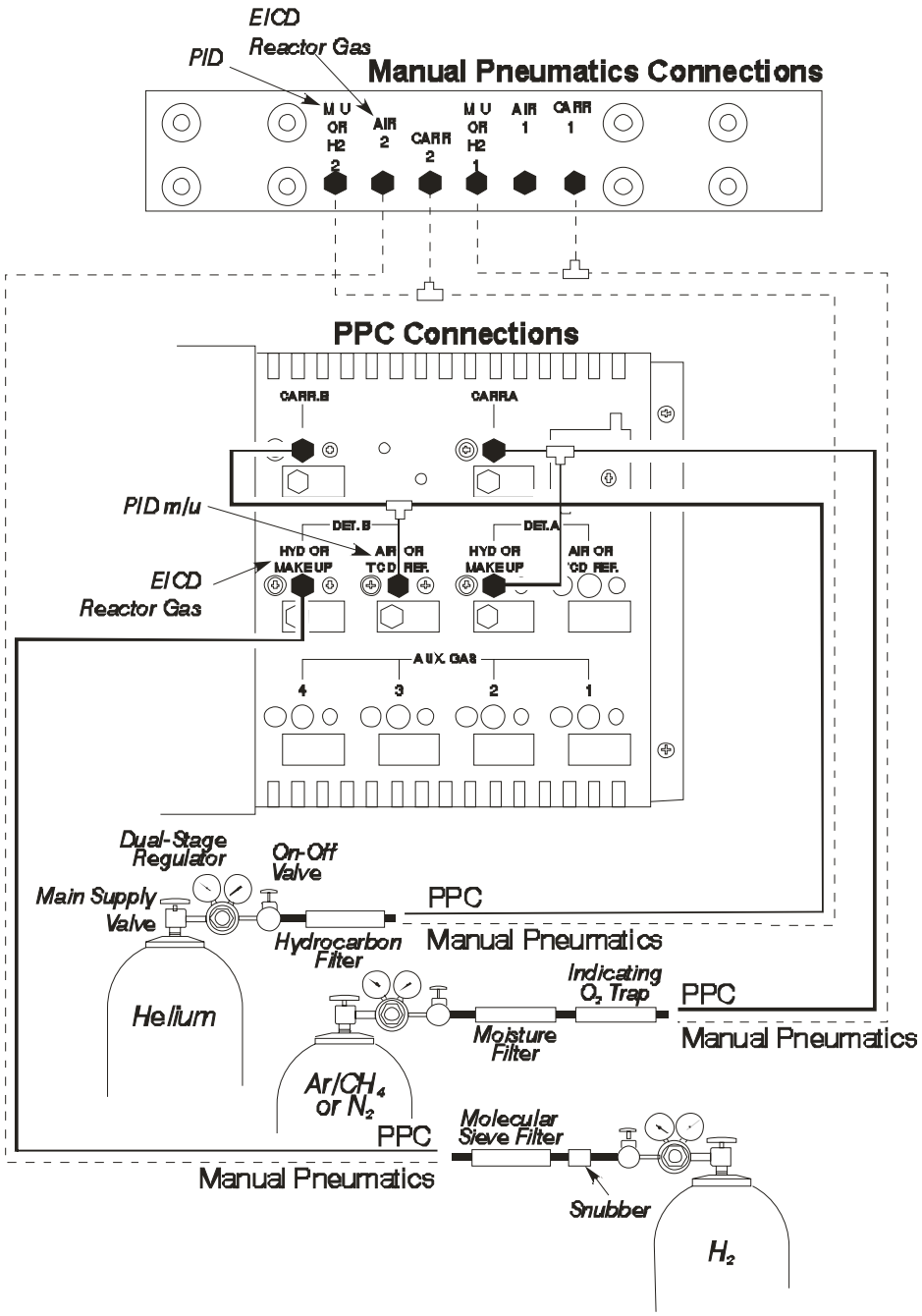


Figure 21. ECD in Channel A, PID/ElCD in Channel B, with two packed injectors.

Connecting the Gas for Subambient Operation

This section describes how to connect a liquid nitrogen or liquid carbon dioxide supply to your Clarus 500 GC for subambient operation.

For liquid nitrogen, use a supply with a liquid delivery pressure of 20 – 30 psig. For liquid carbon dioxide, use a size 1A cylinder equipped with a fitting containing a full-length dip (eductor) tube and approximately 27.3 kg (60 lb) of carbon dioxide.

The LN_2 or CO_2 supply tubing connects the supply tank to the 1/4-in. union on the rear of the Clarus 500 GC. To install the supply tubing, select the procedure that corresponds to the subambient kit you are installing and refer to Figure 22.

Connect the LN_2 Supply Tubing

1. Locate the LN_2 tank. Make sure the tank provides a liquid delivery pressure of 20 – 30 psig.

2. Connect the large nut on one end of the LN_2 supply tubing (P/N N600-0403) to the 1/2-in. pipe to 1/4-in. Swagelok reducer labeled “LIQUID" on the LN_2 tank by turning the nut clockwise until it is finger-tight. To provide a leak-free connection, tighten the nut an additional half-turn with a large adjustable wrench.

3. Connect the 1/4-in. nut on the other end of the tubing to the 1/4-in. union (see Figure 22) on the rear of the Clarus 500 GC by turning the nut clockwise until it is finger-tight. To provide a leak-free connection, place a 9/16-in. wrench on the nut and a 1/2-in. wrench on the union, then tighten the nut an additional half-turn.

4. Turn on the valve and check for leaks.

Connect the CO_2 Supply Tubing

WARNING

Protect the CO_2 supply from undue heating. CO_2 is a gas above 31°C (87.8°F) at a pressure of 1069 psig. The pressure increases rapidly at temperatures above 31°C (87.8°F).

1. Locate a size 1A CO_2 cylinder equipped with a fitting containing a full-length dip (eductor) tube and approximately 27.3 kg (60 lb) of carbon dioxide.

2. Connected to the CO_2 supply tubing (P/N N600-0404) is an envelope containing a Teflon gasket. This goes inside the nut on the tubing before attaching it to the tank. Connect the large nut on one end of the CO_2 supply tubing to the CO_2 tank fitting by turning the nut clockwise until it is finger-tight. To provide a leak-free connection, tighten the nut an additional half-turn with a large adjustable wrench.

3. Connect the 1/4-in. nut on the other end of the tubing to the 1/4-in. union on the rear of the Clarus 500 GC by turning the nut clockwise until it is finger-tight. To provide a leak-free connection, place a 9/16-in. wrench on the nut and a 1/2-in. wrench on the bulkhead fitting, then tighten the nut an addition half-turn.

WARNING

The CO_2 supply system contains liquid CO_2 pressurized at 6000 kPa (870 psig) at 20°C (68°F). Before breaking connections to change cylinders, shut off the liquid CO_2 cylinder valve, then bleed the supply tubing by closing the oven door and adjusting the oven temperature below 60°C (140°F). This opens the coolant solenoid valve and allows the CO_2 supply tubing to bleed.

4. Turn on the valve and check for leaks.

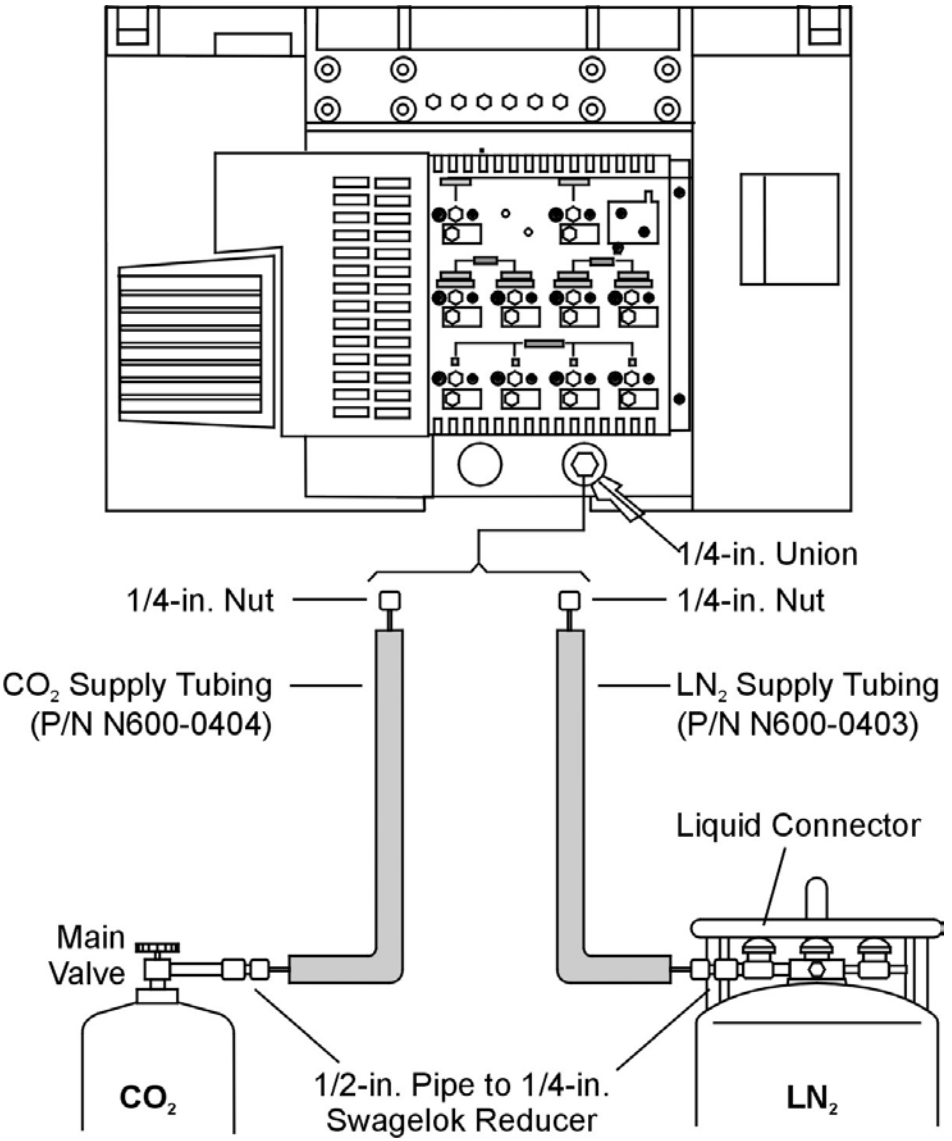


Figure 22. Connecting the CO_2 or LN_2 supply.

Connect the Electrical Supply

This section describes how to connect the Clarus 500 GC to AC line power both in and outside the U.S.

WARNING

Only a PerkinElmer Service representative or similarly trained and authorized personnel should ever change or replace the plug for the Clarus 500 GC.

Connecting the Clarus 500 GC to Line Power in the U.S.

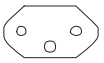
To connect the Clarus 500 GC to line power in the U.S., simply plug the power cord into the proper AC outlet (see Table 2).

Connecting the Clarus 500 GC to Line Power Outside the U.S.

To connect the Clarus 500 GC to line power outside the U.S., connect a properly grounded plug to the power cord and change the wiring on the AC Distribution P.C. board as described in the following procedures.

Table 2 shows the available plugs, their electrical power, and the countries where they are used.

Table 2. Plugs Used in Different Countries

 13A, 250V Two-Pole with Earth Contact for use in Great Britain, Ireland, and Hong Kong	 10/16A, 250V Two-Pole with Earth Contact for use in Austria, Germany, Netherlands, Norway, Portugal, and Sweden
 10/16A, 250V Two-Pole with Dual Earth Contacts for use in Austria, Belgium, France, Germany, Netherlands, Norway, Portugal, Spain, Sweden, and Finland	 10A, 250V Two-Pole with Earth Contact for use in Switzerland
 10A, 250V Two-Pole with Earth Contact for use in Denmark	 20A,120V for use in the United States
 10A, 250V Two-Pole with Earth Contact for use in Australia, New Zealand, New Guinea, and China	 10A, 250V Single Phase for use in South Africa, India, and Hong Kong
 10A, 250VAC for use in Italy and North Africa	 10A, 250V for use in Israel

In Countries with 230V Single-Phase Power

WARNING

Only a PerkinElmer Service representative or similarly trained and authorized personnel should ever change or replace the plug for the Clarus 500 GC.

1. Select the appropriate plug and connect it to the three power cord wires as follows:
   - Connect the brown wire to line (AC).
   - Connect the blue wire to neutral (ACC).
   - Connect the green/yellow wire to chassis ground.
2. Remove the three screws that secure the right side panel to the Clarus 500 GC. Then remove the panel.
3. Verify that the brown wire from the line filter is connected to E1, that the blue wire from the line filter is connected to E2, and that the yellow/green wire is connected to E3 on the AC Distribution P.C. board (see Figure 23).
4. Make sure that a 10-A Slow-Blow fuse is installed in the F3 fuse holder and a wire is soldered across the contacts of the F3 fuse holder to short this connection.
5. Replace the right side panel and connect the power cord to a suitable electrical outlet.

In Countries with 230V Two-Phase Power

WARNING

Only a PerkinElmer Service representative or similarly trained and authorized personnel should ever change or replace the plug for the Clarus 500 GC.

1. Select the appropriate plug and connect it to the three power cord wires as follows:

- Connect the brown wire to line (AC Hot).
- Connect the blue wire to line (AC Hot).
- Connect the green/yellow wire to chassis ground.

2. Remove the three screws that secure the right side panel to the Clarus 500 GC and remove the panel.

3. Verify that the brown wire from the line filter is connected to E1, that the blue wire from the line filter is connected to E2, and that the green/yellow wire is connected to E3 on the AC Distribution P.C. board (see Figure 23).

4. Cut and remove the wire that is used as a jumper across the F3 fuse holder. Make sure that the 10-A Slow-Blow fuse remains installed in the F3 fuse holder.

5. Replace the right side panel and connect the power cord to a suitable electrical outlet.

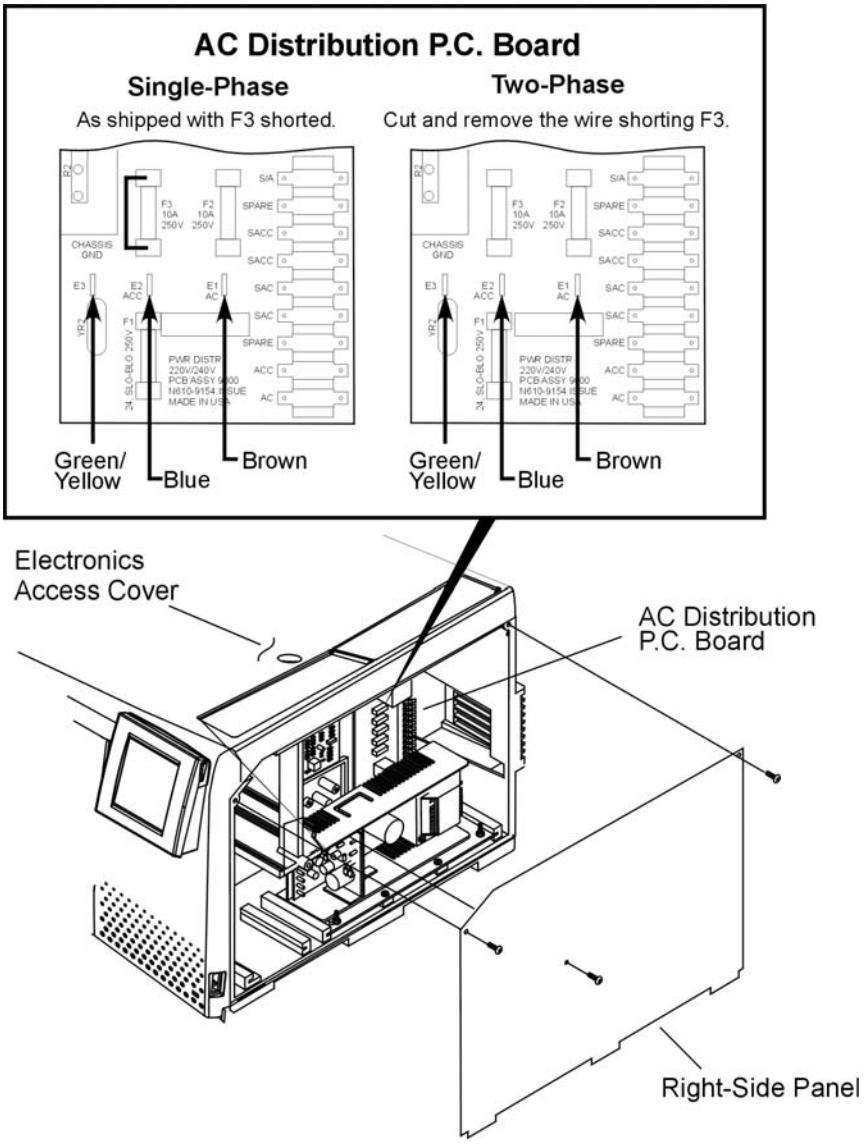


Figure 23. AC Distribution P.C. board connections for countries that use single-phase or two-phase power.

Connecting the Accessories 6

Connect the EICD

If you ordered your Clarus 500 GC with either an EICD (also called a Hall detector) or an EICD in series with a photoionization detector (PID), you must perform the following procedures:

- Connect the EICD Control Unit to the EICD Components
- Connect the EICD solvent system
- Make the EICD/PID series connection
- Check the calibration
- If necessary, convert the EICD Control Unit line voltage setting to 230-V operation. Refer to the procedure described in the *Tremetrics Instruction Manual* that is shipped with the Control Unit.

WARNING

Never operate the Control Unit at an incorrect voltage setting.

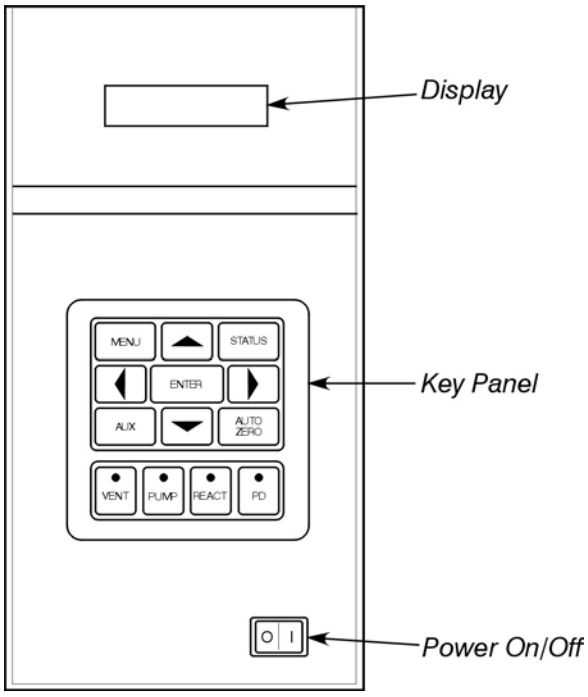


Figure 24. ElCD Control Unit front panel.

Connect the ElCD Control Unit to the ElCD Components

To connect the ElCD Control Unit to the ElCD components, refer to Figure 25 and follow this procedure:

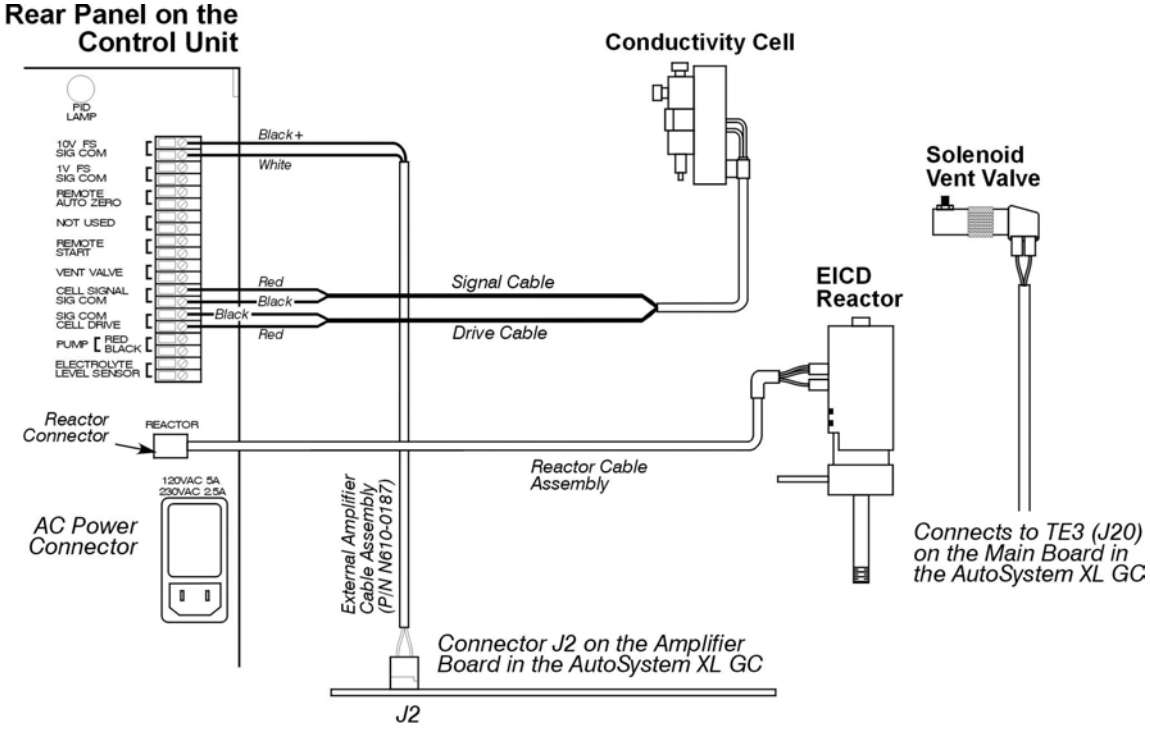


Figure 25. Connection diagram of the ElCD Control Unit to ElCD components.

1. Plug the connector on the end of the Reactor Cable Assembly into the ElCD's Reactor Connector on the rear panel of the Control Unit.
2. Connect the Conductivity Cell Drive Cable and the Signal Cable to the following connectors on the Control Unit rear panel:
   - Connect the Drive Cable red lead to CELL DRIVE and the black lead to SIG COM.

- Connect the Signal Cable red lead to CELL SIGNAL and the black lead to SIG COM.

3. If you are installing an ElCD amplifier board (P/N N612-0060) in the Clarus 500 GC, locate the External Amplifier Cable Assembly (P/N N610-0187) supplied with the amplifier kit.
4. Connect one end of the External Amplifier Cable Assembly to connector J2 on the ElCD amplifier board that is installed in the Clarus 500 GC, and at the other end of the cable connect the red lead to 10V FS and the black lead to SIG COM on the Control Unit rear panel (top two connectors).
5. Connect the solenoid vent valve cable to TE3 (J20) on the main board in the Clarus 500 GC electronics compartment behind the right side panel.
6. Secure all cables in the existing cable clamps.

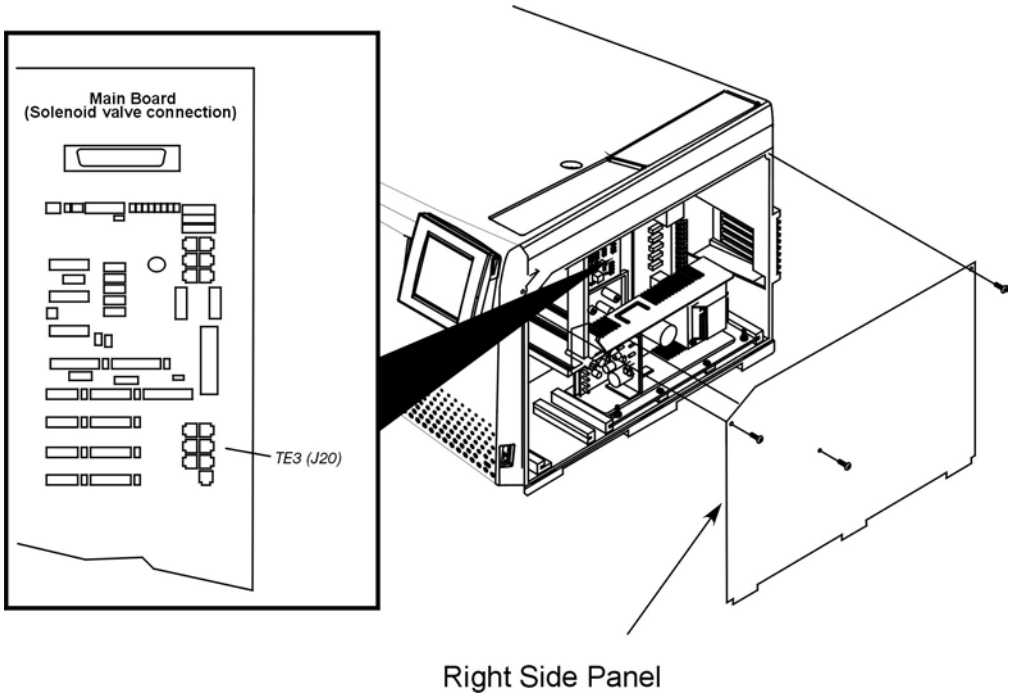


Figure 26. ElCD solenoid valve connection to TE3 on the Main Board in the Clarus 500 GC.

Connect the ElCD Solvent System

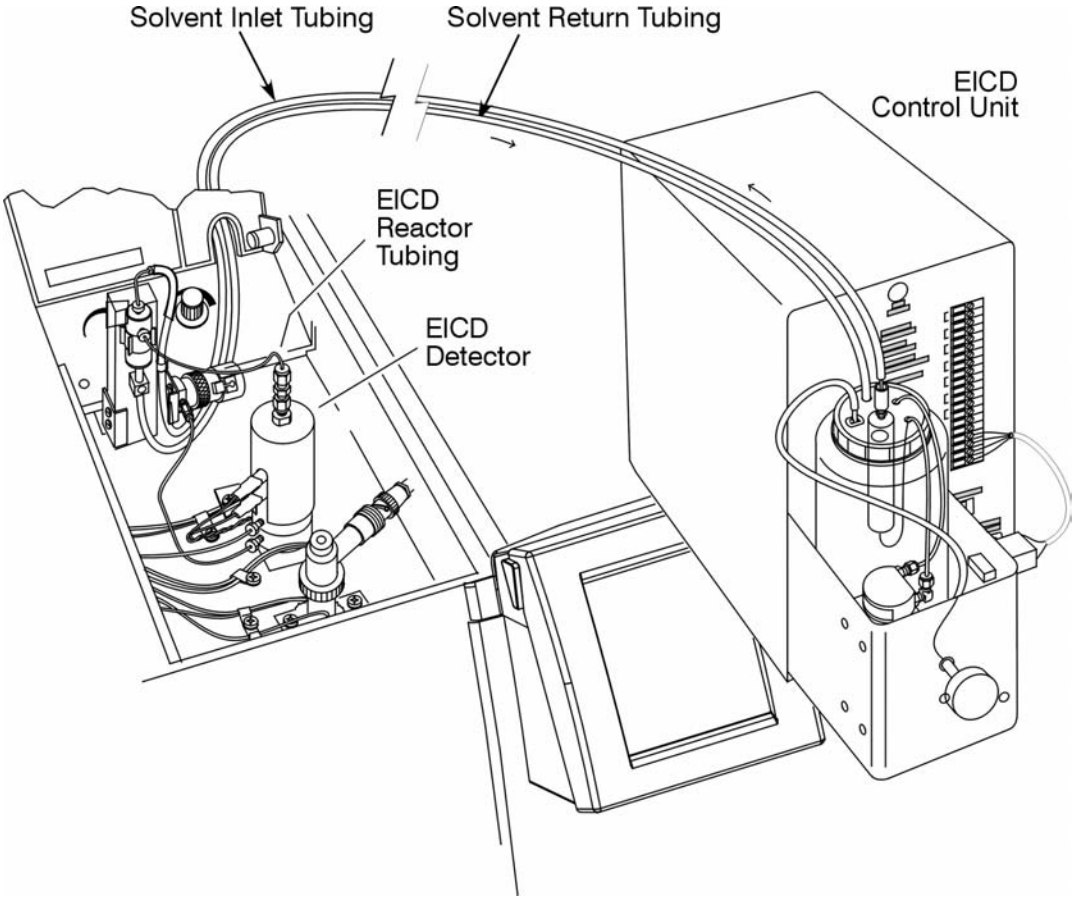


Figure 27. Connecting the ElCD solvent system.

To connect the ElCD solvent system, refer to Figures 27 and 28 and follow the procedure below. The lines have been connected to the detector assembly at the Clarus 500 in the factory. These lines have been dressed to the back of the unit.

1. At the back of the ElCD Control Unit, connect the output of the pump (the elbow fitting on the left side of the pump) to the top of the ion exchange tube. The ion exchange tube is inside the solvent reservoir.

2. Connect the solvent reservoir to the fitting on the right side of the pump.
3. Connect the top of the ElCD reactor tube to the Conductivity Cell.
4. Place the drain tubing from the bottom of the Conductivity Cell into the solvent reservoir.

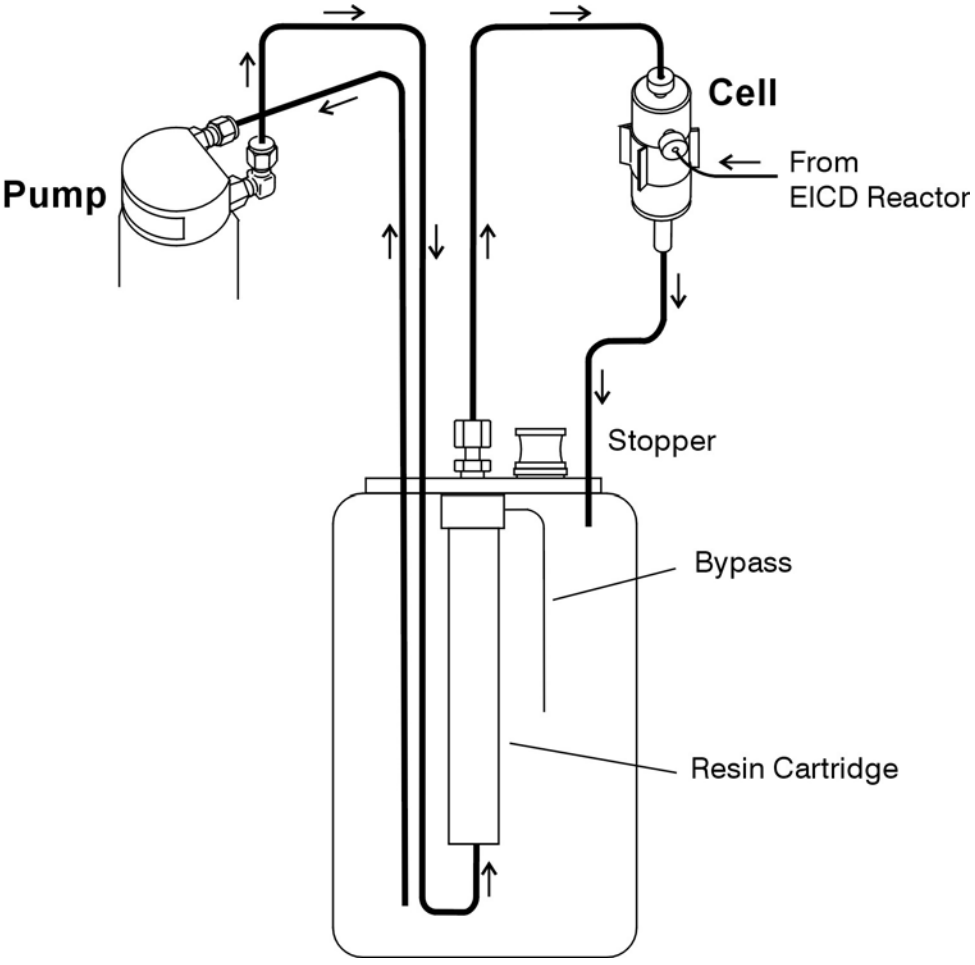


Figure 28. Solvent Delivery System Connections

Make the ElCD/PID Series Connection

Use the following procedure to make the ElCD/PID series connection. After you make this connection, you can operate either the ElCD or the PID without any loss of sensitivity.

NOTE: *Always connect the analytical column to the PID, and the PID exit tube to the ElCD.*

1. Cut a length of the supplied deactivated 0.53-mm. I.D. fused silica tubing (P/N N930-1358) long enough to connect the PID exit line to the ElCD. Try to use the shortest possible length (approximately 12 inches).

2. nsert a 1/16-in. column nut and a 1/16-in. graphite/Vespel ferrule (P/N 0992-0301) over one end of the cut fused-silica tubing. Make sure the tapered end of the ferrule faces the nut as shown below.

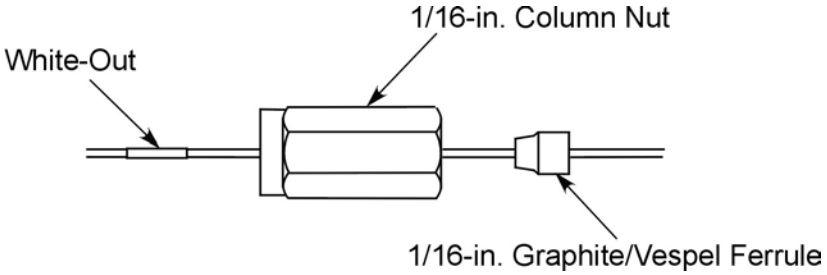


Figure 29. Placing a 1/16-in. nut and graphite ferrule over the fused silica line.

3. Cut about 1 cm (3/8 inch) from the end of the fused-silica tubing using a wafer scribe (P/N N930-1386, pkg. of 10 scribes) or other column cutting tool. Break off the tubing at the score mark and make sure that the break is clean and square. Examine the cut with a magnifying glass and compare it to the examples below.

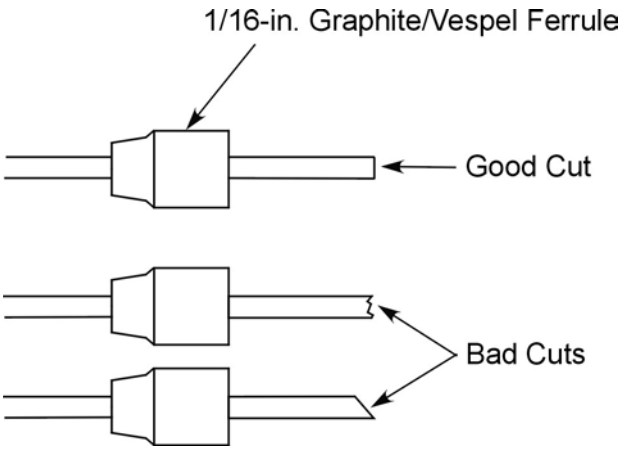


Figure 30. Examples of a good tubing cut and bad cuts.

4. Position the nut on the fused-silica tubing so that the back of the nut is 8.8 cm (3 1/2 inches) from the end of the fused-silica tubing. This positions the fused-silica tubing inside the ElCD receiver.

5. Using typewriter "white-out" or a felt-tipped pen, make a mark on the fused-silica tubing just beyond the back edge of the nut.

CAUTION	*To avoid contaminating the system, make sure the nut does not come into contact with the mark on the fused-silica tubing.*

6. Connect the fused-silica tubing to the ElCD fitting inside the oven as follows:

   a) Insert this end of the fused-silica tubing into the ElCD fitting. Slide the nut up to the ElCD and turn it until it is fingertight.

   b) Push the fused-silica tubing into the ElCD fitting until the mark on the tubing is aligned with the back of the nut.

   c) Using two 1/4-inch wrenches, tighten the nut only until the fused-silica tubing cannot be pulled out of the ElCD fitting. ***Do not overtighten the nut!***

7. Connect the other end of the fused-silica tubing to the PID exit tubing as follows:

    a) Insert the nut on one end of the 1/16 to 1/16-in. union (P/N 0990-3075) over the PID exit tube until it bottoms. Using two wrenches, tighten the nut 1/4 turn past fingertight.

    b) Remove the nut and metal ferrule from the other end of the 1/16 to 1/16-in. union. Put the metal ferrule aside; you will not need it.

    c) Insert the nut and a 1/16-inch graphite/Vespel ferrule (P/N 0992-0301) over the free end of the fused-silica tubing.

    d) Insert the end of the fused-silica tubing into the union until it bottoms. Slide the nut up to the union and tighten it fingertight.

    e) Using two 1/4-in. wrenches, tighten the nut only until the fused-silica tubing cannot be pulled out of the ElCD fitting. ***Do not overtighten the nut!***

You can operate the ElCD and the PID in series or operate either detector independently. Always connect your analytical column to the PID.

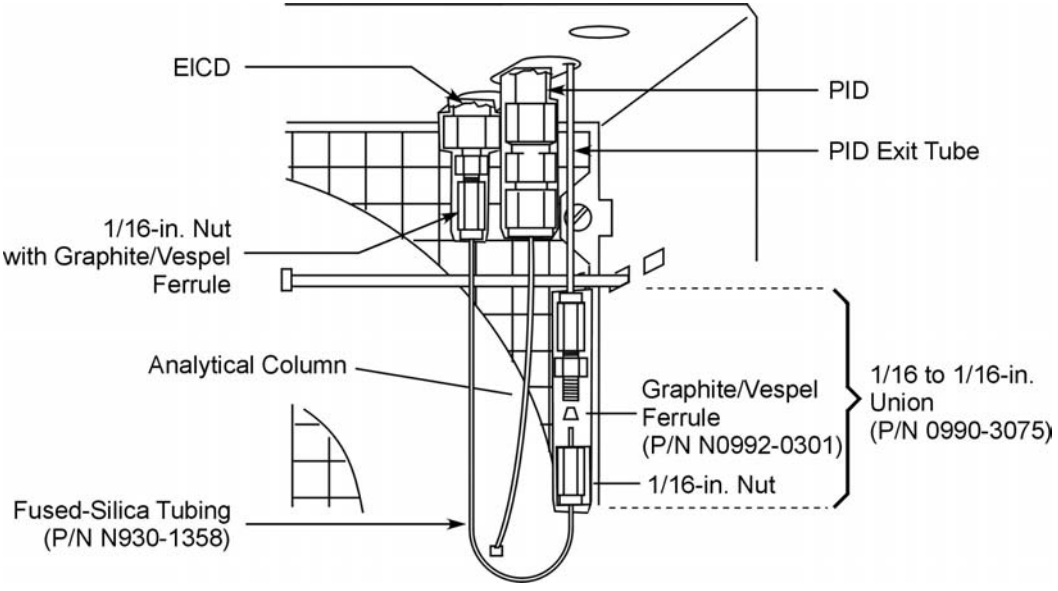


Figure 31. Connecting the fused silica line to the ElCD and the PID.

Check the Calibration

After you have made all the proper connections, check the calibration by following this procedure:

1. Connect the Control Unit to the AC line power.

2. Select SOLVENT FLOW. Then set the SOLVENT FLOW to 0.8 mL/min. You can set the solvent flow to 0.8 mL/min by turning the knob to the right of SOLVENT FLOW until 60 appears.

3. Start the flow by setting the switch to the right of SOLVENT FLOW to the On position.

4. Measure the solvent flow at the exit of the Conductivity Cell and adjust the SOLVENT FLOW until you get 0.8 mL/min.

5. Allow the ElCD to equilibrate at 0.8 mL/min for 4 to 5 hours.

6. Check the CALIBRATE display. It should indicate 2000 $\pm$ 20.

7. If the CALIBRATE display does not indicate 2000 $\pm$ 20, refer to Diagnostic Display in the Operation Section of the *ElCD Operator's Manual* that is supplied with the ElCD.

Install the NPD Bead Assembly

If you purchased your Clarus 500 GC equipped with a Nitrogen Phosphorus Detector (NPD), the NPD bead assembly is packaged separately and shipped inside the Clarus 500 GC oven. To install the NPD bead assembly, use the following procedure and refer to Figure 32.

CAUTION	*After installing a NPD bead, you must set up the NPD and condition a new bead before you can use it. Refer to Setting Up a NPD in Chapter 8 of the Clarus 500 GC User's Manual (P/N 0993-6073).*

1. Open the detector cover.
2. Remove the bead assembly package from the Clarus 500 GC oven.
3. Loosen the knurled ring on the NPD collector assembly. Then remove the collector assembly.

CAUTION	*You may find it easier to first remove the coaxial cable from the collector assembly before you remove the collector assembly.*

4. Remove the screw that secures the bead transformer assembly to the top of the Clarus 500 GC oven.
5. Plug the bead assembly (P/N N612-0092) into the connector on the bead transformer. The connector is keyed so that the bead assembly can only be inserted one way.
6. Carefully insert the bead portion of the bead assembly in the detector body as shown in Figure 32.
7. Secure the bead transformer to the top of the oven with the screw removed in step 4.
8. Replace the collector assembly on the detector body and secure it by tightening the knurled ring. If the coaxial cable was removed, connect it to the collector assembly.

CAUTION	*Ensure that the polarizing wire is still connected to the polarizing pin on the detector body before you set up and run the NPD.*

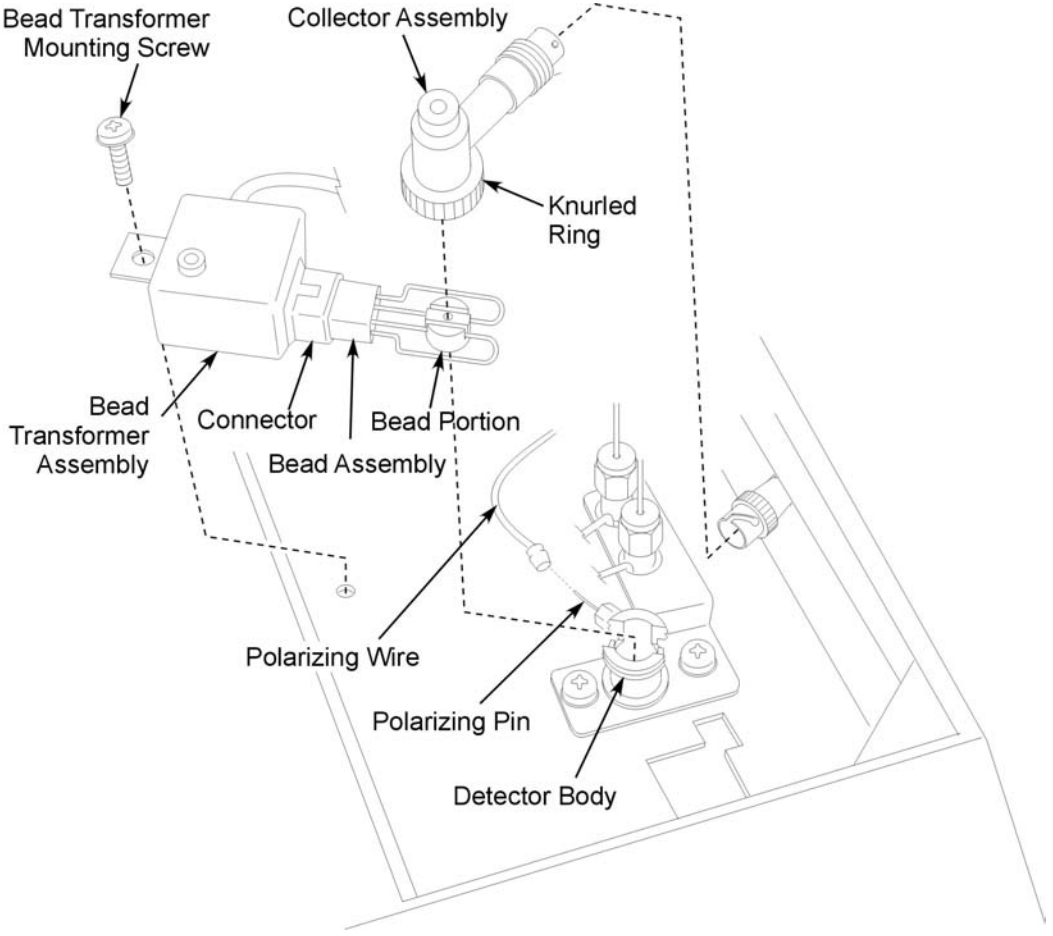


Figure 32. Exploded view of the Nitrogen Phosphorus Detector.

Connect a Recorder or Integrator

This section describes how to connect an optional recorder or integrator to the Clarus 500 GC. To connect either one of these devices, use the following procedure.

1. To connect a device to amplifier Channel A or B, first configure output 1 or 2 for a recorder or integrator as described in Chapter 3, Initial Setup Procedures, in the *Clarus 500 GC User's Manual*.

2. Open the small access cover on top of the Clarus 500 GC. With a large flat bladed screw driver loosen the large screw. On the main cover is a screw well. Loosen this screw with the large flat bladed screwdriver. You will then be able to lift the entire cover up and have access to the recorder or integrator.

3. To connect a recorder or integrator to Channel A, connect the ground lead of the device to TB1-13 and the positive lead of the device to TB1-14. Make sure you route the wires around the strain relief posts as shown in Figure 34.

4. To connect a recorder or integrator to Channel B, connect the ground lead to TB1-15 and the positive lead to TB1-16.

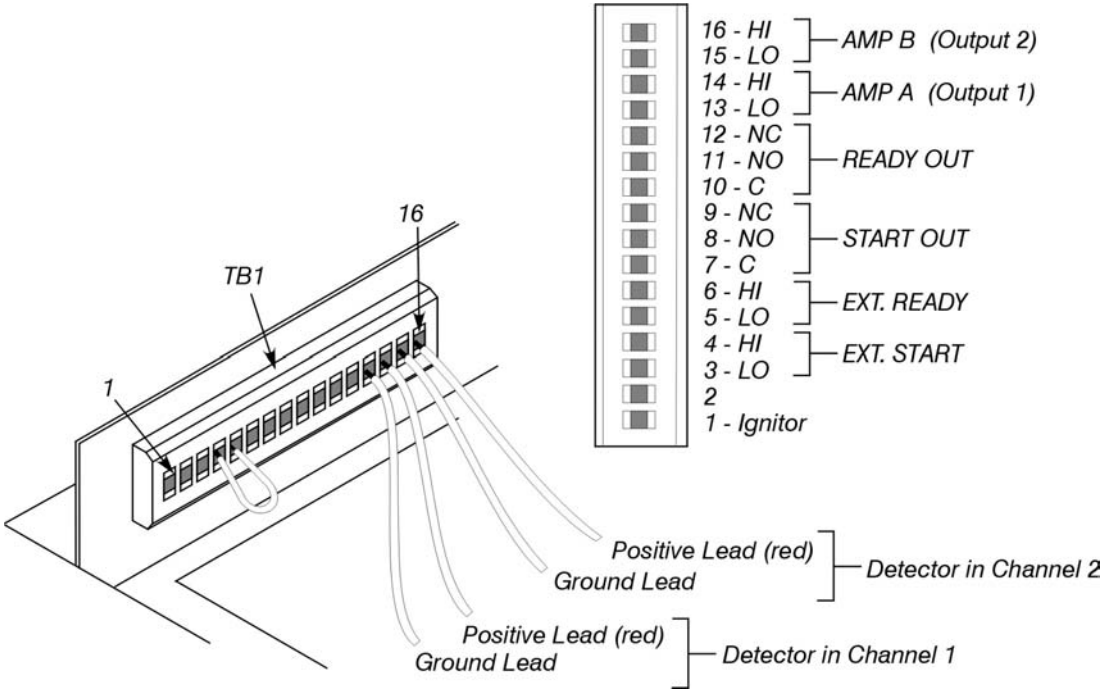


Figure 33. Recorder and integrator connections at TB1.

In addition to the amplifier Channel A and B contacts, TB1 has READY and START contacts. Table 3 describes the functions of these contacts.

Table 3. READY and START Connections at TB1

Connection	Function
READY OUT TB1-10 (C), 11 (NO), 12 (NC)	*Instrument READY OUT Relay:* These contacts are used to tell an external device that the Clarus 500 GC is ready. The normally open contact (NO) is closed in the Ready state.
START OUT TB1-7 (C), 8 (NO), 9 (NC)	*Instrument START OUT Relay:* These contacts are used to start an external device, such as an integrator, when the Clarus 500 GC starts a chromatographic run. The normally open contact is closed for 1 sec when a run is started.
EXT. READY (TB1-5, 6) TB1-6 is signal TB1-5 is ground	*External Ready In:* The Clarus 500 GC requires that these contacts be shorted together to become ready and is shipped with a link across them. When using an external device, such as an integrator, remove the link and wire the device to provide a contact closure indicating the Ready state. This will prevent the instrument from becoming ready before the external device is ready.
EXT. START (TB1-3, 4) TB1-4 is signal TB1-3 is ground	*External Start In:* Shorting these contacts will cause the Clarus 500 GC to start a chromatographic run. It is equivalent to pressing the RUN key.

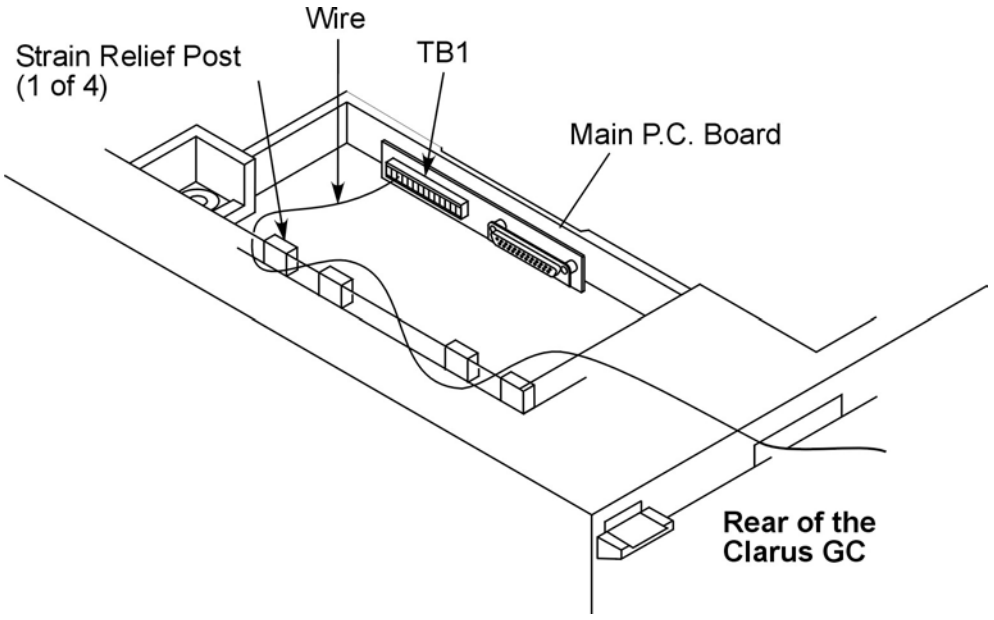
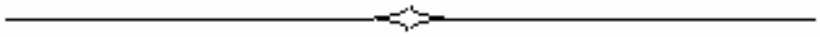


Figure 34. Routing recorder/integrator wires around the strain relief posts.



PPC Restrictor Information 7

Available Restrictors

Restrictor Number	Color	Helium Flow at 30 PSIG, vent to atmosphere
1	Silver	1 mL/min
2	Red	3 mL/min
3	Yellow	10 mL/min
4	Black	30 mL/min
5	Green	100 mL/min
6	Blue	300 mL/min

Restrictors for Carrier Gas Control

Injector	Restrictor Number	Helium Flow (mL/min) (with a 90 psig inlet pressure and a 10 psig drop across the restrictor)
Packed	4 (std)	30
Split/Splitless or PSS	6 (std)	300
Split/Splitless or PSS	4 (acc)	30
POC	3 (std)	10
POC	2 (acc)	3

Restrictors for Detector Gas Control

NOTE: *Maintain an inlet pressure between 60 and 90 psig.*

Detector	Gas	Restrictor Number	Nominal Flow Required (mL/min)
FID	Air	6	450
FID	Hydrogen	4	45
NPD	Air	5	100
NPD	Hydrogen	1	2
FPD	Air	5	90
FPD	Hydrogen	4	75
ECD	Argon/Methane	4	30
ECD	Nitrogen	4	30
TCD	Helium	4	30
TCD	Hydrogen	3	30
ElCD	Hydrogen	3	25

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