
Pegasus® BT GC/MS Instruction Manual

Pegasus BT/Pegasus BT 4D

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Minor revisions may not be reflected in this manual.



LECO

EMPOWERING RESULTS

LECO Corporation
3000 Lakeview Avenue · St. Joseph, MI 49085
Phone: 269-983-5531 · Fax: 269-983-3850
info@leco.com · www.leco.com
ISO-9001:2015 Q-994

LECO Europe B.V.
Vouersweg 118
6161 AG Geleen
(P.O. Box 1174 - 6160 BD Geleen)
The Netherlands
Phone: 31-46-4747473 · Fax: 31-46-4747333
info_nl@leco.com www.nl.leco-europe.com

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Original Instructions

Quality at LECO Corporation means understanding our customer's requirements and establishing specifications that clearly define those requirements. The essence of our quality philosophy is the commitment to quality objectives, aimed at never-ending improvement and complete customer satisfaction.

Safety Symbols

These symbols may be found on LECO equipment or their components. Some of the symbols shown may not appear in this manual. These symbols indicate the use of specific safety guidelines. Important safety information is highlighted in this manual by one of the following symbols, as well as by WARNING and CAUTION statements. Operator and service personnel must follow these instructions for personal safety and to prevent damage to the instrument.



CAUTION



HAZARDOUS VOLTAGE WARNING



HIGH TEMPERATURE WARNING



EXPLOSION HAZARD



ELECTROSTATIC SENSITIVE DEVICES



PINCH HAZARD



PINCH HAZARD



PINCH HAZARD



PINCH HAZARD



FIRE HAZARD



ROTATING FAN BLADES



EXPLOSIVE



FLAMMABLE



OXIDIZING



COMPRESSED GAS



CORROSIVE



TOXIC



HARMFUL



HEALTH HAZARD



ENVIRONMENTAL HAZARD



PROTECTIVE GLOVES



PROTECTIVE EYEWEAR



EAR PROTECTION



NOT ALLOWED

Cautions, Warnings, and Residual Risks



CAUTIONS

- This instrument should be operated only by technically qualified and trained individuals who have fully read and understood these instructions.
- It is highly recommended that users attend training courses provided by LECO Corp. prior to operating this equipment.
- This instrument should be operated only in accordance with these instructions.
- The operator should follow all of the warnings and cautions set forth in this manual and employ all applicable standard laboratory safety procedures.
- If this equipment is used in a manner not specified by the manufacturer, the protection measures provided by the equipment may be impaired.
- Maintenance is to be completed by a Responsible Body: a person who has the proper training and knowledge to perform the task safely.
- Consumables and replacement parts other than those specified and provided by the manufacturer may cause damage to the instrument as well as impair the protection measures provided by the equipment.
- Instruments can be very heavy. Proper equipment must be used to safely transport, position, and lift equipment (if necessary).
- Front panels and other cosmetic parts of this instrument are not designed to be weight bearing. DO NOT use such parts as lifting points, or damage may result. ALWAYS lift near the feet at the sides or the rear of the instrument base.



RISK OF ELECTRICAL SHOCK

- Disconnect the equipment from facility power before servicing or removing any guard or tool-accessible panel.
- The plug on the power cord that connects the instrument to facility power must remain accessible at all times. A "lock-out" device can be installed over the plug when servicing the equipment if so required by local electric code.
- Qualified personnel must ensure that the receptacle providing the facility power has a reliable connection to Protective Earth (Safety Ground). A failure in the Protective Earth terminal may impair the protection provided by the equipment.
- Detachable/interchangeable power cords are available in several wire gauges, voltages, and current ratings and can easily be used with the wrong equipment. Make sure properly rated power cords are used for each piece of equipment. The use of inadequately rated power cords can cause a Fire and/or Electrical Shock Hazard.
- During the installation and operation of this instrument, do not position equipment or materials so that it is difficult to operate or access the On/Off switch (AC Mains Disconnect Device). This switch must remain easily accessible to the user at all times.
- If the instrument power cord is wired directly into an electrical box, the box must supply a lockable disconnect, be located close to the instrument, and remain accessible at all times.
- Facility power connections must meet all local, state, and national electric codes. In some locations, this may require changing the power cord, plug/receptacle, or the cordage used. If unsure, always consult with a local electrical authority.



SOUND PRESSURE LEVELS

Most LECO instruments produce sound pressure levels far below 70 dB(A) and generally do not require ear protection to be worn by the operator in most laboratory environments.

The sound pressure levels on some LECO instruments, such as saws, polisher/grinders, or instruments using vacuum cleaners, may exceed 70 dB(A) for short periods of time, depending on how the instrument is used and the types of materials that are being processed.

Because sound pressure levels can be accumulative and dependent on many factors, including other equipment operating in the vicinity of a workstation, it is recommended by some authorities that a Time Weighted Sound Pressure Level be measured or calculated at the operator's position after installation to assess the possibility of the need for Personal Protective Equipment (PPE) such as ear protection.

INSTRUMENTS WITH ACCESSIBLE HIGH TEMPERATURES



RISK OF SEVERE BURNS

- Do not touch hot surfaces near ovens, heaters, furnaces, crucibles, reagent tubes, catalyst tubes, combustion tubes, etc.
- Wait for surfaces to cool to a safe temperature before performing any maintenance or service operations in these areas.

INSTRUMENTS WITH HOT CRUCIBLES AND MATERIALS



RISK OF SEVERE BURNS

- Spent crucibles are very HOT after leaving the furnace and can remain hot for a long period of time. Do not touch spent crucibles with bare hands.
- Use proper Personal Protection Equipment (PPE) and provided tools when handling hot materials.
- Wait for surfaces to cool to a safe temperature before performing any maintenance or service operations in these areas.



RISK OF FIRE

- Empty spent crucible bucket into a nonflammable, heat-resistant container only.
- Dispose of hot materials into a fireproof container only.
- Do not attempt to permanently dispose of spent crucibles or any hot materials until they have cooled to a safe temperature.

INSTRUMENTS WITH GLASS TUBES



RISK OF INJURY

- Wear protective gloves and eye protection whenever handling glass tubes to prevent injury. Other Personal Protection Equipment (PPE) may also be required.



RISK OF SEVERE BURNS

- Glass tubes used with reduction and catalyst heaters may be hot. The materials inside these tubes may also be hot. Do not attempt to remove tubes until they have cooled to a safe temperature.



RISK OF INJURY

- Visually inspect all glass tubing before installation or repacking. Do not use, and properly dispose of, any glass tubing that has cracks, chips, or scarring. Damaged tubes could possibly rupture under pressure.
- Depressurization of the Incoming Carrier Gas may be necessary before removal of glass tubes to prevent injury or damage to the tubes during the removal process. Turn Off the gas in the software and wait approximately 1 minute before attempting to remove any tubes.

INSTRUMENTS WITH PNEUMATICS, COMPRESSED GASES, AND FLUIDS



CAUTION – RISK OF INJURY OR DAMAGE TO INSTRUMENT

- An external shutoff device must be provided to isolate and depressurize the supply from the instrument. This device must be easily accessible to the user. A means must be provided to indicate that the system has been depressurized, such as a clearly visible pressure gauge. The local codes in some areas may require the shutoff devices (supply isolators) to be lockable.
- Use of external pressure-limiting devices are required to ensure that maximum-rated pressures cannot be exceeded.
- Depressurize the entire system and all supply lines prior to performing any service or maintenance tasks on this instrument.
- External flexible supply lines/piping/hoses/tubes must be securely supported and restrained every 1 meter or shielded by suitable means to reduce sudden hazardous movement (whiplash) resulting from leakage or a failure in the connections.
- Pipes and hoses must be properly marked to clearly identify their purpose and connection point.

- All external elements (pipes, hoses, pop-offs, regulators, gas bottles [tanks], receivers, valves, etc.) must be properly rated for the pressures available in both a normal and a fault condition.
- All external elements must be properly rated for the type of gas, fluid, and/or materials the system is supplying or venting.
- All external elements must be protected from damage from external effects.
- All external elements (especially gas bottles) must be adequately secured to avoid injury or damage.
- It is the responsibility of the facility owner or utility supplier to perform a risk assessment to ensure that a fault in external components of the fluid power system does not cause injury or damage to equipment and to install risk-lowering protection measures if necessary.
- Hazardous gases must be safely vented into a non-hazardous area with a connection to atmosphere.
- Regularly scheduled maintenance must be performed by the facility's management to check for leaks and make sure drains are clear, vents are working properly, filters are replaced, etc.
- Where the quantity of available gas and the volume of the room can cause an asphyxiation hazard, the facility's management is responsible for installing proper safety measures.
- Where flammable gases are used, the facility's management is responsible for ensuring that an unsafe condition cannot occur external to the instrument and for installing proper safety measures.

INSTRUMENTS THAT USE HAZARDOUS CHEMICALS



RISK OF CHEMICAL BURNS, INHALATION, CHEMICAL REACTIONS, AND FIRE

The gaseous and solid productions of this analytical instrument may be toxic relative to the sample material analyzed. Normal laboratory procedures and regulations for handling such materials should be followed. Please refer to the Safety Data Sheet (SDS) of the sample material for further information regarding these potential hazards, and follow the environmental protection measures and regulations applicable to your region.

- Be aware of all hazardous chemicals, solvents, accelerants, oxidizers, cleaners, reagent materials, etc., used by this instrument and its methods. Not all instruments use hazardous chemicals or materials.
- Obtain Safety Data Sheets (SDS) for all hazardous chemicals and materials used, and store them near where they are used. Users must familiarize themselves with all warnings, precautions, and required Safety Procedures for the handling, use, and disposal of such materials.
- Safety information and warnings may also appear on the chemical bottles or containers.
- Wear proper Personal Protective Equipment (PPE) if required.
- Avoid vapors and direct contact with chemicals.

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Identification Grading System™ (IGS™)	Quick Nominal Deconvolution™ (QnD™)

1 Introduction

The Introduction chapter contains general information about the Pegasus® BT instrument, including safety guidelines and warranty terms. Reference this chapter for replacement parts, operating supplies, and optional accessories. To place an order by phone, call 1-800-292-6141 or 269-985-5496. Orders may also be sent by fax to 269-982-8977. To contact our Customer Service Department toll-free, call 1-800-532-6911.

NOTE → The screenshots used throughout this manual are examples only and may or may not be applicable to specific procedures.

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Warranty

Equipment manufactured by LECO Corporation, St. Joseph, Michigan is warranted free from defect in material and workmanship for a period of 1) thirteen months from date of shipment or 2) twelve months from date of installation, whichever occurs first. Equipment not manufactured by LECO is covered to the extent of warranty provided by the original manufacturer and this warranty does not cover any equipment, new or used, purchased from anyone other than LECO Corporation. All replacement parts shall be covered under warranty for a period of thirty days from date of purchase. LECO makes no other representation or warranty of any other kind, expressed or implied, with respect to the goods sold hereunder, whether as to merchantability, fitness for purpose, or otherwise.

Expendable items such as crucibles, combustion tubes, chemicals, and items of like nature are not covered by this warranty.

LECO's sole obligation under this warranty shall be to repair or replace any part or parts which, to our satisfaction, prove to be defective upon return prepaid to LECO Corporation, St. Joseph, Michigan. This obligation does not include labor to install replacement parts, nor does it cover any failure due to accident, abuse, neglect, or use in disregard of instructions furnished by LECO. In no event shall damages for defective goods exceed the purchase price of the goods, and LECO shall not be liable for incidental or consequential damages whatsoever.

All claims in regard to the parts or equipment must be made within ten (10) days after Purchaser learns of the facts upon which the claim is based. Authorization must be obtained from LECO prior to returning any other parts. This warranty is voided by failure to comply with these notice requirements.

Notice

The warranty on LECO equipment remains valid only when genuine LECO replacement parts are employed. Since LECO has no control over the quality or purity of consumable products not manufactured by LECO, the specifications for accuracy of results using LECO instruments are not guaranteed unless genuine LECO consumables are employed in conjunction with LECO instruments. If purchaser defaults in making payment for any parts or equipment, this warranty shall be void and shall not apply to such parts and equipment. No late payment or cure of default in payment shall extend the warranty period provided herein.

LECO Corporation is not responsible for damage to any associated instruments, equipment, or apparatus nor will LECO be held liable for loss of profit or other special damages resulting from abuse, neglect, or use in disregard of instructions. The Buyer, their employees, agents, and successors in interest assume all risks and liabilities for the operation, use, and/or misuse of the product(s) described herein and agree to indemnify, hold harmless, and defend the seller from any and all claims and actions arising from any cause whatsoever, including seller's negligence for personal injury incurred in connection with the use of said product(s) and any and all damages proximately resulting therefrom.

WEEE

Disposal of WEEE and the Wheeled Bin Symbol

In 2002, the European Union introduced the Directive on Waste Electrical and Electronic Equipment (WEEE). The main aim of the Directive is to ensure that WEEE is collected and treated separately. WEEE may contain hazardous substances that should not end up in the (human) environment because it can have adverse effects on it.

Furthermore, WEEE is a vast source of raw materials. With the ever rising worldwide demand for new equipment and the ever decreasing volume of raw materials in nature, letting this potential source of such materials go to waste is unacceptable.

If equipment is collected separately, the equipment can be recycled and up to 85% to 90% of the equipment can be reused as new material, saving the use of virgin raw materials and energy of producing these. Separate collection and treatment of WEEE will thus decrease CO₂ emissions as well.

For the above reasons, LECO expects end users to dispose of the material in an environmentally friendly way, being separate collection and treatment.

Electrical and Electronic Equipment is labeled with the following "crossed-out wheeled bin" symbol, indicating that the equipment should be disposed of by the end user separate from other types of waste.

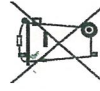


End users should contact their dealer/distributor or our company about disposal, collection, recycling options, and Safety Data Sheets (SDS information) in their country.

English

Correct Disposal of This Product

(Waste Electrical & Electronic Equipment)



(Applicable in the European Union and other European countries with separate collection systems) This marking shown on the product or its literature, indicates that it should not be disposed with other household wastes at the end of its working life. To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate this from other types of wastes and recycle it responsibly to promote the sustainable reuse of material resources.

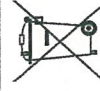
Household users should contact either the retailer where they purchased this product, or their local government office, for details of where and how they can take this item for environmentally safe recycling.

Business users should contact their supplier and check the terms and conditions of the purchase contract. This product should not be mixed with other commercial wastes for disposal.

Deutsch

Korrekte Entsorgung dieses Produkts

(Elektromüll)



(Anzuwenden in den Ländern der Europäischen Union und anderen europäischen Ländern mit einem separaten Sammelsystem)

Die Kennzeichnung auf dem Produkt bzw. auf der dazugehörigen Literatur gibt an, dass es nach seiner Lebensdauer nicht zusammen mit dem normalen Haushaltsmüll entsorgt werden darf. Entsorgen Sie dieses Gerät

bitte getrennt von anderen Abfällen, um der Umwelt bzw. der menschlichen Gesundheit nicht durch unkontrollierte Müllbeseitigung zu schaden. Recyceln Sie das Gerät, um die nachhaltige Wiederverwertung von stofflichen Ressourcen zu fördern.

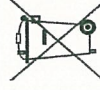
Private Nutzer sollten den Händler, bei dem das Produkt gekauft wurde, oder die zuständigen Behörden kontaktieren, um in Erfahrung zu bringen, wie sie das Gerät auf umweltfreundliche Weise recyceln können.

Gewerbliche Nutzer sollten sich an Ihren Lieferanten wenden und die Bedingungen des Kaufvertrags konsultieren. Dieses Produkt darf nicht zusammen mit anderem Gewerbemüll entsorgt werden.

Français

Comment éliminer ce produit

(déchets d'équipements électriques et électroniques)



(Applicable dans les pays de l'Union Européen et aux autres pays européens disposant de systèmes de collecte sélective)

Ce symbole sur le produit ou sa documentation indique qu'il ne doit pas être éliminé en fin de vie avec les autres déchets ménagers. L'élimination incontrôlée des déchets pouvant porter préjudice à

l'environnement ou à la santé humaine, veuillez le séparer des autres types de déchets et le recycler de façon responsable.

Vous favoriserez ainsi la réutilisation durable des ressources matérielles.

Les particuliers sont invités à contacter le distributeur leur ayant vendu le produit ou à se renseigner auprès de leur mairie pour savoir où et comment ils peuvent se débarrasser de ce produit afin qu'il soit recyclé en respectant l'environnement.

Les entreprises sont invitées à contacter leurs fournisseurs et à consulter les conditions de leur contrat de vente. Ce produit ne doit pas être éliminé avec les autres déchets commerciaux.

Italiano

Corretto smaltimento del prodotto

(rifiuti elettrici ed elettronici)



(Applicable in i paesi dell'Unione Europea e in quelli con sistema di raccolta differenziata)

Il marchio riportato sul prodotto o sulla sua documentazione indica che il prodotto non deve essere smaltito con altri rifiuti domestici al termine del ciclo di vita. Per evitare eventuali danni all'ambiente o alla salute causati dall'inopportuno smaltimento dei rifiuti, si invita l'utente a separare questo prodotto da altri tipi di rifiuti e di riciclarlo in maniera responsabile per favorire il riutilizzo sostenibile delle risorse materiali.

Gli utenti domestici sono invitati a contattare il rivenditore presso il quale è stato acquistato il prodotto o l'ufficio locale preposto per tutte le informazioni relative alla raccolta differenziata e al riciclaggio per questo tipo di prodotto.

Gli utenti aziendali sono invitati a contattare il proprio fornitore e verificare i termini e le condizioni del contratto di acquisto.

Questo prodotto non deve essere smaltito unitamente ad altri rifiuti commerciali.

Español

Eliminación correcta de este producto

(material eléctrico y electrónico de descarte)



(Aplicable en la Unión Europea y en países europeos con sistemas de recogida selectiva de residuos) La presencia de esta marca en el producto o en el material informativo que lo acompaña, indica que al finalizar su vida útil no deberá eliminarse junto con otros residuos domésticos. Para evitar los posibles daños al medio ambiente o a la salud humana que representa la eliminación incontrolada de residuos, separe este producto de otros tipos de residuos y reciclelo correctamente para promover la reutilización sostenible de recursos materiales.

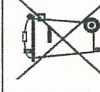
Los usuarios particulares pueden contactar con el establecimiento donde adquirieron el producto, o con las autoridades locales pertinentes, para informarse sobre cómo y dónde pueden llevarlo para que sea sometido a un reciclaje ecológico y seguro.

Los usuarios comerciales pueden contactar con su proveedor y consultar las condiciones del contrato de compra. Este producto no debe eliminarse mezclado con otros residuos comerciales.

Netherlands

Correcte verwijdering van dit product

(elektrische & elektronische afvalapparatuur)



Dit merkteken op het product of het bijbehorende informatiemateriaal duidt erop dat het niet met ander huishoudelijk afval verwijderd moet worden aan het einde van zijn gebruiksduur. Om mogelijke schade aan het milieu of de menselijke gezondheid door ongecontroleerde afvalverwijdering te voorkomen, moet u dit product van andere soorten afval scheiden en op een verantwoorde manier recycelen, zodat het duurzame hergebruik van materiaaibronnen wordt bevordert.

Huishoudelijke gebruikers moeten contact opnemen met de winkel waar ze dit product hebben gekocht of met de gemeente waar ze wonen om te vernemen waar en hoe ze dit product milieuvriendelijk kunnen laten recycelen.

Zakelijke gebruikers moeten contact opnemen met hun leverancier en de algemene voorwaarden van de koopovereenkomsten nalezen. Dit product moet niet worden gemengd met ander bedrijfsafval voor verwijdering.

Czech Republic

Správná likvidace tohoto produktu

(Zničení elektrického a elektronického zařízení)



Tato značka zobrazená na produktu nebo v dokumentaci znamená, že by neměl být používán s jinými domácími zařízeními po skončení svého funkčního období. Aby se zabránilo možnému znečištění životního prostředí nebo zranění člověka díky nekontrolovanému zničení, oddělte je prosíme od dalších typů odpadů a recyklujte je zodpovědně k podpoře opětovného využití hmotných zdrojů.

Členové domácnosti by měli kontaktovat jak prodejce, u něhož produkt zakoupili, tak místní vládní kancelář, ohledně podrobností, kde a jak můžete tento výrobek bezpečně vzhledem k životnímu prostředí recyklovat.

Obchodníci by měli kontaktovat své dodavatele a zkontrolovat všechny podmínky koupě. Tento výrobek by se neměl míchat s jinými komerčními produkty, určenými k likvidaci.

Slovenia

Ustrezno odstranjevanje tega izdelka

(odpadna električna in elektronska oprema)



Oznaka na izdelku ali spremljivalni dokumentaciji pomeni, da ga na koncu uporabne dobe ne smemo odstranjevati skupaj z drugimi gospodinjstskimi odpadki. Da bi preprečili morebitno tveganje za okolje

ali zdravje človeka zaradi nenadzorovanega odstranjevanja odpadkov, izdelek ločite od drugih vrst odpadkov in ga odgovorno reciklirajte ter tako spodbudite trajnostno ponovno uporabo materialnih virov.

Uporabniki v gospodinjstvih naj za podrobnosti o tem, kam in kako lahko odnesejo ta izdelek na okolju varno recikliranje, pokličejo trgovino, kjer so izdelek kupili, ali lokalni vlađni urad. Podjetja naj pokličejo dobavitelja in preverijo pogoje nabavne pogodbe. Tega izdelka pri odstranjevanju ne smete mešati z drugimi gospodarskimi odpadki.

Estonia

Õige viis toote kasutusest kõrvaldamiseks

(elektriliste ja elektrooniliste seadmete jäätmed)



Sellime tähistus tootel või selle dokumentidel näitab, et toodet ei tohi kasutaja lõppemisel kõrvaldada koos muude olmejäätmetega. Selleks, et vältida jäätmete kontrollimatu kõrvaldamisega seotud võimaliku kahju tekitamist keskkonnale või inimese tervisele ning edendada materiaalsete vahendite säästvat taaskasutust, eraldage toode muudest jäätmetest ja suunake taasringlusse.

Kodukasutajad saavad teavet keskkonnohutu ringlussevõtu kohta kas toote müüjal või keskkonnaametist.

Firmad peaksid võtma ühendust tarnijaga ning kontrollima ostulepingu tingimusi ja sätteid. Toodet ei tohi panna muude hävitamiseks mõeldud kaubandusjäätmete hulka.

Sweden

Korrekt avfallshantering av produkten

(elektriska och elektroniska produkter)



Denna markering på produkten och i manualen anger att den inte bör sorteras tillsammans med annat hushållsavfall när dess livstid är över. Till förebyggande av skada på miljön och hälsa bör produkten hanteras separat för ändamålsenlig återvinning av dess beståndsdelar.

Hushållsanvändare bör kontakta den återförsäljare som sålt produkten eller sin kommun för vidare information om var och hur produkten kan återvinnas på ett miljösäkert sätt.

Företagsanvändare bör kontakta leverantören samt verifiera angivna villkor i köpekontraktet. Produkten bör inte hanteras tillsammans med annat kommersiellt avfall.

Finland

Tämän tuotteen turvallinen hävittäminen

(elektroniikka ja sähkölaitteet)



Oheinen merkintä tuotteessa tai tuotteen ohjeismateriaalissa merkitsee, että tätä tuotetta ei tule hävittää kotitalousjätteen mukana sen elinkaaren päätyttyä. Hallitsemattomasta jätteenkäsittelystä ympäristölle ja kanssaihmistien terveydelle aiheutuvien vahinkojen välttämiseksi tuote tulee käsitellä muista jätteistä erillään. Jäte on hyvä kierrättää raaka-aineiksi kestäväan ympäristökehityksen takia.

Kotitalouskäyttäjien tulisi ottaa yhteyttä tuotteen myyneeseen jälleenmyyjään tai paikalliseen ympäristöviranomaiseen, jotka antavat lisätietoja tuotteen turvallisista kierrätysmahdollisuuksista.

Yrityskäyttäjien tulisi ottaa yhteyttä tavarantoimittajaan ja selvittää hankintasopimuksen ehdot. Tätä tuotetta ei tule hävittää muun kaupallisen jätteen seassa.

Latvia

Izstrādājuma pareiza likvidēšana

(noliegtas elektriskās un elektroniskās ierīces)



Uz izstrādājuma vai tam pievienotajās instrukcijās dotais marķējums norāda, ka to nedrīkst likvidēt kopā ar citiem sadzīves atkritumiem pēc tā ekspluatācijas laika. Lai novērstu viedei un cilvēku veselībai iespējamo kaitējumu, kas ir saistīts ar nekontrolējamu atkritumu likvidēšanu, tas jānosūta citiem atkritumiem un jāpārstrādā, lai sekmētu materiālo resursu atbildīgu atkārtotu lietošanu.

Mājsaimniecības lietotājiem jāsazinās vai nu ar veikalu, kurā šis izstrādājums ir pirktis, vai ar pašvaldību, lai iegūtu informāciju par to, kā un kur var nodot šo izstrādājumu, lai garantētu ekoloģiski drošu reciklēšanu.

Rūpnieciskajiem lietotājiem jāsazinās ar piegādātāju un jāpārbauda pirkuma līguma nosacījumi. Šo izstrādājumu nedrīkst sajaukt ar citiem likvidējamiem rūpnieciskajiem atkritumiem.

Greece

Σωστή Διάθεση αυτού του Προϊόντος

(Απορριμμάτια Ηλεκτρικού & Ηλεκτρονικού Εξοπλισμού)



Τα σήματα που εμφανίζονται επάνω στο προϊόν ή στα εγχειρίδια που το συνοδεύουν, υποδεικνύουν ότι δεν θα πρέπει να ρίπτεται μαζί με τα υπόλοιπα οικιακά απορριμμάτια μετά το τέλος του κύκλου ζωής του.

Προκειμένου να αποφευχθούν ενδεχόμενες βλαβερές συνέπειες στο περιβάλλον ή την υγεία: εξαιτίας της ανεξέλεγκτης διάθεσης απορριμμάτων, σας παρακαλούμε να το διαχωρίσετε από άλλους τύπους απορριμμάτων και να το ανακυκλώσετε, ώστε να βοηθήσετε στην βιώσιμη επαναχρησιμοποίηση των υλικών πόρων.

Οι οικιακοί χρήστες θα πρέπει να έλθουν σε επικοινωνία είτε με τον πωλητή απ' όπου αγόρασαν αυτό το προϊόν, είτε τις κατά τόπους υπηρεσίες, προκειμένου να πληροφορηθούν τις λεπτομέρειες σχετικά με τον τόπο και τον τρόπο με τον οποίο μπορούν να δώσουν αυτό το προϊόν για ασφαλή προς το περιβάλλον ανακύκλωση.

Οι επιχειρήσεις-χρήστες θα πρέπει να έλθουν σε επαφή με τον προμηθευτή τους και να ελέγξουν τους όρους και τις προϋποθέσεις του συμβολαίου πώλησης. Το προϊόν αυτό δεν θα πρέπει να αναμειγνύεται με άλλα συνθησμενά απορριμμάτια προς διάθεση.

Norway

Korrekt avhending av dette produkt

(Avfall elektrisk og elektronisk utstyr)



Denne merkingen som vises på produktet eller dens dokumentasjon, indikerer at den ikke skal kastes sammen med annet husholdningsavfall ved slutten av sin levetid. For å hindre mulig skade på miljøet eller menneskelig helse fra ukontrollert avfallsavhending, vennligst atskill dette fra andre typer avfall og resirkuler det ansvarlig for å fremme bærekraftig gjenbruk av materielle ressurser.

Husholdningsbrukere bør kontakte enten forhandleren de kjøpte produktet av, eller lokale myndigheter, for detaljer om hvor og hvordan de kan frakte denne artikkelen for miljømessig trygg resirkulering.

Forretningsbrukere bør kontakte sin leverandør og undersøke vilkårene i kjøpekontrakten. Dette produktet skal ikke blandes med annet kommersielt avfall som skal kastes.

Poland

Pravidlowe usuwanie produktu

(zużyty sprzęt elektryczny i elektroniczny)



Oznaczenie umieszczone na produkcie lub w odnoszących się do niego tekstach wskazuje, że produkt po upływie okresu użytkowania nie należy usuwać z innymi odpadami pochodzącymi z gospodarstw domowych. Aby uniknąć szkodliwego wpływu na środowisko naturalne i zdrowie ludzi wskutek niekontrolowanego usuwania odpadów, prosimy o oddzielenie produktu od innego typu odpadów oraz odpowiedzialny recycling w celu promowania ponownego użycia zasobów materialnych jako stałej praktyki.

W celu uzyskania informacji na temat miejsca i sposobu bezpiecznego dla środowiska recyklingu tego produktu użytkownicy w gospodarstwach domowych powinni skontaktować się z punktem sprzedaży detalicznej, w którym dokonali zakupu produktu, lub z organami władz lokalnych. Użytkownicy w firmach powinni skontaktować się ze swoim dostawcą i sprawdzić warunki umowy zakupu. Produktu nie należy usuwać razem z innymi odpadami komercyjnymi.

Romania & Moldova

Evacuarea corectă a acestui produs

(reziduuri provenind din aparatură electrică și electronică)



Marcajele de pe acest produs sau menționate în instrucțiunile sale de folosire indică faptul că produsul nu trebuie aruncat împreună cu alte reziduuri din gospodărie atunci când nu mai este în stare de funcționare. Pentru a preveni posibile efecte dăunătoare asupra mediului înconjurător sau a sănătății oamenilor datorate evacuării necontrolate a reziduurilor, vă rugăm să separați acest produs de alte tipuri de reziduuri și să-l reciclați în mod responsabil pentru a promova re folosirea resurselor materiale.

Utilizatorii casnici sunt rugați să ia legătura fie cu distribuitorul de la care au achiziționat acest produs, fie cu autoritățile locale, pentru a primi informații cu privire la locul și modul în care pot depozita acest produs în vederea reciclării sale ecologice.

Companiile sunt rugate să ia legătura cu furnizorul și să verifice condițiile stipulate în contractul de vânzare. Acest produs nu trebuie amestecat cu alte reziduuri de natură comercială.

Macedonia

Правилно отстранување на овој производ

(Истрошена електрична и електронска опрема)



Oваа ознака прикажана на производот или во неговата документација покажува дека тој не треба да се фрла со преостанатиот отпад од домаќинствата, кога веќе нема да биде употреблив.

За да се избегне можното нарушување на животната средина или на човековото здравје, како резултат на неконтролираното отстранување на отпадот, ве молиме да го рециклирате, одделите од другите видови отпад и совесно да го рециклирате, за да промовирате одржлива повторна употреба на материјалните ресурси.

Корисниците во домаќинствата треба да се обратат до дистрибутерите кај кои го купиле производот или до локалните власти, за да ги дознаат деталите за тоа каде и како можат да го однесат производот заради рециклирање коешто е безбедно за животната средина.

Деловните корисници треба да се обратат до нивните набавувачи и да ги проверат условите од договорот за купопродажба. При отстранувањето, овој производ не треба да се меша со другиот комерцијален отпад.

Bulgaria

Изхвърляйте правилно този продукт

(отпадъчно електрическо и електронно оборудване)



Това обозначение на продукта или съпътстващите го материали означава, че той не бива да бъде изхвърлян заедно с другите битови отпадъци след края на ползвания му живот. За да се предотврати възможно увреждане на околната среда или човешки живот от неконтролното изхвърляне на отпадъци,

моля, отделяйте такива продукти от другите видове отпадъци и го рециклирайте, демонстрирайки отговорно отношение към насърчаването на устойчива многократно употреба на материални ресурси.

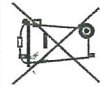
При употреба за битови нужди трябва да се свържете с продавача на дребно, от когото сте закупили продукта или с местните власти за подробности относно това къде и как можете да предадете продукта за безопасно рециклиране.

При употреба за стопански нужди трябва да се свържете с доставчика си и да проверите реда и условията в договора за закупуване. Този продукт не трябва да се смесва с други отпадъци на работното място.

Denmark

Korrekt affaldsbortskaffelse af dette produkt

(elektrisk & elektronisk udstyr)



Mærket på dette produkt eller i den medfølgende dokumentation betyder, at produktet ikke må bortskaffes sammen med almindeligt husholdningsaffald efter endt levetid. For at undgå skadelige miljø- eller sundhedspåvirkninger på grund af ukontrolleret affaldsbortskaffelse skal dette produkt bortskaffes særskilt fra andet affald og indleveres behørigt til fremme for bæredygtig materialer genvinning.

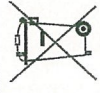
Hjemmebrugere bedes kontakte forhandleren, hvor de har købt produktet, eller den lokale myndighed for oplysning om, hvor og hvordan de kan indlevere produktet med henblik på miljøforsvarlig genvinning.

Erhvervsbrugere bedes kontakte leverandøren og læse betingelserne og vilkårene i købekontrakten. Dette produkt bør ikke bortskaffes sammen med andet erhvervsaffald.

Slovakia

Správna likvidácia tohoto výrobku

(Elektrotechnický a elektronický odpad)



Toto označenie na výrobku alebo v sprievodnej brožúre hovorí, že po skončení jeho životnosti by nemal byť likvidovaný s ostatným odpadom.

Pripadámu poškodeniu životného prostredia alebo ľudského zdravia môžete predísť tým, že budete takéto typy výrobkov oddeľovať od ostatného odpadu a vrátiť ich na recykláciu.

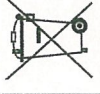
Používateľia v domácnostiach by pre podrobnejšie informácie, ako ekologicky bezpečne naložiť s týmto výrobkom, mali kontaktovať buď predajcu, ktorý im výrobok predal, alebo príslušný úrad v okolí ich bydliska.

Priemyselní používatelia by mali kontaktovať svojho dodávateľa a preventívne si podmienky kúpnej zmluvy. Tento výrobok by nemal byť likvidovaný spolu s ostatným priemyselným odpadom.

Hungary

A termék megfelelő leadása

(Elektromos és elektronikus készülékek hulladékkezelése)



A terméken vagy a hozzá tartozó dokumentáción szereplő jelzés arra utal, hogy hasznos élettartama végen a terméket nem szabad háztartási hulladékkal együtt kidobni. Annak érdekében, hogy megelőzhető legyen a szabálytalan hulladékleadás által okozott környezeti- és egészségkárosodás, különítse ezt el a többi hulladéktól, és felelősségteljesen gondoskodjon a hulladék leadásáról, a hulladékananyagok fenntartható szintű újrafelhasználása céljából.

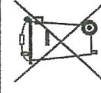
A háztartási felhasználók a termék forgalmazójától vagy a helyi önkormányzati szervektől kérjenek tanácsot arra vonatkozóan, hogy és hogyan vihetik el ez elhasznált terméket a környezetvédelmi szempontból biztonságos hulladékleadás céljából.

Az üzleti felhasználók lépjenek kapcsolatba a forgalmazóval, és vizsgálják meg az adásvételi szerződés feltételeit. A terméket nem szabad leadni kereskedelmi forgalomból származó egyéb hulladékkal együtt.

Republic of Ireland (Gaelic)

Díúscairt Cheart an Táirge Seo

(Trealamh Leictreach agus Leictreonach Dramháiola)



Léiríonn an mharcáil seo atá ar an táirge nó sa litríocht a thagann leis, nár chóir é a dhíúscairt le dramhail tí eile ag deireadh a shaoil oibre. Chun cosaínt i gcoinne dochar don chomhshaoil nó do shláinte an duine, a d'fhéadfadh bheith mar thoradh ar an ndíúscairt dramháiola neamhtheoranta, scar an dramhail seo ó chineálacha eile dramháiola le do thoil agus déan athchursáil fhreagrach air chun athúsáid inmhharthana na hacmhainní ábhartha a chur chun cinn.

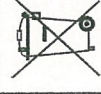
Ba chóir dóibh siúd a úsáideann an trealamh sa bhailé dul i dteagmháil leis an dfoiúir ónar cheannaigh siad an táirge seo, nó lena n-oifig áitiúil Rialtais, ar mhaithe le sonraí a fháil faoi cá háit agus cathain is féidir athchursáil atá slán ó thaobh an chomhshaoil de a dhéanamh ar an táirge seo.

Ba chóir dóibh siúd a úsáideann an trealamh seo ina ngnó dul i dteagmháil leis an soláthóir agus téarmaí agus coinníollacha an chonartha ceannaigh a sheiceáil. Níor chóir an táirge seo a chur le dramhail eile tráchtála agus díúscairt á déanamh.

Lithuania

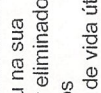
Tinkamas produkto atliekų tvarkymas

(atitarnavusi elektros ir elektronikos įranga)



Šis ženklas, pateikiamas ant produkto ar jo dokumentacijoje, nurodo, kad pasibaigus produkto tarnavimo laikui, jo negalima išmesti kartu su kitomis buitinėmis atliekomis. Kad būtų išvengta galimos nekontroliuojamo atliekų išmetimo žalos aplinkai arba žmonių sveikatai, ir siekiant skatinti aplinką tausojančių antrinių žaliavų panaudojimą, pašom atskirti jį nuo kitų rūšių atliekų ir atiduoti perdirbti.

Informacijos, kur ir kaip pristatyti šį produktą saugiai perdirbti, privatius vartotojai turėtų kreiptis arba į parduotuvę, kurioje šį produktą pirko, arba į vietines valdžios institucijas. Verslo vartotojai turėtų kreiptis į savo tiekėją ir peržiūrėti pirkinio sutarties sąlygas. Šis produktas tvarkant atliekas negali būti sumaišytas su kitomis atliekomis.



Esta marca, apresentada no produto ou na sua literatura indica que ele não deverá ser eliminado juntamente com os resíduos domésticos indiferenciados no final do seu período de vida útil.

Para impedir danos ao ambiente e à saúde humana causados pela eliminação incontrolada de resíduos deverá separar este equipamento de outros tipos de resíduos e reciclá-lo de forma responsável, para promover uma reutilização sustentável dos recursos materiais.

Os utilizadores domésticos deverão contactar ou o estabelecimento onde adquiriram este produto ou as entidades oficiais locais para obterem informações sobre onde e de que forma podem levar este produto para permitir efectuar uma reciclagem segura em termos ambientais.

Os utilizadores profissionais deverão contactar o seu fornecedor e consultar os termos e condições do contrato de compra. Este produto não deverá ser misturado com outros resíduos comerciais para eliminação.

LECO-Supplied Hewlett-Packard® Computers

Hewlett-Packard Support

All LECO-supplied *Hewlett-Packard* computers include HP® customer technical support and warranty claim information.

The inclusion of *HP* customer technical support and product warranty with LECO-supplied *HP* Computers ensures that any computer-related service issues are handled directly by the experts at *HP*. This eliminates the unnecessary step of working through the LECO service professionals for a resolution from *HP*.

For more information, call 1-866-625-1175, or access the *HP* website by following the link below and selecting the appropriate country and support language:

<http://www8.hp.com/us/en/contact-hp/ww-contact-us.html>

To expedite service, please have your *HP* computer serial number and model number available when contacting *HP*. These can be found on the back or side of the computer tower.

Declaration of Conformity Statement

European Union Directives - CE Marking

This equipment, which bears the CE Marking, complies with all the applicable requirements set out in the EU Directives.

NOTE → The EU Declaration of Conformity (EU-DoC) for this instrument is available upon request.

The following information sets out the content of the EU-DoC, including a list of EU Directives, harmonized standards, supporting standards and other applicable documents.

Machinery Directive (Product Safety)

EN ISO 12100 Risk Assessment - Safety of Machinery

EN/IEC 61010-1 Safety requirements for electrical equipment for measurement, control, and laboratory use.

EMC Directive (Electromagnetic Compatibility)

EN55011 RF Emissions Class A

EN 61000-3-2 & EN 61000-3-12 Harmonic Emissions

EN 61000-3-3 & EN 61000-3-11 Flicker Emissions

EN 61326-1 EMC requirements for electrical equipment for measurement, control, and laboratory use.

CISPR11 RF Emissions Class A

IEC 61000-4-2 Electrostatic Discharge

IEC 61000-4-3 Radiated RF Immunity

IEC 61000-4-4 Fast Transient Burst

IEC 61000-4-5 Surge Immunity

IEC 61000-4-6 Conducted RF Immunity

IEC 61000-4-8 Magnetic Immunity

IEC 61000-4-11 Voltage Dips, Interrupts

RoHS Directive (Restriction of Hazardous Substances)

EN 50581 RoHS in Electrical and Electronic Equipment

Product Safety

The equipment is also designed and manufactured to meet the following product safety requirements.

International

IEC 61010-1 Safety requirements for electrical equipment for measurement, control, and laboratory use.

USA

UL 61010-1 Safety requirements for electrical equipment for measurement, control, and laboratory use.

Canada

CAN/CSA-C22.2 No. 61010 Safety requirements for electrical equipment for measurement, control, and laboratory use.

Australia & New Zealand

AS/NZS 61010-1 Safety requirements for electrical equipment for measurement, control, and laboratory use.

Instruments with Hydraulic and/or Pneumatic Fluid Systems

The hydraulic and pneumatic systems and their components are in accordance with the applicable sections of the following:

ISO 4413, Hydraulic fluid power-General rules and safety requirements for systems and their components.

ISO 4414, Pneumatic fluid power-General rules and safety requirements for systems and their components.

Electromagnetic Compatibility Notices

USA

Federal Communications Commission (FCC) statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 (Part 18 where applicable) of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. LECO Corporation is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 (Part 18 where applicable) of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that might cause undesired operation.

Canada

Industry Canada Class A Emission Compliance Statement

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

European Union

European Union EMC Directive conformance statement

LECO Corporation cannot accept responsibility for any failure to satisfy the protection requirements resulting from a non-authorized modification of the product.

Attention: This is an EN 55011 Class A Group 1 product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

Australia & New Zealand

Attention: This is a CISPR 11 Class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

Radio-Frequency Disturbance

This product complies with IEC/EN 55011/CISPR11 Radio-frequency disturbance characteristics of industrial, scientific and medical equipment (ISM), which requires the following information to be provided within the User Documentation:

NOTE → The use of **Interconnecting Cables** other than those provided and/or specified may cause undesired electromagnetic compatibility performance.

Definitions

NOTE → This is a Class A Group 1 Product.

Class A equipment is equipment suitable for use in all establishments other than domestic and those directly connected to a low-voltage power supply network that supplies buildings used for domestic purposes.

Class B equipment is equipment suitable for use in domestic establishments and in establishments directly connected to a low-voltage power supply network that supplies buildings used for domestic purposes.

Group 1 equipment contains all equipment in the scope of this standard that is not classified as group 2 equipment.

Group 2 equipment contains all ISM RF equipment (Industrial, Scientific, Medical) in which radio-frequency energy in the frequency range 9 kHz to 400 GHz is intentionally generated and used, or only used, in the form of electromagnetic radiation, inductive and/or capacitive coupling, for the treatment of material or inspection/analysis purposes.

Flicker and Harmonic Emissions

To reduce the chance of voltage fluctuations, flicker emissions, or harmonic emissions, it is recommended that this equipment be connected to a private low-voltage distribution system. If connected to a public low-voltage distribution system, a minimum facility service current capacity of 100 amps is required. Consultation with the distribution system authority may be required.

About this Manual

The organization of this instruction manual is explained as follows. For each chapter, there is a hyperlinked table of contents and a list of illustrations, if applicable.

NOTE →

The screenshots used throughout this manual are examples only and may or may not be applicable to specific procedures.

Chapter 1, [Introduction](#), page [1-9](#), describes general information including safety guidelines and warranty terms. This chapter also provides information about parts and accessories.

Chapter 2, [Installation](#), page [2-1](#), describes hardware setup and connection.

Chapter 3, [Option Installation](#), page [3-1](#), describes setting up and operating optional equipment.

Chapter 4, [Maintenance](#), page [4-1](#), explains the procedures to perform on a regular basis to improve the instrument's performance and lifespan.

Chapter 5, [Theory of Operation](#), page [5-1](#), provides a theoretical overview of instrument operation.

Chapter 6, [Diagnostics](#), page [6-1](#), describes how to monitor the instrument to ensure proper operation.

Chapter 7, [Service](#), page [7-1](#), describes service procedures. Contact the LECO Service Department for additional information.

Chapter 8, [Illustrations](#), page [8-1](#), provides illustrations and photographs that can assist with procedures and location of parts.

Chapter 9, [Index](#), page [9-1](#), provides page numbers for topics throughout the manual. In the electronic manual available through the software, the page numbers in the index provide a hyperlink to the corresponding topic.

Accessing the Manual

The instruction manual is available in Adobe® Portable Document Format (PDF).

To access the manual, press the F1 key, or select Help on the Menu Bar and then select Help F1.

Tips for Navigating the Electronic Manual

The features available in *Adobe Acrobat*® and *Adobe Reader*® software may vary depending on the software version installed on your computer. Refer to the *Adobe Acrobat* software Help menu for additional information. Some of the following tips apply only to *Adobe* versions 7.0 and later, but most apply to versions 5.0 and later.

Using Bookmarks

After opening the PDF, select the Bookmarks tab, located on the left side of the screen, to access a tree that displays the main section headings. Select a heading to go immediately to the corresponding section. If a + appears for a chapter or section, select it to display more section headings.

Using Find

Select Edit, and then select Find on the menu bar (or select the Ctrl + F keyboard keys) to display a search box where you can enter a word or phrase. Each time you select Next, the software highlights the next occurrence of the word or phrase in the manual. The Find tool is most useful when the word or phrase is used infrequently in the manual.



Using Search

Select Edit, and then select Search on the Menu bar (or select the Ctrl + Shift + F keyboard keys) to display a side bar with a search box. Enter the desired word or phrase, and each occurrence of the word or phrase, in context, displays in the Results area. The Search (or Advanced Search) tool makes it easier to find words or phrases that occur many times in the manual. Search also provides the ability to search words or phrases in more than one PDF documents, if applicable. To search the instruction manual only, select the In The Current Document radio button.

Using Links

In the manual, text or a page number that is highlighted in blue provides a direct link to the associated topic. In the Index, select the page number to go directly to the associated topic.

Using Previous and Next Arrows

Use the view arrows located on the toolbar to toggle between views in the document once more than one page of the document has been viewed. Select  to return to the previous view, or select  to go to the next view.

Equipment Packages

Items listed as follows are repeated throughout this manual and are subject to revision. Please consult the packing slip received with the instrument.

SSL	Split/Splitless Inlet	CF	Consumable Free Cooling System
IF	Inert Flowpath	LN2	Liquid Nitrogen Cooling System
MMI	Multimode Inlet		

BT2 PKG PEGASUS BT2 TOFMS PC 230V

1	614-700-300	ASSY PEGASUS BT2 230VAC 50/60HZ 1PH
2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	618-380	CASE HOLDER CD-12 BLACK
1	686-551	MONITOR PC 24 IN
2	704-241	ASSY KEY COPY PROTECTION
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT2LIQ24 PKG PEGASUS BT2 GC/MS LIQ MMI-CO2 PC 230V

1	614-700-300	ASSY PEGASUS BT2 230VAC 50/60HZ 1PH
2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	618-380	CASE HOLDER CD-12 BLACK
1	686-551	MONITOR PC 24 IN
2	704-241	ASSY KEY COPY PROTECTION
1	L-PAL3-LIQ-110	KIT CONSUMABLE L-PAL3-LIQ
1	GC-STD-024B	GC AGILENT 7890B MMI-C02
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	L-PAL3-LIQ	AUTO SAMPLER L-PAL3 LIQ INJ

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT2LIQ25 PKG PEGASUS BT2 GC/MS LIQ MMI-LN2 PC 230V

1	614-700-300	ASSY PEGASUS BT2 230VAC 50/60HZ 1PH
2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	618-380	CASE HOLDER CD-12 BLACK
1	686-551	MONITOR PC 24 IN
2	704-241	ASSY KEY COPY PROTECTION
1	L-PAL3-LIQ-110	KIT CONSUMABLE L-PAL3-LIQ
1	GC-STD-025B	GC AGILENT 7890B MMI-LN2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	L-PAL3-LIQ	AUTO SAMPLER L-PAL3 LIQ INJ

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT2LIQ32 PKG PEGASUS BT2 GC/MS LIQ SSL IF PC 230V

1	614-700-300	ASSY PEGASUS BT2 230VAC 50/60HZ 1PH
2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	618-380	CASE HOLDER CD-12 BLACK
1	686-551	MONITOR PC 24 IN
2	704-241	ASSY KEY COPY PROTECTION
1	L-PAL3-LIQ-110	KIT CONSUMABLE L-PAL3-LIQ
1	GC-STD-032B	GC AGILENT 7890B SSL/IF
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	L-PAL3-LIQ	AUTO SAMPLER L-PAL3 LIQ INJ

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT2LIQ37 PKG PEGASUS BT2 GC/MS LIQ SSL IF/MMI-LN2 PC 230V

1	614-700-300	ASSY PEGASUS BT2 230VAC 50/60HZ 1PH
2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	618-380	CASE HOLDER CD-12 BLACK
1	686-551	MONITOR PC 24 IN
2	704-241	ASSY KEY COPY PROTECTION
1	L-PAL3-LIQ-110	KIT CONSUMABLE L-PAL3-LIQ
1	GC-STD-037B	GC AGILENT 7890B SSL IF/MMI-LN2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	L-PAL3-LIQ	AUTO SAMPLER L-PAL3 LIQ INJ

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT2AI24 PKG PEGASUS BT2 GC/MS 7693A MMI-CO2 PC 230V

1	614-700-300	ASSY PEGASUS BT2 230VAC 50/60HZ 1PH
2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	618-380	CASE HOLDER CD-12 BLACK
1	686-551	MONITOR PC 24 IN
2	704-241	ASSY KEY COPY PROTECTION
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-STD-024B	GC AGILENT 7890B MMI-CO2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT2AI25 PKG PEGASUS BT2 GC/MS 7693A MMI-LN2 PC 230V

1	614-700-300	ASSY PEGASUS BT2 230VAC 50/60HZ 1PH
2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	618-380	CASE HOLDER CD-12 BLACK
1	686-551	MONITOR PC 24 IN
2	704-241	ASSY KEY COPY PROTECTION
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-STD-025B	GC AGILENT 7890B MMI-LN2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10

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BT2AI32 PKG PEGASUS BT2 GC/MS 7693A SSL IF PC 230V

1	614-700-300	ASSY PEGASUS BT2 230VAC 50/60HZ 1PH
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1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-STD-032B	GC AGILENT 7890B SSL/IF
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT2AI37 PKG PEGASUS BT2 GC/MS 7693A SSL IF/MMI-LN2 PC 230V

1	614-700-300	ASSY PEGASUS BT2 230VAC 50/60HZ 1PH
2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	618-380	CASE HOLDER CD-12 BLACK
1	686-551	MONITOR PC 24 IN
2	704-241	ASSY KEY COPY PROTECTION
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-STD-037B	GC AGILENT 7890B SSL IF/MMI-LN2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT2IT24 PKG PEGASUS BT2 GC/MS 7693A/TRAY MMI-CO2 PC 230V

1	614-700-300	ASSY PEGASUS BT2 230VAC 50/60HZ 1PH
2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	618-380	CASE HOLDER CD-12 BLACK
1	686-551	MONITOR PC 24 IN
2	704-241	ASSY KEY COPY PROTECTION
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-TRAY-200	TRAY AUTO INJECTOR 150 VIALS AGILENT
1	GC-STD-024B	GC AGILENT 7890B MMI-CO2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT2IT25 PKG PEGASUS BT2 GC/MS 7693A/TRAY MMI-LN2 PC 230V

1	614-700-300	ASSY PEGASUS BT2 230VAC 50/60HZ 1PH
2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	618-380	CASE HOLDER CD-12 BLACK
1	686-551	MONITOR PC 24 IN
2	704-241	ASSY KEY COPY PROTECTION
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-TRAY-200	TRAY AUTO INJECTOR 150 VIALS AGILENT
1	GC-STD-025B	GC AGILENT 7890B MMI-LN2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT2IT32 PKG PEGASUS BT2 GC/MS 7693A/TRAY SSL IF PC 230V

1	614-700-300	ASSY PEGASUS BT2 230VAC 50/60HZ 1PH
2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	618-380	CASE HOLDER CD-12 BLACK
1	686-551	MONITOR PC 24 IN
2	704-241	ASSY KEY COPY PROTECTION
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-TRAY-200	TRAY AUTO INJECTOR 150 VIALS AGILENT
1	GC-STD-032B	GC AGILENT 7890B SSL/IF
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT2IT37 PKG PEGASUS BT2 GC/MS 7693A/TRAY SSL IF/MMI-LN2 PC 230V

1	614-700-300	ASSY PEGASUS BT2 230VAC 50/60HZ 1PH
2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	618-380	CASE HOLDER CD-12 BLACK
1	686-551	MONITOR PC 24 IN
2	704-241	ASSY KEY COPY PROTECTION
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-TRAY-200	TRAY AUTO INJECTOR 150 VIALS AGILENT
1	GC-STD-037B	GC AGILENT 7890B SSL IF/MMI-LN2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT224 PKG PEGASUS BT2 GC/MS MMI-CO2 PC NO A-SMPLR/INJ

1	614-700-300	ASSY PEGASUS BT2 230VAC 50/60HZ 1PH
2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	618-380	CASE HOLDER CD-12 BLACK
1	686-551	MONITOR PC 24 IN
2	704-241	ASSY KEY COPY PROTECTION
1	GC-STD-024B	GC AGILENT 7890B MMI-C02
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT225 PKG PEGASUS BT2 GC/MS MMI-LN2 PC NO A-SMPLR/INJ

1	614-700-300	ASSY PEGASUS BT2 230VAC 50/60HZ 1PH
2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
1	618-380	CASE HOLDER CD-12 BLACK
1	686-551	MONITOR PC 24 IN
2	704-241	ASSY KEY COPY PROTECTION
1	GC-STD-025B	GC AGILENT 7890B MMI-LN2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT232 PKG PEGASUS BT2 GC/MS SSL IF PC NO A-SMPLR/INJ

1	614-700-300	ASSY PEGASUS BT2 230VAC 50/60HZ 1PH
2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	618-380	CASE HOLDER CD-12 BLACK
1	686-551	MONITOR PC 24 IN
2	704-241	ASSY KEY COPY PROTECTION
1	GC-STD-032B	GC AGILENT 7890B SSL/IF
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT237 PKG PEGASUS BT2 GC/MS SSL IF/MMI-LN2 PC NO A-SMPLR/INJ

1	614-700-300	ASSY PEGASUS BT2 230VAC 50/60HZ 1PH
2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	618-380	CASE HOLDER CD-12 BLACK
1	686-551	MONITOR PC 24 IN
2	704-241	ASSY KEY COPY PROTECTION
1	GC-STD-037B	GC AGILENT 7890B SSL IF/MMI-LN2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10

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BT2886010 PKG PEGASUS BT2 GC/MS 8860 SSL PC 230V

1	614-700-300	ASSY PEGASUS BT2 230VAC 50/60HZ 1PH
2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	618-380	CASE HOLDER CD-12 BLACK
1	686-551	MONITOR PC 24 IN
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
2	704-241	ASSY KEY COPY PROTECTION
1	GC-8860-010	GC AGILENT 8860 S/SL

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BT2889032 PKG PEGASUS BT2 GC/MS 8890 SSL /IF PC 230V

1	614-700-300	ASSY PEGASUS BT2 230VAC 50/60HZ 1PH
2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	618-380	CASE HOLDER CD-12 BLACK
1	686-551	MONITOR PC 24 IN
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
2	704-241	ASSY KEY COPY PROTECTION
1	GC-8890-032	GC AGILENT 8890 SSL/IF

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BT2IT889032 PKG PEGASUS BT2 GC/MS AUTO INJ/TRAY 8890 SSL/IF PC 230V

1	614-700-300	ASSY PEGASUS BT2 230VAC 50/60HZ 1PH
2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	618-380	CASE HOLDER CD-12 BLACK
1	686-551	MONITOR PC 24 IN
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
2	704-241	ASSY KEY COPY PROTECTION
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-TRAY-200	TRAY AUTO INJECTOR 150 VIALS AGILENT
1	GC-8890-032	GC AGILENT 8890 SSL/IF

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BT2AI889032 PKG PEGASUS BT2 GC/MS AUTO INJ 8890 SSL/IF PC 230V

1	614-700-300	ASSY PEGASUS BT2 230VAC 50/60HZ 1PH
2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	618-380	CASE HOLDER CD-12 BLACK
1	686-551	MONITOR PC 24 IN
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
2	704-241	ASSY KEY COPY PROTECTION
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-8890-032	GC AGILENT 8890 SSL/IF

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BT2LIQS15889032 PKG PEGASUS BT2 GC/MS L-PAL3 LIQ 8890 SSL/IF PC 230V

1	614-700-300	ASSY PEGASUS BT2 230VAC 50/60HZ 1PH
2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	618-380	CASE HOLDER CD-12 BLACK
1	686-551	MONITOR PC 24 IN
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
2	704-241	ASSY KEY COPY PROTECTION
1	L-PAL3-S15-LIQ	AUTO SAMPLER L-PAL3-S15 LIQ INJ
1	L-PAL3-LIQ-110	KIT CONSUMABLE L-PAL3-LIQ
1	GC-8890-032	GC AGILENT 8890 SSL/IF

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BT2LIQS15889037 PKG PEGASUS BT2 GC/MS L-PAL3 LIQ 8890 SSL/IF PC 230V

1	614-700-300	ASSY PEGASUS BT2 230VAC 50/60HZ 1PH
2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	618-380	CASE HOLDER CD-12 BLACK
1	686-551	MONITOR PC 24 IN
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
2	704-241	ASSY KEY COPY PROTECTION
1	L-PAL3-S15-LIQ	AUTO SAMPLER L-PAL3-S15 LIQ INJ
1	L-PAL3-LIQ-110	KIT CONSUMABLE L-PAL3-LIQ
1	GC-8890-037	GC AGILENT 8890 SSL IF/MMI-LN2

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Options

614-700-10P ASSY PEGASUS BT OPTIONS

1	709-809-356	WRENCH TORQUE 5/16 OPEN END 4IN/LBS SST
1	259-090-CPK	SOFTWARE KIT PEGBT W/KEY
1	259-090UPGR	SOFTWARE KIT UPGR PEGBT
1	709-809-396	OIL LEYBOLD PUMP 1 LITER
1	L-PAL3-ADD-ATX	KIT ADD ATX TO L-PAL3-HS OR L-PAL3-SPME
1	L-PAL3-ADD-ATX-DS	KIT ADD ATX TO L-PAL3-HS OR L-PAL3-SPME
1	L-PAL3-ADD-HS	KIT ADD HEADSPACE TO L-PAL3-SPME
1	L-PAL3-ADD-SPME	KIT ADD SPME TO L-PAL3-HS
1	L-PAL3-ATX	AUTO SAMPLER L-PAL3 ATX SPME HS LIQ INJ
1	L-PAL3-ATX-110	KIT CONSUMABLES L-PAL3-ATX
1	L-PAL3-HS	AUTO SAMPLER L-PAL3 HS LIQ INJ
1	L-PAL3-HS-110	KIT CONSUMABLES L-PAL3-HS
1	L-PAL3-LIQ	AUTO SAMPLER L-PAL3 LIQ INJ
1	L-PAL3-LIQ-110	KIT CONSUMABLE L-PAL3-LIQ
1	L-PAL3-SPME-110	KIT CONSUMABLES L-PAL3-SPME
1	002-224	TRAINING COURSE PEG BT 3-DAY
1	002-225	TRAINING COURSE ONLINE PEG BT
1	709-809-660	KIT POWERVAR 4KVA UPS WITH CORDS
1	709-809-667	KIT REPL 709-809-322 MASS CTRLR
1	709-813-207	TOOL ALIGN TRANSFER LINE TIP
1	709-809-676	KIT REPL MANIFOLD VALVE/TUBING PEGBT
1	359-001-230-UPGR	LIBRARY UPGR NIST V2.3 07-2017
1	200-999-234	MANUAL SERVICE TRAINING PEGASUS BT
1	200-999-235	MANUAL TUTORIAL PEGASUS BT
1	709-813-563	KIT HYDROGEN CARRIER GAS PEGBT
1	502-938-HAZ*	STD SOLUTION LECO-022J OFN 1X1ML CAL KIT
1	709-809-846	KIT ADD SECOND MONITOR FOR Z440/Z640 PC
1	709-809-857-HAZ*	KIT IQ/OQ PEGASUS BT
1	709-809-854	SLIT ALIGNMENT TOOL
1	709-813-292	PUSH ALIGNMENT TOOL
1	709-809-917-HAZ*	KIT CONVERT BT2 TO BT4D LN2 110V
1	709-809-919-HAZ*	KIT CONVERT BT2 TO BT4D CF 110V
1	709-809-938	KIT REPL BT MCP DETECTOR
1	709-802-263	COOLING ACCESSORY LN2 GC OVEN
1	709-809-780	FERRULE BLANK VESPEL/GRAPHITE .062 10/PK
1	GC-7820-110	GC AGILENT 7820A S/SL L-PAL3 SUPPORT W/HOLES
1	GC-7820-111	GC AGILENT 7820A S/SL AGILENT SUPPORT W/HOLES
1	709-809-767	KIT FOR 7820GC/L-PAL3 SUPPORT LECO SPLY GC
1	709-809-768	KIT FOR 7820GC/L-PAL3 SUPPORT CUSTOMER SPLY GC

1	709-809-769	KIT FOR 7820GC/AGILENT SUPPORT CUSTOMER SPLY GC
1	709-813-630	CARTRIDGE REPL TURBOVAC 350/300
1	709-813-647	KIT HYDROGEN CARRIER GAS BT2/4D
1	709-809-870-HAZ*	KIT IQ/OQ PEGASUS BT 4D
1	709-809-940	FILTER REPLACEMENT GAS TRIPLE
1	709-813-801	KIT SOFTWARE BT SUBSCRIPTION 1/90 DAY
1	709-813-803	KIT SOFTWARE BT SUBSCRIPTION 5/1YR
1	709-813-805	KIT SOFTWARE BT SUBSCRIPTION 25/1YR
1	709-813-807	KIT SOFTWARE BT GCD SUBSCRIPTION 1/90 DAY
1	709-813-809	KIT SOFTWARE BT GCD SUBSCRIPTION 5/1YR
1	709-813-811	KIT SOFTWARE BT GCD SUBSCRIPTION 25/1YR
1	709-813-813	KIT SOFTWARE FAST GC BT ONLY
1	104-199	KIT PMA PEG BT STANDARD
1	104-201	KIT PMA PEG BT EXTENDED
1	709-813-910	KIT SOFTWARE BT 4D SUBSCRIPTION 1/90 DAY
1	709-813-912	KIT SOFTWARE BT 4D SUBSCRIPTION 5/ 1YR
1	709-813-914	KIT SOFTWARE BT 4D SUBSCRIPTION 25/ 1YR
1	709-813-916	KIT SOFTWARE BT 4D GCD SUBSCRIPTION 1/ 90 DAY
1	709-813-918	KIT SOFTWARE BT 4D GCD SUBSCRIPTION 5/ 1 YR
1	709-813-920	KIT SOFTWARE BT 4D GCD SUBSCRIPTION 25/ 1 YR
1	359-010-011	LIBRARY WILEY V11
1	359-010-011-UPGR	LIBRARY WILEY V11 UPGR
1	359-010-012	LIBRARY WILEY 11 EDITION/NIST 2017
1	359-012	LIBRARY WILEY MASS SPECTRA DES DRUGS 2018
1	359-013	LIBRARY WILEY M/P/W MASS SPEC 5TH EDITION
1	359-014	LIBRARY WILEY LIPIDS MASS SPECT DATABASE
1	359-015	LIBRARY WILEY PESTICIDES W/LRI 2ND EDITION
1	359-016	LIBRARY WILEY FAMES MASS SPECTRAL
1	359-017	LIBRARY WILEY FFNSC 3RD EDITION
1	359-018	LIBRARY WILEY MASS SPECTRA ORGANIC COMP
1	359-019	LIBRARY WILEY MASS SPECTRA PESTICIDES 2009
1	359-020	LIBRARY WILEY PHYSIOLOGICALLY ACTIVE SUBS
1	359-021	LIBRARY WILEY VOLATILES FOOD 2ND EDITION
1	709-686	KIT STATISTICAL COMPARE PEG BT 4D
1	151-075-B/M	SCHEMATIC CABINET FLOW MOD BOX
1	709-813-869	COLUMN STABILWAX 30M X 0.25MM X 0.25UM
1	709-813-870	COLUMN 5XI-17SIL MS CAP 30M X 0.25MM X 0.25UM
1	709-813-871	COLUMN RTX-200 CAP 30M X 0.25MM X 0.25UM
1	709-813-872	COLUMN RXI-5SIL MS CAP 2M X 0.18MM X 0.18
1	709-813-873	COLUMN RXI-5SIL MS CAP 2M X 0.25MM X 0.25
1	709-813-874	WAFER SCORING CERAMIC
1	709-813-875	SYRINGE MICROLITER STANDARD 10UL

1	709-813-876	SYRINGE 5UL
1	709-813-877	FERRULE GRAPHITE
1	709-813-878	SEAL GOLD INLET RING VESPEL DUAL
1	709-813-879	FILTER REPLACEMENT KIT HE SC GAS
1	709-813-880	PURIFIER GAS INLINE DISPOSABLE
1	709-813-881	SYRINGE AUTOSAMPLER 10UL
1	709-813-882	CARTRIDGE TRAP VENT SPLIT
1	709-813-883	VIAL HS SCREW CAP 20ML CLEAR
1	709-813-884	VIAL HS SCREW CAP 10ML CLEAR
1	709-813-885	VIAL HS SCREW CAP 20ML AMBER
1	709-813-886	VIAL HS SCREW CAP 10ML AMBER
1	709-813-887	CAP SCREW VIAL HS MAGNETIC
1	709-813-888	LINER INLET ARROW 1.8MM ID STR/SPME TOPAZ
1	709-813-889	LINER INLET W/WOOL 4.0MM SNGL ID TAPER TOPAZ
1	709-813-890	LINER INLET W/WOOL 4.0MM ID PRECISION TOPAZ
1	709-813-891	LINER INLET W/WOOL 4.0MM LOW PRES DRP PRECISION
1	709-813-892	LINER INLET STRAIGHT/SMPE 0.75 ID TOPAZ
1	709-813-893	SEPTA THERMOLITE PLUS GREEN
1	709-813-894	SYRINGE 5UL GERSTEL MPS2
1	709-813-895	VIAL SCREW CAP SHORT 2ML RUBBER GC
1	709-813-896	SEPTA BTO NON-STICK PREMIUM
1	709-813-897	COLUMN RXI-5SIL MS CAP 2M X 0.10X 0.10
1	709-813-898	COLUMN CAP RXI-17SIL MS 2M X 0.10MM X 0.10
1	709-813-899	COLUMN STABILWAX CAP 2M X 0.10 X 0.10
1	709-813-922	COLUMN RTX-200 MS CAP 2M X 0.10 X 0.10
1	709-813-965	GAS FILTER KIT HE SUPER CLEAN GREY
1	PEGBT4D-FM-1YR	CONTRACT SERVICE PEGBT4D FM 1YR
1	PEGBT4D-FM-3YR	CONTRACT SERVICE PEGBT4D FM 3YR
1	PEGBT4DATX-FM-1YR	CONTRACT SERVICE PEGBT4DATX FM 1YR
1	PEGBT4DATX-FM-3YR	CONTRACT SERVICE PEGBT4DATX FM 3YR
1	PEGBT4DHS-FM-1YR	CONTRACT SERVICE PEGBT4DHS FM 1YR
1	PEGBT4DHS-FM-3YR	CONTRACT SERVICE PEGBT4DHS FM 3YR
1	PEGBT4DIT-FM-1YR	CONTRACT SERVICE PEGBT4DIT FM 1YR
1	PEGBT4DIT-FM-3YR	CONTRACT SERVICE PEGBT4DIT FM 3YR
1	PEGBT4DLIQ-FM-1YR	CONTRACT SERVICE PEGBT4DLIQ FM 1YR
1	PEGBT4DLIQ-FM-3YR	CONTRACT SERVICE PEGBT4DLIQ FM 3YR
1	PEGBT4DSPME-FM-1YR	CONTRACT SERVICE PEGBT4DSPME FM 1YR
1	PEGBT4DSPME-FM-3YR	CONTRACT SERVICE PEGBT4DSPME FM 3YR
1	259-102	SOFTWARE KIT PEGASUS BT 4D
1	259-102-CPK	SOFTWARE KIT PEGBT4D W/KEY
1	259-102UPGR	SOFTWARE KIT UPGR PEGBT4D
1	709-802-265	KIT UPGRADE CONN W/END FLANGE PEG BT

1	709-802-267	KIT UPGRADE VENT VALVE PEG BT
1	709-802-269	KIT UPGRADE FLANGE TRANSFER LINE PEG BT
1	709-813-865	ASSEMBLY WIRE REPLACEMENT BT1 PUSH
1	259-103	SOFTWARE KIT CHROMATOF 5 ADMINISTRATOR TOOL
1	709-814-201	TRANSFORMER BUCK-BOOST
1	709-814-306	COLUMN RXI-624SIL MS 30M X 0.25MM ID 1.4UM
1	709-814-307	COLUMN STABILWAX 2M X 0.25MMX 0.50UM
1	709-814-401	MOUNT DISPLAY VFS-DV
1	723-101-277	PUMP VACUUM NXDS15I
1	709-814-230	KIT WORK STATION BT W/NIST
1	709-813-902	KIT CONVERT BT1 TO FLOW MODULATOR
1	709-813-902-HAZ*	KIT CONVERT BT1 TO FLOW MODULATOR
1	709-813-904-HAZ*	KIT CONVERT BT2 TO FLOW MODULATOR
1	709-813-987	ASSY SOURCE BT2 SHIP - TESTED
1	709-809-793	HEAD PAL RSI W/COVER AND GAS PURGE TUBE
1	051-119	SPEC SHEET PEGASUS BT/4D
1	709-448	TRAY ROUGHING PUMP
1	723-101-282	KIT PUMP ROUGH UNO-6-M
1	723-101-280	KIT CONVERT BT2/BT4D ROUGH PUMP RV5 TO UNO-6-M
1	L-PAL3-S15-HS	AUTO SAMPLER L-PAL3-S15 HS LIQ INJ
1	L-PAL3-S15-LIQ	AUTO SAMPLER L-PAL3-S15 LIQ INJ
1	L-PAL3-S15-ATX	AUTO SAMPLER L-PAL3-S15 ATX SPME HS LIQ INJ
1	L-PAL3-S15-SPME	AUTO SAMPLER L-PAL3-S15 SPME HS LIQ INJ
1	L-PAL3-S15-SPME-NC	AUTO SAMPLER L-PAL3-S15 SPME HS LIQ INJ NO CNDTNR
1	L-PAL3-S15-SPME-NCDS	AUTO SAMPLER L-PAL3-S15 SPME HS LIQ INJ NO CNDTNR
1	L-PAL3-S15-SPME-DS	AUTO SAMPLER L-PAL3-S15 SPME HS LIQ INJ
1	L-PAL3-S15-HS-DS	AUTO SAMPLER L-PAL3-S15 HS LIQ INJ
1	L-PAL3-S15-LIQ-DS	AUTO SAMPLER L-PAL3-S15 LIQ INJ
1	L-PAL3-S15-ATX-DS	AUTO SAMPLER L-PAL3-S15 ATX SPME HS LIQ INJ
1	709-809-967	KIT FIELD SERVICE BPG400 VAC GAUGE
1	709-814-425-HAZ*	KIT CONVERT BT2 8890 TO BT4D QUADJET 8890 LN2 110V
1	709-814-427-HAZ*	KIT CONVERT BT2 8890 TO BT4D QUADJET 8890 CF 110V
1	709-814-429-HAZ*	KIT CONVERT BT2 8890 TO BT4D FLUX 8890 HAZ
1	GC-8860-010	GC AGILENT 8860 S/SL
1	GC-8890-015	GC AGILENT 8890 SSL/INLET
1	GC-8890-016	GC AGILENT 8890 SSL/PTV LCO2
1	GC-8890-017	GC AGILENT 8890 SSL/PTV LN2
1	GC-8890-018	GC AGILENT 8890 SSL/INLET/FID
1	GC-8890-019	GC AGILENT 8890 PTV LN2/FID

1	GC-8890-022	GC AGILENT 8890
1	GC-8890-023	GC AGILENT 8890 2-SSL INLETS/FID
1	GC-8890-024	GC AGILENT 8890 MMI-CO2
1	GC-8890-025	GC AGILENT 8890 MMI-N2
1	GC-8890-028	GC AGILENT 8890 MMI-CO2/SSL
1	GC-8890-029	GC AGILENT 8890 MMI-N2/SSL
1	GC-8890-030	GC AGILENT 8890 MMI-CO2/SSL/FID
1	GC-8890-032	GC AGILENT 8890 SSL/IF
1	GC-8890-033	GC AGILENT 8890 SSL IF/FID
1	GC-8890-034	GC AGILENT 8890 SSL/IF/PTV LCO2
1	GC-8890-035	GC AGILENT 8890 SSL/IF/PTV LN2
1	GC-8890-036	GC AGILENT 8890 SSL/IF/MM1 CO2
1	GC-8890-037	GC AGILENT 8890 SSL IF/MMI-LN2
1	709-814-440	COLUMN HP-5MS 30M X 0.25MM X 0.25UM
1	709-809-229	COLUMN 2M X 0.25MM X 0.25UM RXI-17SIL
1	502-885-HAZ*	STD OFN 0.05PG/UL IN ISOCTANE
1	502-886-HAZ*	STD OFN 5PG/UL IN ISOCTANE

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

Components and Accessories

614-720-072 PACK COMPONENT INSTALLATION PEGASUS BT

1	200-999-017	MANUAL INSTR PEGASUS BT
1	200-999-025	MANUAL INSTR HRT CHROMATOF SOFTWARE
1	203-505-548	FORM PEGASUS BT INSTALLATION CHECKLIST
1	502-233	ALUMINA A PELLETS 1LB
1	502-349	SAMPLE CAL PFTBA MS 35G
1	603-433	O-RING 109 .299X .485X.093V
1	607-111	TRAP OIL VAPOR
2	615-341	CLAMP FTG FLANGE NW25
2	615-343	SEAL RING CENTERING NW25
3	619-590-809	CABLE ASSY CAT 5E 7FT RJ-45
1	621-605-748	WRENCH OPEN END 3/16 X 1/4 ST CP
1	709-566	FOAM NON-SKID NS901 3.0 PSA
1	709-802-132	TUBE CU GC TO HELIUM SUPPLY
1	709-806-720	CORD POWER ASSY 8FT 15A/250V
1	709-807-453	FLANGE FTG ADPTR NW25 - NW25
1	709-809-198	KIT MODIFY 7890B GC PEGHT/PEGHRT
1	709-809-220	FTG NUT HEX 1.2MM DIA X.06 THD
1	709-809-221	FTG FRL 0.4MM ID 60/40 VESPEL/GRAPHITE 10PK
1	709-809-334	SCREWDRIVER TORX BALL T25
1	709-809-347	ASSY CABLE REMOTE DSUB M-M 5FT
1	709-809-508	COLUMN 30M X 0.25MM X 0.25UM RXI-5MS
1	709-809-663	DRIVE USB FLASH 8GB
1	709-810-251	INSULATOR REPELLER CERAMIC
1	709-811-524	ASSY TOOL REMOVAL FILAMENT PEG BT
1	709-812-181	DRIVER HEX .078 MINIATURE
2	709-812-233	FILAMENT ASSY BLOCK FF50TY CENTER MNT
1	709-812-589-110	VIAL SAMPLE 2ML CLEAR CRIMP 1/PK
2	709-812-641	ROD ALIGNMENT PLT
1	709-813-437	ASSY BASE SLIDING GC STEPPED TOP
1	711-690	CORD POWER 3X100MM 10A 8FT
20	711-887	TUBING FLX POLYU C.062IDX.031W
1	612-240	FTG RED AL KF NW25 - NW16 BSP
1	709-809-394	HOSE VAC NW16 THIN 96 INCH SST
3	615-342	CLAMP FTG FLANGE NW16
3	615-344	SEAL RING CENTERING NW16
1	709-812-554	O-RING 262 7.000X7.250X.125 V
1	723-101-278	PUMP VANE ROTARY 230-240V 50/60 HZ
1	723-101-279	INLET ELIMINATOR MIST OIL OME 16S

Equipment Packages for the *Pegasus* BT 4D

Items listed as follows are repeated throughout this manual and are subject to revision. Please consult the packing slip received with the instrument.

SSL	Split/Splitless Inlet	CF	Consumable Free Cooling System
IF	Inert Flowpath	LN2	Liquid Nitrogen Cooling System
MMI	Multimode Inlet		

BT4DLN24D PKG PEGASUS BT AND 4D LN2-7890-MMI-CO2 DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-820	KIT LIQUID LEVELER MODEL 1700 120V
1	GC4DCLN-24	ASSY GC 7890B MMI-CO2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DLN25D PKG PEGASUS BT AND 4D LN2-7890-MMI-LN2 DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-820	KIT LIQUID LEVELER MODEL 1700 120V
1	GC4DCLN-25	ASSY GC 7890B MMI-LN2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DLN32D PKG PEGASUS BT AND 4D LN2-7890-SSL-IF DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-820	KIT LIQUID LEVELER MODEL 1700 120V
1	GC4DCLN-32	ASSY GC 7890B SSL IF
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

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BT4DLN35D PKG PEGASUS BT AND 4D LN2-7890-SSL-IF/PTV-LN DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-820	KIT LIQUID LEVELER MODEL 1700 120V
1	GC4DCLN-35	ASSY GC 7890B SSL IF PTV-LN2 GCXGC
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

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BT4DLN37D PKG PEGASUS BT AND 4D LN2-7890-SSL-IF/MMI-LN2 DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-820	KIT LIQUID LEVELER MODEL 1700 120V
1	GC4DCLN-37	ASSY GC 7890B SSL IF / MMI-LN2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

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BT4DLN24I PKG PEGASUS BT AND 4D LN2-7890-MMI-CO2 INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-822	KIT LIQUID LEVELER MODEL 1700 240V
1	GC4DCLN-24	ASSY GC 7890B MMI-CO2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

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BT4DLN25I PKG PEGASUS BT AND 4D LN2-7890-MMI-LN2 INTL

2	259-090	SOFTWARE KIT PEGASUS BT
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2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-822	KIT LIQUID LEVELER MODEL 1700 240V
1	GC4DCLN-25	ASSY GC 7890B MMI-LN2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

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BT4DLN32I PKG PEGASUS BT AND 4D LN2-7890-SSL-IF INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-822	KIT LIQUID LEVELER MODEL 1700 240V
1	GC4DCLN-32	ASSY GC 7890B SSL IF
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

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BT4DLN35I PKG PEGASUS BT AND 4D LN2-7890-SSL-IF/PTV-LN INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-822	KIT LIQUID LEVELER MODEL 1700 240V
1	GC4DCLN-35	ASSY GC 7890B SSL IF PTV-LN2 GCXGC
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

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BT4DLN37I PKG PEGASUS BT AND 4D LN2-7890-SSL-IF/MMI-LN2 INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-822	KIT LIQUID LEVELER MODEL 1700 240V
1	GC4DCLN-37	ASSY GC 7890B SSL IF / MMI-LN2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

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BT4DCF24D PKG PEGASUS BT AND 4D CF-7890-MMI-CO2 DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-901	KIT IMMERSION COOLER -100C 120V
1	GC4DCCF-24	ASSY GC 7890 MMI-CO2 REFRIGERANT COOL GCXGC
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

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BT4DCF25D PKG PEGASUS BT AND 4D CF-7890-MMI-LN2 DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-901	KIT IMMERSION COOLER -100C 120V
1	GC4DCCF-25	ASSY GC 7890 MMI-LN2 REFRIGERANT COOL GCXGC
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

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BT4DCF32D PKG PEGASUS BT AND 4D CF-7890-SSL-IF DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-901	KIT IMMERSION COOLER -100C 120V
1	GC4DCCF-32	ASSY GC 7890 S/SL IF REFRIGERANT COOL GCXGC
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

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BT4DCF35D PKG PEGASUS BT AND 4D CF-7890-SSL-IF/PTV-LN DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-901	KIT IMMERSION COOLER -100C 120V
1	GC4DCCF-35	ASSY GC 7890B SSL IF PTV-LN2 RC GCXGC
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

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BT4DCF37D PKG PEGASUS BT AND 4D CF-7890-SSL-IF/MMI-LN DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-901	KIT IMMERSION COOLER -100C 120V
1	GC4DCCF-37	ASSY GC 7890 SSL IF / MMI-LN2 REFRIGERANT COOL CF GCXGC
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

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BT4DCF24I PKG PEGASUS BT AND 4D CF-7890-MMI-CO2 INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-902	KIT IMMERSION COOLER -100C 220V
1	GC4DCCF-24	ASSY GC 7890 MMI-CO2 REFRIGERANT COOL GCXGC
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

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BT4DCF25I PKG PEGASUS BT AND 4D CF-7890-MMI-LN2 INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-902	KIT IMMERSION COOLER -100C 220V
1	GC4DCCF-25	ASSY GC 7890 MMI-LN2 REFRIGERANT COOL GCXGC
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DCF32I PKG PEGASUS BT AND 4D CF-7890-SSL-IF INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-902	KIT IMMERSION COOLER -100C 220V
1	GC4DCCF-32	ASSY GC 7890 S/SL IF REFRIGERANT COOL GCXGC
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

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BT4DCF35I PKG PEGASUS BT AND 4D CF-7890-SSL-IF/PTV-LN INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
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1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
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1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-902	KIT IMMERSION COOLER -100C 220V
1	GC4DCCF-35	ASSY GC 7890B SSL IF PTV-LN2 RC GCXGC
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DCF37I PKG PEGASUS BT AND 4D CF-7890-SSL-IF/MMI-LN INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-902	KIT IMMERSION COOLER -100C 220V
1	GC4DCCF-37	ASSY GC 7890 SSL IF / MMI-LN2 REFRIGERANT COOL CF GCXGC
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DLIQLN24D PKG PEGASUS BT AND 4D LIQ AS LN2-7890-MMI-CO2 DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-820	KIT LIQUID LEVELER MODEL 1700 120V
1	GC4DCLN-24	ASSY GC 7890B MMI-CO2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DITLN24D PKG PEGASUS BT AND 4D INJ/TRAY LN2-7890-MMI-CO2 DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-820	KIT LIQUID LEVELER MODEL 1700 120V
1	GC4DCLN-24	ASSY GC 7890B MMI-CO2
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-TRAY-200	TRAY AUTO INJECTOR 150 VIALS AGILENT
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DLIQLN25D PKG PEGASUS BT AND 4D LIQ AS LN2-7890-MMI-LN2 DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-820	KIT LIQUID LEVELER MODEL 1700 120V
1	GC4DCLN-25	ASSY GC 7890B MMI-LN2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DITLN25D PKG PEGASUS BT AND 4D INJ/TRAY LN2-7890-MMI-LN2 DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-820	KIT LIQUID LEVELER MODEL 1700 120V
1	GC4DCLN-25	ASSY GC 7890B MMI-LN2
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-TRAY-200	TRAY AUTO INJECTOR 150 VIALS AGILENT
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DLIQLN32D PKG PEGASUS BT AND 4D LIQ AS LN2-7890-SSL-IF DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-820	KIT LIQUID LEVELER MODEL 1700 120V
1	GC4DCLN-32	ASSY GC 7890B SSL IF
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	L-PAL3-LIQ	AUTO SAMPLER L-PAL3 LIQ INJ

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DITLN32D PKG PEGASUS BT AND 4D INJ/TRAY LN2-7890-SSL-IF DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-820	KIT LIQUID LEVELER MODEL 1700 120V
1	GC4DCLN-32	ASSY GC 7890B SSL IF
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-TRAY-200	TRAY AUTO INJECTOR 150 VIALS AGILENT
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

**BT4DLIQLN35D PKG PEGASUS BT AND 4D LIQ AS LN2-7890-SSL-IF/PTV-LN
DOM**

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-820	KIT LIQUID LEVELER MODEL 1700 120V
1	GC4DCLN-35	ASSY GC 7890B SSL IF PTV-LN2 GCXGC
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

**BT4DITLN35D PKG PEGASUS BT AND 4D INJ/TRAY LN2-7890-SSL-IF/PTV-
LN DOM**

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-820	KIT LIQUID LEVELER MODEL 1700 120V
1	GC4DCLN-35	ASSY GC 7890B SSL IF PTV-LN2 GCXGC
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-TRAY-200	TRAY AUTO INJECTOR 150 VIALS AGILENT
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DLIQLN37D PKG PEGASUS BT AND 4D LIQ AS LN2-7890-SSL-IF/MMI-LN DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-820	KIT LIQUID LEVELER MODEL 1700 120V
1	GC4DCLN-37	ASSY GC 7890B SSL IF / MMI-LN2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	L-PAL3-LIQ	AUTO SAMPLER L-PAL3 LIQ INJ

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BT4DITLN37D PKG PEGASUS BT AND 4D INJ/TRAY LN2-7890-SSL-IF/MMI-LN DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-820	KIT LIQUID LEVELER MODEL 1700 120V
1	GC4DCLN-37	ASSY GC 7890B SSL IF / MMI-LN2
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-TRAY-200	TRAY AUTO INJECTOR 150 VIALS AGILENT
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DLIQCF24D PKG PEGASUS BT AND 4D LIQ AS CF-7890-MMI-CO2 DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-901	KIT IMMERSION COOLER -100C 120V
1	GC4DCCF-24	ASSY GC 7890 MMI-CO2 REFRIGERANT COOL GCXGC
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	L-PAL3-LIQ	AUTO SAMPLER L-PAL3 LIQ INJ

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DITCF24D PKG PEGASUS BT AND 4D INJ/TRAY CF-7890-MMI-CO2 DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-901	KIT IMMERSION COOLER -100C 120V
1	GC4DCCF-24	ASSY GC 7890 MMI-CO2 REFRIGERANT COOL GCXGC
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-TRAY-200	TRAY AUTO INJECTOR 150 VIALS AGILENT
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DLIQCF25D PKG PEGASUS BT AND 4D LIQ AS CF-7890-MMI-LN2 DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-901	KIT IMMERSION COOLER -100C 120V
1	GC4DCCF-25	ASSY GC 7890 MMI-LN2 REFRIGERANT COOL GCXGC
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	L-PAL3-LIQ	AUTO SAMPLER L-PAL3 LIQ INJ

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DITCF25D PKG PEGASUS BT AND 4D INJ/TRAY CF-7890-MMI-LN2 DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-901	KIT IMMERSION COOLER -100C 120V
1	GC4DCCF-25	ASSY GC 7890 MMI-LN2 REFRIGERANT COOL GCXGC
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-TRAY-200	TRAY AUTO INJECTOR 150 VIALS AGILENT
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DLIQCF32D PKG PEGASUS BT AND 4D LIQ AS CF-7890-SSL-IF DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-901	KIT IMMERSION COOLER -100C 120V
1	GC4DCCF-32	ASSY GC 7890 S/SL IF REFRIGERANT COOL GCXGC
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	L-PAL3-LIQ	AUTO SAMPLER L-PAL3 LIQ INJ

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DITCF32D PKG PEGASUS BT AND 4D INJ/TRAY CF-7890-SSL-IF DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-901	KIT IMMERSION COOLER -100C 120V
1	GC4DCCF-32	ASSY GC 7890 S/SL IF REFRIGERANT COOL GCXGC
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-TRAY-200	TRAY AUTO INJECTOR 150 VIALS AGILENT
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

**BT4DLIQCF35D PKG PEGASUS BT AND 4D LIQ AS CF-7890-SSL-IF/PTV-LN
DOM**

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-901	KIT IMMERSION COOLER -100C 120V
1	GC4DCCF-35	ASSY GC 7890B SSL IF PTV-LN2 RC GCXGC
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	L-PAL3-LIQ	AUTO SAMPLER L-PAL3 LIQ INJ

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

**BT4DITCF35D PKG PEGASUS BT AND 4D INJ/TRAY CF-7890-SSL-IF/PTV-LN
DOM**

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-901	KIT IMMERSION COOLER -100C 120V
1	GC4DCCF-35	ASSY GC 7890B SSL IF PTV-LN2 RC GCXGC
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-TRAY-200	TRAY AUTO INJECTOR 150 VIALS AGILENT
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

**BT4DLIQCF37D PKG PEGASUS BT AND 4D LIQ AS CF-7890-SSL-IF/MMI-LN
DOM**

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-901	KIT IMMERSION COOLER -100C 120V
1	GC4DCCF-37	ASSY GC 7890 SSL IF / MMI-LN2 REFRIGERANT COOL CF GCXGC
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	L-PAL3-LIQ	AUTO SAMPLER L-PAL3 LIQ INJ

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**BT4DITCF37D PKG PEGASUS BT AND 4D INJ/TRAY CF-7890-SSL-IF/MMI-LN
DOM**

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-901	KIT IMMERSION COOLER -100C 120V
1	GC4DCCF-37	ASSY GC 7890 SSL IF / MMI-LN2 REFRIGERANT COOL CF GCXGC
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-TRAY-200	TRAY AUTO INJECTOR 150 VIALS AGILENT
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DLIQLN24I PKG PEGASUS BT AND 4D LIQ AS LN2-7890-MMI-CO2 INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-822	KIT LIQUID LEVELER MODEL 1700 240V
1	GC4DCLN-24	ASSY GC 7890B MMI-CO2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	L-PAL3-LIQ	AUTO SAMPLER L-PAL3 LIQ INJ

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DITLN24I PKG PEGASUS BT AND 4D INJ/TRAY LN2-7890-MMI-CO2 INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-822	KIT LIQUID LEVELER MODEL 1700 240V
1	GC4DCLN-24	ASSY GC 7890B MMI-CO2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-TRAY-200	TRAY AUTO INJECTOR 150 VIALS AGILENT
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DLIQLN25I PKG PEGASUS BT AND 4D LIQ AS LN2-7890-MMI-LN2 INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-822	KIT LIQUID LEVELER MODEL 1700 240V
1	GC4DCLN-25	ASSY GC 7890B MMI-LN2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	L-PAL3-LIQ	AUTO SAMPLER L-PAL3 LIQ INJ

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BT4DITLN25I PKG PEGASUS BT AND 4D INJ/TRAY LN2-7890-MMI-LN2 INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-822	KIT LIQUID LEVELER MODEL 1700 240V
1	GC4DCLN-25	ASSY GC 7890B MMI-LN2
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-TRAY-200	TRAY AUTO INJECTOR 150 VIALS AGILENT
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

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BT4DLIQLN32I PKG PEGASUS BT AND 4D LIQ AS LN2-7890-SSL-IF INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-822	KIT LIQUID LEVELER MODEL 1700 240V
1	GC4DCLN-32	ASSY GC 7890B SSL IF
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	L-PAL3-LIQ	AUTO SAMPLER L-PAL3 LIQ INJ

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BT4DITLN32I PKG PEGASUS BT AND 4D INJ/TRAY LN2-7890-SSL-IF INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-822	KIT LIQUID LEVELER MODEL 1700 240V
1	GC4DCLN-32	ASSY GC 7890B SSL IF
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-TRAY-200	TRAY AUTO INJECTOR 150 VIALS AGILENT
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

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BT4DLIQLN35I PKG PEGASUS BT AND 4D LIQ AS LN2-7890-SSL-IF/PTV-LN INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-822	KIT LIQUID LEVELER MODEL 1700 240V
1	GC4DCLN-35	ASSY GC 7890B SSL IF PTV-LN2 GCXGC
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	L-PAL3-LIQ	AUTO SAMPLER L-PAL3 LIQ INJ

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BT4DITLN35I PKG PEGASUS BT AND 4D INJ/TRAY LN2-7890-SSL-IF/PTV-LN INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-822	KIT LIQUID LEVELER MODEL 1700 240V
1	GC4DCLN-35	ASSY GC 7890B SSL IF PTV-LN2 GCXGC
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-TRAY-200	TRAY AUTO INJECTOR 150 VIALS AGILENT
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

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BT4DLIQLN37I PKG PEGASUS BT AND 4D LIQ AS LN2-7890-SSL-IF/MMI-LN INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-822	KIT LIQUID LEVELER MODEL 1700 240V
1	GC4DCLN-37	ASSY GC 7890B SSL IF / MMI-LN2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	L-PAL3-LIQ	AUTO SAMPLER L-PAL3 LIQ INJ

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BT4DITLN37I PKG PEGASUS BT AND 4D INJ/TRAY LN2-7890-SSL-IF/MMI-LN INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-822	KIT LIQUID LEVELER MODEL 1700 240V
1	GC4DCLN-37	ASSY GC 7890B SSL IF / MMI-LN2
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-TRAY-200	TRAY AUTO INJECTOR 150 VIALS AGILENT
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

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BT4DLIQCF24I PKG PEGASUS BT AND 4D LIQ AS CF-7890-MMI-CO2 INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-902	KIT IMMERSION COOLER -100C 220V
1	GC4DCCF-24	ASSY GC 7890 MMI-CO2 REFRIGERANT COOL GCXGC
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	L-PAL3-LIQ	AUTO SAMPLER L-PAL3 LIQ INJ

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DITCF24I PKG PEGASUS BT AND 4D INJ/TRAY CF-7890-MMI-CO2 INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-902	KIT IMMERSION COOLER -100C 220V
1	GC4DCCF-24	ASSY GC 7890 MMI-CO2 REFRIGERANT COOL GCXGC
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-TRAY-200	TRAY AUTO INJECTOR 150 VIALS AGILENT
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

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BT4DLIQCF25I PKG PEGASUS BT AND 4D LIQ AS CF-7890-MMI-LN2 INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-902	KIT IMMERSION COOLER -100C 220V
1	GC4DCCF-25	ASSY GC 7890 MMI-LN2 REFRIGERANT COOL GCXGC
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	L-PAL3-LIQ	AUTO SAMPLER L-PAL3 LIQ INJ

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BT4DITCF25I PKG PEGASUS BT AND 4D INJ/TRAY CF-7890-MMI-LN2 INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-902	KIT IMMERSION COOLER -100C 220V
1	GC4DCCF-25	ASSY GC 7890 MMI-LN2 REFRIGERANT COOL GCXGC
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-TRAY-200	TRAY AUTO INJECTOR 150 VIALS AGILENT
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

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BT4DLIQCF32I PKG PEGASUS BT AND 4D LIQ AS CF-7890-SSL-IF INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-902	KIT IMMERSION COOLER -100C 220V
1	GC4DCCF-32	ASSY GC 7890 S/SL IF REFRIGERANT COOL GCXGC
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	L-PAL3-LIQ	AUTO SAMPLER L-PAL3 LIQ INJ

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BT4DITCF32I PKG PEGASUS BT AND 4D INJ/TRAY CF-7890-SSL-IF INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-902	KIT IMMERSION COOLER -100C 220V
1	GC4DCCF-32	ASSY GC 7890 S/SL IF REFRIGERANT COOL GCXGC
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-TRAY-200	TRAY AUTO INJECTOR 150 VIALS AGILENT
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

**BT4DLIQCF35I PKG PEGASUS BT AND 4D LIQ AS CF-7890-SSL-IF/PTV-LN
INTL**

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-902	KIT IMMERSION COOLER -100C 220V
1	GC4DCCF-35	ASSY GC 7890B SSL IF PTV-LN2 RC GCXGC
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	L-PAL3-LIQ	AUTO SAMPLER L-PAL3 LIQ INJ

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**BT4DITCF35I PKG PEGASUS BT AND 4D INJ/TRAY CF-7890-SSL-IF/PTV-LN
INTL**

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-902	KIT IMMERSION COOLER -100C 220V
1	GC4DCCF-35	ASSY GC 7890B SSL IF PTV-LN2 RC GCXGC
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-TRAY-200	TRAY AUTO INJECTOR 150 VIALS AGILENT
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

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BT4DLIQCF37I PKG PEGASUS BT AND 4D LIQ AS CF-7890-SSL-IF/MMI-LN INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-902	KIT IMMERSION COOLER -100C 220V
1	GC4DCCF-37	ASSY GC 7890 SSL IF / MMI-LN2 REFRIGERANT COOL CF GCXGC
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	L-PAL3-LIQ	AUTO SAMPLER L-PAL3 LIQ INJ

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BT4DITCF37I PKG PEGASUS BT AND 4D INJ/TRAY CF-7890-SSL-IF/MMI-LN INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-902	KIT IMMERSION COOLER -100C 220V
1	GC4DCCF-37	ASSY GC 7890 SSL IF / MMI-LN2 REFRIGERANT COOL CF GCXGC
1	GC-AUTO-200	INJECTOR AUTO GC 7693A AGILENT
1	GC-TRAY-200	TRAY AUTO INJECTOR 150 VIALS AGILENT
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DFM25 PKG PEGASUS BT4D W/FM MM1-LN2 GCXGC

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	GC4DCFM-25	ASSY GC 7890B FM MMI-LN2
1	502-971-HAZ*	STD OFN 20PG/UL IN ISOCTANE
1	709-813-906	PACK COMPONENT PEG BT 4D FLOW MODULATOR
1	502-972-HAZ*	STD OFN 50PG/UL IN ISOCTANE
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DFM32 PKG PEGASUS BT4D W/FM SSL IF GCXGC

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	GC4DCFM-32	ASSY GC 7890B FM SSL IF
1	502-971-HAZ*	STD OFN 20PG/UL IN ISOCTANE
1	709-813-906	PACK COMPONENT PEG BT 4D FLOW MODULATOR
1	502-972-HAZ*	STD OFN 50PG/UL IN ISOCTANE
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DFM37 PKG PEGASUS BT4D W/FM SSL IF MMI-LN2 GCXGC

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	GC4DFM-37	ASSY GC 7890B FM SSL IF / MMI-LN2
1	502-971-HAZ*	STD OFN 20PG/UL IN ISOCTANE
1	709-813-906	PACK COMPONENT PEG BT 4D FLOW MODULATOR
1	502-972-HAZ*	STD OFN 50PG/UL IN ISOCTANE
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DFM889032 PKG PEGASUS BT4D W/FLOW MODULATOR 8890 SSL/IF

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-972-HAZ*	STD OFN 50PG/UL IN ISOCTANE
1	502-971-HAZ*	STD OFN 20PG/UL IN ISOCTANE
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-813-906	PACK COMPONENT PEG BT 4D FLOW MODULATOR
1	GC4DFM-889032	ASSY GC 8890 FM SSL IF GCXGC

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

**BT4DFM889037 PKG PEGASUS BT4D W/FLOW MODULATOR 8890
SSL/IF/MMI-LN2**

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-972-HAZ*	STD OFN 50PG/UL IN ISOCTANE
1	502-971-HAZ*	STD OFN 20PG/UL IN ISOCTANE
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-813-906	PACK COMPONENT PEG BT 4D FLOW MODULATOR
1	GC4DFM-889037	ASSY GC 8890 FM SSL IF MMI-LN2 GCXGC

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DCFADDON PKG ADD ON PEG BT4D W/CF AND UPGRADE KIT

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	723-101-275	KIT UPGR PEG4D CF TO PEG BT4D CF
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

*Packed and shipped separately in the U.S.A. Not included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DLNADDON PKG ADD ON PEG BT4D W/LN AND UPGRADE KIT

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-891	KIT UPGR PEG4D LN2 TO PEG BT4D LN2
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX

*Packed and shipped separately in the U.S.A. Notes included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DLN889032D PKG PEGASUS BT AND 4D LN2-8890 SSL IF DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-820	KIT LIQUID LEVELER MODEL 1700 120V
1	GC4DLN-889032	ASSY GC 8890 LN SSL IF GCXGC

*Packed and shipped separately in the U.S.A. Notes included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DLN889037D PKG PEGASUS BT AND 4D LN2-8890-SSL IF-MMI-LN2 DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-820	KIT LIQUID LEVELER MODEL 1700 120V
1	GC4DLN-889037	ASSY GC 8890 LN SSL IF/MMI-LN2 GCXGC

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BT4DLN889032I PKG PEGASUS BT AND 4D LN2-8890 SSL IF INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-822	KIT LIQUID LEVELER MODEL 1700 240V
1	GC4DLN-889032	ASSY GC 8890 LN SSL IF GCXGC

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BT4DLN889037I PKG PEGASUS BT AND 4D LN2-8890 SSL IF INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-822	KIT LIQUID LEVELER MODEL 1700 240V
1	GC4DLN-889037	ASSY GC 8890 LN SSL IF/MMI-LN2 GCXGC

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BT4DCF889032D PKG PEGASUS BT AND 4D CF-8890-SSL-IF DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-901	KIT IMMERSION COOLER -100C 120V
1	GC4DCF-889032	ASSY GC 8890 CF SSL IF GCXGC

*Packed and shipped separately in the U.S.A. Nots included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DCF889037D PKG PEGASUS BT AND 4D CF-8890-SSL-IF/MMI-LN DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-901	KIT IMMERSION COOLER -100C 120V
1	GC4DCF-889037	ASSY GC 8890 CF SSL IF/MMI-LN2 GCXGC

*Packed and shipped separately in the U.S.A. Nots included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DCF889032I PKG PEGASUS BT AND 4D CF-8890-SSL-IF INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-902	KIT IMMERSION COOLER -100C 220V
1	GC4DCF-889032	ASSY GC 8890 CF SSL IF GCXGC

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BT4DCF889037I PKG PEGASUS BT AND 4D CF-8890-SSL-IF/MMI-LN INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-902	KIT IMMERSION COOLER -100C 220V
1	GC4DCF-889037	ASSY GC 8890 CF SSL IF/MMI-LN2 GCXGC

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BT4DLIQS15LN889032D PKG PEGASUS BT AND 4D LPAL3 LIQ LN2-8890-SSL-IF DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-820	KIT LIQUID LEVELER MODEL 1700 120V
1	GC4DLN-889032	ASSY GC 8890 LN SSL IF GCXGC
1	L-PAL3-S15-LIQ	AUTO SAMPLER L-PAL3-S15 LIQ INJ
1	L-PAL3-LIQ-110	KIT CONSUMABLE L-PAL3-LIQ

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BT4DLIQS15LN889037D PKG PEGASUS BT AND 4D LPAL3 LIQ LN2-8890-SSL-IF/MMI-LN DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-820	KIT LIQUID LEVELER MODEL 1700 120V
1	GC4DLN-889037	ASSY GC 8890 LN SSL IF/MMI-LN2 GCXGC
1	L-PAL3-S15-LIQ	AUTO SAMPLER L-PAL3-S15 LIQ INJ
1	L-PAL3-LIQ-110	KIT CONSUMABLE L-PAL3-LIQ

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BT4DLIQS15LN889032I PKG PEGASUS BT AND 4D LPAL3 LIQ LN2-8890-SSL-IF INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-822	KIT LIQUID LEVELER MODEL 1700 240V
1	GC4DLN-889032	ASSY GC 8890 LN SSL IF GCXGC
1	L-PAL3-S15-LIQ	AUTO SAMPLER L-PAL3-S15 LIQ INJ
1	L-PAL3-LIQ-110	KIT CONSUMABLE L-PAL3-LIQ

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BT4DLIQS15LN889037I PKG PEGASUS BT AND 4D LPAL3 LIQ LN2-8890-SSL-IF/MMI-LN INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-822	KIT LIQUID LEVELER MODEL 1700 240V
1	GC4DLN-889037	ASSY GC 8890 LN SSL IF/MMI-LN2 GCXGC
1	L-PAL3-S15-LIQ	AUTO SAMPLER L-PAL3-S15 LIQ INJ
1	L-PAL3-LIQ-110	KIT CONSUMABLE L-PAL3-LIQ

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BT4DLIQS15CF889032D PKG PEGASUS BT AND 4D LPAL3 LIQ CF-8890-SSL-IF DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-901	KIT IMMERSION COOLER -100C 120V
1	GC4DCF-889032	ASSY GC 8890 CF SSL IF GCXGC
1	L-PAL3-S15-LIQ	AUTO SAMPLER L-PAL3-S15 LIQ INJ
1	L-PAL3-LIQ-110	KIT CONSUMABLE L-PAL3-LIQ

*Packed and shipped separately in the U.S.A. Notes included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DLIQS15CF889037D PKG PEGASUS BT AND 4D LPAL3 LIQ CF-8890-SSL-IF/MMI-LN DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-901	KIT IMMERSION COOLER -100C 120V
1	GC4DCF-889037	ASSY GC 8890 CF SSL IF/MMI-LN2 GCXGC
1	L-PAL3-S15-LIQ	AUTO SAMPLER L-PAL3-S15 LIQ INJ
1	L-PAL3-LIQ-110	KIT CONSUMABLE L-PAL3-LIQ

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BT4DLIQS15CF889032I PKG PEGASUS BT AND 4D LPAL3-LIQ CF-8890-SSL-IF INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-902	KIT IMMERSION COOLER -100C 220V
1	GC4DCF-889032	ASSY GC 8890 CF SSL IF GCXGC
1	L-PAL3-S15-LIQ	AUTO SAMPLER L-PAL3-S15 LIQ INJ
1	L-PAL3-LIQ-110	KIT CONSUMABLE L-PAL3-LIQ

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BT4DLIQS15CF889037I PKG PEGASUS BT AND 4D LPAL3 LIQ CF-8890-SSL-IF/MMI-LN INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-815	PACK COMPONENT PEG HRT/BT 4D CF
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-902	KIT IMMERSION COOLER -100C 220V
1	GC4DCF-889037	ASSY GC 8890 CF SSL IF/MMI-LN2 GCXGC
1	L-PAL3-S15-LIQ	AUTO SAMPLER L-PAL3-S15 LIQ INJ
1	L-PAL3-LIQ-110	KIT CONSUMABLE L-PAL3-LIQ

*Packed and shipped separately in the U.S.A. Notes included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DSPMES15LN889032D PKG PEGASUS BT AND 4D LPAL3 SPME LN2-8890-SSL-IF DOM

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	614-700-200	ASSY PEGASUS BT 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-820	KIT LIQUID LEVELER MODEL 1700 120V
1	GC4DLN-889032	ASSY GC 8890 LN SSL IF GCXGC
1	L-PAL3-S15-SPME	AUTO SAMPLER L-PAL3-S15 SPME HS LIQ INJ
1	L-PAL3-SPME-110	KIT CONSUMABLES L-PAL3-SPME

*Packed and shipped separately in the U.S.A. Notes included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

BT4DSPMES15LN889032I PKG PEGASUS BT AND 4D LPAL3 SPME LN2-8890-SSL-IF INTL

2	259-090	SOFTWARE KIT PEGASUS BT
1	359-001-230	LIBRARY NIST V2.3 07-2017
2	704-241	ASSY KEY COPY PROTECTION
1	502-939-HAZ*	STD OFN 1PG/UL IN ISOCTANE
1	502-940-HAZ*	STD OFN 2 PG/UL IN ISOCTANE
1	502-395-HAZ*	STD GROB CAPILLARY TEST MIX
1	614-700-200	ASSY PEGASUS BT 4D 230VAC 50/60HZ 1PH
1	709-809-816	PACK COMPONENT PEG HRT/BT 4D LN2
1	686-721	ASSY PC TOWER PEGASUS BT HP Z4 W10
1	686-551	MONITOR PC 24 IN
1	618-380	CASE HOLDER CD-12 BLACK
1	709-809-822	KIT LIQUID LEVELER MODEL 1700 240V
1	GC4DLN-889032	ASSY GC 8890 LN SSL IF GCXGC
1	L-PAL3-S15-SPME	AUTO SAMPLER L-PAL3-S15 SPME HS LIQ INJ
1	L-PAL3-SPME-110	KIT CONSUMABLES L-PAL3-SPME

*Packed and shipped separately in the U.S.A. Nots included with international shipments due to shipping regulations. These items are essential for operation. Contact your LECO distributor for quotation and delivery.

Options for the *Pegasus* BT 4D

Refer to [Options](#), page 1-44.

Components for the *Pegasus* BT 4D

614-720-071 PACK COMPONENT INSTALLATION *PEGASUS* BT

1	200-999-017	MANUAL INSTR PEGASUS BT
1	200-999-025	MANUAL INSTR HRT CHROMATOF SOFTWARE
1	203-505-548	FORM PEGASUS BT INSTALLATION CHECKLIST
1	502-233	ALUMINA A PELLETS 1LB
1	502-349	SAMPLE CAL PFTBA MS 35G
1	603-433	O-RING 109 .299X .485X.093V
1	607-064	FILTER OIL MIST EDWARDS
1	607-111	TRAP OIL VAPOR
4	615-341	CLAMP FTG FLANGE NW25
4	615-343	SEAL RING CENTERING NW25
3	619-590-809	CABLE ASSY CAT 5E 7FT RJ-45
1	621-605-748	WRENCH OPEN END 3/16 X 1/4 ST CP
1	709-448	TRAY ROUGHING PUMP
1	709-566	FOAM NON-SKID NS901 3.0 PSA
1	709-802-132	TUBE CU GC TO HELIUM SUPPLY
1	709-806-720	CORD POWER ASSY 8FT 15A/250V
1	709-807-453	FLANGE FTG ADPTR NW25 - NW25
1	709-809-220	FTG NUT HEX 1.2MM DIA X.06 THD
10	709-809-221	FTG FRL 0.4MM ID 60/40 VESPEL/GRAPHITE 10PK
1	709-809-334	SCREWDRIVER TORX BALL T25
1	709-809-347	ASSY CABLE REMOTE DSUB M-M 5FT
1	709-809-663	DRIVE USB FLASH 8GB
1	709-809-670	PUMP VACUUM EDWARDS RV5 230V
1	709-810-251	INSULATOR REPELLER CERAMIC
1	709-811-239	HOSE FLEX VAC SST NW25 96IN
1	709-811-524	ASSY TOOL REMOVAL FILAMENT PEG BT
1	709-811-932	O-RING 260 6.484X6.76X.139 V
1	709-812-181	DRIVER HEX .078 MINIATURE
2	709-812-233	FILAMENT ASSY BLOCK FF50TY CENTER MNT
1	709-812-589-110	VIAL SAMPLE 2ML CLEAR CRIMP 1/PK
2	709-812-641	ROD ALIGNMENT PLT
1	709-813-437	ASSY BASE SLIDING GC STEPPED TOP
1	711-690	CORD POWER 3X100MM 10A 8FT
20	711-887	TUBING FLX POLYU C.062IDX.031W
1	709-809-526	FTG COLUMN KIT UNION/0.35MM FRL SILTITE
1	621-605-560	O-RING 225 1.859X 2.137X.139V MIL-SPEC

709-813-906 PACK COMPONENT PEG BT 4D FLOW MODULATOR

1	621-605-748	WRENCH OPEN END 3/16 X 1/4 ST CP
2	709-813-799	NUT INTERNAL STD .0312 SST
2	709-813-678	COLUMN CONNECTING TUBE
3	709-813-797	FTG NUT/FERRULE SST FUSED SILICA TUBING
3	709-813-798	FERRULE ZERO VOLUME 1/32 TUBING
1	709-813-832	FERRULE .125 - .0625 TFE
1	709-813-853	TOOL FTG 360 TIGHTEN
1	710-525	ROD ALIGNMENT SECONDARY OVEN
1	709-809-508	COLUMN 30M X 0.25MM X 0.25UM RXI-5MS
1	709-813-829	COLUMN 2M X 0.1MM X 0.1UM

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2 Installation

The Installation chapter lists step-by-step instructions on the preparation and requirements necessary for installation of the Pegasus® BT. For software setup and configuration, refer to the ChromaTOF® Brand Software Manual. For additional details, refer to the *Pegasus* BT Pre-installation Guide included with the instrument.



HAZARDOUS VOLTAGE WARNING

During installation and operation of this instrument, the On/Off switch must be easily accessible. This switch is located on the left side panel of the instrument.



PROTECTIVE EYEWEAR/PROTECTIVE GLOVES
Protective eyewear and gloves should be worn when handling chemicals.



Refer to the Safety Data Sheet (SDS) for the specific chemical for additional information.

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Installing the Electrical

Power Requirements (without Power Conditioner or UPS)

The quality of the electrical power will determine how efficiently your system operates. All electrical power must be stable: both short- and long-term.

NOTE → LECO does not recommend the use of a power conditioner.

Provided: Mass spectrometer plug: NEMA 6-15P 2 Pole, 3-wire grounding

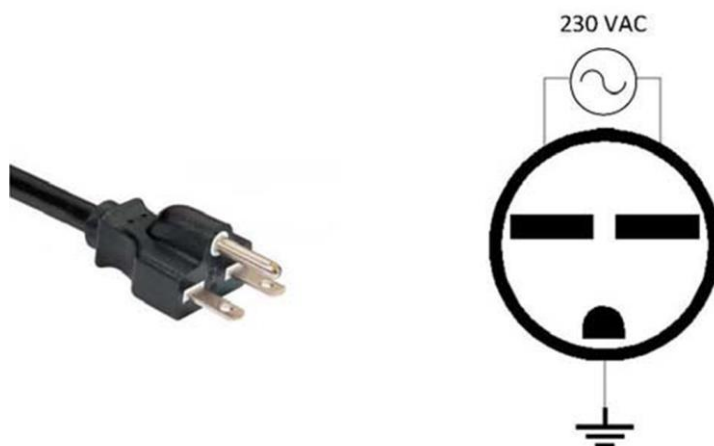


Figure 2-1
End View of Plug: NEMA 6-15P (15A)

Electrical Requirements for *Pegasus* BT Mass Spectrometer

- Grounded receptacle only
- 230 VAC +10%/-15%
- 50/60 Hz
- 15 A service recommended; plug and receptacle provided; refer to [Figure 2-1](#), previous.
- One dedicated circuit for the *Pegasus* BT

Electrical Requirements for *Peripherals and Accessories*

- 120 VAC; 50/60 Hz for computer, monitor, printer, modem, etc.
- For Agilent 8890 and 7890B Fast-Heating GC, refer to [Agilent 7890/8890 with Fast-heating Option](#), page 2-7. For all other GCs, refer to the OEM manual.

NOTE → For power requirements outside of North America, contact your local service office.

Minimum Requirements for North America

- One dedicated 230 V, 15 A circuit for the *Pegasus* BT.
- Sufficient 115 VAC, 15 A receptacles based on [Table 2-1](#), following.
- One dedicated circuit for the Agilent 7890/8890 GC with fast-heating option (requires 240 V \pm 10%, 15 A).

Item	Notes	Power Requirements	Receptacles – North America Only
<i>Pegasus</i> BT/ <i>Pegasus</i> BT 4D	N/A	230 VAC, +10%/-15%, 50/60Hz	NEMA 6-15R
Agilent 7890/8890 GC Fast-heating Option	For other GCs, refer to their respective manuals.	240 VAC, \pm 10%, 50/60Hz	NEMA L6-15R
Computer	N/A	115/230 VAC, 50/60HZ	NEMA 5-15R
Monitor(s)	N/A	115/230 VAC, 50/60HZ	NEMA 5-15R
L-PAL3	Optional	115/230 VAC, 50/60HZ	NEMA 5-15R
QUADJET™ Modulator Controller- 7890/8890	Used with <i>Pegasus</i> BT 4D LN2 and CF	115/230 VAC, 50/60HZ	NEMA 5-15R
FLUX™ Modulator Controller- 7890/8890	Used with <i>Pegasus</i> BT 4D FLUX	115/230 VAC, 50/60HZ	NEMA 5-15R
Liquid Leveler - North America	Used with <i>Pegasus</i> BT 4D LN2	115 VAC, 15A circuit, 60Hz	NEMA 5-15R
Liquid Leveler	Used with <i>Pegasus</i> BT 4D LN2	Rest of the world, contact your local service.	N/A
Cryogenic Chiller - North America	Used with <i>Pegasus</i> BT CF	115 VAC, 15A circuit, 60Hz	NEMA 5-15R
Cryogenic Chiller	Used with <i>Pegasus</i> BT CF	Rest of the world, contact your local service.	N/A

**Table 2-1
Power Requirements and Receptacles**

Agilent 7890/8890 with Fast-heating Option

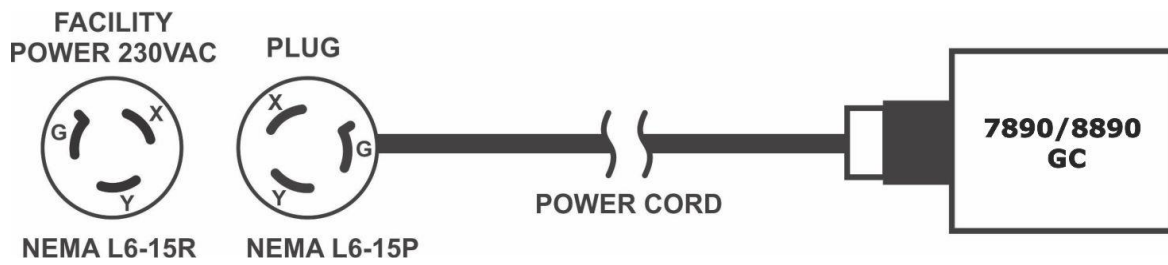


Figure 2-2
Agilent 7890/8890 Wiring Diagram

Installing the Instrument



CAUTION

The final installation of the *Pegasus* BT 4D should be performed only by a LECO employee. The customer is responsible only for transport from shipping docks/delivery locale to a placement that is near to its final positioning in the laboratory.



CAUTION

Operator(s) and laboratory personnel must be present during the unpacking, inventorying, moving, and installation process to prepare the operator(s) efficiently and effectively.

During installation, the LECO Field Service Engineer demonstrates the instrument's sensitivity specifications and trains the operator(s). The LECO Field Service Engineer trains the operator(s) in the use of system software, general troubleshooting, and routine operator preventive maintenance.

Because this training is so important, it is the laboratory's responsibility to assure the operator(s) is present during the entire installation process. If the operator(s) is not present and additional training is required, billable rates will apply.



HAZARDOUS VOLTAGE WARNING

During installation and operation of this instrument, the ON/OFF switch must be easily accessible. This switch is located on the left side panel of the instrument.

Setting up and Unpacking the Instrument

When the *Pegasus* BT 4D GC/MS system arrives, inspect the exterior of all containers for:

- Signs of obvious mishandling
- Water damage
- Check all shock indicators

Damaged Containers

Complete the following steps to identify and assess any damaged containers.

1. If any of the containers appear to have been damaged during shipment, note it on the shipping papers.
2. Open any containers appearing damaged to evaluate the extent of the possible damage.
3. Immediately notify LECO of any shipping damage. A thorough damage evaluation may be scheduled and performed.
4. Note damage on the shipping papers.
5. After identifying and notifying LECO of damaged items, move items to a safe location until the time of damage evaluation.

Undamaged Containers

Do not unpack any of the undamaged boxes. Move all undamaged boxes to a safe location until the time of installation.

Unpacking the *Pegasus* BT 4D GC/MS system



CAUTION

If no shipping damage is reported and/or any of the shipping containers are open, LECO is not responsible for any shortages.

The Field Service Engineer unpacks and inventories all components at the time of installation.

If transit damage occurs, the Field Service Engineer provides a damage evaluation, so long as the steps in [Damaged Containers](#), previous, are followed. Before the Field Service Engineer's arrival, notify LECO of any shipping damage.

Removing the *Pegasus* BT 4D from the Shipping Pallet



CAUTION

Front panels and other cosmetic parts of this instrument are not designed to be weight bearing. DO NOT use such parts as lifting points or damage may result. ALWAYS lift near the feet at the sides or the rear of the instrument base.

Failure to follow the directions exactly may result in damage to the instrument. Minor damage may include bending of the sheet metal skirting and/or breaking of the feet. LECO will not be responsible for any damage to the instrument if these steps are not strictly followed.



CAUTION

Follow your institution's guidelines for lifting heavy equipment, as LECO is not responsible for injury acquired during the unpacking process.



CAUTION

At least two people are required to remove the *Pegasus* BT 4D from the shipping crate.

Complete the following steps to remove the *Pegasus* BT 4D from the shipping crate. For crate and instrument weight and dimensions, refer to the *Pegasus* BT 4D Pre-installation Guide.

1. Remove the shipping material (plywood and foam packing) from around the *Pegasus* BT 4D.
2. Team-lift the *Pegasus* BT 4D onto the benchtop.
3. Move the *Pegasus* BT 4D on the bench to be as near as possible to its final resting place. The field engineer will install it in its proper position.

Gas Connections



FLAMMABLE/HEALTH HAZARD/HARMFUL PROTECTIVE GLOVES/PROTECTIVE EYEWEAR



Hydrogen is commonly used as a carrier gas in GCs and associated equipment. Hydrogen accumulations, or leaks in GCs and any associated equipment, can potentially be explosive and dangerous, and hydrogen should be used only as a carrier gas in accordance with all applicable installation, maintenance, and use instructions.



Failure to follow instructions may result in serious injury or death. This manual is not intended as a complete guide to the proper and safe use of hydrogen as a carrier gas. In addition to the following information and instructions, refer to the **Agilent Hydrogen Carrier Gas Safety Guide** and to the applicable **Agilent GC User Information Guide(s)** and **Safety Manual(s)** (or other GC manufacturers' instructions), as well as any hydrogen generator or gas supplier instructions, for more information.



CAUTION

Hydrogen carrier gas cannot be used with the **FLUX™ GCxGC Flow Modulator**.



CAUTION

To achieve the highest possible sensitivity, the lowest possible background noise must exist inside the gas chromatograph and mass spectrometer. Only high-purity gases from reliable vendors should be used with the **Pegasus BT 4D GC/MS system**.



CAUTION

Oxygen, water, and hydrocarbons are detrimental to the operation of gas chromatographic equipment and may cause damage to certain chromatographic columns.

Gas Requirements

GC Carrier Gas

UHP Grade Helium 99.999% pure using 1/8-inch copper or stainless tubing for connection.

Nitrogen Gas

Backfill UHP gas supplied by either generator or tank must be able to provide 30 psi (2.07 bar).

NOTE →

A -50 °C dewpoint or below must be maintained.

Coolant Supply



COMPRESSED GAS/PROTECTIVE EYEWEAR/PROTECTIVE GLOVES

Liquid nitrogen is a refrigerated gas and may cause cryogenic burns or frostbite. Eye protection and gloves that insulate against cold temperatures must be worn when handling liquid nitrogen.

Refer to the Safety Data Sheet (SDS) for additional information.



CAUTION

High pressure Liquid Nitrogen CANNOT be used.

Low pressure (<30 psi or <2.07 bar) Liquid Nitrogen (LN₂) is required for cooling.

Gas Options

Two main options exist for gas supply usage during analysis using the *Pegasus* BT 4D LN₂ systems:

1. Hot and Cold Jets Tied Together:

Gaseous nitrogen (N₂) is required in this case for the gas flow supply at 40 psi (2.76 bar). Gaseous nitrogen (N₂) may be used for both hot and cold jets.

2. Hot and Cold Jets Separated (Recommended):

Cold Jets - Gaseous Nitrogen (N₂) is required for the gas flow supplied to the cold jets. This nitrogen supply must be high-purity grade and it will require at least an in-line moisture trap and a regulator that can regulate at no greater than 100 psi (6.89 bar). Operational pressure is 40 psi (2.76 bar).

Hot Jets - Compressed air tank or air compressor with both moisture and oil removed may be used. A regulator that can regulate at no greater than 100 psi (6.89 bar) will also be needed. Operational pressure is 40 psi (2.76 bar).



CAUTION

It is NOT possible to use bleed from the low pressure LN₂ tank being used as coolant. This can potentially cause problems in originally learning the valves, as well as in the modulation process due to a drop off in flow capacity.

The N₂ source for these two options can come from either a compressed N₂ tank or N₂ bleed from a separate high pressure LN₂ tank.

Gaseous Nitrogen (N₂) generators may be used in place of tanks, but only if they meet the following criteria:

- Able to generate 30 lpm if connected only to cold jets (separate gases supplied to hot/cold jets). This configuration is recommended if a generator is to be used with the *Pegasus* BT 4D system.
- Able to generate 150 lpm if connected to both hot and cold jets. This configuration is not recommended due to prohibitive costs for generators capable of producing this high flow rate.
- Contain <1.0 ppm CO₂.
- Produce clean/dry N₂ with a dew point at or below -50 °C.
- Meets the pressure regulation requirements listed previously.

Gas Consumption

If the *Pegasus* BT is used consistently (8 hours per day, 5 days per week), gas consumption may be estimated as follows for either of the previously discussed options:

NOTE →

Gas consumption may change dramatically between methods based on modulation setup, temperature ramping, and other method characteristics.

- Hot and Cold Jets Tied Together:
 - Liquid Nitrogen (cools the gaseous nitrogen) – 5 to 7 days per tank.
- Compressed Nitrogen – 4 to 8 hours per tank.
- Hot and Cold Jets Separated:
 - Liquid Nitrogen (cools the gaseous nitrogen) – 5 to 7 days per tank.
 - Compressed Nitrogen – 1 day per tank.
 - Compressed Air – 1 to 2 days per tank.
- *FLUX* GCxGC Flow Modulator:
 - Compressed Air (cools the secondary oven) – 2 to 3 days per tank.
 - Adds an additional 3.5 ml/min Helium Auxillary Flow.

NOTES →

- The hot jets have a flow rate of approximately 14.5 lpm each (therefore, the two jets result in an approximate flow rate of 29 lpm).
- The secondary oven cooling has a flow rate of approximately >100 lpm (the incoming gas for the hot jets is responsible for secondary oven cooling).
- The cold jets for an LN₂ system have a flow rate of approximately 6 lpm each. Therefore, the two jets result in a flow rate of 12 lpm.
- The cold jets for a CF system have a flow rate of approximately 10 lpm each. Therefore, the two jets result in a flow rate of 20 lpm.
- Unstable gas regulation on the hot and cold can cause poor modulation when they dip below flow requirement.
- Ensure that the gases (air and nitrogen) are dry. If there is moisture in the gas, the cold jets can develop an ice buildup.
- All tubing must be pre-cleaned.

Carrier Gas Contaminant Concentration Limits



CAUTION

Filters do not convert a lower grade of gas to a high-purity gas suitable for chromatographic purposes. Their adsorptive capacity is quickly exceeded, causing the entire chromatographic system to become contaminated and potentially damage system components.

Oxygen, water, and hydrocarbons are detrimental to the operation of gas chromatographic equipment and may cause damage to certain chromatographic columns. Refer to [Table 2-2](#), following, for the maximum permissible concentrations of typical contaminants in GC carrier gas.

Maximum Permissible Concentration of Typical Contaminants in GC Carrier Gas (He 99.999% Pure)	
Gases:	Concentrations:
Water	< 1.0 ppm
Oxygen	< 1.0 ppm
Total Hydrocarbons	< 1.0 ppm

**Table 2-2
Permissible Carrier Gas Contaminant Levels**

NOTE →

LECO recommends using trapping filters for oxygen, water, and hydrocarbons on the carrier gas stream and indicating filters downstream of the main filter.

Gas Safety



COMPRESSED GAS

To avoid injury or damage to equipment, follow all proper safety procedures.

Secure pressurized gas cylinders during transportation and use. Remove the gas cylinder regulators and reinstall the protective metal cap during transportation or when not in use. LECO recommends marking gas cylinders partially full as "In Use," including a remaining pressure and date of last use.

Gas Chromatograph

Instrument

Your gas chromatographic system may be equipped with other components requiring compressed gas. Please check with the manufacturer's manual or the manufacturer's Field Service Engineer for your additional component requirements.

All components associated with the pneumatics system must be as clean as possible in order to achieve the lowest detection limits.

Tubing

Only pre-cleaned, chromatographic quality, chemically and thermally treated tubing is acceptable:

- No "refrigeration grade" tubing or tubing of unknown origin.
- For 1/8-inch diameter metal tubing: copper or stainless steel.
- For fittings: high quality brass, stainless steel.
- Use Polytetrafluoroethylene (PTFE) tape only on "national pipe threads" (NPT) connections.
- No pipe "dope" on any pipe fittings.
- Do not use Polytetrafluoroethylene (PTFE) tape on ferruled fittings.

Gas Cylinders



CAUTION

Do not supply more pressure to the gas chromatograph than the pneumatic system require; otherwise, damage may occur to the mechanical and electrical components for EPC equipped systems.

A two-stage regulator with a stainless steel diaphragm is necessary to reduce the pressure inside a compressed gas cylinder to a level suitable for the GC pneumatics hardware.

The maximum output pressure required is dependent on several factors:

- Column length
- Column diameter

- Injector split ratio
- Column operating temperature

General

At installation, be prepared and have the following ready:

- Regulators
- Filters
- Fittings
- Tubing
- Pneumatic connection components

NOTE →

Some fittings and tubing may be provided with the GC startup kit. Consult with the gas chromatograph manufacturer's Field Service Engineer for specific information.

Use a thermal conductivity-based detector to leak check each connection in the gas flow path prior to heating the gas chromatograph oven. Do not use soap-based leak detection systems for chromatographic pneumatics. Do not over-tighten fittings if a leak is detected; replace the leaking ferrule. Install new ferrules according to the manufacturer's recommendations.

Use a carrier gas that meets or exceeds the gas chromatograph manufacturer's specified minimum purity requirements. Refer to the gas chromatograph manufacturer's installation guide or operator manual for gas type, purity and flow requirements. Please consult the manufacturer's technical support department for any questions.

NOTE →

If there is any intention to install additional devices on or at the instrument (such as an autosampler, different inlets, desorption devices, etc.), please contact the service or sales department first. Due to the physical modifications on the GC, certain options might not be available or additional changes may be required.

Installing the Rough Vacuum System



CAUTION

It is strongly recommended to connect the exhaust ports of the roughing pump to outside ventilation (for example: hood or forced air intake). Regardless of the nature of the samples analyzed, long-term exposure to oil vapors or organic solvents normally used in gas chromatography may cause adverse health effects.



CAUTION

Shutting down any portion of the *Pegasus* BT 4D vacuum system or removing power from the *Pegasus* BT 4D, either purposefully or due to an unexpected event, can cause GC carrier gas to vent from the *Pegasus* BT 4D vacuum system. Thus, the area in which the *Pegasus* BT 4D is installed must be properly ventilated to prevent buildup of dangerous levels of the GC carrier gas.



CAUTION

The roughing pump is delivered without oil and will need to be filled prior to operation. **DO NOT RUN THE PUMP DRY OR SEVERE DAMAGE WILL RESULT.**



CAUTION

While filling the roughing pump with oil, be careful to avoid allowing oily residues or dust to enter the pump, which could damage the pump.



CAUTION

Refer to the *Edwards FL20K Foreline Trap Instruction Manual* for any hazards and warnings regarding the sorbent prior to handling the sorbent.

1. Fill the roughing pump oil to just below the top line beside the sight glass in the sight glass.
2. Assemble the foreline trap with the alumina pellets.
3. Remove the blank cap from the roughing port on the side of the *Pegasus* BT 4D.
4. Install the NW25-NW25 flange fitting adapter (PN 709-807-453) onto the MS bulkhead, using the NW25 centering o-ring that is already installed.
5. Attach the foreline trap (with the cap facing away from the *Pegasus* BT 4D to allow room for the sliding tray) to the adapter installed in step 4, previous.
6. Install the NW25-to-NW16 reducer fitting to the foreline trap using a NW25 centering o-ring and clamp.
7. Attach the SS vacuum tubing to the outlet of the alumina trap using a NW16 centering o-ring and clamp.

8. Connect the other open end of the SS vacuum tubing to the inlet of the roughing pump using a NW16 o-ring and clamp.
9. Attach the oil mist filter to the roughing pump exhausts using a NW25 centering o-ring and clamp.
10. Plug the roughing pump power cable (PN 711-690) into the back of the *Pegasus* BT 4D (230 VAC) next to the main power switch and underneath the pump symbol. Refer to [Figure 2-3](#), following.

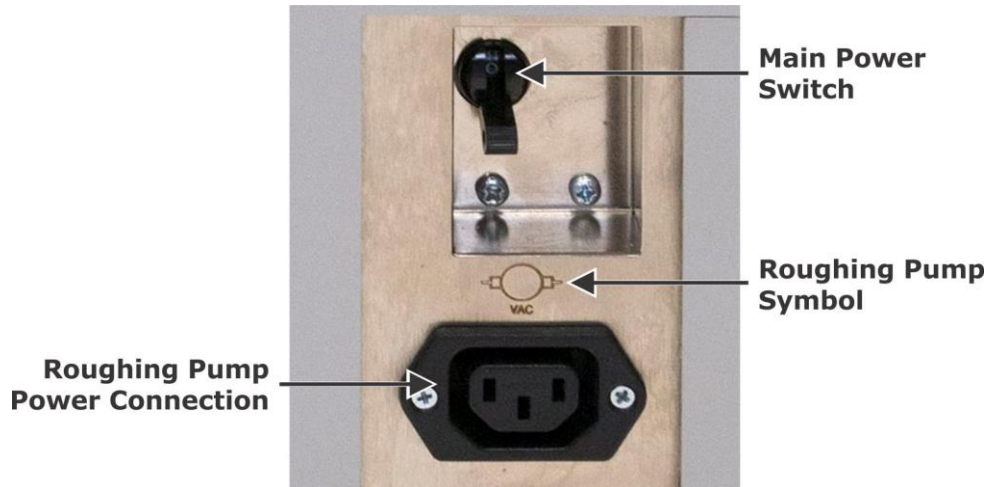


Figure 2-3
Roughing Pump Power Receptacle

11. Make sure that the roughing pump is switched On, and then plug in the other end of the cord to the pump.
12. Ensure the main power is switched Off on the *Pegasus* BT 4D, and attach the MS main power cord next to the roughing pump power cord, and then connect the power cord to the wall outlet.
13. Connect the nitrogen gas line to the rear of the *Pegasus* BT 4D by inserting it until the orange lock clicks into place.
14. Connect the other end of the nitrogen gas line to the nitrogen supply source, and set the source pressure to 30 psi (2.07 bar).

Installing the Calibration Gas Vial



HARMFUL/PROTECTIVE EYEWEAR/PROTECTIVE GLOVES

PFTBA is a skin and eye irritant and may cause respiratory irritation.

Refer to the Safety Data Sheet (SDS) for additional information.



CAUTION

Do not remove the PFTBA vials without venting the source or turbo pump damage may result.

Complete the following steps to install the calibration gas vial.

1. Place an o-ring around the included 2 mL calibration vial neck, and fill $\frac{3}{4}$ of the vial with the provided PFTBA chemical ($\frac{3}{4}$ is to the uppermost graduated line).
2. Remove the plug and stopper held in the PFTBA gas vial slot on the MS.
3. Plug in the newly filled vial. Once the vacuum system is running, the vial should be tightly held in place.



Installing the Desktop Computer

1. Place the computer tower at its station, near the *Pegasus* BT 4D.
2. Place the monitor(s) (Dual display is optional) on top of the station.
3. Plug the HDMI and power cord(s) into their respective monitor(s).
4. Plug the other end of the HDMI cord(s) into the display port(s) on the back of the computer tower.



CAUTION: NETWORK CONNECTION

Connect the Ethernet port on the instrument to the appropriate port on the computer as instructed in this manual. Connecting the instrument directly to a corporate network (LAN) may result in communication problems.

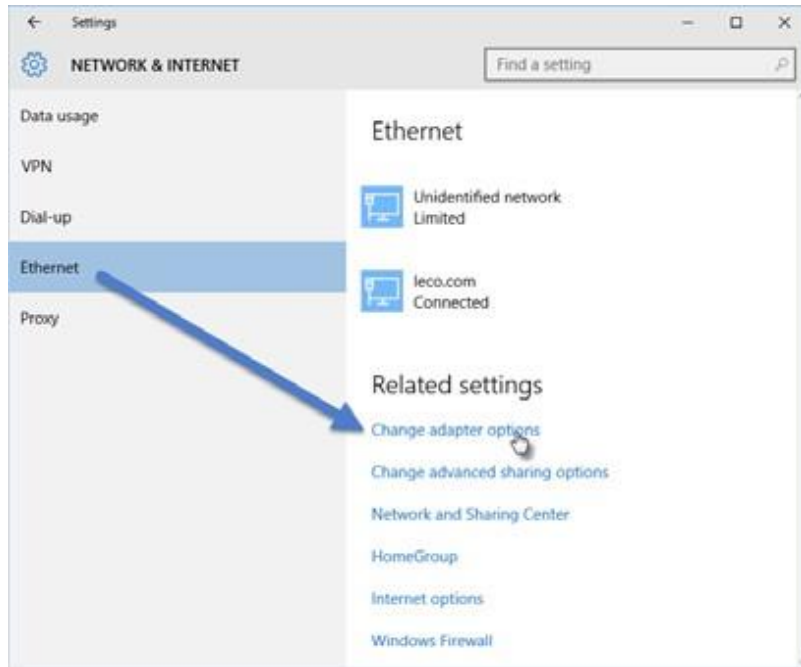
5. Attach a CAT5E Cable (PN 709-802-170) to the computer tower on the added Ethernet peripheral card (the Ethernet Port closest to the bottom of the tower).
6. Plug in the other end of the CAT5E (LAN) cable into an Ethernet 
Port  in the network switch location on the back of the *Pegasus* BT 4D. Any slot will suffice.
7. Plug in the keyboard, mouse, and copy protection key (dongle) to the USB ports on the back of the computer tower.
8. Plug in the power cord to the back of the tower in the power supply port.
9. Plug in a power strip with surge suppression and turn it On.

NOTE →

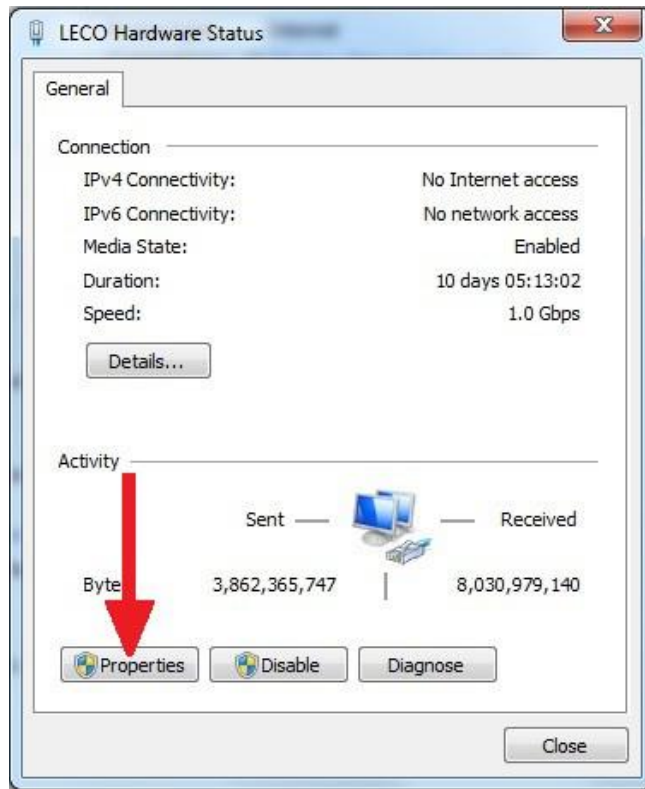
The supplied power strip can be used only with 115 VAC circuits.

10. Plug in the tower and monitor power cords into the power strip with surge suppression.
11. Turn On the computer tower and monitor(s).
12. Configure the PC network card according to steps [A](#) through [E](#), following.
 - A. With the computer ON, select Start.
 - B. Select Settings.
 - C. Select Network and Internet.
 - D. Select Ethernet.

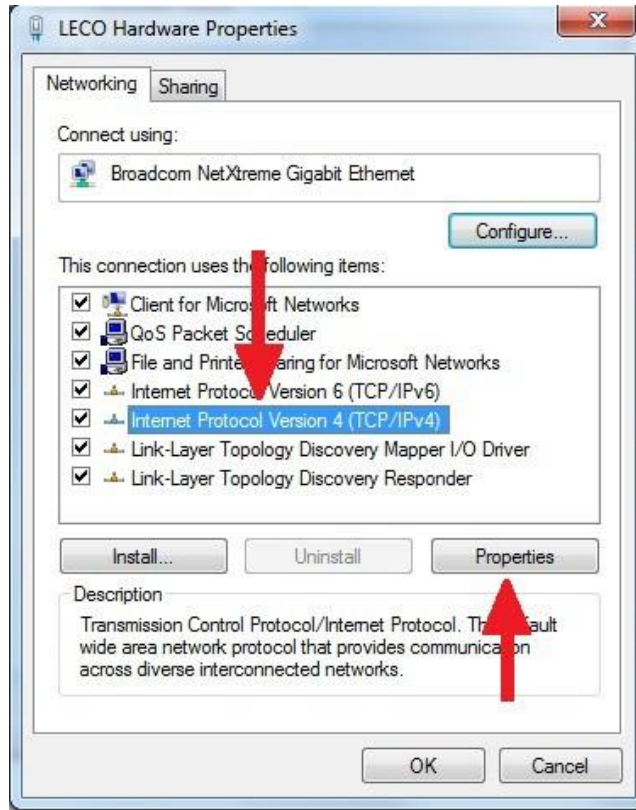
E. Select Change Adapter Options.



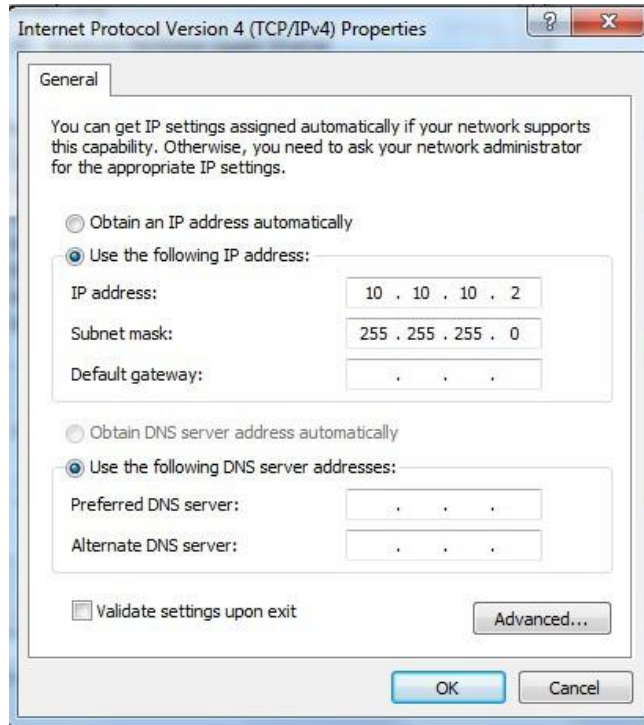
13. Right-click on LECO Hardware and select Properties. The LECO Hardware Status dialogue box launches.



14. On the LECO Hardware Properties window, select Internet Protocol Version 4 (TCP/IPv4).



15. Select Properties. The TCP/IP properties screen appears.



16. Select Use the Following IP Address.
17. Enter the IP address as 10.10.10.2.
18. Enter the Subnet Mask as 255.255.255.0.
19. Leave the Default Gateway, Preferred DNS Server, and Alternate DNS Server blank.
20. Select OK.
21. Select OK again to save the settings.

Installing the Agilent 7890/8890/8860 GC

1. Attach grip tape to the bottom of the GC tray in all four corners (to keep the tray from sliding on the bench).

NOTE →

Make sure the lever used to release the slide tray is facing forward toward the user.

2. Set the tray on top of the table and to the right of the MS unit.
3. With the assistance of a second person, lift the GC onto the tray.
4. Use the locating brackets in all four corners of the tray to position the GC flush to the tray.
5. Perform the instructions (PN 709-809-199 for the 7890 GC, or PN 709-809-969 for the 8890 GC) included in the GC modification kit (PN 709-809-198 for the 7890 GC, or PN 709-814-451 for the 8890 GC).
6. Confirm the carrier gas purity is 99.999% or better.
7. Confirm the regulators for the gases have a stainless steel (not rubber) diaphragm.
8. Plumb the GC using pre-cleaned $\frac{1}{8}$ -inch copper tubing (not refrigeration grade) to the gas cylinder regulators or gas drops, as appropriate.
9. If the GC has two inlets installed, first connect a splitter that will be able to separate the helium flow to both of the installed EPCs.
10. Connect the other end of the copper plumbing to the EPC controller.
11. Ensure that the connections are properly tightened.

NOTE →

The low pressure regulators should show a pressure drop of at least 20 psi (1.4 bar) across each stage to work correctly. If the maximum column pressure to be used is 80 psi (5.5 bar), at least 100 psi (6.9 bar) must be provided from the regulator.

12. Open the gas cylinder and set the low pressure regulator to 100 to 120 psi (6.9 to 8.3 bar).
13. Perform a leak check on all connections using a helium leak check detector.
14. Connect the extra CAT5E cable (PN 709-802-170) from the Network Switch on the MS to the LAN connection on the back of the GC. Any port on the MS will work.
15. Plug in one end of the remote serial cable to the rear of the GC and the other end to the rear of the MS (either port will work).



HAZARDOUS VOLTAGE WARNING

Ensure proper power requirements are met before connecting power.

16. Plug in the GC's power cord to the port on the rear of the GC and to the wall outlet.
17. Tighten the GC power cord harness.

18. Enter the network configuration by completing the following steps for the applicable GC.

For the Agilent 7890 GC Only:

- A. Power On the GC, and confirm that it passes a self-test.
- B. Enter the network configuration on the Agilent GC by completing the following steps.
 - 1) Press Options on the GC keypad.
 - 2) Select Communication.

NOTE → The DHCP must be Off in order to enter a fixed IP address.

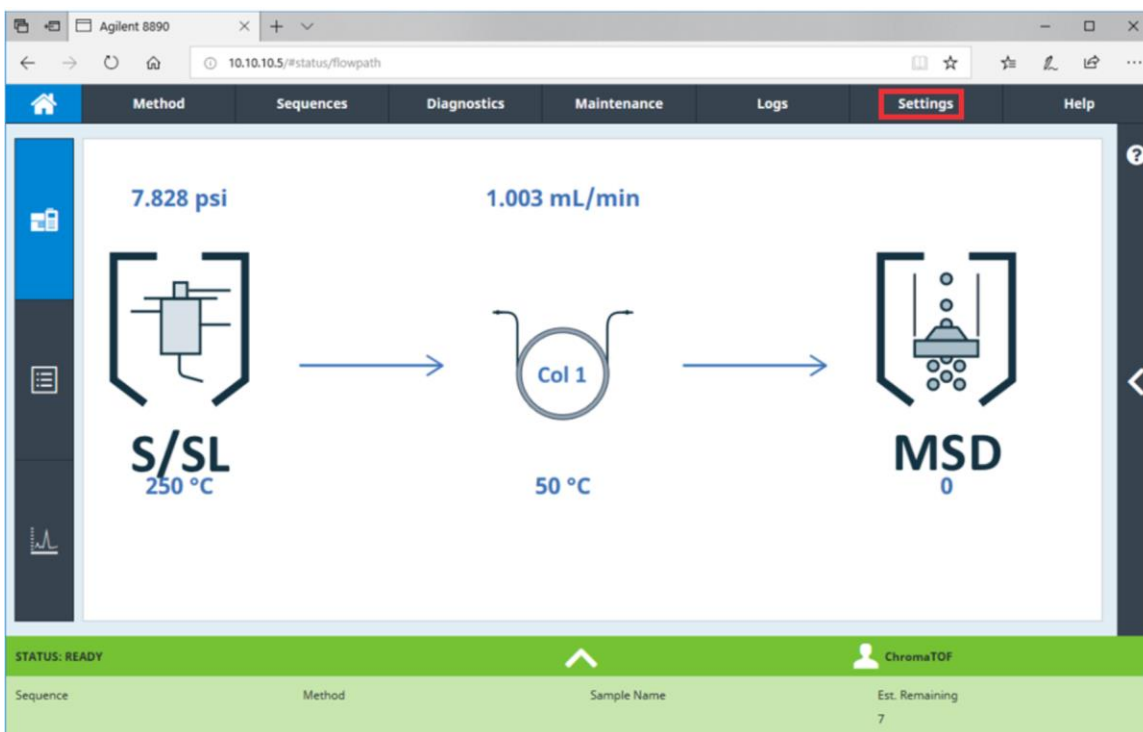
- 3) For Enable DHCP, select Off.
- 4) Enter 10.10.10.5 for the IP address.
- 5) Enter the submask (SM) as 255.255.255.0.
- 6) Gateway (GW) should be blank or all zeros.

NOTE → The GC column may be installed in the inlet of the GC and conditioned before the instrument is ready for vacuum system checkout. Note the instructional points and have the user handle the column, set GC conditions, etc. When choosing between inlets, make sure to use a S/SL for specifications testing with the install column.

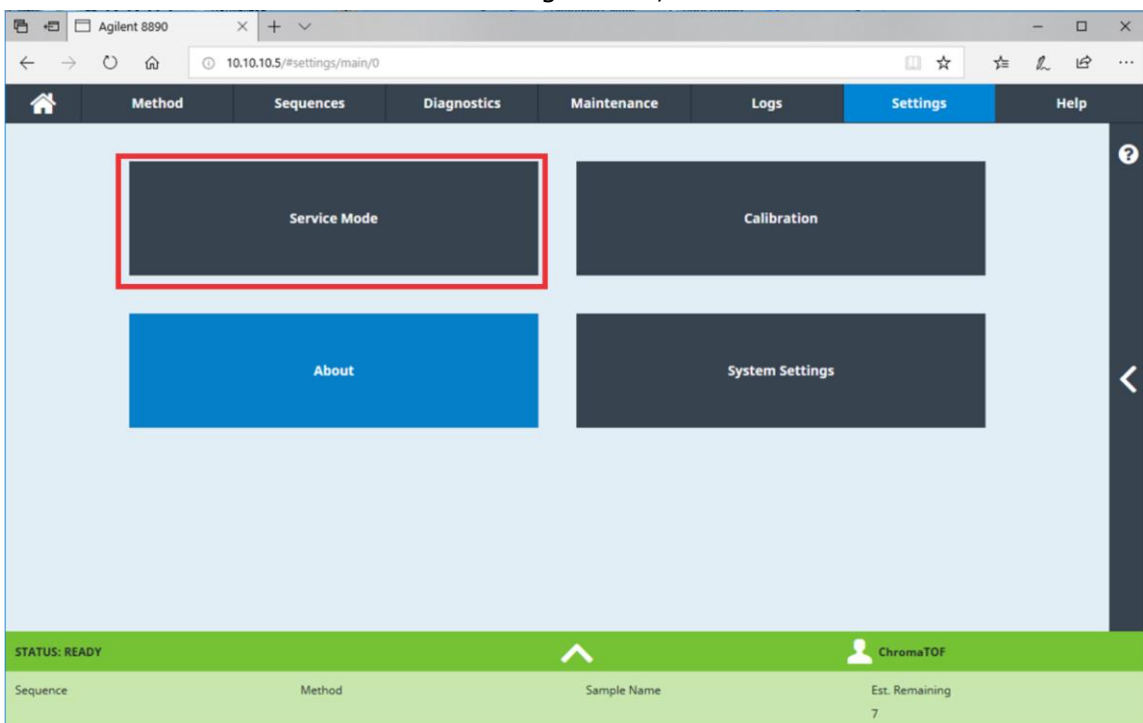
For the Agilent 8860 GC and 8890 GC Only:

- A. Power On the GC.
- B. When the Agilent 8890/8860 GC are powered On for the first time, they will automatically go through a System Setup. Complete the System Setup steps to configure the GC. For step 5 (Set-up Network DHCP) and step 6 (Setup Network Static IP) of the System Setup, enter the parameters as follows.
 - 1) Uncheck DHCP Enable.
 - 2) IP address: 10.10.10.5
 - 3) Net Mask: 255.255.255.0
 - 4) Gateway: 0.0.0.0
- C. When the System Setup is complete, reboot the GC by navigating from the touchscreen to Settings ➤ Power ➤ Restart.
- D. Access the web browser from the PC by opening the internet browser, and then typing the following IP address in the bar: 10.10.10.5.

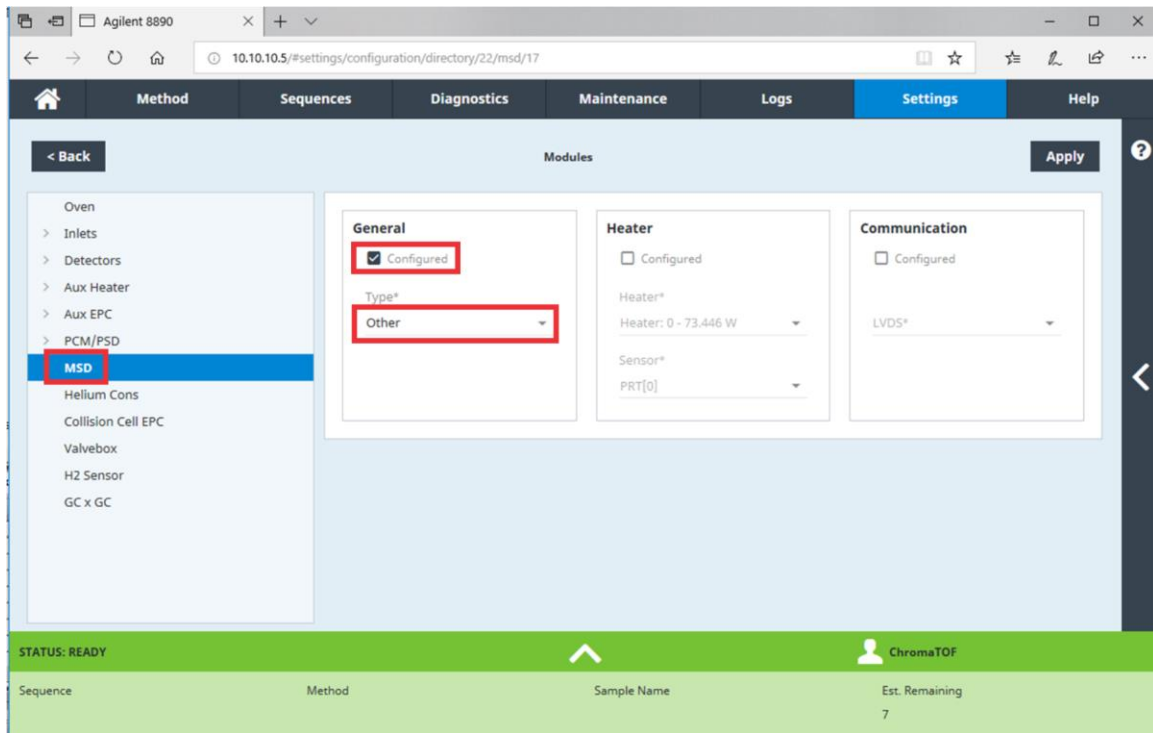
E. From the Home screen, select Settings.



F. From the Settings menu, select Service Mode:



- G. Select MSD, and then make the following selections.
- 1) Select the checkbox next to Configured.
 - 2) Under Type, select Other from the drop-down menu.
 - 3) Select Apply.



- H. Exit the web browser.

NOTE →

The GC column may be installed in the inlet of the GC and conditioned before the instrument is ready for vacuum system checkout. Note the instructional points and have the user handle the column, set GC conditions, etc. When choosing between inlets, make sure to use a S/SL for specifications testing with the install column.

Installing and Preparing GC Accessories for Operation

1. If available, install the tray and the auto-injector tower on the top of the GC. Refer to [Installing the Agilent 7693A Automatic Liquid Sampler](#), page 3–7.
2. If an L-PAL3 auto sampler is included, install the auto sampler as described in [Installing the L-PAL3 Automated Sample Injector](#), beginning on page 3–8. If a different rail system is included, complete the installation of the auto sampler by referring to the documentation supplied with the auto sampler.
3. Check the GC septum, liner, and liner o-ring to confirm that they are in good condition.

NOTE →

Note the slip joint on the transfer line and the black o-ring is provided with the instrument.

4. Remove the metal blank that was installed into the slip joint and set it aside.
5. Using an open-end wrench, adjust the feet on the MS so that the transfer line aligns with its opening on the GC.
6. Ensure that the *Pegasus* BT 4D is level before proceeding.
7. Using the transfer line, assemble the slip joint (knurled nut, compression washer, and o-ring) onto the main shaft. These components are to be removed from the metal blank that was set aside in step 4, previous.
8. Insert the transfer line into the source so that the end of the transfer line presses up against the source.
9. Tighten the knurled nut, securing the transfer line in place.
10. Align the GC using small, careful movements, so that the nut end of the transfer line protrudes through the cutout in the side of the GC when the GC slide tray is slid closed into its left position.

NOTE →

A portion of the column nut must be visible through the wall of the GC when viewed from the inside of the oven.

11. Once the GC alignment is completed, slide the GC back to the right.
12. Remove the transfer line from the source.
13. Insert one end of the supplied Agilent column through the GC inlet nut and ferrule.
14. Cut 1 cm (0.394 in) to 2 cm (0.787 in) of column off of the end of the column.

NOTE →

Once installed into the GC inlet, the column should extend 5 mm (0.197 in) beyond the inlet end of the inlet ferrule.

15. Install the column into the GC inlet.

NOTE →

A 60/40 graphite/vespel mixture ferrule must be used to install the column into the transfer line.

16. Ensure that the tapered end of the ferrule is facing the transfer line nut.

17. Tighten the ferrule so that there is enough play in the column to adjust its length, while not sliding inside the transfer line inadvertently.
18. Install the column into the transfer line, being careful not to create sharp bends in the column.
19. Trim the outlet end of the column.
20. Adjust the column so that the end of the column protrudes approximately 5 mm (0.197 in) past the end of the transfer line.
21. Tighten the transfer line nut.
22. Insert the transfer line into the source so that the end presses up against the source.
23. Tighten the knurled nut, securing the transfer line in place.
24. Enter the column dimensions by completing the following steps for the applicable GC.

For the Agilent 7890 GC Only:

- A. On the front keypad of the GC, select Config.
- B. Select Column#.
- C. Select the appropriate column.
- D. Enter 30 for Length (m), 250 for Diameter (u), and 0.25 for film thickness (u).
- E. Set the Outlet to MSD by using the Mode/Type key.
- F. Set the GC flow to 1.0 mL/min.

NOTE →

The Column and Flow Information can be downloaded from a *ChromaTOF* GC method to the GC with the Green Arrow.

- G. Skip to step 25, page 2-29.

For the Agilent 8860 GC and 8890 GC Only:

- A. On the GC touchscreen, navigate to Settings ➤ Configuration ➤ Columns.
- B. Enter the appropriate column dimensions: 30 for Length (m), 250 for Diameter (u), and 0.25 for film thickness (u).
- C. Set the GC flow to 1.0 mL/min.

NOTES →

- If you have an Agilent Column with a Smart Key, do not insert the key. The Smart Key interferes with *ChromaTOF*'s ability to send Column Dimensions, which causes an error with column flow calculations.
- Alternatively, for the 7890 GC, 8860 GC, and 8890 GC, the Column and Flow Information can be downloaded from a *ChromaTOF* GC method to the GC with the Green Arrow.

For the Agilent 7890 GC, 8860 GC, and 8890 GC:



CAUTION

When feeding the column through the oven wall, mount the column on the hanger, so that the column does not touch the sides or floor of GC oven.

25. Slide the GC left into place while feeding the column through the oven wall.
26. Turn On the main power switch for the *Pegasus* BT 4D.

NOTE →

You will hear the turbo and the roughing pump power On as well.

27. Launch the *ChromaTOF* for BT software and connect to the default database.
28. Navigate to the Vacuum button in the lower right-hand part of the screen and left-click. The dialogue box opens, displaying the status of the vacuum system.
29. Select the Enable Heater Power after Evacuation box.
30. Set both the source and transfer line temperatures to 250 °C.
31. Ensure that the vacuum pressure is decreasing, and that the turbo frequency reaches a stable operating value of 1,000 Hz. It may take several minutes to reach the correct speed.
32. After the transfer line has reached 250 °C, set the GC oven temperature to 200 °C for a several minutes, then cool the GC oven back to 50 °C.
33. Carefully slide the GC to the right, away from the MS unit.
34. Retighten the transfer line nut.
35. Slide the GC back left into place while feeding the column through the oven wall.
36. Activate the locking mechanism.

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3 Option Installation

This chapter lists step-by-step instructions to install optional equipment.



Complete the installation of the Pegasus® BT 4D according to the information and referenced manuals provided in this chapter. For software setup and configuration, refer to the ChromaTOF® Brand Software Manual.



HAZARDOUS VOLTAGE WARNING

During installation and operation of this instrument, the ON/OFF switch must be easily accessible. This switch is located on the left side panel of the instrument.



PROTECTIVE EYEWEAR/PROTECTIVE GLOVES

Protective eyewear and gloves should be worn when handling chemicals.



Refer to the Safety Data Sheet (SDS) for the specific chemical for additional information.

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Installing the Agilent 7693A Automatic Liquid Sampler

The following section explains how to install the Agilent 7693A Automatic Liquid Sampler. Refer to [Figure 3-1](#), following, when completing the following steps.

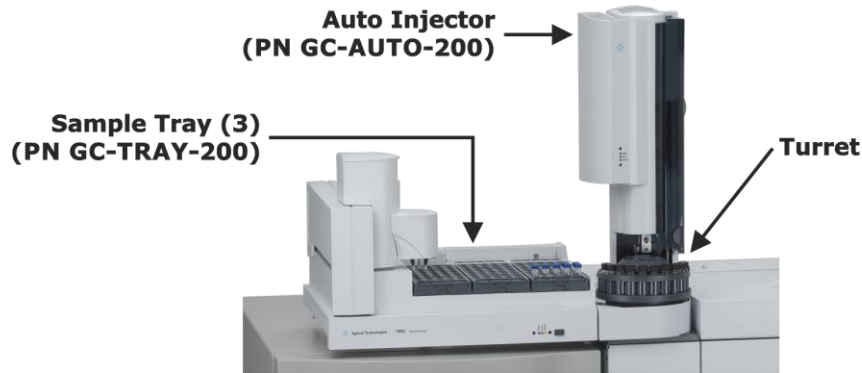


Figure 3-1
Agilent 7693A Autosampler Overview

1. Install the tray and auto-injector tower on the top of the GC, if available.
2. Check the Agilent GC septum and liner to confirm that they are in good condition.
3. Set the column flow for column 1 to 1.5 mL/min. Check to see if the column is providing flow by inserting the open end into methanol and observing bubbles.
4. Turn the flow to 0.2 mL/min after checking the inlet.
5. Leave the oven and injector at ambient temperature.

Installing the L-PAL3 Automated Sample Injector

The following section explains how to install the L-PAL3 Automated Sample Injector.

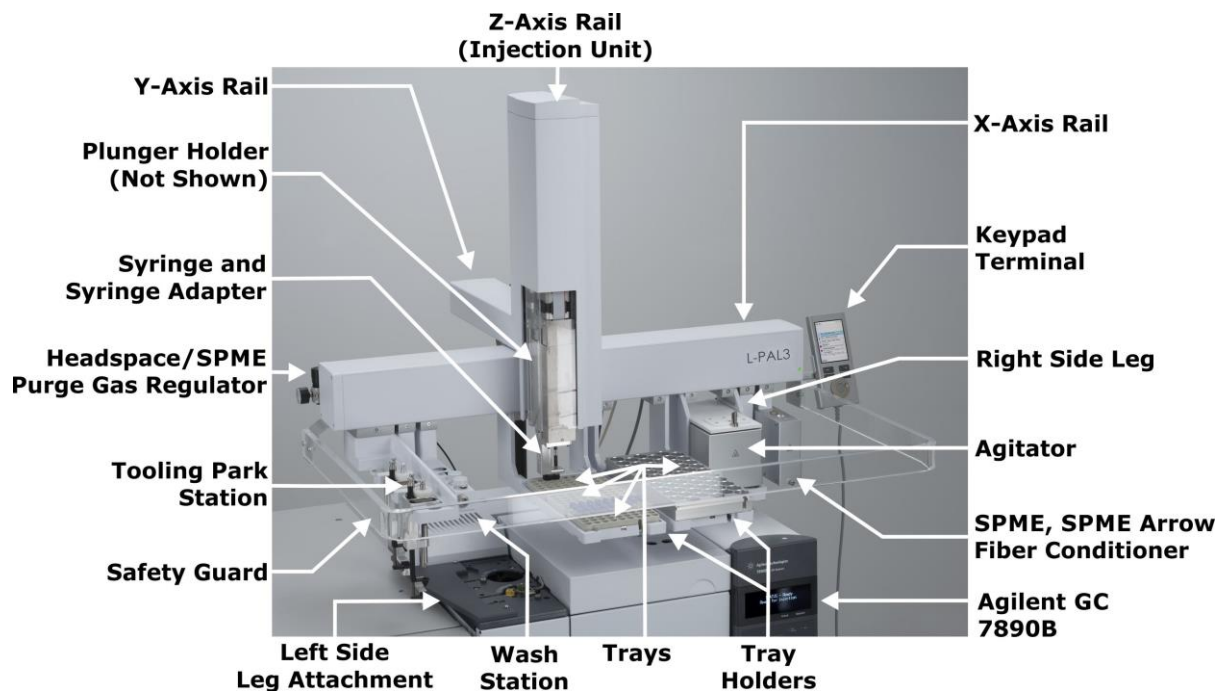


Figure 3-2
L-PAL3 Overview with Tray Configuration

CTC Name	L-PAL3	L-PAL3 Series 1.5
PAL RTC	L-PAL3-ATX	L-PAL3-S15-ATX
PAL RSI (Liquid and Headspace Only)	L-PAL3-HS	L-PAL3-S15-HS
PAL RSI (Liquid and SPME Only)	L-PAL3-SPME	L-PAL3-S15-SPME
PAL LSI (Liquid Only)	L-PAL3-LIQ	L-PAL3-S15-LIQ

Table 3-1
L-PAL3 Configuration Names

L-PAL3 Options

L-PAL3 Options (L-PAL3-00P)

1	200-999-030	MANUAL INSTR L-PAL3 AUTO SAMPLER
1	709-809-701	KIT CONTROL PCB REPL FOR ALL L-PAL3
1	709-809-702	HEAD ATX L-PAL3 REPL W/O COVER
1	709-809-703	KIT PREVENTIVE MAINTANCE FOR ATX L-PAL3
1	709-809-704	KIT PREVENTIVE MAINTANCE FOR LIQ L-PAL3
1	709-809-705	KIT LUBRICATION FOR L-PAL3 W/BRUSH
1	709-809-706	KIT SPARE PARTS FOR L-PAL3 850MM
1	709-809-707	KIT SPARE PARTS FOR L-PAL3 850MM
1	709-809-708	CABLE INTERFACE L-PAL3 3M 15P 4-OPEN WIRES
1	709-809-709	CABLE BUS ALL L-PAL3 14-PIN 250MM
1	709-809-710	CABLE BUS ALL L-PAL3 14-PIN 850MM
1	709-809-711	POWER SUPPLY MAIN L-PAL3 90-254 VAC 200W
1	709-809-712	TERMINAL L-PAL3 SYSTEM
1	709-809-713	WINDOW ATX L-PAL3 FOR INJECTION UNIT
1	709-809-714	COVER ATX L-PAL3 FOR INJECTION UNIT
1	709-809-715	COVER HS/LIQ L-PAL3 FOR INJECTION UNIT
1	709-809-716	KIT Z-AXIS PCB REPL FOR ALL L-PAL3
1	709-809-717	KIT RIBBON CABLES FOR ATX L-PAL3
1	709-809-718	KIT RIBBON CABLES FOR HS/LIQ L-PAL3
1	709-809-719	BELT DRIVING L-PAL3 AGITATOR 6X20 ML
1	709-809-720	COVER X-AXIS LEFT HAND SIDE L-PAL3
1	709-809-721	KIT X-AXIS GAS TUBE REPL FOR ATX/HS L-PAL3
1	709-809-722	KIT Z-AXIS GAS TUBE REPL FOR HS L-PAL3
1	709-809-723	KIT Z-AXIS GAS TUBE REPL FOR ATX L-PAL3
1	709-809-724	REGULATOR PRESSURE 0-35PSI W/FTGS/WRNCH L-PAL-3
1	709-809-725	CONNECTOR TUBE L-PAL3 PRESS REG-TUBING 1/8 IN
1	709-809-726	CONNECTOR L-PAL3 X-RAIL TO PRESS REG
1	709-809-727	VIAL AMBER SCREW CAP 2ML 100/PK
1	709-809-728	CAP VIAL PTFE LINED SCREW 2ML 100/PK
1	709-809-729	VIAL CLEAR SCREW HEADSPACE RB 10ML 100/PK
1	709-809-730	VIAL CLEAR SCREW HEADSPACE RB 20ML 100/PK
1	709-809-731	CAP VIAL HEADSPACE MAGNETIC 100/PK
1	709-809-732	KIT 10ML VIAL CAPS AND SEALS 10/PK
1	709-809-733	KIT 20MM CAPS AND PRE-SLIT SEALS 10/PK
1	709-809-734	SYRINGE 10UL HAMILTON 701 57MM 23GA
1	709-809-735	SYRINGE 2500UL SGE HEADSPACE 23GA
1	709-809-736	FIBER SPME 2CM DVD/CAR/PDMS 3/PK
1	709-809-737	INSERT AGITATOR FOR 2ML VIAL 6/PK
1	709-809-738	SCREW KIT FOR L-PAL3
1	709-809-739	MODULE SPME ARROW CONDITIONING

L-PAL3 Options (L-PAL3-OOP)

1	709-809-740	SPME KIT FOR PAL3 SYSTEM
1	709-809-760	TRAY HOLDER FOR MTP/DW PLATE/SAMPLE RACK L-PAL3
1	709-809-761	KIT ADD DYNAMIC HEAD SPACE ITEX TO L-PAL3
1	709-809-763	MOUNTING KIT FOR 6890/7890 GC SIDE
1	709-809-764	NEEDLE KIT PAL DLW 51 MM 22GA 3PST W/NUT
1	709-809-765	TRANSFER TUBING KIT FOR DILUTOR
1	709-809-773	SAMPLE RACK FOR 60 VIALS OF 10/20 ML
1	709-809-774	SAMPLE RACK FOR 15 VIALS OF 10/20 ML 1 PC
1	709-809-775	SAMPLE RACK FOR 15 VIALS OF 10/20 ML 3 PC
1	709-809-776	SAMPLE RACK FOR 54 VIALS OF 2 ML 1 PC
1	709-809-777	SAMPLE RACK FOR 54 VIALS OF 2 ML 3 PC
1	709-809-778	INSERTS AGITATOR L-PAL 10ML 6/SET
1	709-809-782	KIT FOR COOLED STACK WITH 2 VT15 RACKS
1	709-809-783	KIT FOR COOLED STACK WITH 2 VT54 RACKS
1	709-809-784	KIT FOR COOLED STACK WITH OUT RACKS
1	709-809-788	COUPLING PLUNGER W FIELD REPLACEABLE
1	709-809-789	KIT COUPLING HEAD T, V AND W
1	709-809-792	CUTTER FOIL PAL 3
1	709-809-874	ARROW 1.1MM DIA DVB/C-WR/PDMS DG 3PC
1	709-809-875	ARROW 1.1MM DIA DVB/C-WR/PDMS DG 5PC
1	709-809-876	ARROW 1.5MM DIA DVB/C-WR/PDMS DG 3PC
1	709-809-877	ARROW 1.5MM DIA DVB/C-WR/PDMS DG 5PC
1	709-809-878	LINER ARROW SPME 1.7MM FOR GC 7890 3PC
1	709-809-879	LINER FOR CONDITIONING MODULE 3PC
1	709-809-880	ADAPTER SPLIT/SPLITLESS FOR GC 7890
1	709-809-881	LINER FOR SSL INJECTOR 1.1MM OD
1	709-809-882	KIT ARROW SPME FOR 20ML VIALS
1	L-PAL3-ADD-ATX	KIT ADD ATX TO L-PAL3-HS OR L-PAL3-SPME
1	L-PAL3-ADD-HS	KIT ADD HEADSPACE TO L-PAL3-SPME
1	L-PAL3-ADD-SPME	KIT ADD SPME TO L-PAL3-HS
1	L-PAL3-SPME-NC	AUTO SAMPLER L-PAL3 SPME HS LIQ INJ NO CNDTNR
1	L-PAL3-SPME-NC-DS	AUTO SAMPLER L-PAL3 SPME HS LIQ INJ NO CNDTNR

L-PAL3-S15-LIQ Components and Consumables

L-PAL3-S15-LIQ CTC Components

2	7890/8860/8890 MOUNTING KIT
1	850MM RAIL
1	INJECTION HEAD
1	PALTERMINAL TERMINAL
1	SAFETY GUARD
1	POWER SUPPLY / CABLE
1	10UL SYRINGE (CTC)
1	TRAY HOLDER
1	VT-54 RACK FOR 2ML VIALS
2	STANDARD WASH MODULE

L-PAL3-S15-LIQ LECO Consumables Pack (L-PAL3-LIQ-110)

1	709-809-727	VIAL AMBER SCREW CAP 2ML 100/PK
1	709-809-728	CAP VIAL PTFE LINED SCREW 2ML 100/PK
1	709-809-732	KIT 10ML VIAL CAPS AND SEALS 10/PK
1	709-809-733	KIT 20MM CAPS AND PRE-SLIT SEALS 10/PK
1	709-809-734	SYRINGE 10UL HAMILTON 701 57MM 23GA

L-PAL3-S15-HS Components and Consumables

L-PAL3-S15-HS CTC Components

1	7890/8860/8890 MOUNTING KIT
1	850MM RAIL
1	INJECTION HEAD
1	PALTERMINAL TERMINAL
1	SAFETY GUARD
1	POWER SUPPLY / CABLE
1	2500UL HEADSPACE SYRINGE
1	HS65-2500 HEADSPACE TOOL
2	10UL LIQUID SYRINGE (CTC)
1	D7-57 LIQUID TOOL
2	TRAY HOLDER
3	VT-54 RACK FOR 2ML VIALS
3	VT-15 RACK FOR 10/20ML VIALS
1	AGITATOR
1	STANDARD WASH MODULE

L-PAL3-S15-HS LECO Consumables Pack (L-PAL3-HS-110)

1	709-809-727	VIAL AMBER SCREW CAP 2ML 100/PK
1	709-809-728	CAP VIAL PTFE LINED SCREW 2ML 100/PK
1	709-809-729	VIAL CLEAR SCREW HEADSPACE RB 10ML 100/PK
1	709-809-730	VIAL CLEAR SCREW HEADSPACE RB 20ML 100/PK
1	709-809-731	CAP VIAL HEADSPACE MAGNETIC 100/PK
1	709-809-732	KIT 10ML VIAL CAPS AND SEALS 10/PK
1	709-809-733	KIT 20MM CAPS AND PRE-SLIT SEALS 10/PK
1	709-809-734	SYRINGE 10UL HAMILTON 701 57MM 23GA

L-PAL3-S15-SPME Components and Consumables

L-PAL3-S15-SPME CTC Components

1	7890/8860/8890	MOUNTING KIT
1	850MM	RAIL
1		INJECTION HEAD
1		PALTERMINAL TERMINAL
1		SAFETY GUARD
1		POWER SUPPLY / CABLE
1		SPME ARROW CONDITIONING STATION
1		SPME KIT
		• 1 PC SPME TOOL
		• 1 PC SPME FIBER HOLDER
		• 1 PC SPME PERFORMANCE EVALUATION MIX
		• 1 PC SPME FIBER ASSORTMENT KIT (FIB-SEL5-S1)
		- 10MM PDMS; 7, 30 AND 100UM
		- 10MM ACRYLATE; 85UM
		- 10MM CARBON WR; 95UM
2		10UL LIQUID SYRINGE (CTC)
1		D7-57 LIQUID TOOL
2		TRAY HOLDER
3		VT-54 RACK FOR 2ML VIALS
3		VT-15 RACK FOR 10/20ML VIALS
1		AGITATOR
1		STANDARD WASH MODULE

L-PAL3-S15-SPME LECO Consumables Pack (L-PAL3-SPME-110)

1	709-809-727	VIAL AMBER SCREW CAP 2ML 100/PK
1	709-809-728	CAP VIAL PTFE LINED SCREW 2ML 100/PK
1	709-809-732	KIT 10ML VIAL CAPS AND SEALS 10/PK
1	709-809-733	KIT 20MM CAPS AND PRE-SLIT SEALS 10/PK
1	709-809-734	SYRINGE 10UL HAMILTON 701 57MM 23GA

1	709-809-729	VIAL CLEAR SCREW HEADSPACE RB 10ML 100/PK
1	709-809-730	VIAL CLEAR SCREW HEADSPACE RB 20ML 100/PK
1	709-809-731	CAP VIAL HEADSPACE MAGNETIC 100/PK

L-PAL3-S15-ATX Components and Consumables

L-PAL3-S15-ATX CTC Components

1	7890/8860/8890	MOUNTING KIT
1	1205MM	RAIL
1	RTC	INJECTION HEAD
1	TOOL	PARK STATION
1	PAL	TERMINAL TERMINAL
1	SAFETY	GUARD
1	POWER	SUPPLY / CABLE
1	SPME	ARROW CONDITIONING STATION
1	SPME	KIT
		<ul style="list-style-type: none"> • 1 PC SPME TOOL • 1 PC SPME FIBER HOLDER • 1 PC SPME PERFORMANCE EVALUATION MIX • 1 PC SPME FIBER ASSORTMENT KIT (FIB-SEL5-S1) <ul style="list-style-type: none"> - 10MM PDMS; 7, 30 AND 100UM - 10MM ACRYLATE; 85UM - 10MM CARBON WR; 95UM
2	10UL	LIQUID SYRINGE (CTC)
1	D7-57	LIQUID TOOL
2	2500UL	HEADSPACE SYRINGE
1	HS65-2500	TOOL
2	TRAY	HOLDER
3	VT-54	RACK FOR 2ML VIALS
3	VT-15	RACK FOR 10/20ML VIALS
1	AGITATOR	
1	SPME	ARROW CONDITIONING MODULE
1	STANDARD	WASH MODULE

L-PAL3-S15-ATX LECO Consumables Pack (L-PAL3-ATX-110)

1	709-809-727	VIAL AMBER SCREW CAP 2ML 100/PK
1	709-809-728	CAP VIAL PTFE LINED SCREW 2ML 100/PK
1	709-809-729	VIAL CLEAR SCREW HEADSPACE RB 10ML 100/PK
1	709-809-730	VIAL CLEAR SCREW HEADSPACE RB 20ML 100/PK
1	709-809-731	CAP VIAL HEADSPACE MAGNETIC 100/PK
1	709-809-732	KIT 10ML VIAL CAPS AND SEALS 10/PK
1	709-809-733	KIT 20MM CAPS AND PRE-SLIT SEALS 10/PK
1	709-809-734	SYRINGE 10UL HAMILTON 701 57MM 23GA

Installing the L-PAL3 Legs to the *Pegasus* BT 4D



HAZARDOUS VOLTAGE WARNING

Disconnect the instrument from facility power before servicing or removing the GC panel or any guard tool-accessible panel.

1. Turn Off the instrument, and then disconnect it from facility power.
2. Remove the two bolts near the GC inlet and the bolts from the rear of the right side panel of the GC. Refer to [Figure 3-3](#), following.

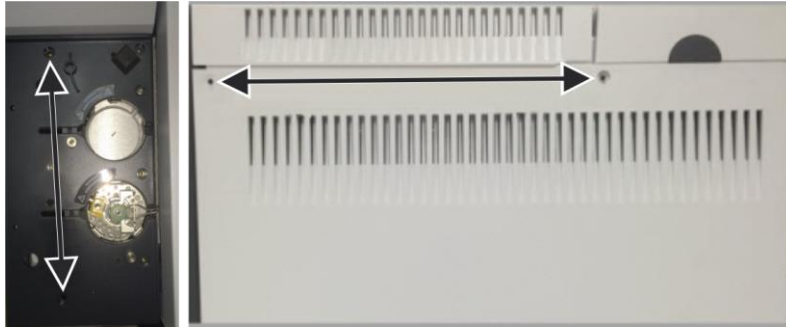


Figure 3-3
Bolt Locations on 7890/8860/8890

3. Remove the pop-off cover from the front of the right side panel.
4. **For the 7890 GC Only:** Take off the GC side panel and remove the front bolt. Refer to [Figure 3-4](#), following.

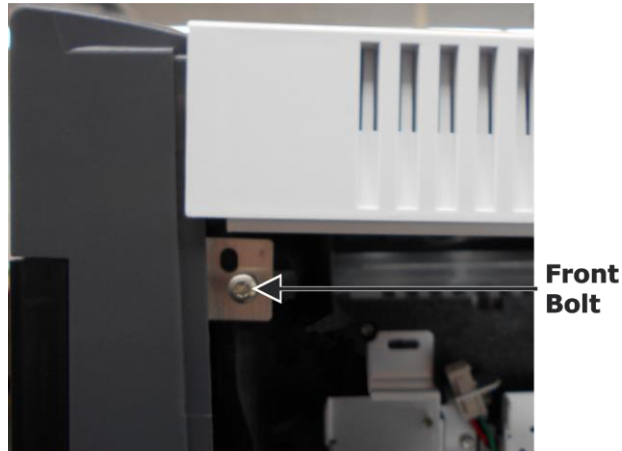
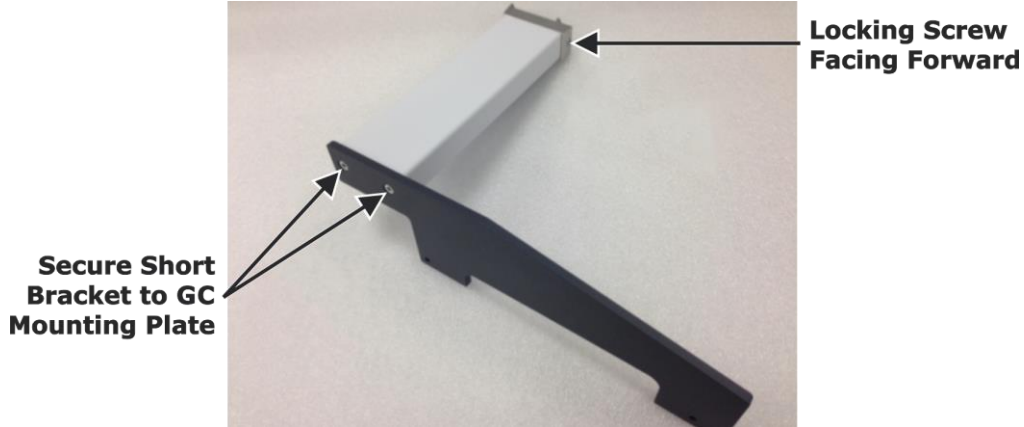


Figure 3-4
Right Side Panel Front Bolt on 7890

5. Remove the bolts from the inlet side leg and then use them to attach the foot to the inlet side leg. Refer to [Figure 3-5](#), following.

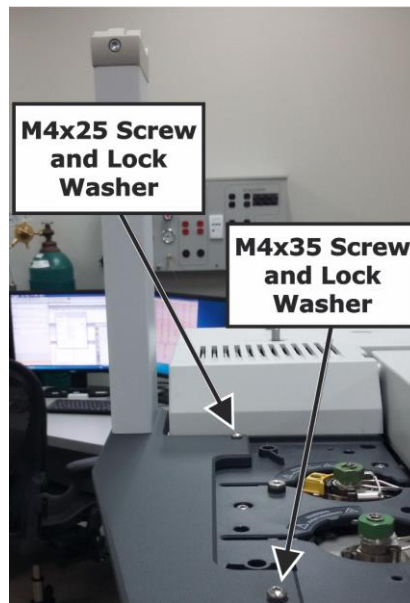


**Figure 3-5
Inlet Arm Mount**

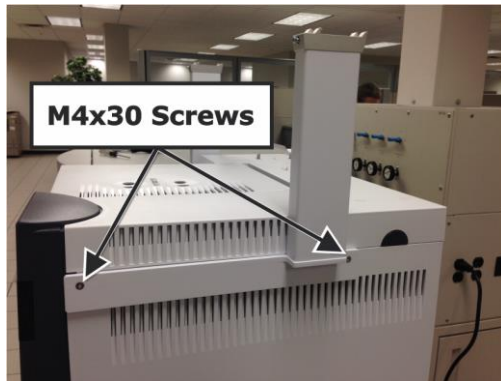
6. Install the auto sampler legs using the bolts from the L-PAL3 kit (PAL3-KIT-88XX-D). Refer to [Figure 3-6](#) and [Figure 3-7](#), following.

NOTE →

The shorter bolts with the star washers are used on the GC inlet, and the longer of the two bolts for the front of the GC. The star washers may be in a separate package than the bolts.



**Figure 3-6
Installing Legs**

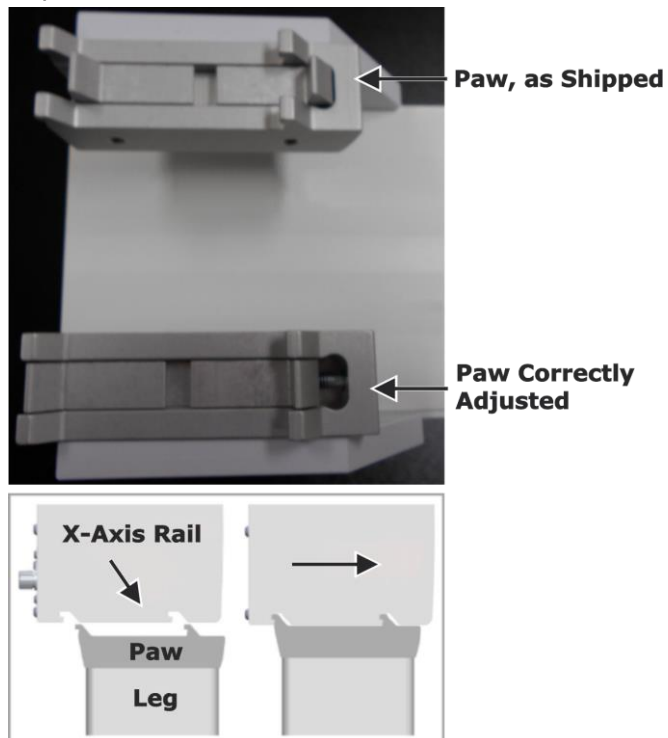


**Figure 3-7
Leg/Foot Assembly Installed**

7. Using the provided screwdriver, adjust the paws on the legs until they fit into the x-axis rail. Refer to [Figure 3-8](#), following.

NOTE →

Make sure the paws on the legs fit squarely into the x-axis rail before tightening the paw bolts.



**Figure 3-8
Attaching X-Axis Rail to Legs**

System Module Restrictions

Install the system modules (wash station, trays, etc.), ensuring the following restrictions are met:

- Do not install any module within 1 inch (2.5 cm) of either end of the rail. Refer to [Figure 3-9](#), following.

1-inch Exclusion Zones

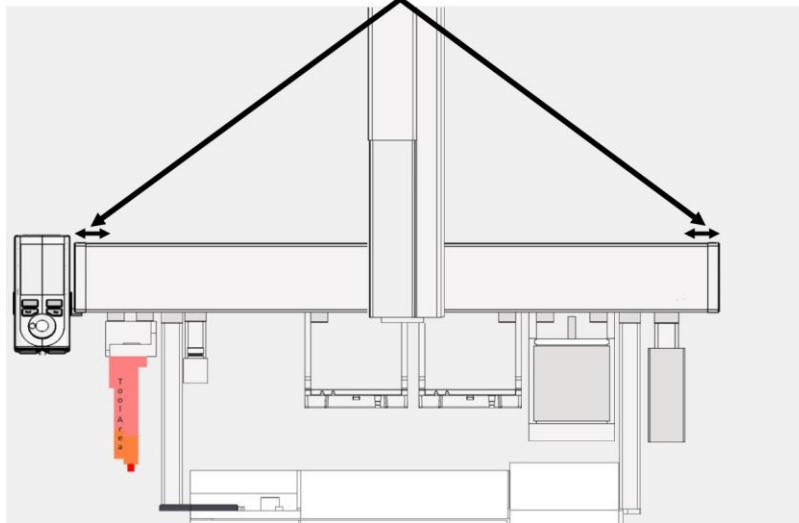


Figure 3-9
Module Exclusion Zones

- Leave enough clear space above the inlet for the injection head.
- For L-PAL3-ATX systems, leave enough space around the park station module for the injection head.
- Always make sure the modules' paws fit squarely into the x-axis rail before tightening their bolts.

Installing the Injection Head

The different L-PAL3 systems (ATX, HS and SPME, and LIQ) have different procedures for attaching the injection head. Refer to the following injection head installation procedures for their respective system configuration.

Installing the L-PAL3-LIQ PALhead

1. Locate and remove the transport lock on the injection head with a Torx® T20 screwdriver. Refer to [Figure 3-10](#), following.

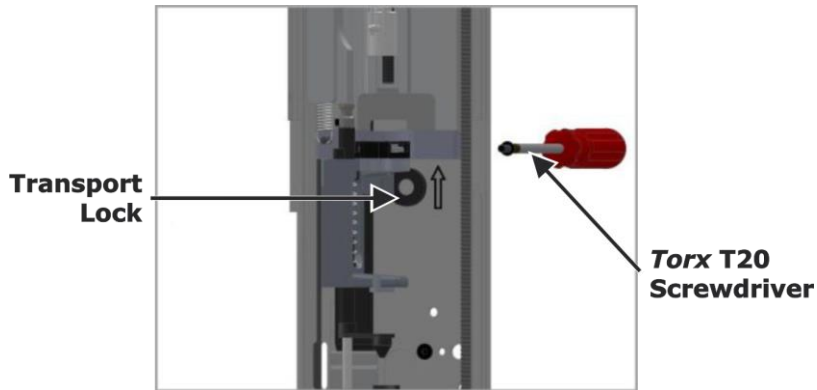


Figure 3-10
Removing Transport Lock

2. Save the transport lock in a safe location; if the head must be returned for service, the transport lock will need to be reinstalled.
3. Align the injection head with the guide pins on the y-axis arm. Refer to [Figure 3-11](#), following.

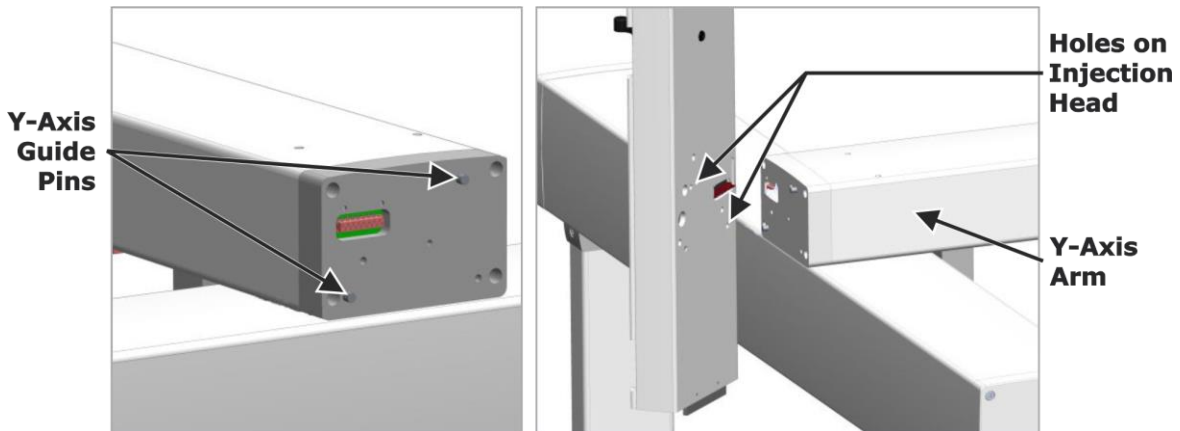


Figure 3-11
Aligning Injection Head with Y-Axis Arm

- Using a *Torx T25* wrench, securely install the screws attaching the injection head to the y-axis arm. Refer to [Figure 3-12](#), following.

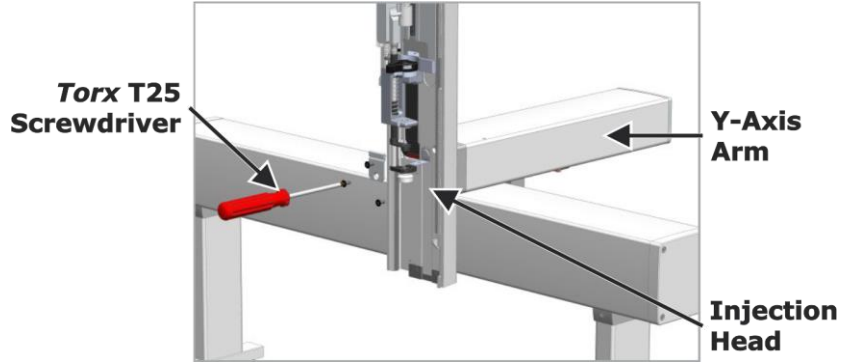


Figure 3-12
Installing Injection Head

- Slide the cover onto the injection head, and secure the cover with the provided *Torx T20* bolt. Refer to [Figure 3-13](#), following.

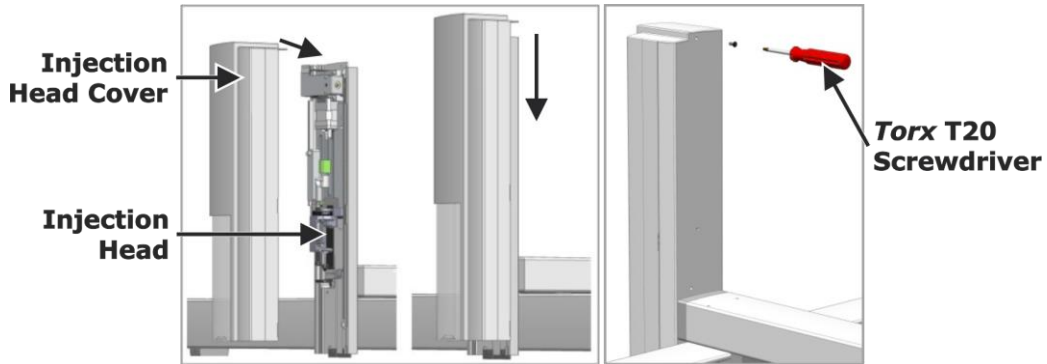


Figure 3-13
Installing Injection Head Cover

- Gently slide the y-axis arm to both ends of the x-axis rail to make sure there are no obstructions that will interfere with the system in later steps.

Installing the L-PAL3-HS and SPME PALhead

1. Locate and remove the transport lock on the injection head with a *Torx T20* screwdriver. Refer to [Figure 3-14](#), following.

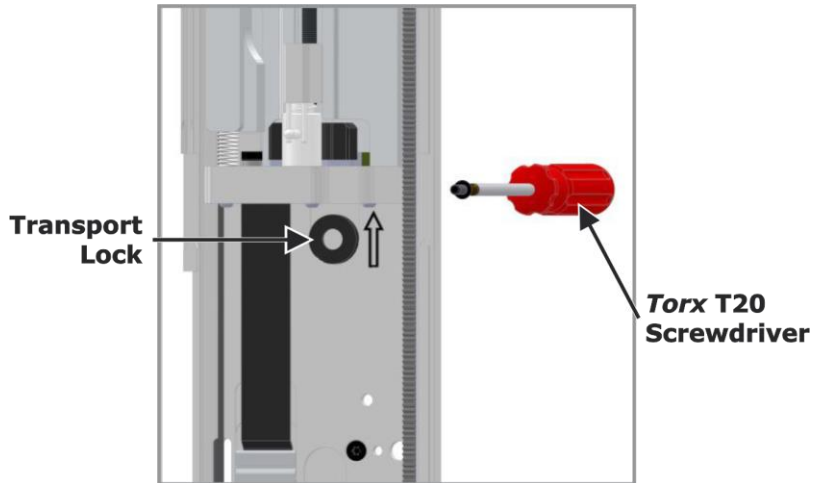


Figure 3-14
Removing Transport Lock

2. Save the transport lock in a safe location; if the head is returned for service, the transport lock will need to be reinstalled.
3. Align the injection head with the guide pins on the y-axis arm. Refer to [Figure 3-15](#), following.

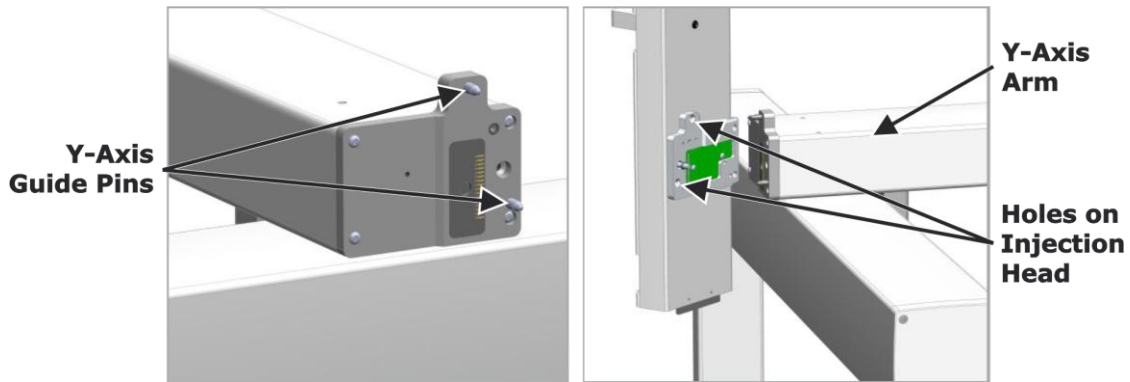


Figure 3-15
Aligning Injection Head with Y-Axis Arm

4. With a *Torx T25* screwdriver, securely attach the injection head to the y-axis arm. Refer to [Figure 3-16](#), following.

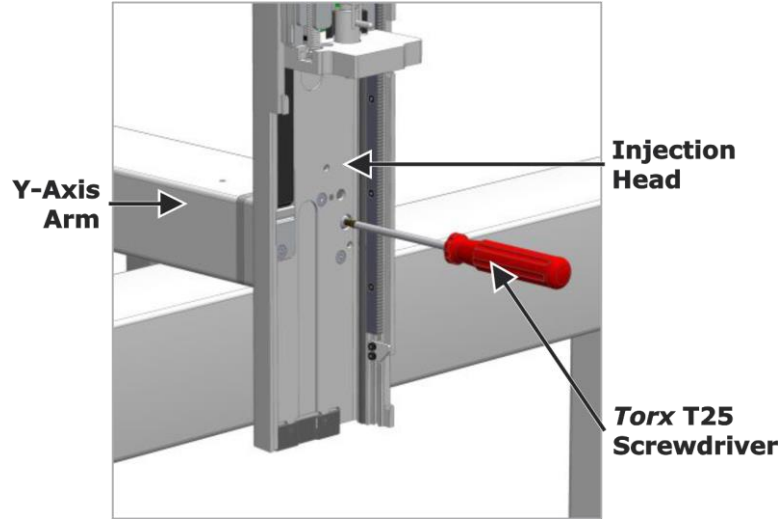


Figure 3-16
Securing Injection Head to Y-Axis Arm

5. Slide the cover onto the injection head, and secure the cover with the provided *Torx T20* bolt. Refer to [Figure 3-17](#), following.

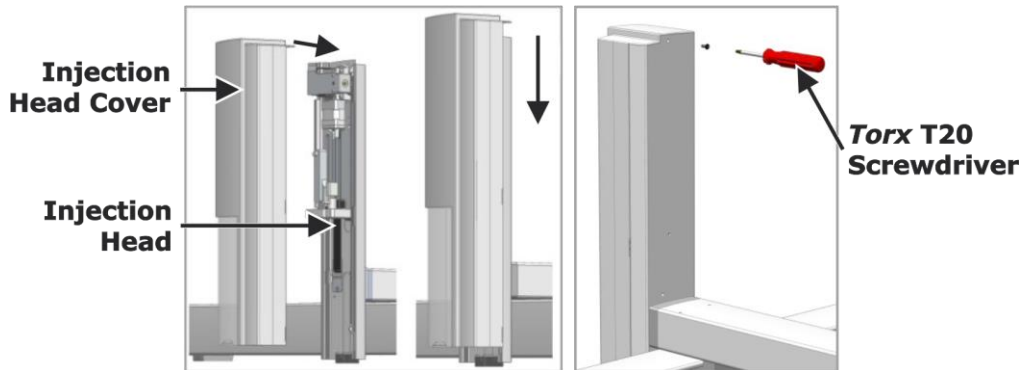


Figure 3-17
Installing Injection Head Cover

6. Gently slide the y-axis arm to both ends of the x-axis rail to make sure there are no obstructions that will interfere with the system in later steps.

Installing the L-PAL3-ATX PALhead

1. Locate and remove the transport lock and plastic spacer on the L-PAL3-ATX injection head with a *Torx T10* screwdriver. Refer to [Figure 3-18](#), following.

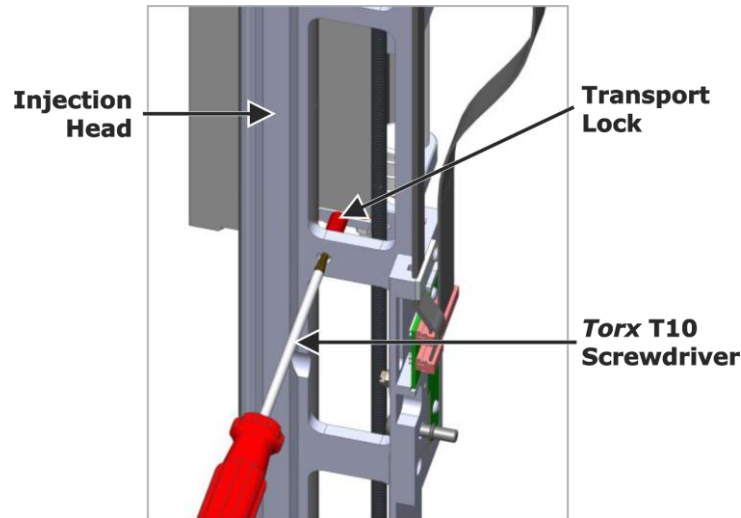


Figure 3-18
Removing Transport Lock

2. Save the transport lock in a safe location; if the head must be returned for service, the transport lock will need to be reinstalled.
3. Align the injection head with the guide pins on the y-axis arm. Refer to [Figure 3-19](#), following.

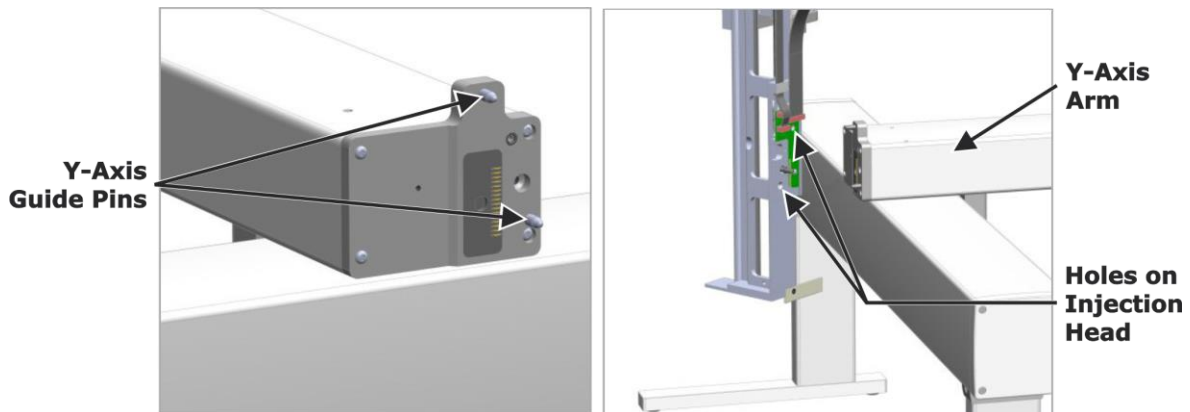


Figure 3-19
Aligning Injection Head with Y-Axis Arm

4. With a *Torx* T25 wrench, securely attach the injection head to the y-axis arm. Refer to [Figure 3-20](#), following.

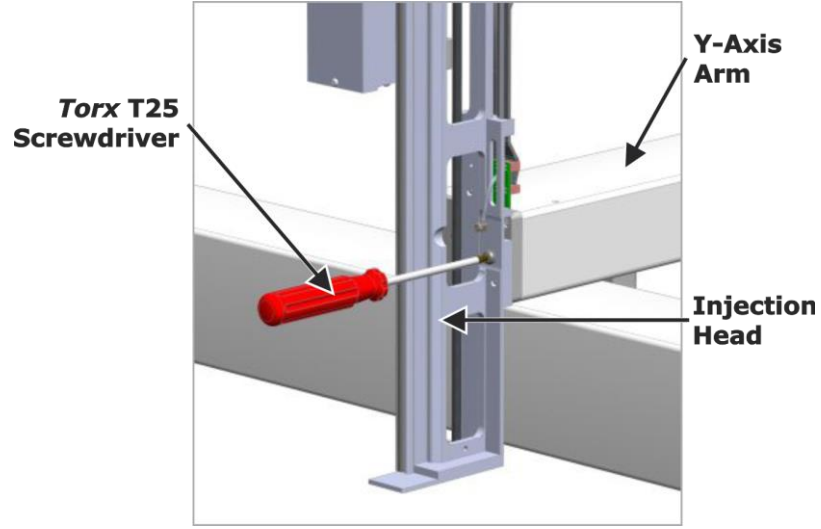


Figure 3-20
Securing Injection Head to Y-Axis Arm

5. Slide the cover straight down onto the injection head. Refer to [Figure 3-21](#), following, for the correct orientation of the injection head during installation.

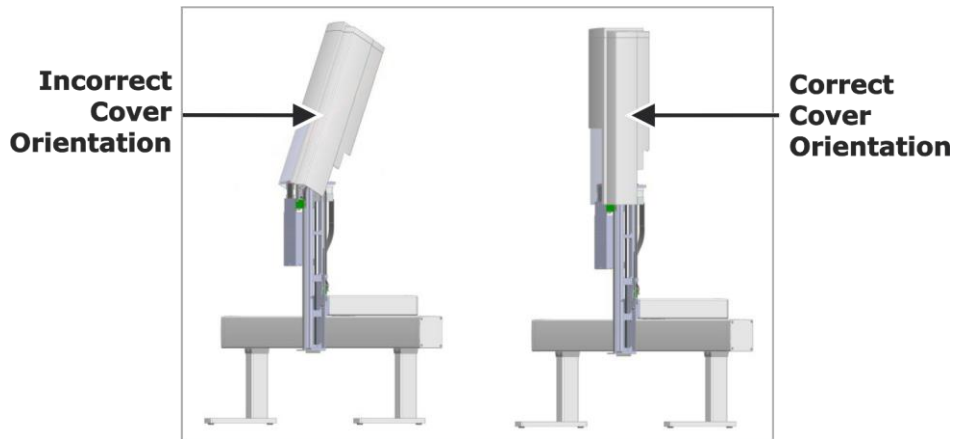


Figure 3-21
Sliding Cover Over Injection Head

- Secure the cover with the provided *Torx T20* bolt. Refer to [Figure 3-23](#), following.

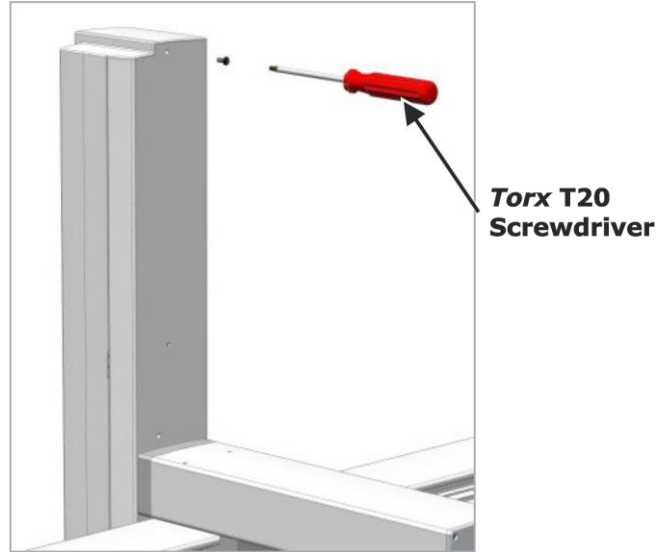


Figure 3-22
Securing Injection Head Cover

- Slide the y-axis arm to both ends of the x-axis rail to make sure there are no obstructions that will interfere with the system in later steps.

Connecting Modules

- Plug the PALbus cables into each of the modules. It is possible to daisy-chain multiple modules together. Make sure to attach one end of the chain to the PALbus connection on the x-axis rail. Refer to [Figure 3-23](#), following.

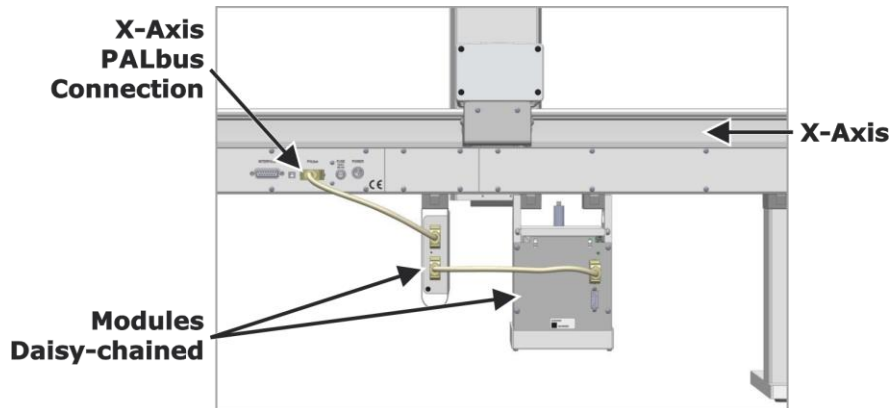


Figure 3-23
PALbus Connections

- Plug the network cable into the x-axis rail and the MS system, network switch, or computer.

Installing the Purge Gas Pressure Regulator

1. **If installing an LIQ system:** Skip to step 6, page 3-26.
2. **If installing an HS, SPME, or ATX system:** Attach the purge gas regulator to the x-axis, as displayed in [Figure 3-25](#), following.

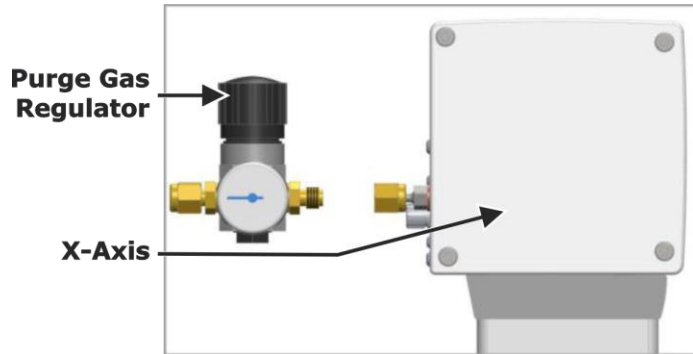


Figure 3-24
Attaching Purge Gas Regulator to X-Axis

3. Using the provided flat wrenches, tighten, but do not over-tighten, the nut connecting the purge gas pressure regulator to the x-axis. Refer to [Figure 3-25](#), following.

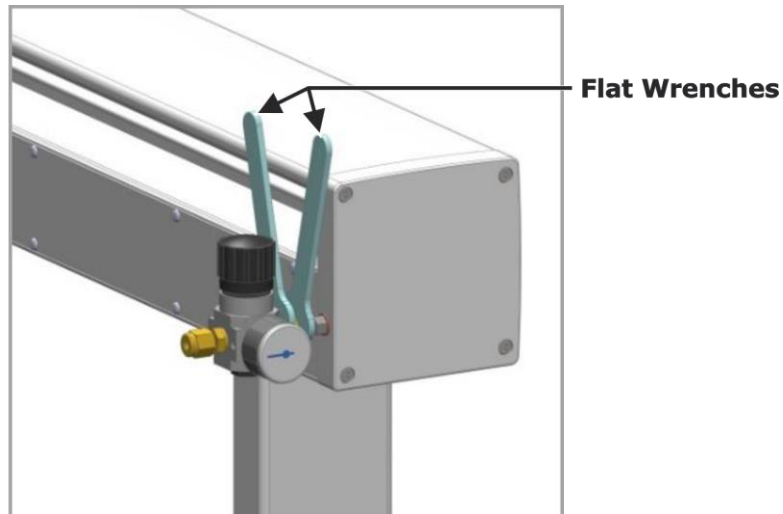


Figure 3-25
Tightening Connection to X-Axis

4. **If installing a SPME system:** Remove the plug on the back of the purge gas regulator, and then install the fitting attached to the flow line connected to the SPME fiber conditioning module, ensuring the o-ring is used. Refer to [Figure 3-26](#), following.

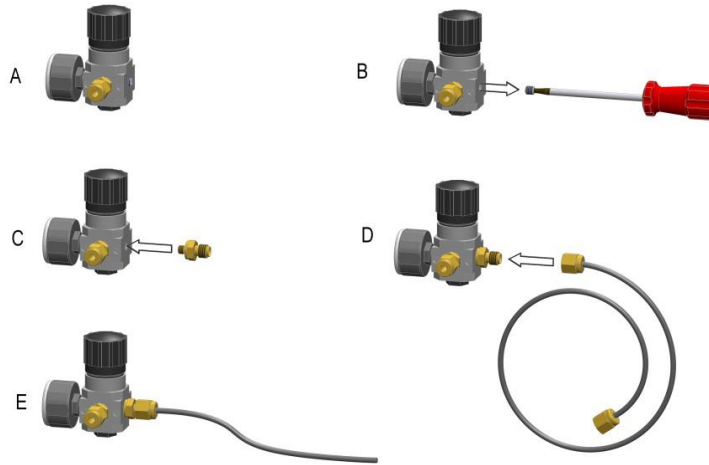


Figure 3-26
Attaching SPME Fiber Conditioner to Regulator

5. Set the pressure to 0.5 bar for both HS and SPME operation.
6. Attach the guard brackets and safety guard, as displayed in [Figure 3-27](#), following, with the guard bracket screws and washers that come with the L-PAL3.

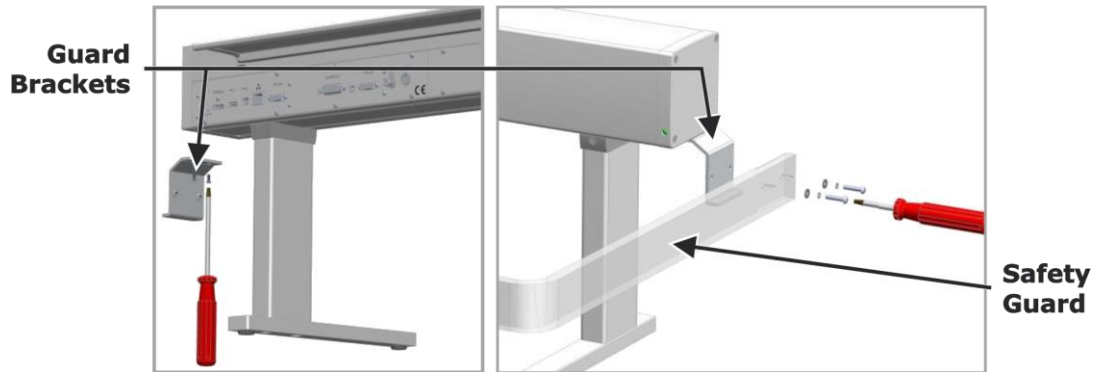


Figure 3-27
Attaching Guard Brackets and Guard

Installing the Purge Gas Line

NOTES →

- If the system has a 1205 mm rail (850 mm is standard), the external gas flush tube must be installed.
 - The gas purge line consists of an inner gas line (a thin, flexible tube) inserted through a supportive outer gas line (a thicker, rigid tube). These components will be preassembled prior to installation, with portions of the inner gas line protruding from both ends of the outer gas line.
1. Remove the six plastic clamps attached to the back of the rail system and slide them onto the tubing. Refer to [Figure 3-28](#), following.
 2. Insert the long end of the gas purge line into the quick coupling located on the lower right side of the back of the x-axis.
 3. Attach the first four clamps back to the x-axis rail, ensuring they are faced down and do not interfere with the movement of the y-axis.
 4. Bend the other end of the tubing to the y-axis and attach it with the remaining two clamps.
 5. Insert the inner tubing into the quick coupling.
 6. Ensure that none of the claps interfere with the movement of the rail. Refer to [Figure 3-28](#), following.

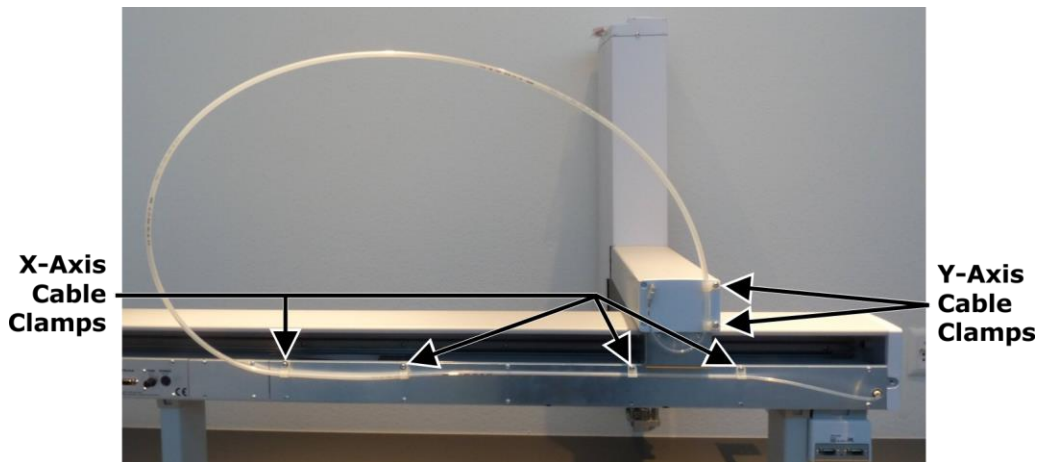


Figure 3-28
Purge Gas Line Cable Clamp Locations

Installing the PALterminal and Guard Bracket

1. Install the PALterminal bracket on the end of the Y-Axis arm, as illustrated in [Figure 3-29](#), following, and then place the PALterminal in the bracket.

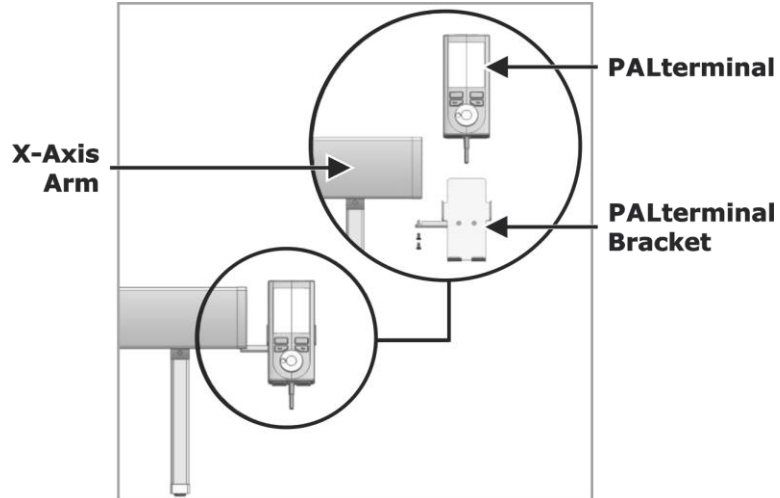


Figure 3-29
Installing PALterminal Bracket

2. Connect the PALterminal cord to the TERMINAL port on the back of the x-axis rail. Refer to [Figure 3-30](#), following.

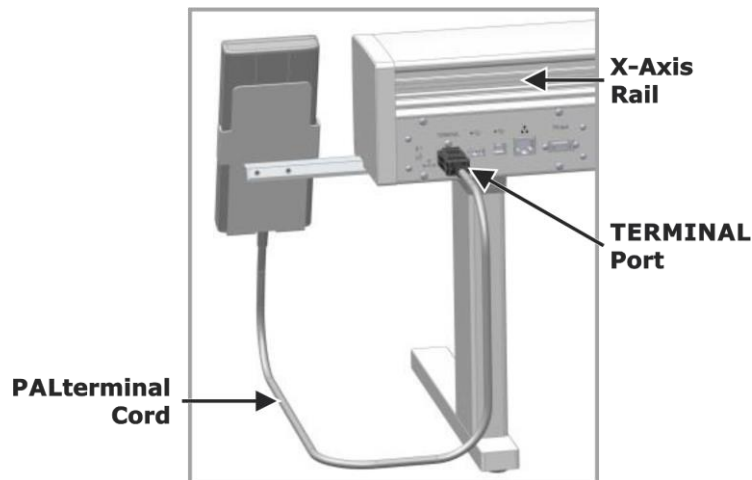


Figure 3-30
PALterminal Cord Connected

3. Plug in the L-PAL3 power supply and connect it to the POWER port on the x-axis rail. Refer to [Figure 3-31](#), following.

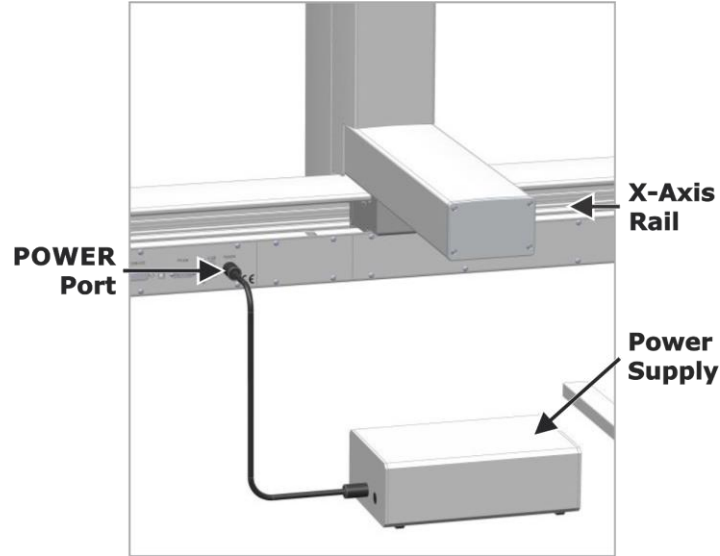


Figure 3-31
Power Supply Connected to X-Axis Rail

4. Turn On the power supply.

NOTE →

The indicator LED is yellow when the L-PAL3 is waiting, green when the L-PAL3 is ready, and flashing green when the L-PAL3 is running or one of the modules is adjusting to a new setpoint (for example, the agitator is heating up). The indicator LED will be blue during software updates and backup/restore functions.

5. Once everything is assembled and all the cables are connected, turn On the L-PAL3. The indicator LED on the right side of the PAL will be yellow while the controller boots up and does an axis check. Once this is finished, the LED will change to green. This takes about 5 minutes.

Module Position Teaching

The following section explains how to teach the positions and configure the settings of the L-PAL3 modules.

NOTES →

- The following section covers the teaching and settings for most of the available L-PAL3 modules, but not all of them.
- The L-PAL3 PALterminal may display screens not shown in these instructions.
- When a button is selected on the PALterminal, there is often a delay before it takes effect. During this time, the display will not change, and it may be tempting to select the button again. If the button is selected again during this delay, you are effectively making the next selection as well. This often leads to falling out of the sequence. At times, the update to the display is minimal, so you must pay attention to the display before you select the button. Select the button once, and wait at least 10 seconds before selecting it again.
- The following installation procedures (the remainder of this chapter) must be done in one day. They cannot be postponed overnight, or the system will go into standby and clear all of the settings entered into the install sequence.

Extended User Level Access

1. On the L-PAL3 control terminal, open the Extended User Level control by pressing both “-” buttons at the same time (located above the Back and Stop buttons). Refer to [Figure 3-32](#), following.



Figure 3-32
Extended User Level Access on PALterminal

2. Select Extended User Level from the menu. A key icon appears on the top bar indicating Extended User Level. Refer to [Figure 3-33](#), following.

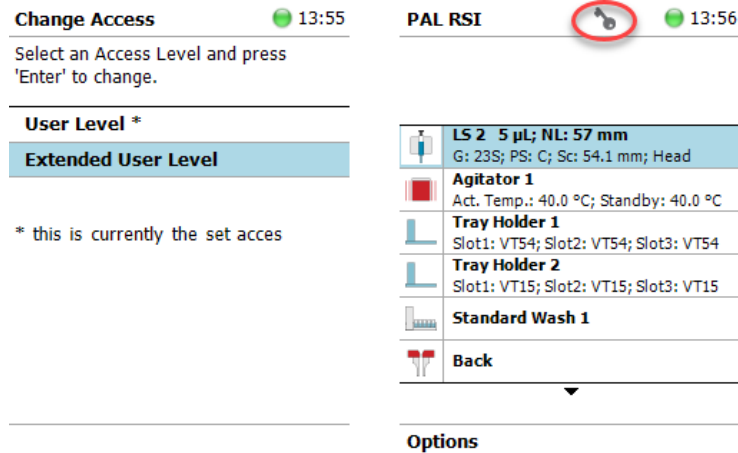


Figure 3-33
Extended User Level Access

Installation Settings

1. On the PALterminal, select Options, then Service, then Installation, then Set Regional Settings.
2. Choose the appropriate setting for your region, and select OK.
3. Select Set Date and Time; set the date and time, and then select OK.
4. Select Set PALrobot Name.

NOTE

The first character of the name cannot be a number. Input the name in the format of "SNxxxxxx," where "xxxxxx" is the system's Serial Number.

5. Enter the L-PAL3 serial number (printed on the sticker on the end of the x-axis rail), and select OK. Refer to [Figure 3-34](#), following, for an example of the L-PAL3 Identification Sicker.

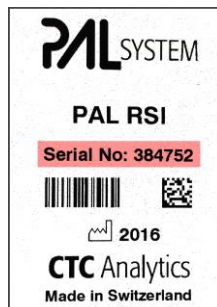


Figure 3-34
L-PAL3 Identification Sticker

6. Select Setup Network. Make sure the IP address is set to 10.10.10.6. Do not adjust the other available settings. This must be done before CT can communicate to the rail.

Calibrating PALdrives

1. On the PALterminal, select Calibrate PALdrives, and then select Calibrate.
2. While the system is calibrating install syringes on all of the tools, ensure the notch cut on the top of the syringe matches the one cut in the tool holder. The tolerances while installing the syringes are tight, and some resistance is normal.
3. When the system is done with its calibration, select OK to move the head back to the home position.

Setting the PALtool Exchange Position



CAUTION

If installing the L-PAL3-ATX, this option will be called Teach PALtool Station on the PALcontrol Terminal. Note that when connecting a tool to the ATX system for the first time, the rail must connect it. You must first line up the pins on the tool with the holes on the head but do not engage the tool; allow the rail to complete that step.



CAUTION

There is a magnet on the bottom of these tools that may come in contact with the tool exchange; ensure it does not interfere with the tool exchange before proceeding. The SPME and HS syringe tools are longer than the other tools and should be used for determining the exchange position, if they are included.



CAUTION

The suggested exchange position is in front of the wash station. Make sure the PALhead is far enough forward, so that the tool holder can drop without hitting the wash station. Refer to [Figure 3-35](#), following.

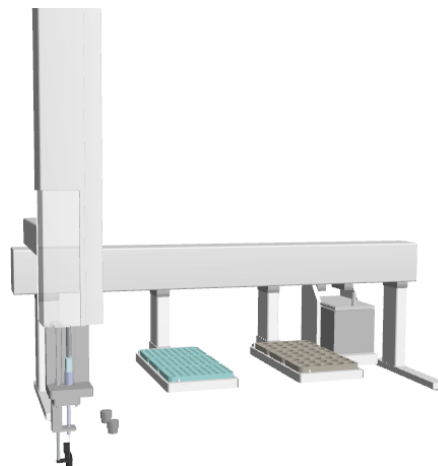


Figure 3-35
Suggested Exchange Position

1. Place the syringe holder in the PALhead.
2. **If installing an ATX system:** On the PALterminal, select Teach PALtool Station; follow the directions on the PALterminal for this setup. This position is where the PALhead will go to exchange tools (LIQ, HS, and SPME) and syringes.
3. **If installing a non-ATX system:** On the PALterminal, select Teach Exchange Position. This position is where the PALhead will go to exchange tools (LIQ, HS, and SPME) and syringes.
4. Gently move the injection PALhead manually (by hand) to the desired tool exchange position.
5. Select Save on the PALterminal, and then select OK.

Changing the PALtool

1. On the PALterminal, select Change Tool; the PALhead will move to the exchange location.



CAUTION

A syringe must be present in the PALtool before proceeding. Syringes are provided with the system; any L-PAL3-compliant syringe that has a broken needle can be used for teaching the exchange position as well.

2. Slide the tool holder lock to the right. Refer to [Figure 3-36](#), following.

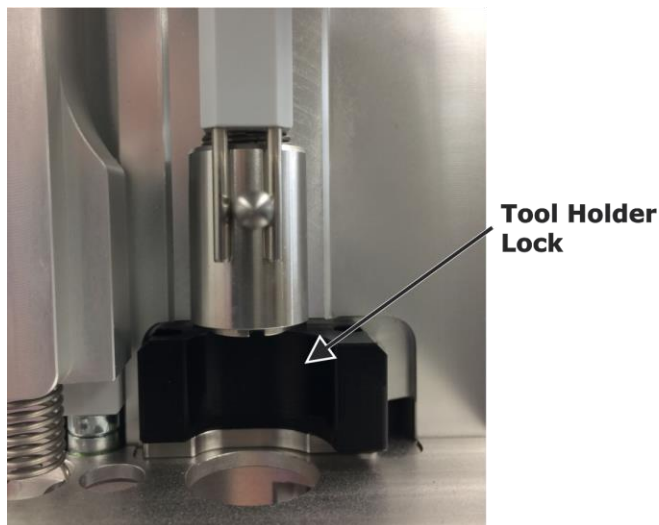


Figure 3-36
Tool Holder Lock

3. Select Next on the PALterminal; the injection PALhead will connect to the syringe plunger.



The syringe type is printed on the syringe barrel and box. Refer to [Figure 3-37](#), following.

4. Select the syringe type.



Figure 3-37
Syringe Type Information



CAUTION

Ensure that the needle guide type matches what is displayed on the PALtool.

5. Select the needle guide type.
6. Select Set Reference Point.



The reference point for the L-PAL3-ATX will be located on the tool holder.

7. Select Next.
8. Select OK to move the PALhead to the home location.



A teaching location can be on one of the L-PAL3 trays.

Teaching other Tools



CAUTION

For L-PAL3-ATX systems, all tools must be placed in the tool holder prior to the following steps being performed. If all tools are not present, the rail will not know what tools are to be calibrated. The L-PAL3-ATX system automatically changes tools during the following steps.

1. On the PALterminal, select PALtools.
2. Manually (by hand) move the PALhead gently to the reference point.
3. Select Save, and then select Next.
4. If other injection tools are included, scroll up on the PALterminal, and select Next Tool.
5. Manually detach the PALhead from the plunger by squeezing the release lever and the block above it. Refer to [Figure 3-38](#), following.

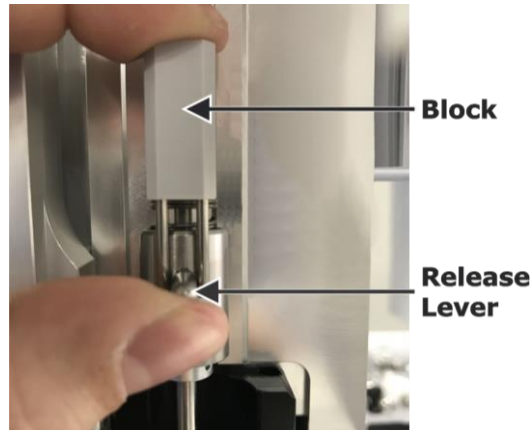


Figure 3-38
Unlocking Plunger

6. Once the plunger is released, slide it down to the top of the syringe to avoid pulling the plunger out of the syringe. Refer to [Figure 3-39](#), following.

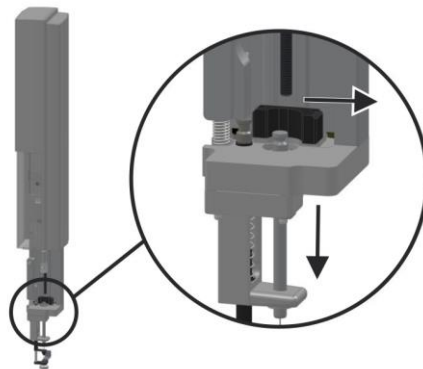


Figure 3-39
Removing Tool from PALhead



CAUTION

There must be a syringe in the new tool.

7. Select Next.
8. Manually (by hand) move the tool gently to the reference point.
9. Select Save, and then select Next.
10. Select the syringe type and select the needle guide type.
11. Repeat steps 1 through 10 for any remaining tools.
12. If all tools are taught, select Next Tool, and then Load Liquid Tool. This is done to avoid breaking the headspace or SPME needles in the remaining steps.
13. Select Finish.

Setting up PALmodules

1. On the PALterminal, select Setup Pal Modules.
2. Verify that the setup is correct for the agitator.
3. Verify that the vial type and size match what is being used.
4. Select Next.
5. Select Next again to leave Needle Penetration Depth at default.
6. Select Next.
7. Select Next again to leave the Minimum Needle Penetration Depth at default.
8. Select Next.

Teaching PALmodules

On the PALterminal, select Teach PALmodules, and then complete the following steps to teach each module.



CAUTION

It is very important to complete the following steps exactly, ensuring needles do not break in the process.

Teaching the Agitator (If Included)

1. Open the lid on the rear of the agitator.
2. Once the lid is open, a small hole will be exposed on the side of the lid. Insert a tool small enough to fit inside of the hole, such as a screwdriver, to hold the lid open. Refer to [Figure 3-40](#), following.

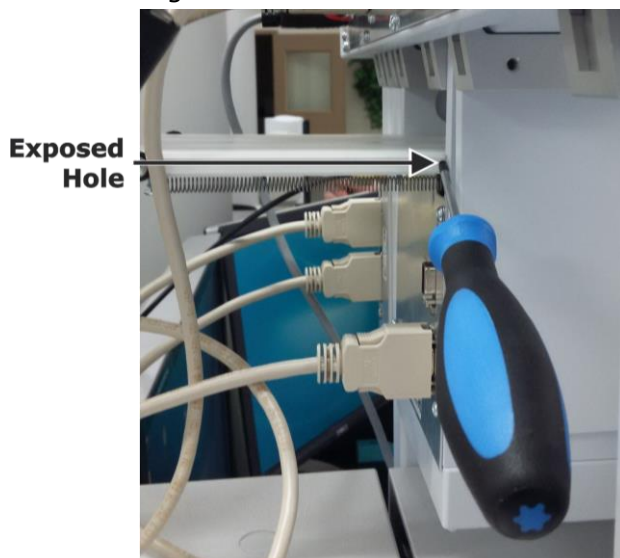


Figure 3-40
Locking Agitator Lid Open

3. Load the teaching tool into position 1 of the agitator. Refer to [Figure 3-41](#), following. Refer to the L-PAL3 Automated Sample Injector Instruction Manual for more information on the agitator.

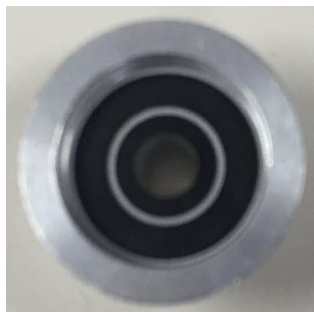


Figure 3-41
Agitator Teaching Tool

4. Manually (by hand) move the PALhead gently to the teaching tool.
5. On the PALterminal, select Save.
6. Select Next if no adjustment is needed, or use the controls on the PALterminal to make the final adjustments.
7. Select Next.
8. Remove the teaching tool.

Teaching the Back Inlet

1. Manually (by hand) move the PALhead gently to the back inlet. If there is not a back inlet on the GC, move the PALhead to the approximate location of where it would be.
2. On the PALterminal, select Save and, if necessary, use the PALterminal to make any fine adjustments.
3. Select Next.

Teaching the Front Inlet

1. Manually (by hand) move the PALhead gently to the front inlet.
2. On the PALterminal, select Save and, if necessary, use the PALterminal to make any fine adjustments.
3. Select Next.

Teaching Tray Holder 1

1. Manually (by hand) move the PALhead gently to the teaching reference point on Tray 1.
2. On the PALterminal, select Save and, if necessary, use the PALterminal to make any fine adjustments.
3. Select Next.
4. Label the tray if desired.

Teaching Tray Holder 2 (If Included)

1. Manually (by hand) move the PALhead to the teaching reference point on Tray 2.
2. On the PALterminal, select Save and, if necessary use the PALterminal to make the fine adjustments.
3. Select Next.
4. Label the tray if desired.

Teaching the SPME Conditioning Module

1. Manually (by hand) move the PALhead gently to the back conditioning port.
2. On the PALterminal, select Save and, if necessary, use the PALterminal to make the fine adjustments.
3. Select Next.

Teaching the Wash Station

1. Move the PALhead to the wash vial indicated on the PALterminal.
2. On the PALterminal, select Save and, if necessary, use the PALterminal to make the fine adjustments.
3. Select Next.
4. Select OK to move the PALhead back to the home position.

Checking PALmodule Teaching

1. On the PALterminal, select Check Teaching PALmodules.
2. If still installed, remove the teaching tool from the agitator.
3. Select Check, and then step through each of the check procedures.
4. If a module must be retight, go back to the menu, and choose Teach PALmodules.
5. Select OK to move the PALhead back to the home position.

Configuration Backup

1. On the PALterminal, change the name to the system Serial Number (located on the end of the x-axis rail). Input the name in the format of "SNxxxxxx," where "xxxxxx" is the system's Serial Number.
2. Select Start.
3. Allow the save process to finish.
4. Select Exit.
5. Select OK.

Tray Holder 1 Teaching Check

1. On the PALterminal, scroll to Tray Holder 1.
2. Select Slot 1/Rack 1.
3. Make sure the parameters are correct.
4. Select Options.
5. Select Check Teaching.



CAUTION

If using a mag 10/20 mL needle guide, do not use the included 2 mL magnetic vials as it will get caught on the 10/20 mL head and jam.

6. Load the capped vials into the prescribed positions (1, 46, and 54, if the tray type is VT54).
7. Select Check, and verify that the PALhead moves to the appropriate locations.

8. If the PALhead does not move to an acceptable location, reteach the tray location from the main menu.
 - A. Select Teach PALmodules/Tray Holder 1.
 - B. Go back and select Select Slot 2/Rack 2, and repeat the steps in [Teaching Tray Holder 1](#), page 3–38.
 - C. Repeat the previous step for Slot 3/Rack 3.

Tray Holder 2 (If Included) Teaching Check

1. On the PALterminal, scroll to Tray Holder 2 (if included).
2. Select Slot 1/Rack 4.
3. Ensure that the parameters are correct.
4. Select Options.
5. Select Check Teaching.



CAUTION

If using a mag 10/20 mL needle guide, do not use the included 2 mL magnetic vials as it will get caught on the 10/20 mL head and jam.

6. Load the capped vials into the prescribed positions (1, 46, and 54, if the tray type is VT54).
7. Select Check, and verify that the PALhead moves to the appropriate locations.
8. If the PALhead does not move to an acceptable location, reteach the tray location from the main menu.
 - A. Select Teach PALmodules/Tray Holder 2.
 - B. Go back and select Slot 2/Rack 5, and repeat the steps in [Teaching Tray Holder 2 \(If Included\)](#), page 3–38.
 - C. Repeat the previous step for Slot 3/Rack 6.

Backing up Teaching Data

1. On the PALterminal, select Maintenance.
2. Select Copy Backup.
3. Plug the included L-PAL3 USB into the back of the x-axis rail.
4. Select Start, and wait for the copy process to finish.
5. When prompted, remove the USB and select OK.
6. Select Exit.

User Level

1. On the PALterminal, press both “-” buttons at the same time (located above the Back and Stop buttons). Refer to [Figure 3-32](#), page 3–30.
2. Select User Level.

Configuring *ChromaTOF* for the L-PAL3



CAUTION

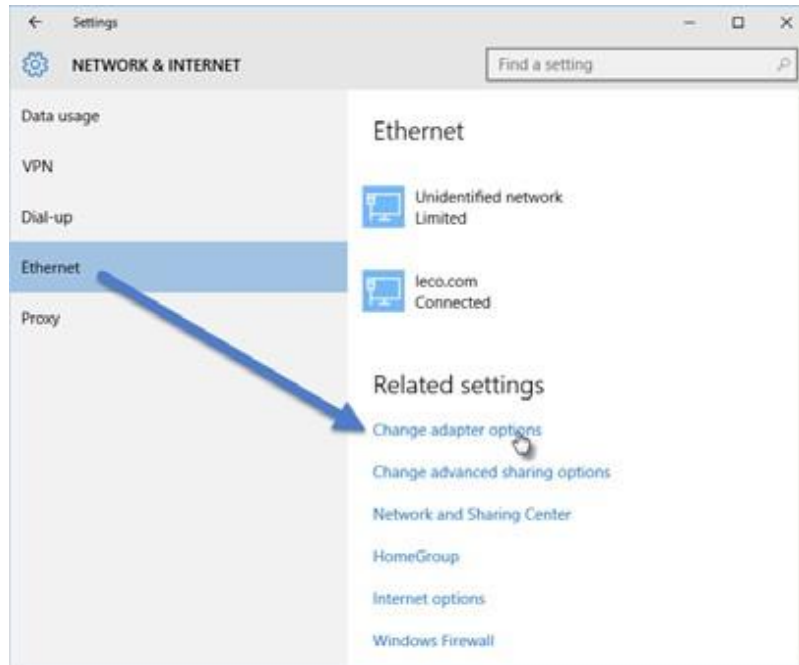
Vial must be selected in Vial column of the Acquisition Queue.

1. Launch *ChromaTOF* for BT.
2. Select the System Tab.
3. Select Instrument.
4. Select Autosampler.
5. Set the Model selection to LECO L-PAL3.
6. Select the radio button on the left side of the Network.
7. Set the Host Name to "10.10.10.6" and the Host Port to "0."

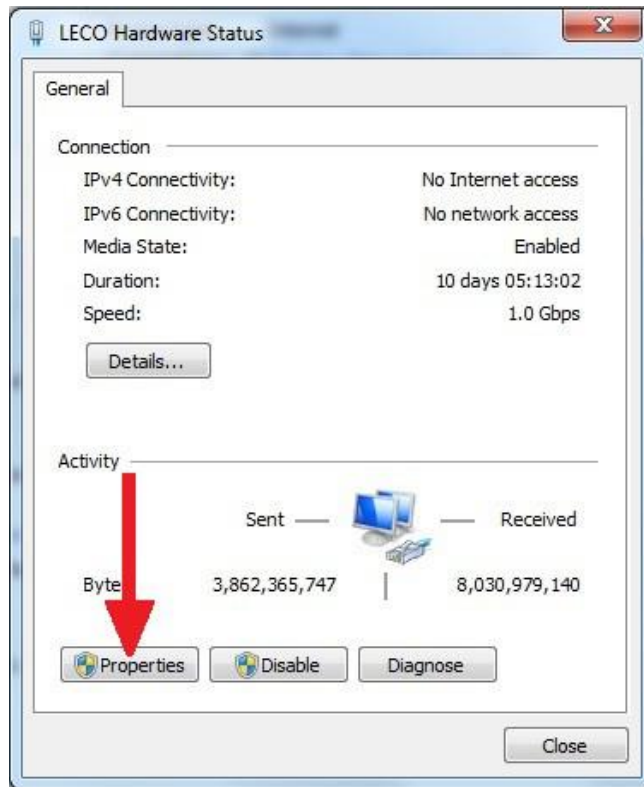
The screenshot shows the 'Instrument Configuration' dialog box with the 'Chromatograph' tab selected. The 'Autosampler' sub-tab is also active. The 'Communications' section has 'Encoding' set to 'ASCII' and 'Device' set to 'Network'. The 'Host Name' is '10.10.10.6' and the 'Host Port' is '0'. An 'Important Note' states: 'Changing communication settings will require a software restart to take effect'. The 'Defaults' section shows the 'Model' set to 'LECO L-PAL3'. At the bottom are 'OK', 'Cancel', and 'Help' buttons.

Section	Field/Option	Value
Communications	Encoding	Unicode <input type="radio"/> ASCII <input checked="" type="radio"/> Binary <input type="radio"/>
	Device	Network <input checked="" type="radio"/> Serial Port <input type="radio"/>
	Host Name	10.10.10.6
	Host Port	0
Important Note	Changing communication settings will require a software restart to take effect	
Defaults	Model	LECO L-PAL3

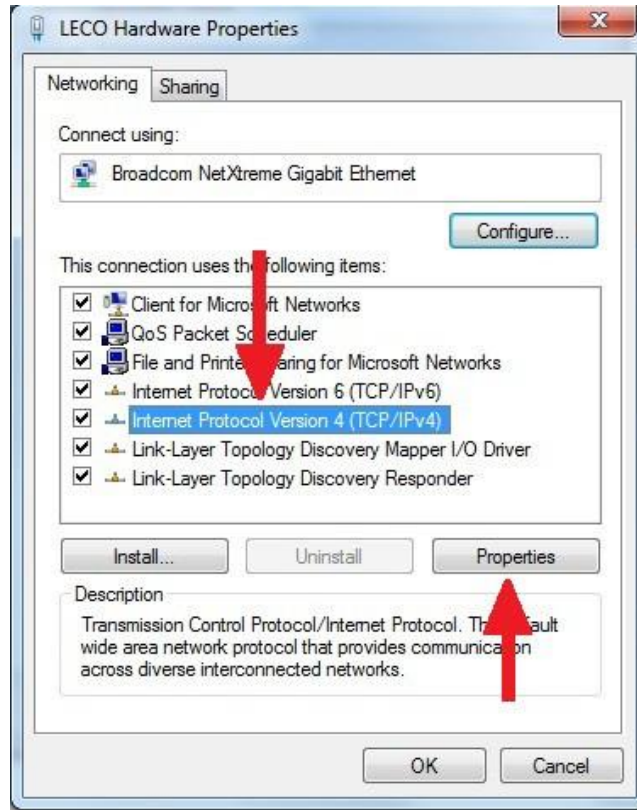
8. Select Change adapter options.



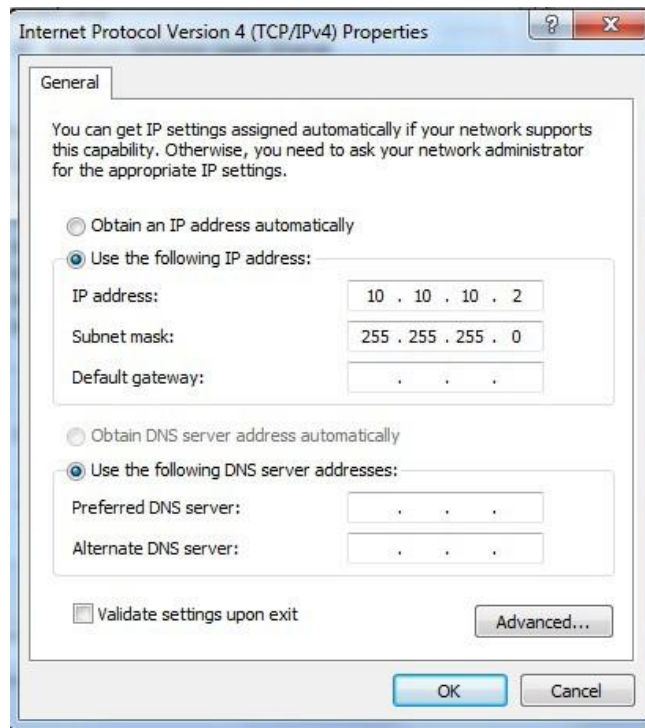
9. Right-click on LECO Hardware and select Properties. This launches the LECO Hardware Status dialogue box.



10. On the LECO Hardware Properties window, select Internet Protocol Version 4 (TCP/IPv4).



11. Select Properties. The TCP/IP properties screen appears.



12. Select Use the Following IP Address.
13. Enter the IP address as 10.10.10.2.
14. Enter the Subnet Mask as 255.255.255.0.
15. Leave the Default Gateway, Preferred DNS Server, and Alternate DNS Server blank.
16. Select OK.
17. Select OK again to save the settings.

Modulation Systems

IMPORTANT → Perform a leak check on all connections after installing a modulation system. Refer to [Performing a Leak Check](#), page 4-5.

Installing CF or LN₂ Modulation Systems

Complete the steps in this section to install a LN₂ or CF modulation system.

- NOTES** →
- This section covers customer site installation of LECO factory-installed modulation systems. For customer site upgrade installation procedures, refer to the installation bulletin provided with the instrument.
 - The control box bracket and the dewar bracket anchor displayed in [Figure 3-42](#) (7890) and [Figure 3-43](#) (8890), following, are installed to the instrument at LECO before the customer receives the instrument.



Figure 3-42
Modulation System Installation Locations on 7890 GC



Figure 3-43
Modulation System Installation Locations on 8890 GC

1. Using a Phillips screwdriver, loosen, but do not remove, the two mounting screws and washers on each side of the control box. Refer to [Figure 3-44](#) (7890) and [Figure 3-45](#) (8890), following.
2. Slide the control box onto the GC mounting bracket until the mounting screws slide fully into the slots on the bracket, ensuring the washers and screw heads are positioned on the exterior portion of the bracket. Refer to [Figure 3-44](#) (7890) and [Figure 3-45](#) (8890), following.

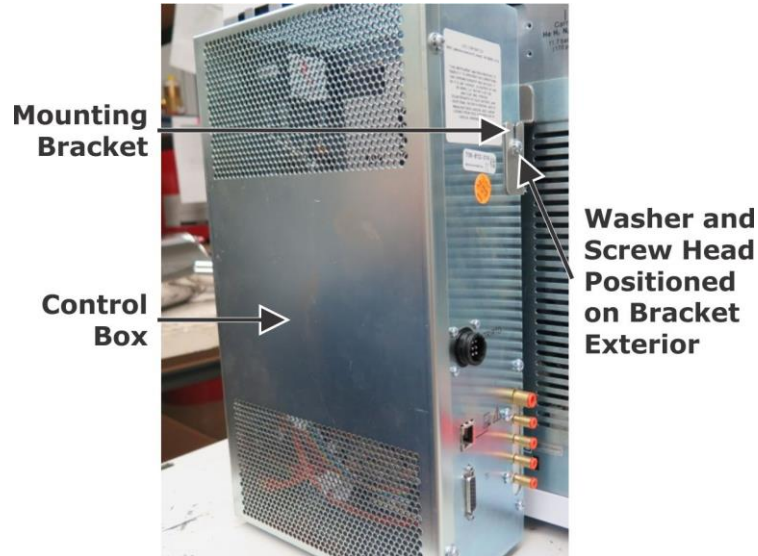


Figure 3-44
Control Box Installed to 7890 GC Mounting Bracket

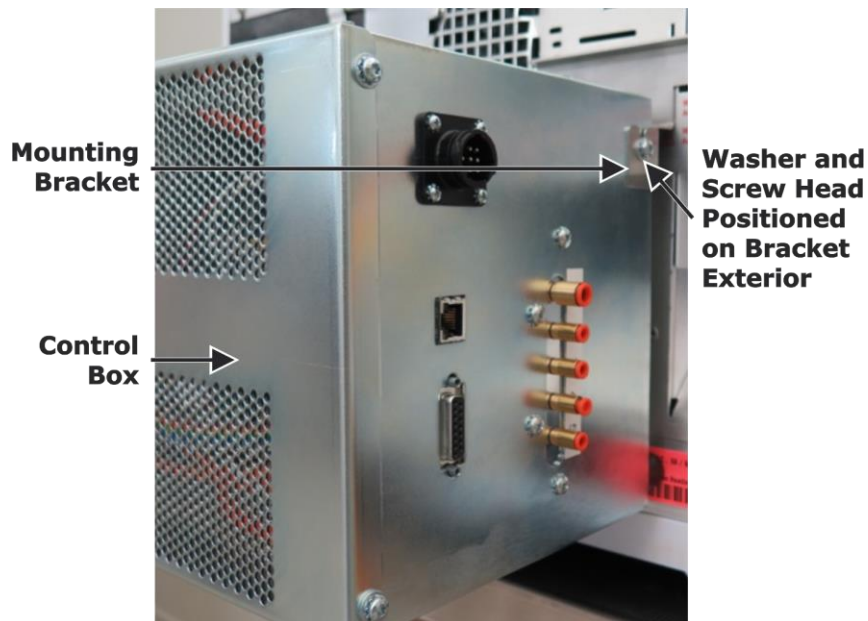


Figure 3-45
Control Box Installed to 8890 GC Mounting Bracket

3. Tighten the mounting screws with a Phillips screwdriver.

4. Route the LECO factory-installed control cable to the control box at the HTR/RTD connection, avoiding the GC oven exhaust path, and then connect the control cable to the control box. Refer to [Figure 3-46](#) (7890) and [Figure 3-47](#) (8890), following.



Figure 3-46
Control Cable Installed to 7890 Control Box



Figure 3-47
Control Cable Installed to 8890 Control Box

5. Route the LECO factory-installed tubing harness along the same path as the control cable to the control box, and then connect the tubing to the control box. Refer to [Figure 3-48](#) (7890), previous, and [Figure 3-49](#) (8890), following.

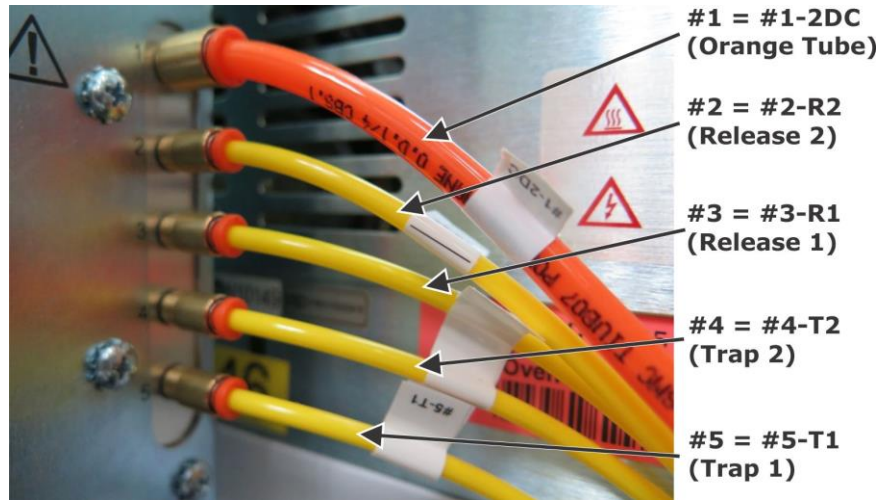


Figure 3-48
Installing Tubing Harness to 7890 Control Box

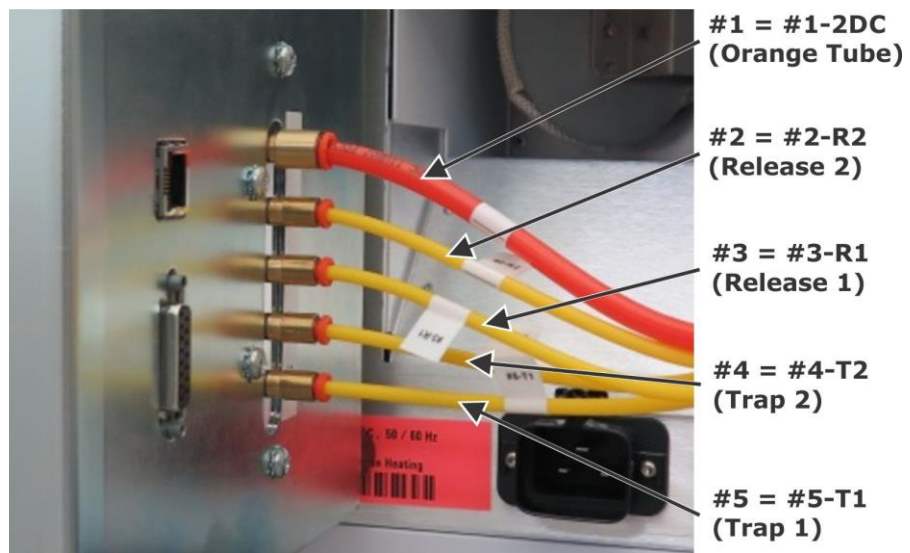
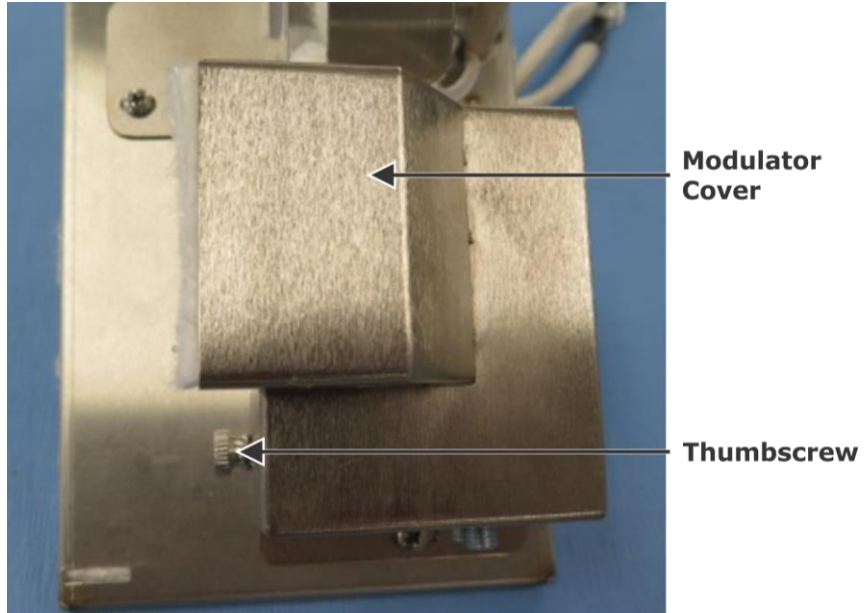


Figure 3-49
Installing Tubing Harness to 8890 Control Box

6. Loosen the thumbscrew on the left side of the modulator, and remove the modulator cover. Refer to [Figure 3-50](#), following.

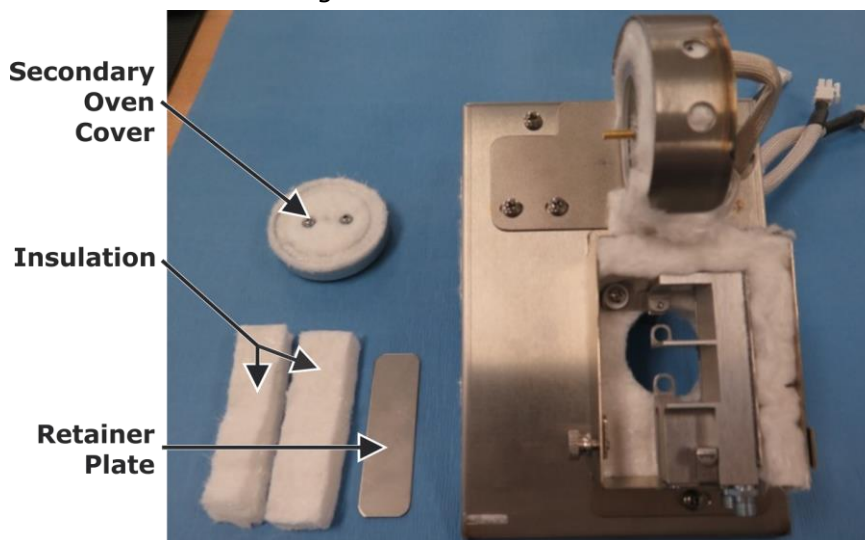
NOTE →

The modulator/oven assembly is removed from the instrument in [Figure 3-50](#) and [Figure 3-51](#), following, to better illustrate the installation procedure; however, the user will not need to entirely remove the assembly to complete this installation.



**Figure 3-50
Modulator Cover**

7. Unscrew and remove the secondary oven cover. Refer to [Figure 3-51](#), following.
8. Remove the two pieces of insulation and the insulation retainer plate from the left side of the modulator. Refer to [Figure 3-51](#), following.



**Figure 3-51
Components Removed from Assembly**

9. Loosen, but do not remove, the mounting screws displayed in [Figure 3-52](#), following, with a Phillips screwdriver.



Figure 3-52
Mounting Screws for Modulator and Oven

10. Loosen, but do not remove, the lower modulator mounting screw displayed in [Figure 3-53](#), following, with a Phillips screwdriver. The modulator and oven assembly are now slightly adjustable to accommodate alignment later in the procedure.

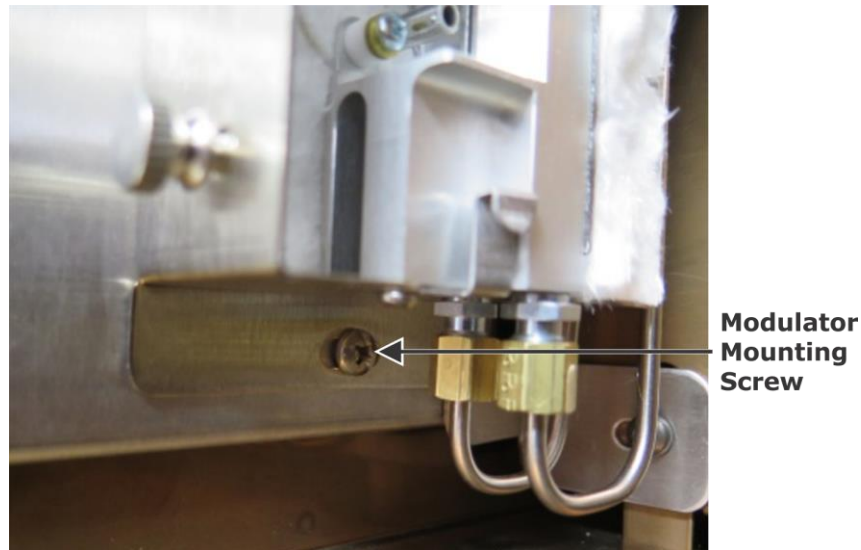


Figure 3-53
Mounting Screw for Modulator

11. If installing a CF system, skip to [For CF Modulation Only](#), page 3-60. If installing an LN₂ system, proceed to [For LN₂ Modulation Only](#), page 3-51.

For LN₂ Modulation Only

1. Install the dewar bracket assembly included with the instrument by completing the following steps for the applicable GC.
 - A. Place the dewar bracket against the back of the GC and the GC side panel so the mounting screw holes align. Refer to [Figure 3-54](#) (7890), following, and [Figure 3-55](#) (8890), page 3-52.
 - B. Install the screws to the dewar bracket by completing the following steps for the applicable GC.

For the Agilent 7890 GC Only:

NOTE → Continue to press the bracket against the GC as screws are installed in the following steps, maintaining hole alignment. Refer to [Figure 3-54](#), following.



Figure 3-54
Dewar Bracket Installed to 7890 GC

- 1) Install one screw (and lock washer if supplied with the GC) in the upper mounting screw hole with a *Torx* T20 screwdriver.
- 2) Install a screw, lock washer, and flat washer included with the instrument into the lower bracket screw hole with a T20 *Torx* T20 screwdriver.
- 3) Skip to step 2, page 3-52.

For the Agilent 8890 GC Only:

NOTE →

Continue to press the bracket against the GC as screws are installed in the following steps, maintaining hole alignment. Refer to [Figure 3-55](#), following.



Figure 3-55
Dewar Bracket Installed to 8890 GC

- 1) Install one flat washer (PN 193-010) and one nut (PN-194-172) onto the upper mounting screw with a $1\frac{1}{32}$ -inch open-end wrench.
 - 2) Install one flat washer (PN 193-010) and one nut (PN-194-172) onto the lower bracket screw with a $1\frac{1}{32}$ -inch open-end wrench.
2. Cut the shipping ties and release the hose clamp to the fully open position. Refer to [Figure 3-56](#), following.

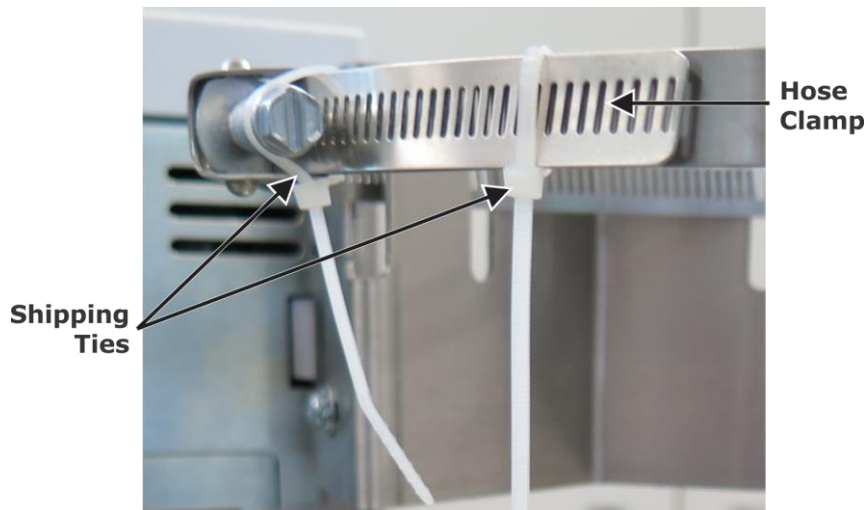


Figure 3-56
Shipping Ties on Hose Clamp

3. Release and lay open the cinch straps, as displayed in [Figure 3-57](#), following.



Figure 3-57s
Inserting Strap through Bracket Extension Arm



COMPRESSED GAS/PROTECTIVE EYEWEAR/PROTECTIVE GLOVES

Liquid nitrogen is a refrigerated gas and may cause cryogenic burns or frostbite. Eye protection and gloves that insulate against cold temperatures must be worn when handling liquid nitrogen.



Refer to the Safety Data Sheet (SDS) for additional information.



4. Remove all plug caps from the inlet and outlet tubes on the end of the dewar. Refer to [Figure 3-58](#), following.

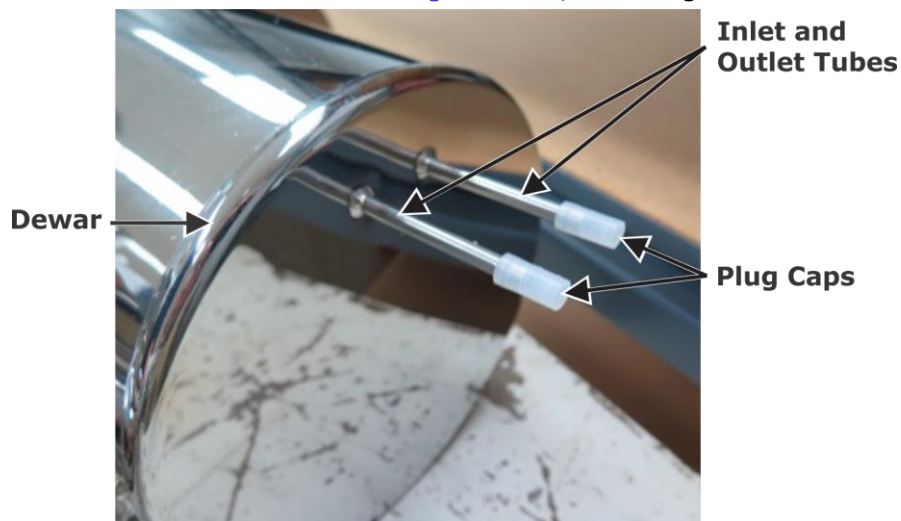


Figure 3-58
Dewar Inlet and Outlet Plug Caps

5. Remove all screws, washers, and ceramic insulators from the modulator mounting position on the end of the dewar cold jet arm. Retain these parts for later installation. Refer to [Figure 3-59](#), following.

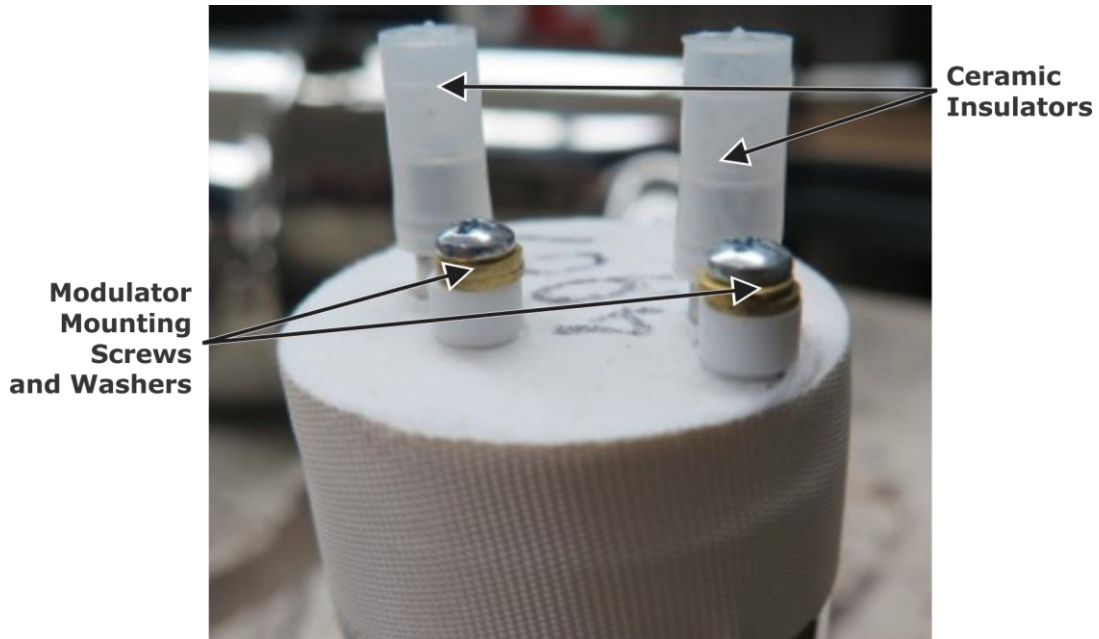


Figure 3-59
Modulator Mounting Position

6. Gently use fingers to spread the insulation inside of the GC side panel cold jet insertion hole, allowing the cold jet arm to be inserted without interference. Refer to [Figure 3-60](#), following.



Figure 3-60
Insulation Spread for Cold Jet Insertion

7. Angle the dewar so that it aligns with the extension arm of the dewar bracket, and then carefully insert the cold jet arm of the dewar through the GC side panel and insulation to the modulator block. Refer to [Figure 3-61](#), following.



Figure 3-61
Inserting Cold Jet Arm into GC

8. Set the dewar onto the extension arm of the bracket and securely tighten the cinch straps around the dewar, ensuring the buckles are positioned on top of the dewar. Refer to [Figure 3-62](#), following.

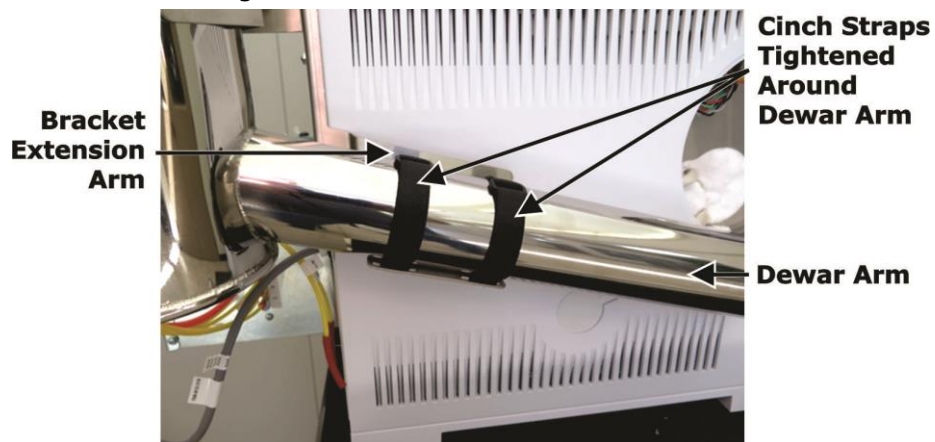


Figure 3-62
Cinch Straps Tightened Around Dewar Arm

9. Position the dewar reservoir vertically plumb to the dewar bracket, and securely tighten the strap around the dewar.

NOTE → The alignment adjustment screws illustrated in [Figure 3-63](#), following, allow the user to adjust the dewar so that the cold jet arm aligns with the modulator. This position is usually set at LECO factory settings. Always ensure that the alignment adjustment screws are tight upon the completion of an alignment.

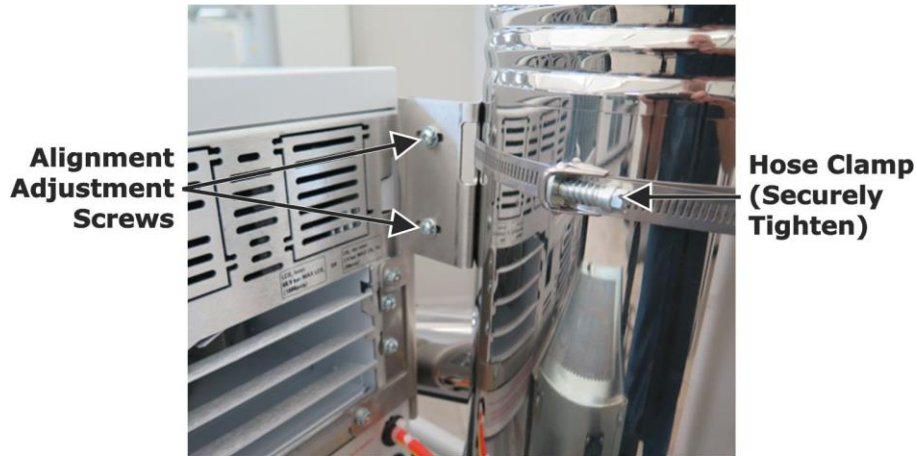


Figure 3-63
Dewar Aligned Vertically

NOTE → When viewed from the side of the GC, the dewar reservoir will tilt away from the GC at the top to provide correct flow to the condensate drain. When viewed from the front of the GC, the dewar will align vertically plumb to the GC. Refer to [Figure 3-64](#) and [Figure 3-65](#), following.

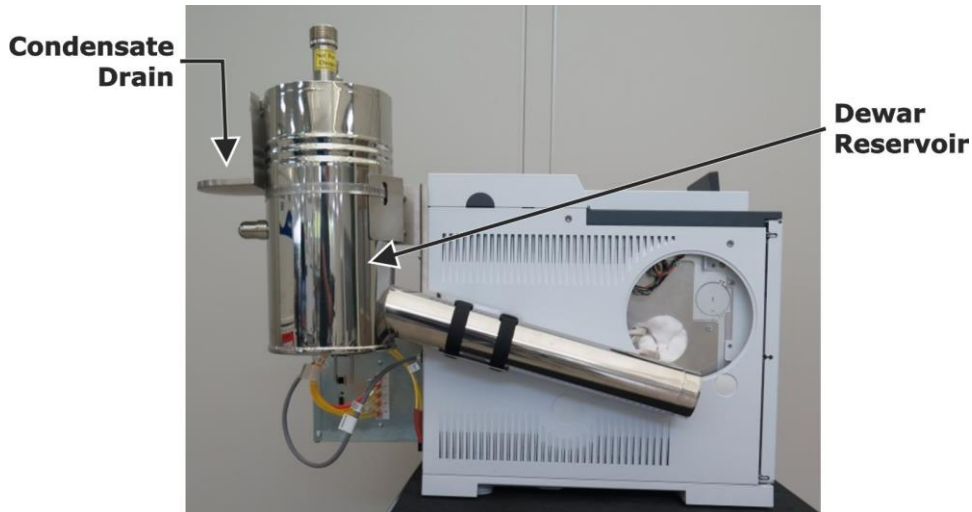


Figure 3-64
Side View of Dewar Installed

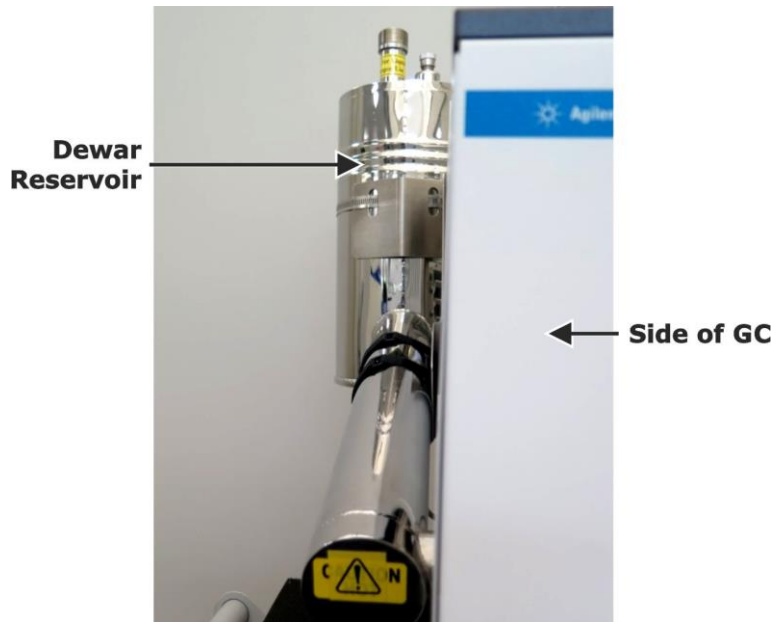


Figure 3-65
Front View of Dewar Installed

10. With the dewar securely positioned onto the bracket, observe the mounting hole alignment of the dewar cold jet from the inside of the GC. If the mounting holes on the dewar cold jet do not concentrically align with the modulator mounting holes, gently adjust the position of the modulator until they are aligned. Refer to [Figure 3-66](#), following.

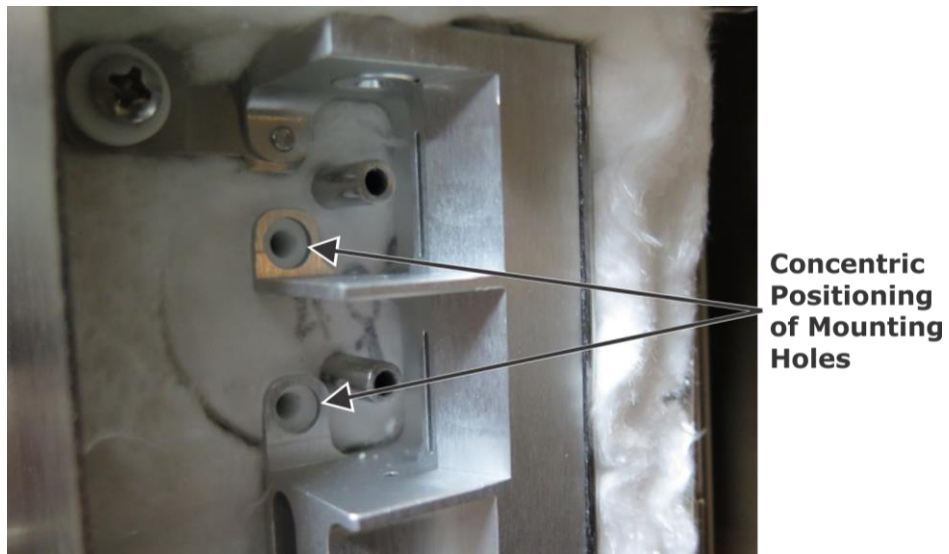


Figure 3-66
Mounting Holes Concentrically Aligned



CAUTION

Securely fasten, but do not overtighten, the mounting screws, or ceramic insulator breakage may occur.

11. Reinstall the ceramic insulators, washers, and screws that were removed in step 5, page 3-54, making sure not to overtighten the screws. Refer to Figure 3-67, following.

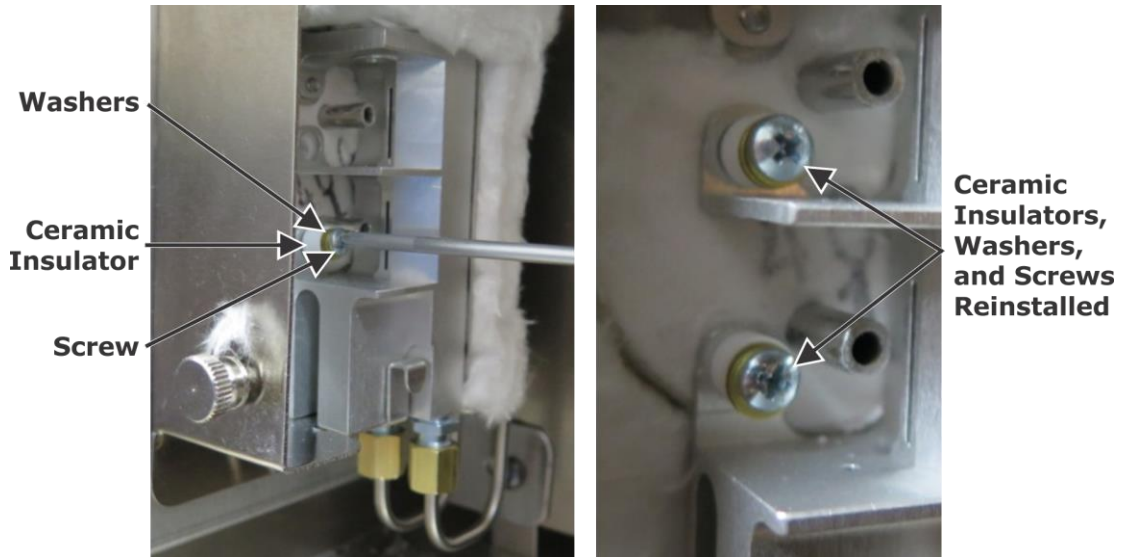


Figure 3-67
Modulator Screws Reinstalled

12. Tighten the mounting screws for the secondary oven and modulator that were loosened in steps 9 and 10 of [Installing CF or LN2 Modulation Systems](#), beginning on page 3-50.
13. Insert a scrap piece of column through the modulator to check the cold jet alignment. Refer to Figure 3-68, following.

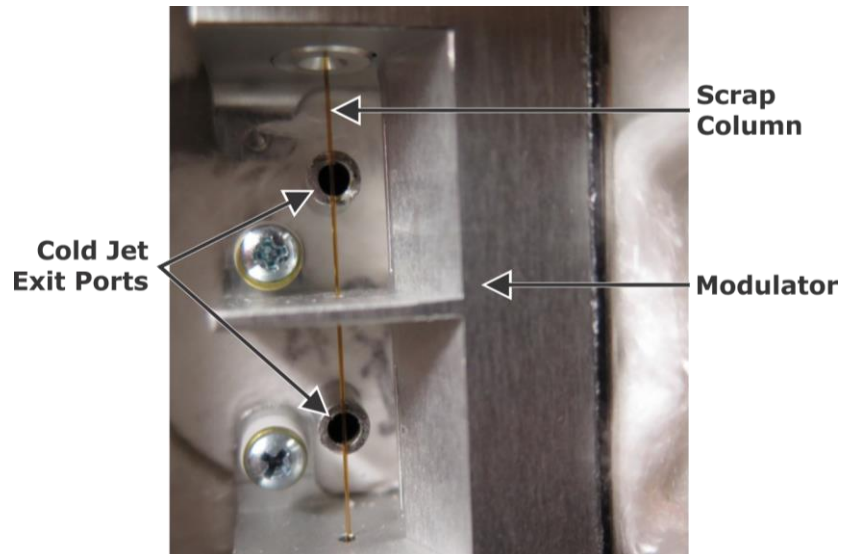


Figure 3-68
Column Inserted Through Modulator

14. Measure the distance between the column and the exit port of the cold jets, and ensure there is at least 0.5 mm to 2 mm of empty space.
15. Align the cold jets so that the column runs vertically on the center of the cold jet exit ports. The cold jets can be aligned by placing a $\frac{3}{16}$ -inch nut driver over the cold jet tube, and then gently bending the cold jet into alignment with the leverage of the nut driver. Refer to [Figure 3-69](#), following.

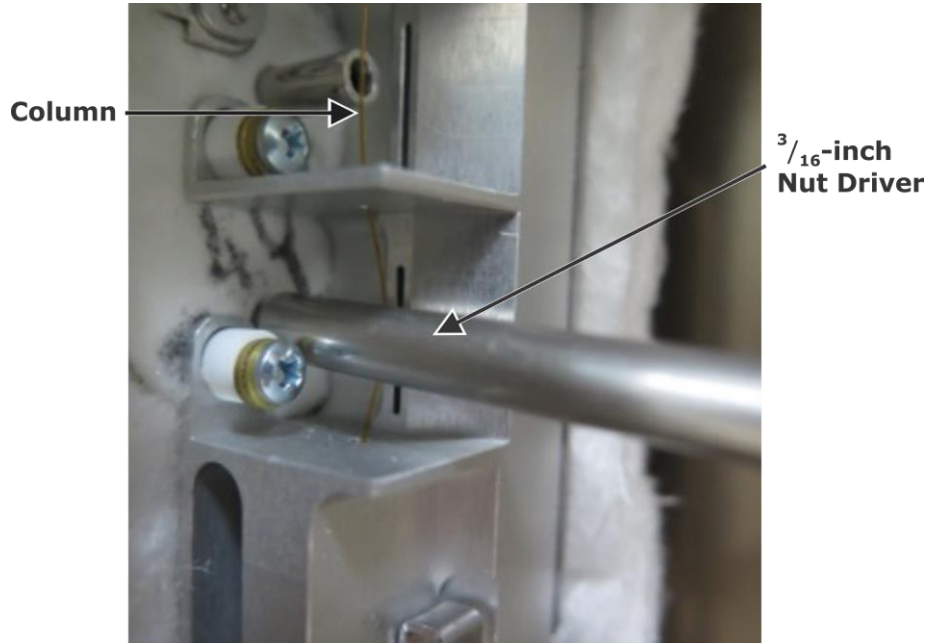


Figure 3-69
Aligning Column

16. Insert the column into the secondary oven, verifying there is nothing obstructing the column's path. The secondary oven position can be independently adjusted to alleviate obstruction.
17. Reinstall the insulation and retainer plate on the side of the modulator block that were removed in step 8 of [Installing CF or LN2 Modulation Systems](#), page 3-49.
18. Reinstall the secondary oven and modulator covers that were removed in step 6 and step 7 of [Installing CF or LN2 Modulation Systems](#), beginning on page 3-49.
19. Skip to [For LN2 and CF Modulation](#), page 3-73.

For CF Modulation Only

1. Install the heat exchanger bracket by completing the following steps for the applicable GC.
 - A. Place the heat exchanger bracket against the back of the GC and the GC side panel so the mounting screw holes align. Refer to [Figure 3-70](#) (7890), following, and [Figure 3-71](#) (8890), page 3-61.
 - B. Install the screws to the heat exchanger bracket by completing the following steps for the applicable GC.

For the Agilent 7890 GC Only:

NOTE → Continue to press the bracket against the GC as screws are installed in the following steps, maintaining hole alignment. Refer to [Figure 3-70](#), following.



Figure 3-70
7890 CF Heat Exchanger Bracket Installed

- 1) Using a *Torx* T20 screwdriver, install a T20 screw (and lock washer, if supplied with the GC) in the upper mounting screw hole.
- 2) Using a *Torx* T20 screwdriver, install a T20 screw, lock washer, and flat washer included with the instrument into the lower bracket screw hole.
- 3) Skip to step 2, page 3-61.

For the Agilent 8890 GC Only:

NOTE → Continue to press the bracket against the GC as screws are installed in the following steps, maintaining hole alignment. Refer to [Figure 3-71](#), following.



Figure 3-71
8890 CF Heat Exchanger Bracket Installed

- 1) Install one flat washer (PN 193-010) and one nut (PN-194-172) onto the upper mounting screw with a $1\frac{1}{32}$ -inch open-end wrench.
 - 2) Install one flat washer (PN 193-010) and one nut (PN-194-172) onto the lower bracket screw with a $1\frac{1}{32}$ -inch open-end wrench.
2. Cut and install a 1.25-inch wide piece of friction tape included with the instrument onto the bracket as illustrated in [Figure 3-72](#), following.

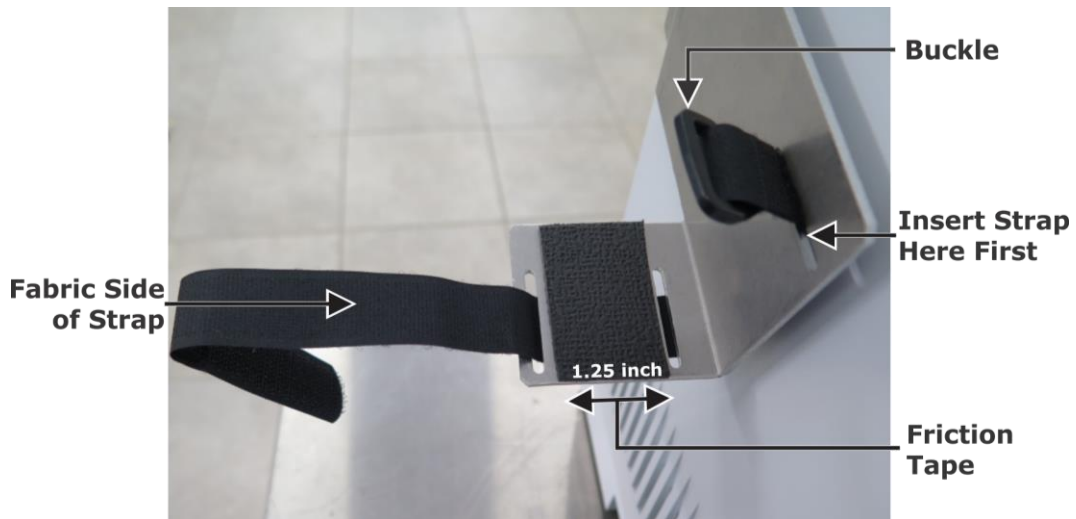


Figure 3-72
Strap and Friction Tape Installed on Bracket

3. Insert the cinch strap included with the instrument through the uppermost slot in CF heat exchanger bracket, with the fabric side of the strap facing away from the GC. Continue to pull the strap through the upper slot until the buckle prevents the strap from being pulled farther. Refer to [Figure 3-72](#), previous.
4. Pull the loose end of the strap up through the heat exchanger bracket slot farthest from the GC.
5. Partially screw the two alignment rods included with the instrument into the threaded holes on the cold jet arm of the heat exchanger assembly. Refer to [Figure 3-73](#), following.

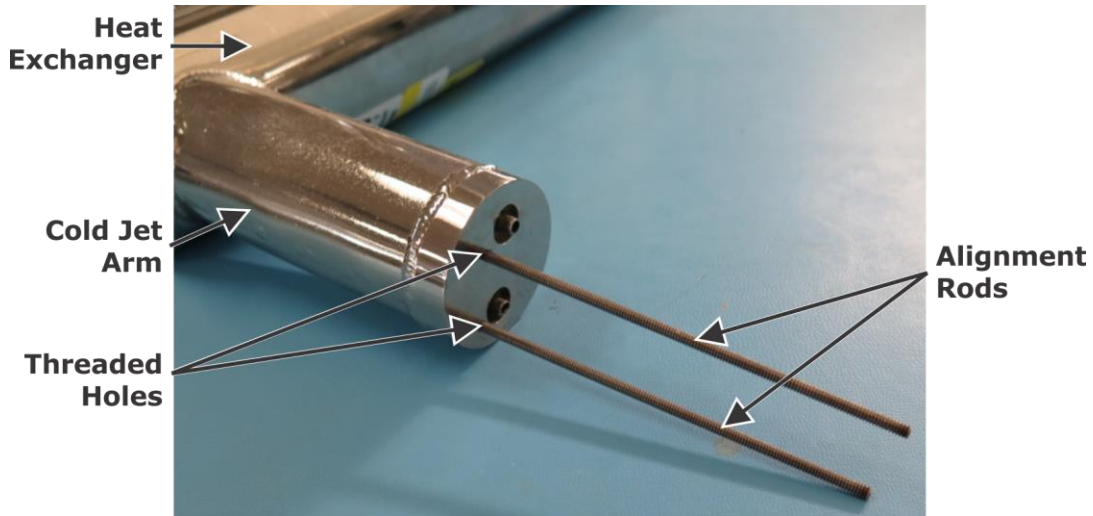


Figure 3-73
Alignment Rods into Cold Jet Arm

6. Install the heat exchanger assembly onto the heat exchanger bracket by completing steps A through E, following.
 - A. Position the loose end of the cinch strap away from the GC, as displayed in [Figure 3-72](#), page 3-61, so it will not come in contact with the heat exchanger dewar when the dewar is installed to the bracket.
 - B. Lift the heat exchanger assembly into a position where the alignment rods can be inserted through the mounting holes on the GC modulator block. The bottom portion of the heat exchanger dewar should align with the heat exchanger bracket. Refer to [Figure 3-74](#), following.
 - C. Set the heat exchanger dewar onto the heat exchanger bracket and securely tighten the strap around the dewar, ensuring the buckle is positioned on top of the dewar. Refer to [Figure 3-74](#), following.

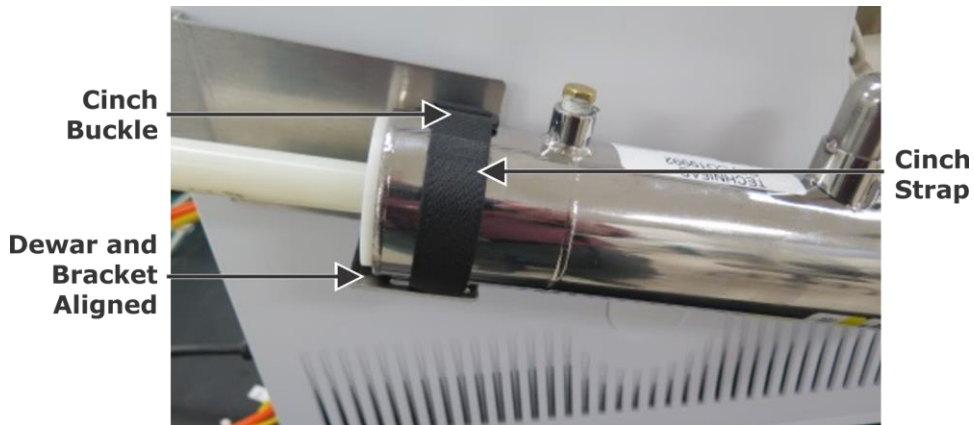


Figure 3-74
Heat Exchanger Attached to Bracket

- D. Slowly insert the alignment rods attached to the cold jet arm of the heat exchanger assembly through the modulator mounting holes. Refer to [Figure 3-75](#), following.

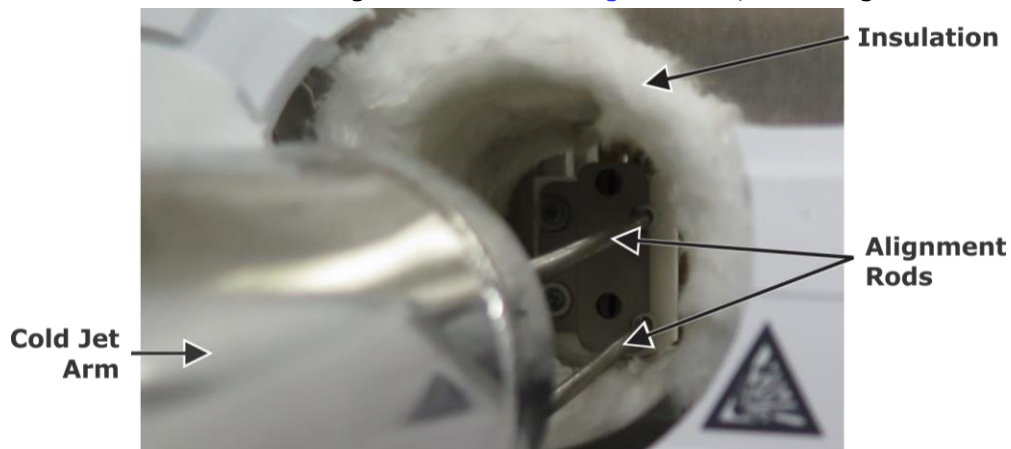


Figure 3-75
Inserting Alignment Rods into Modulator

- E. Insert the cold jet arm through the GC side panel and insulation to the modulator block. Ensure that the GC insulation does not interfere with the cold jet arm during insertion by sufficiently opening up the hole through the insulation with your fingers, as needed. Refer to [Figure 3-75](#), previous.
7. Verify that the heat exchanger dewar is aligned to the modulator from the inside of the GC oven. The exit ports on the heat exchanger arm must engage into the nozzles.
8. Measure the gap between the back of the ceramic insulator and the face of the heat exchanger with a ruler. Verify the gap is approximately 2.5 mm. Refer to [Figure 3-76](#), following.



Figure 3-76
Measuring Gap Between Insulator and Heat Exchanger

9. Unscrew and remove the top alignment rod.



CAUTION

Securely fasten, but do not overtighten, the mounting screws, or ceramic insulator breakage may occur.

10. Install, but do not overtighten, one mounting screw and one ceramic spacer (both included with the instrument) into the screw hole where the top alignment rod was removed. Refer to [Figure 3-77](#), following.

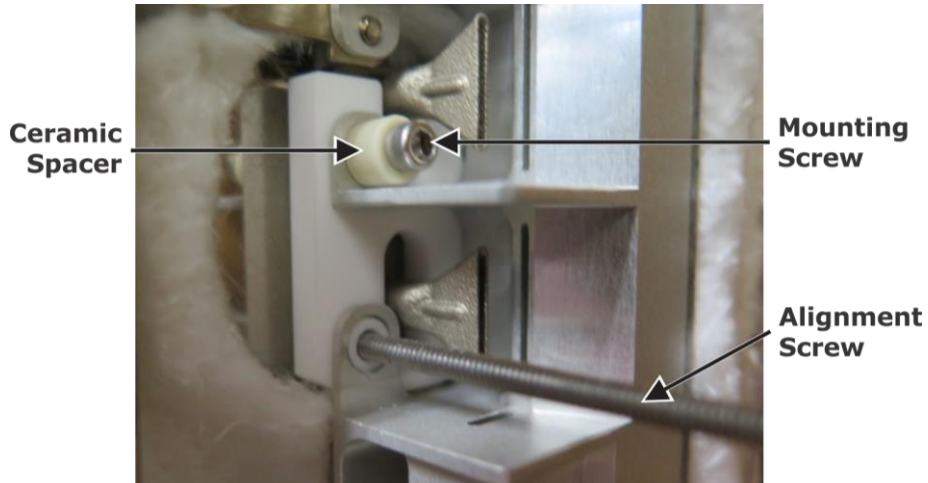


Figure 3-77

Upper Mounting Screw and Spacer Installed

11. Unscrew and remove the bottom alignment rod.
12. Install one mounting screw and one ceramic spacer (both included with the instrument) into the screw hole where the bottom alignment rod was removed. Refer to [Figure 3-78](#), following.

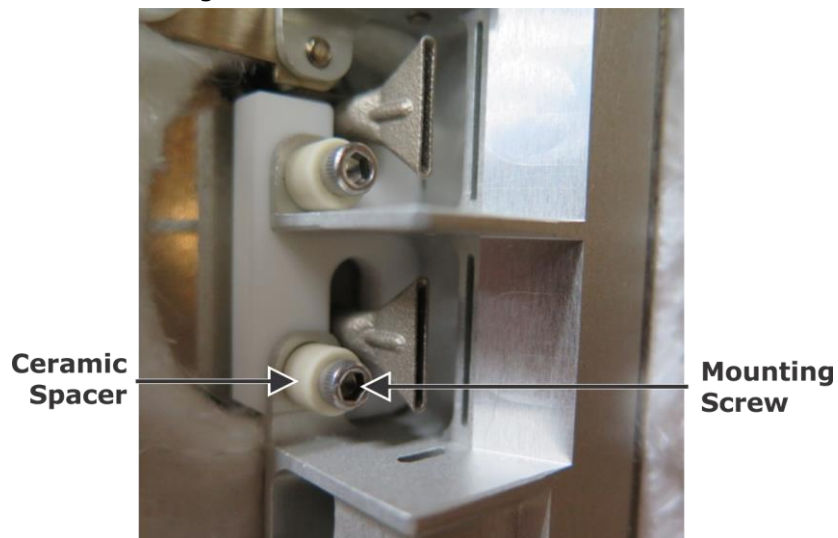


Figure 3-78

Bottom Screw and Spacer Installed

13. Tighten the modulator and secondary oven mounting screws loosened in steps 9 and 10 of [Installing CF or LN2 Modulation Systems](#), beginning on page 3-50. Refer to [Figure 3-79](#), following.
14. Reinstall the insulation and retainer plate removed in step 8 of [Installing CF or LN2 Modulation Systems](#), page 3-49, on the side of the modulator block. Refer to [Figure 3-79](#), following.
15. Reinstall the secondary oven and modulator covers removed in steps 6 and 7 of [Installing CF or LN2 Modulation Systems](#), beginning on page 3-50. Refer to [Figure 3-79](#), following.

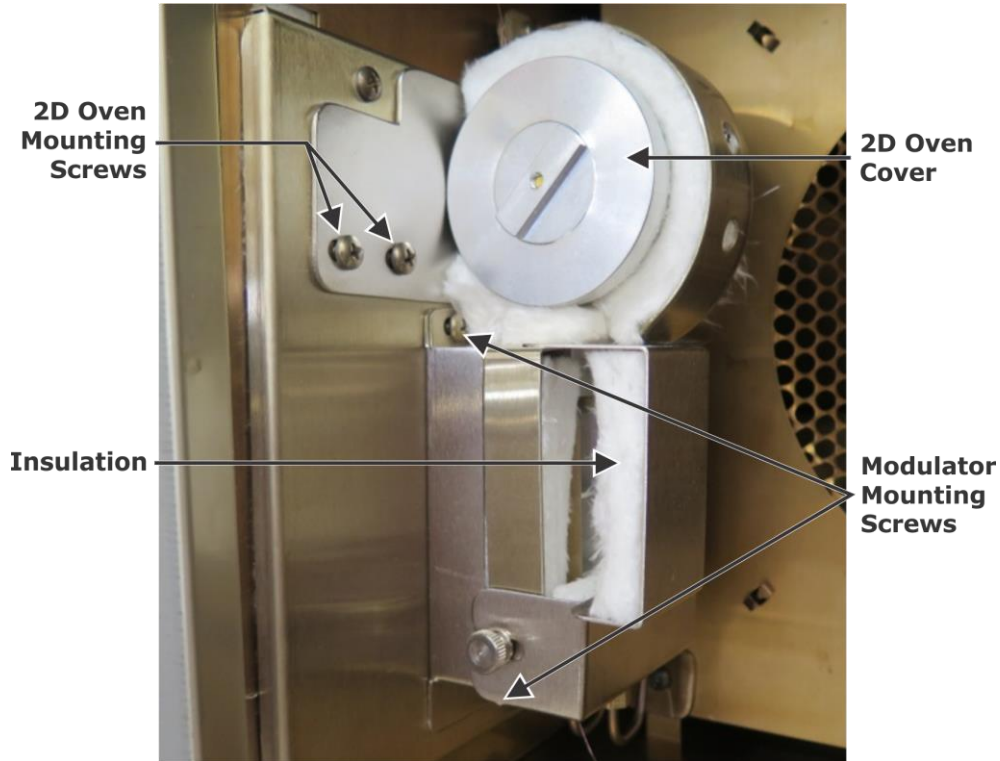


Figure 3-79
Secondary Oven and Modulator Reinstalled

16. Install two right-angle quick-disconnect fittings included with the instrument into the heat exchanger arm inlet ports. Tighten using a $\frac{5}{16}$ -inch wrench. Refer to [Figure 3-80](#), following.

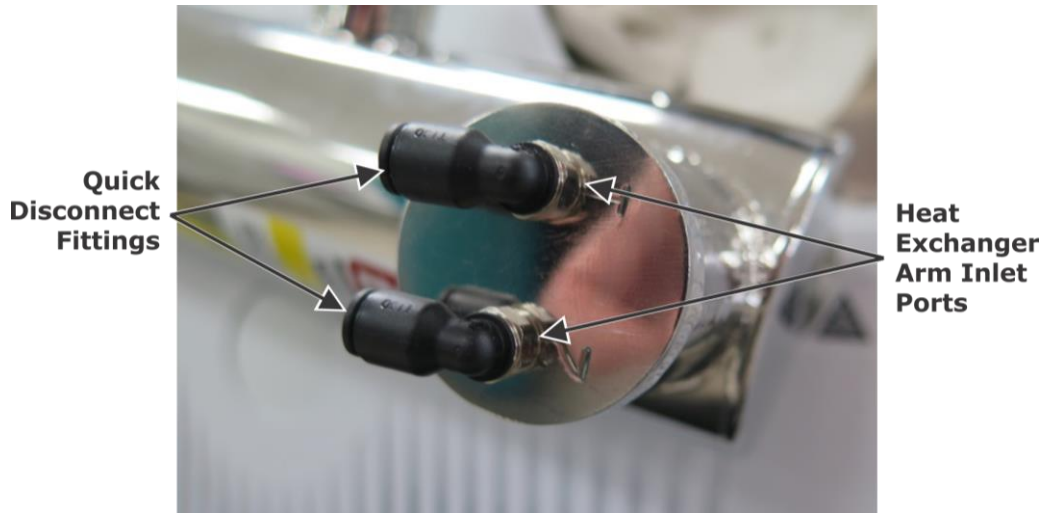


Figure 3-80
Quick Disconnect Fittings on Cold Jet Arm

17. Install the gas lines to the heat exchanger by completing steps [A](#) and [B](#), following. Refer to [Figure 3-81](#), following.
 - A. Connect the yellow harness tube labeled #5-T1 (Trap 1) to the disconnect fitting in the first inlet port on the cold jet arm.
 - B. Connecting the yellow harness tube labeled #4-T2 (Trap 2) to the second inlet port on the cold jet arm.

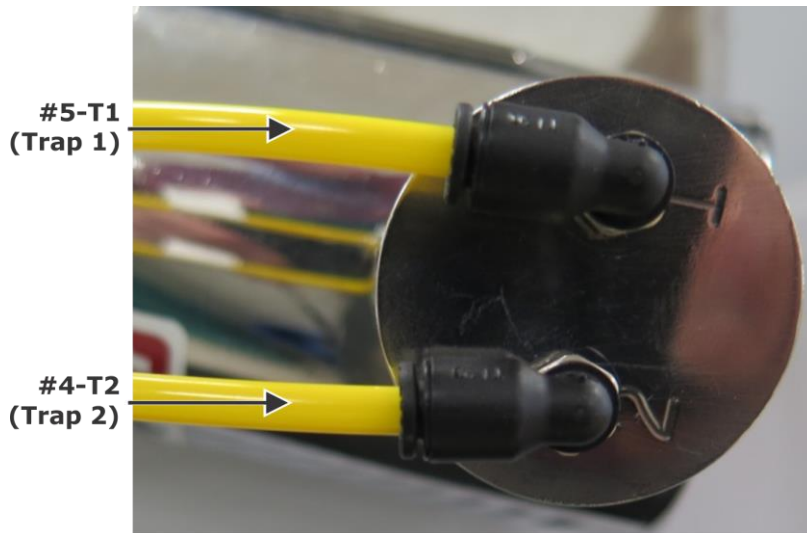


Figure 3-81
Harness Tubes Connected to Inlet Ports



PROTECTIVE EYEWEAR/PROTECTIVE GLOVES

Protective eyewear and gloves should be worn when handling the thermal bath fluid.



Refer to the Safety Data Sheet (SDS) for the specific chemical for additional information.

18. Pour 160 ml of thermal bath fluid included with the instrument into the graduated cylinder included with the instrument. Refer to [Figure 3-82](#), following.

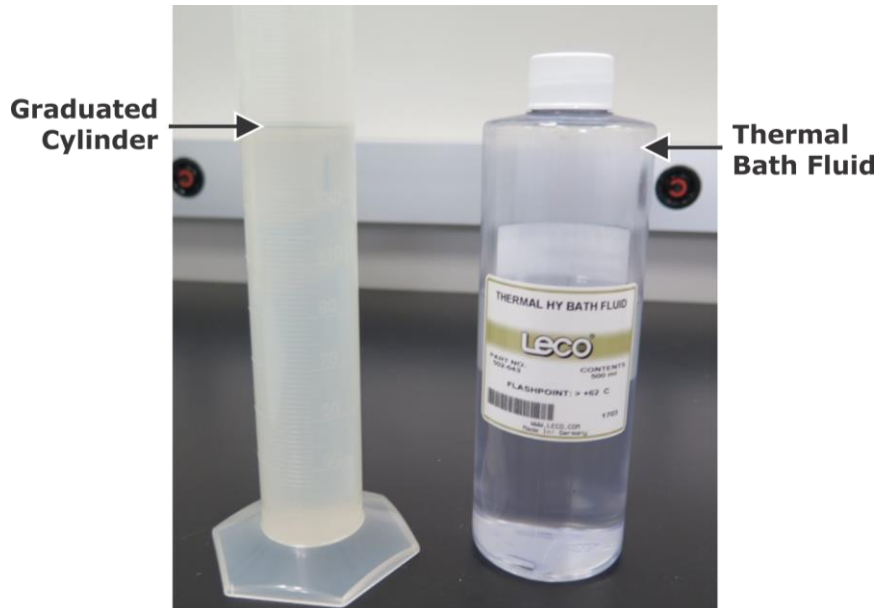


Figure 3-82
Thermal Bath Fluid Poured
into Graduated Cylinder

19. Insert the funnel (included with the instrument) into the tubing (included with the instrument) to create a funnel extension. Refer to [Figure 3-83](#), following.



Figure 3-83
Funnel Inserted into Tubing

20. Gently pull the shipping plug out of the heat exchanger. Refer to [Figure 3-84](#), following.



Figure 3-84
Heat Exchanger Shipping Plug

21. Unscrew and remove the vent port plug using a $\frac{7}{16}$ -inch wrench. Refer to [Figure 3-84](#), previous.
22. Insert the funnel extension tube approximately 1 inch (2.5 cm) into the heat exchanger. Refer to [Figure 3-85](#), following.



Figure 3-85
Extension Tube Inserted Into Heat Exchanger

23. Slowly pour 160 ml of thermal bath fluid from the graduated cylinder into the funnel. Refer to [Figure 3-86](#), following.

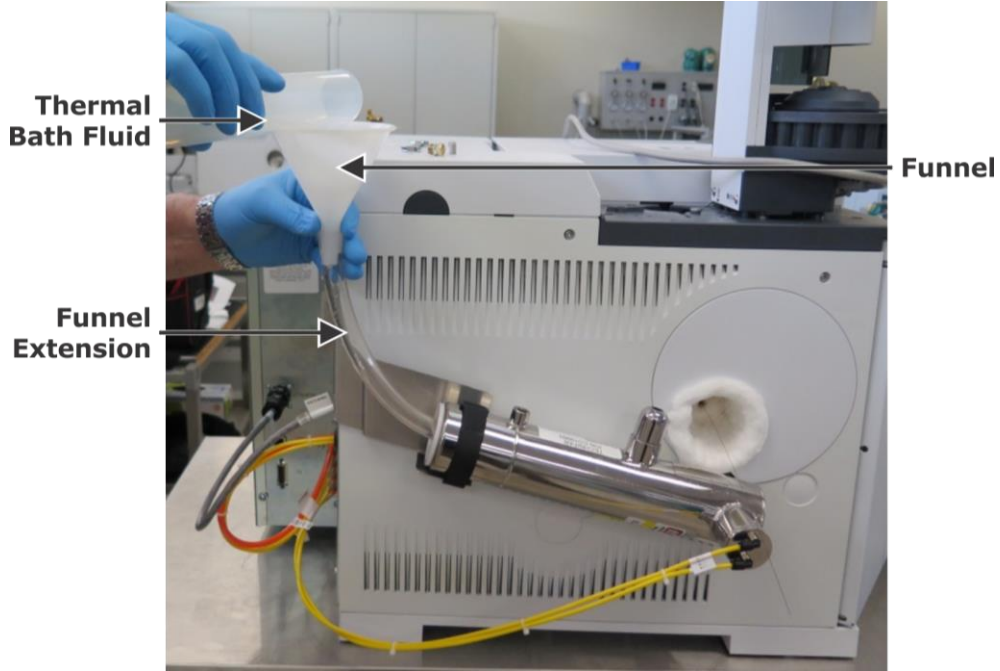


Figure 3-86
Pouring Thermal Bath Fluid into Heat Exchanger

24. Gently remove the funnel extension from the heat exchanger. Use an absorbent towel to catch any potential drips. Refer to [Figure 3-87](#), following.

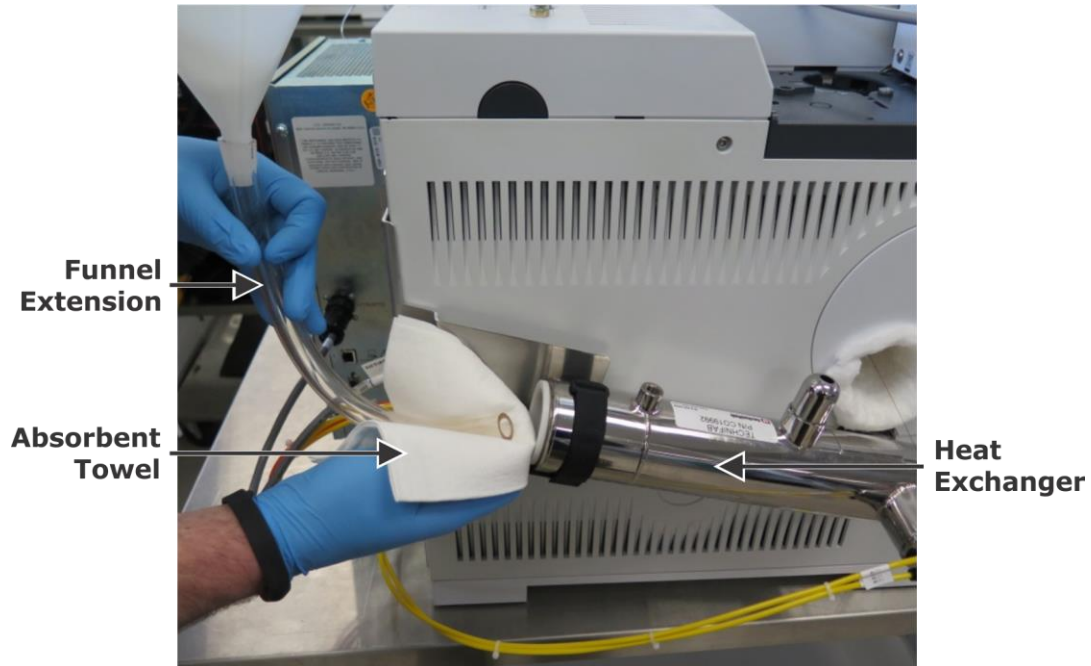


Figure 3-87
Removing Funnel Extension from Heat Exchanger

25. Insert the RTD from the immersion chiller into the heat exchanger until it stops at the heat shrink. Refer to [Figure 3-88](#), following.

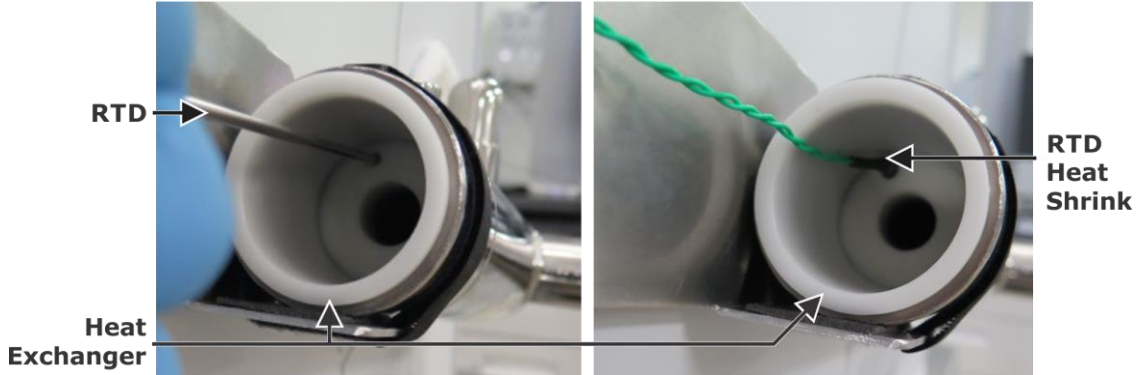


Figure 3-88
Inserting RTD into Heat Exchanger

26. Slowly insert the cold finger from the immersion chiller into the heat exchanger until it stops. Refer to [Figure 3-89](#) and [Figure 3-90](#), following.

NOTE → Observe the vent port as the cold finger is inserted, and use an absorbent towel to catch any potential overflow. Refer to [Figure 3-90](#), following.



Figure 3-89
Inserting Immersion Chiller Cold Finger

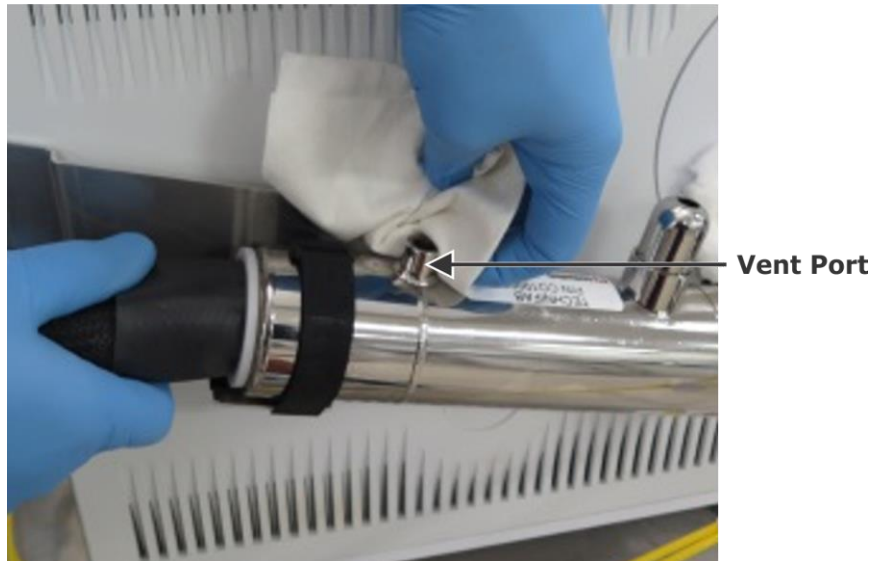


Figure 3-90
Catching Overflow with Absorbent Towel

27. Reinstall the vent port plug by finger-tightening the plug to the heat exchanger, and then fully tighten the plug with a $\frac{7}{16}$ -inch wrench. Refer to [Figure 3-91](#), following.



Figure 3-91
Reinstalling Vent Port Plug

For LN₂ and CF Modulation

1. Use the spare insulation included with the instrument to fill all voids between the GC side panel and the heat exchanger arm that could allow heat to escape the GC oven wall. Examples of potential leak points are displayed in [Figure 3-92](#), following.

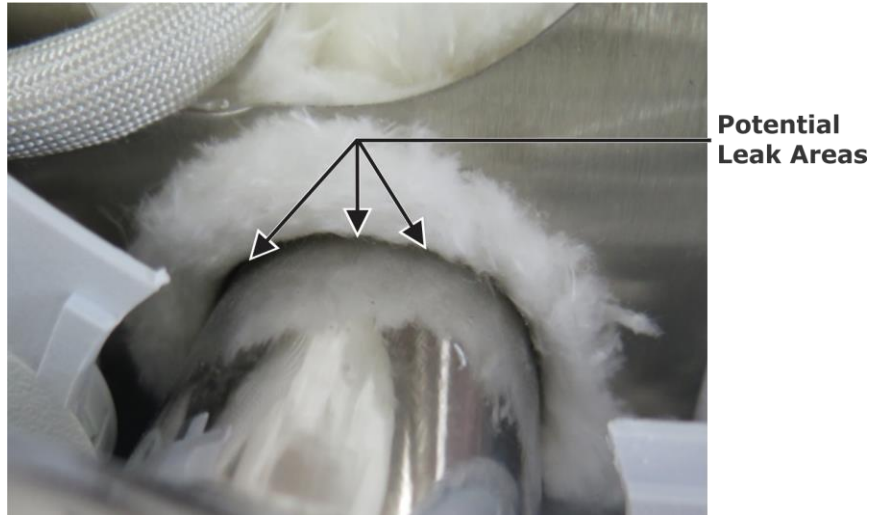


Figure 3-92
Potential GC Oven Wall Leak Spots

2. Connect the incoming gas lines to the left side of the control box. Refer to [Figure 3-93](#), following.

NOTE → It is recommended that gas lines be connected to two sources, but they can be connected to a single source as well, as long as enough flow is achieved and gas quality meets specifications for cold jets. Gas lines connected to a single source require the Y-fitting included with the instrument.

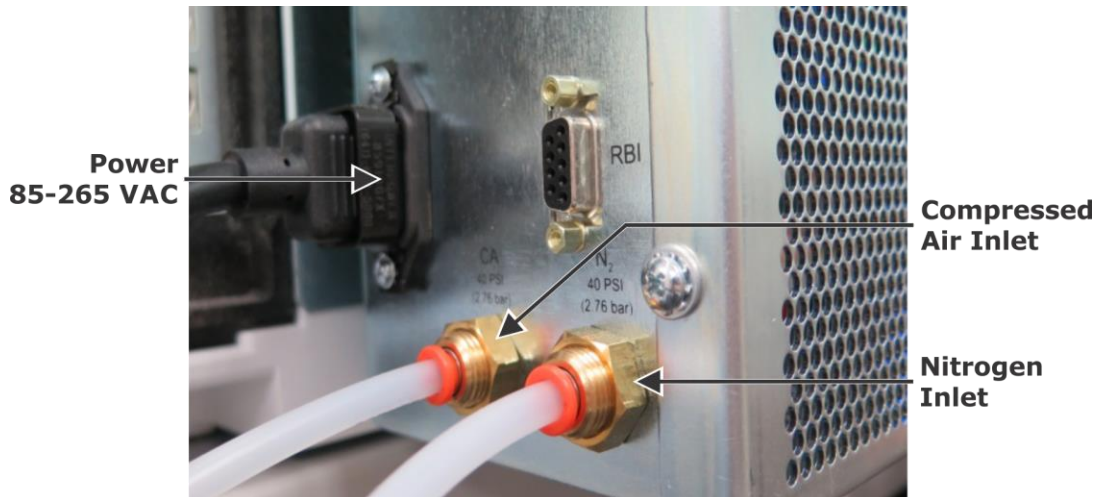


Figure 3-93
Gas and Power Connected to the Control Box

3. Set the Compressed Air source pressure to 40 psi (2.8 bar).

4. Set the Nitrogen source pressure to 40 psi (2.8 bar).
5. Connect the power cord to the control box. Refer to [Figure 3-93](#), previous.
6. Connect the GCxGC control cable from the control box to the instrument. Refer to [Figure 3-94](#), following.

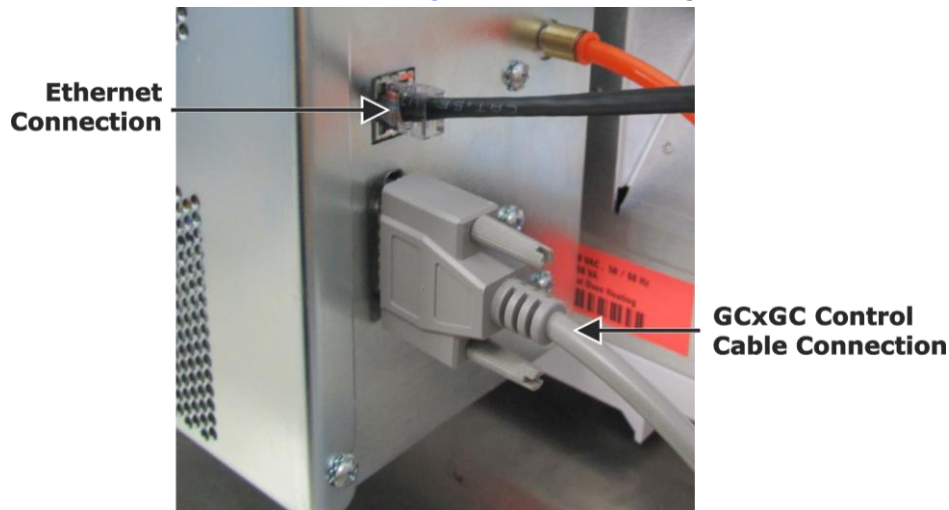




Figure 3-94
Ethernet and Control Cables Connected to Control Box



CAUTION: NETWORK CONNECTION

Connect the Ethernet port on the instrument to the Ethernet port on the control box as instructed in this manual. Connecting the instrument directly to a corporate network (LAN) may result in communication problems.

7. Connect the Ethernet cable from the Ethernet Port  on the control box to the Ethernet Port  on the instrument. Refer to [Figure 3-94](#), previous.

NOTE →

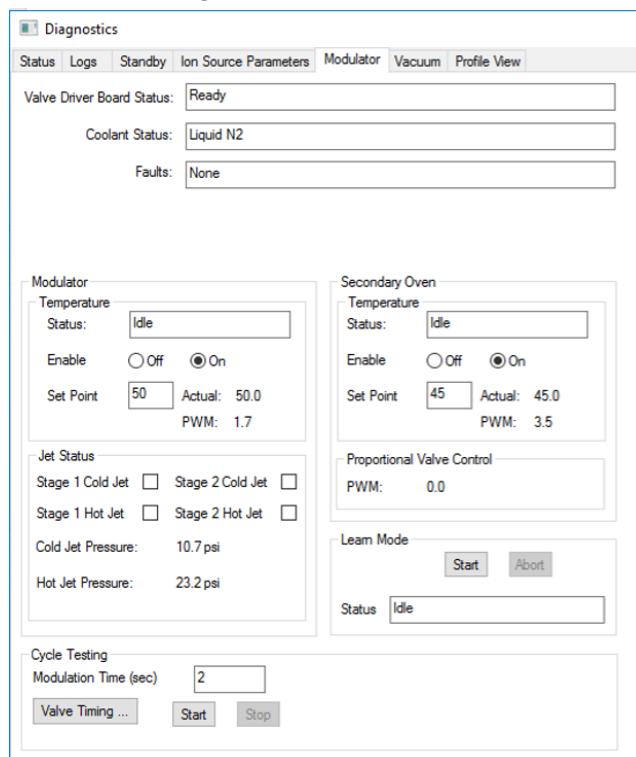
The LECO mass spectrometer instrument, the computer, and the GC installations must be complete and powered On prior to initializing the following steps for setting and learning modulation system gas flows.

8. Verify and configure the correct flows from the control box by completing steps A through D, following.
 - A. Confirm that gas pressures to the control box are set to 40 psi (2.8 bar).
 - B. Turn On the control box power breaker. Refer to [Figure 3-95](#), following.



Figure 3-95
Control Box Power Breaker

- C. In the *ChromaTOF* software, select Instrument on the Menu bar, select Diagnostics, and then select the Modulator tab.



- D. Turn Off (Disable) the modulator and secondary oven.



CAUTION

Steps 9 and 10, following, must be completed by a qualified LECO Service Engineer only.

9. Verify and configure the nitrogen pressure regulator by completing steps A through G, following.
 - A. Loosen the four cover screws on cover of the control box, and then remove the cover. Refer to [Figure 3-96](#) (7890) and [Figure 3-97](#) (8890) following.

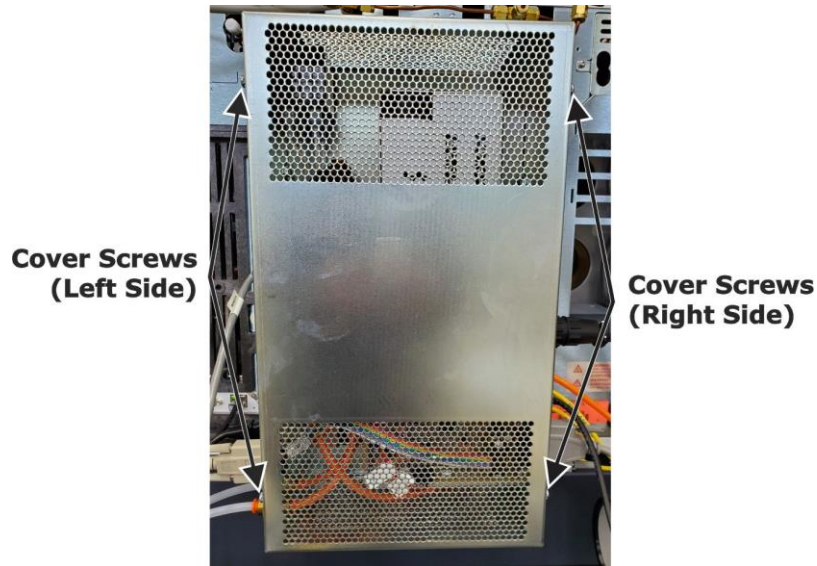


Figure 3-96
7890 Control Box Cover Screws

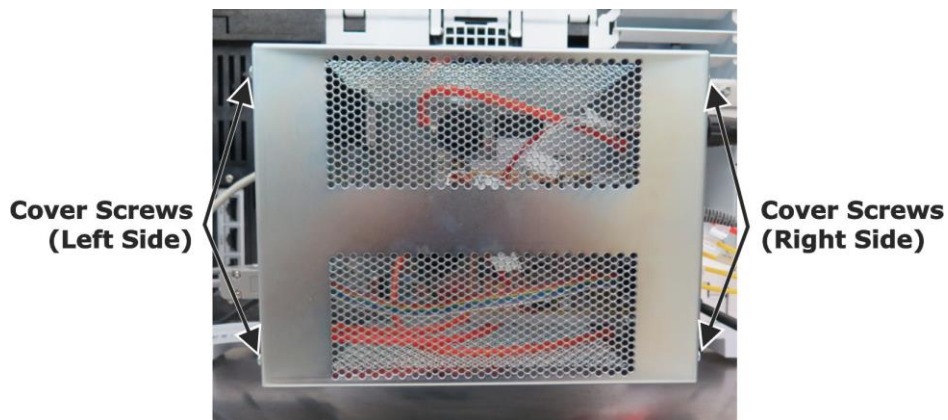


Figure 3-97
8890 Control Box Cover Screws

- B. Pull out the knob on the N₂ pressure regulator to unlock the regulator. Refer to [Figure 3-99](#), following.

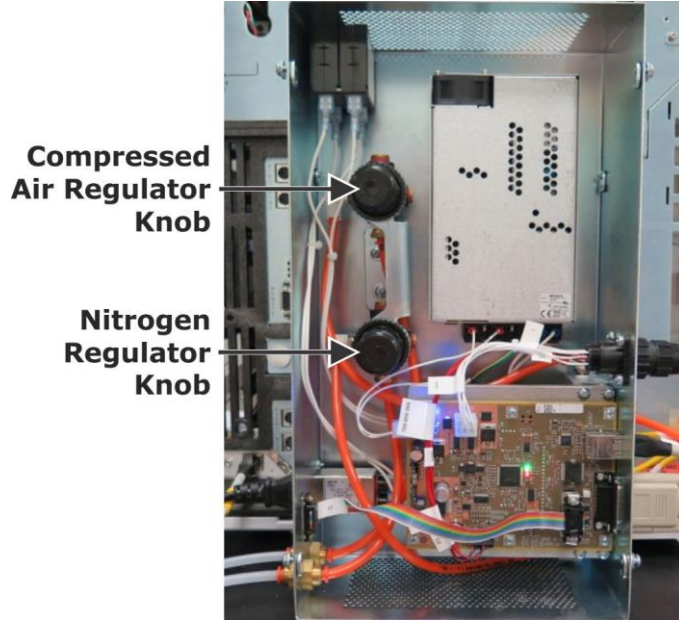


Figure 3-98
7890 Gas Pressure Regulator Knobs

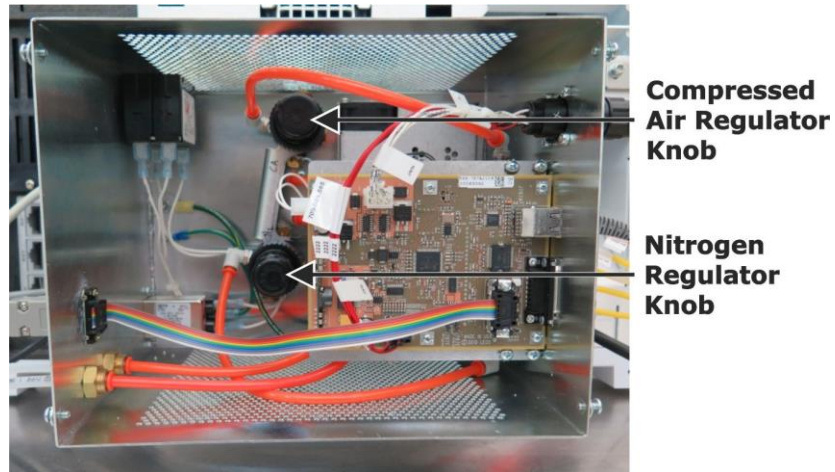


Figure 3-99
8890 Gas Pressure Regulator Knobs

- C. In the *ChromaTOF* software, select Instrument on the Menu bar, select Diagnostics, and then select the Modulator tab.

- D. Select the Stage 1 Cold Jet checkbox to open cold jet 1.

The screenshot shows two panels from a software interface. The left panel, titled 'Jet Status', contains four checkboxes: 'Stage 1 Cold Jet' (unchecked), 'Stage 2 Cold Jet' (unchecked), 'Stage 1 Hot Jet' (unchecked), and 'Stage 2 Hot Jet' (unchecked). Below these are two pressure readings: 'Cold Jet Pressure: 10.7 psi' and 'Hot Jet Pressure: 23.2 psi'. The right panel, titled 'Proportional Valve Control', shows 'PWM: 0.0'. Below this is a 'Learn Mode' section with 'Start' and 'Abort' buttons, and a 'Status' dropdown menu currently set to 'Idle'.

- E. Adjust the pressure regulator to the following specifications, if required:

NOTE →

Pressure must be within the following ranges specifications when the regulator is locked and either cold jet is turned On.

- For LN₂ systems: between 10 to 11 psi (0.7 to 0.8 bar) (6 lpm)
- For CF systems: between 29 to 30 psi (2 to 2.1 bar) (10 lpm)

- F. Press the knob on the N₂ regulator to lock it.

- G. Select the checkbox for Stage 1 Cold Jet to close cold jet 1.

10. Verify and configure the compressed air pressure regulator by completing steps A through G, following.

- A. Pull out the knob on the CA pressure regulator to unlock it. Refer to [Figure 3-99](#), page 3-77.

- B. In the *ChromaTOF* software, select Instrument on the Menu bar, select Diagnostics, and then select the Modulator tab.

- C. Select the Stage 1 Hot Jet checkbox to open hot jet 1.

This screenshot is identical to the one above, showing the 'Jet Status' and 'Proportional Valve Control' panels. The 'Stage 1 Hot Jet' checkbox is now checked, and the 'Status' dropdown menu remains at 'Idle'.

NOTE →

Pressure must be within the following range specification when the regulator is locked and either cold jet is turned On.

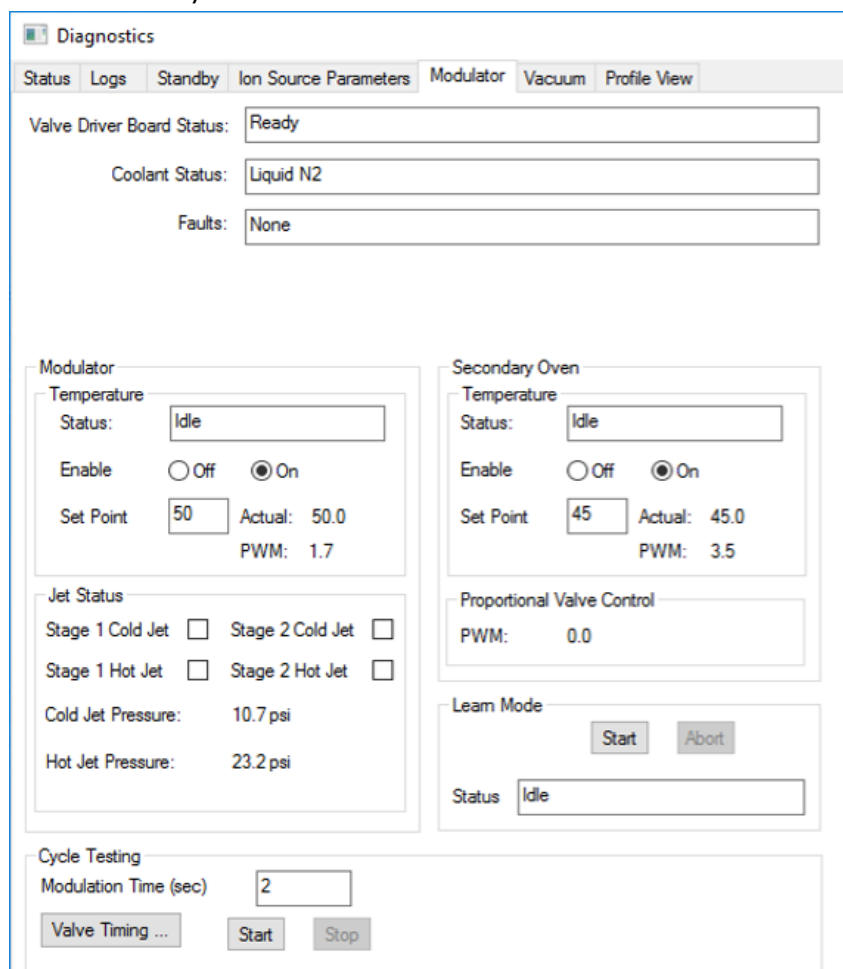
- D. Adjust the pressure regulator to the following specifications, if required. Both CF and LN₂ systems should be between 20 to 21 psi (1.38 to 1.45 bar) (14.5 lpm).

- E. Push in the knob on the CA regulator to lock it.

- F. Select the Stage 1 Hot Jet checkbox to close hot jet 1.

- G. Replace the control box cover.

11. Learn the secondary oven cooling proportional valve by completing steps A through H, following. Learn Mode determines the power required to open the proportional valve used for cooling the secondary oven during modulation cycles.
 - A. In the *ChromaTOF* software, select Instrument on the Menu bar, select Diagnostics, and then select the Modulator tab.
 - B. Select the On (Enable) radio button for both the modulator and secondary oven.



- C. Ensure that the cover is on the secondary oven, and then close the GC oven door.
- D. Set Modulator and Secondary Oven temperatures to 60 °C.
- E. Set the GC Oven to 40 °C.
- F. Wait for temperatures to equilibrate to the setpoint.
- G. Select Start to begin the Learn Mode.

NOTE → This process can take 5 to 60 minutes to complete.

- H. "Learn Mode Passed" is displayed in the Status box of the Learn Mode section when complete.

Installing the LN₂ Transfer Line (LN₂ Systems Only)

Without a Liquid-Level Controller

1. Attach the transfer line assembly directly to the male flare fitting on the main supply dewar.
2. Insert intake tube of the transfer line into the GCxGC dewar and secure it as shown in [Figure 3-100](#), following.

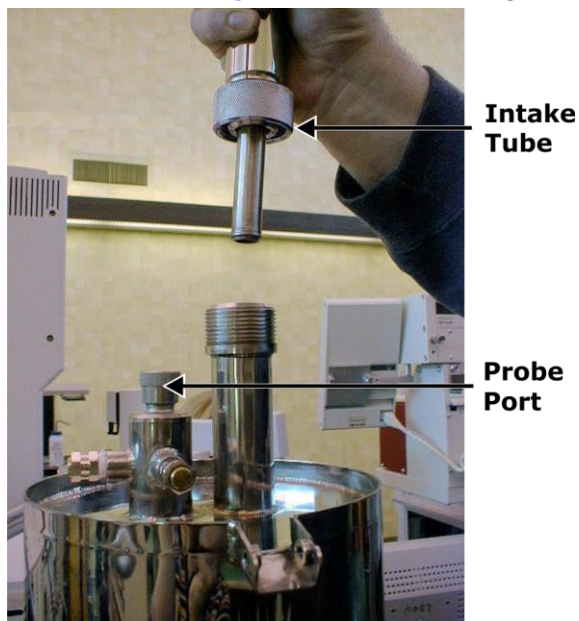


Figure 3-100
Dewar Intake Tube

With a Liquid-Level Controller

1. Use thread tape to connect the pop-off valve assembly to the solenoid assembly input supplied with the liquid-level system. Refer to the liquid-level system instruction manual for additional information.
2. Attach the solenoid assembly to the male fitting.
3. Obtain the fitting adapter supplied by LECO.
4. Use thread tape on the MPT side of the flare fitting – not the flare side.

- Attach the fitting adapter to the output of the solenoid assembly on the liquid-level system solenoid assembly as shown in [Figure 3-101](#), following.

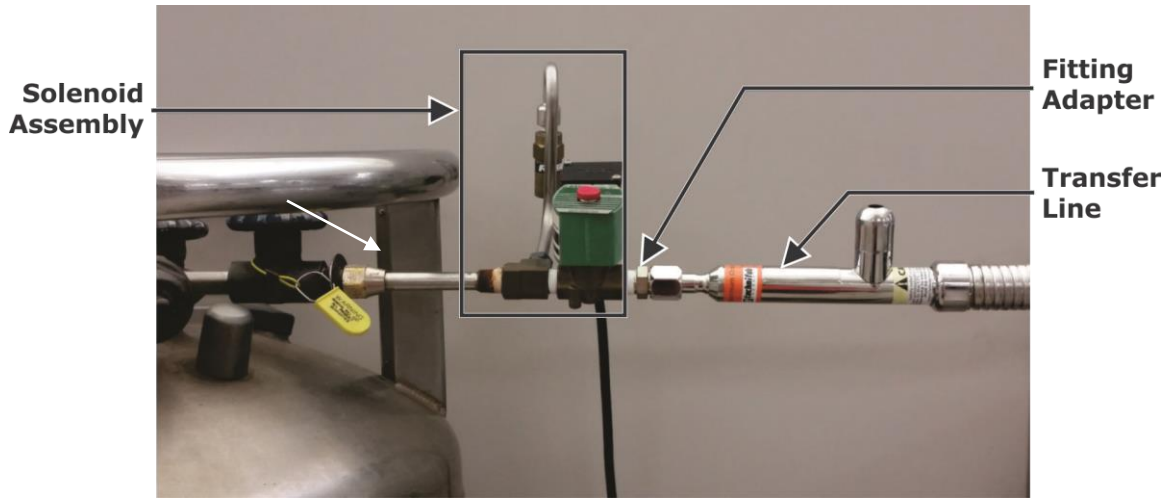


Figure 3-101
Solenoid Assembly Attached to Transfer Line

- Attach the transfer line assembly to the fitting adapter.
- Connect the solenoid assembly cable to the liquid-level controller.
- Insert the intake tube into the GCxGC dewar and secure it.
- Remove the nut, compression washer, and o-ring from the GCxGC dewar.
- Install the nut, compression washer, and o-ring onto the probe. Verify the correct order and orientation of each component, as shown in [Figure 3-102](#), following.



Figure 3-102
Components Installed on Probe

- Fully insert the probe into the dewar and tighten the nut. Connect the other end of the probe to the liquid-level controller. Refer to [Figure 3-100](#), page 3-80.
- Attach the cable from the RS-232 port on the liquid-level system to the COM port 2 on the PC tower.
- Connect the liquid-level controller to the required power source, specific to the model, provided onsite: 120 VAC or 240 VAC, depending on the model controller ordered.

Installing the FLUX™ GCxGC Flow Modulator

This section describes how to install the *FLUX* GCxGC Flow Modulator.

NOTE →

This section covers customer site installation of LECO factory-installed flow modulation systems. For customer site upgrade installation procedures, refer to the installation bulletin provided with the instrument.

Installing the Control Box

NOTE →

The control box bracket displayed in [Figure 3-103](#) (7890) and [Figure 3-104](#) (8890), following, is installed onto the instrument at LECO before the customer receives the instrument.



Figure 3-103
Control Box Bracket on 7890 GC



Figure 3-104
Control Box Bracket on 8890 GC

1. Using a Phillips screwdriver, loosen, but do not remove, the two mounting screws and washers on each side of the modulator control box. Refer to [Figure 3-105](#) (7890) and [Figure 3-106](#) (8890), following.



Figure 3-105
Control Box Installed to 7890 GC Mounting Bracket

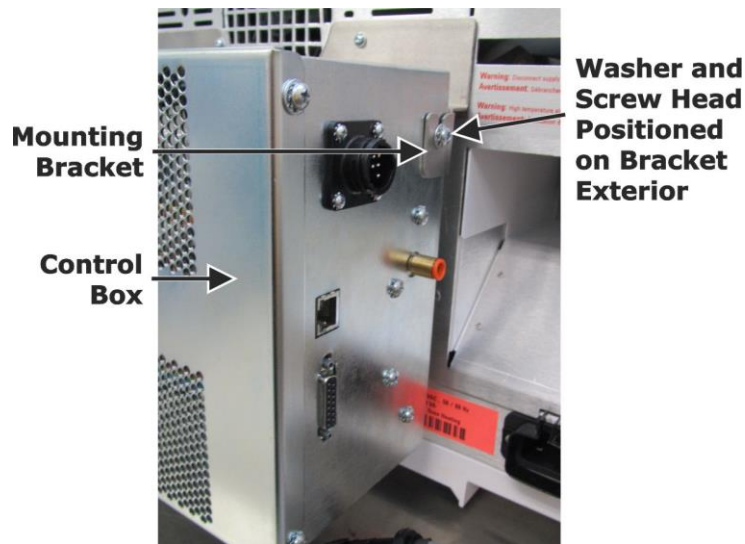


Figure 3-106
Control Box Installed to 8890 GC Mounting Bracket

2. Slide the control box onto the GC mounting bracket until the mounting screws slide fully into the slots on the bracket, ensuring the washers and screw heads are positioned on the exterior portion of the bracket. Refer to [Figure 3-106](#), previous.
3. Tighten the mounting screws with a Phillips screwdriver.

4. Route the LECO factory-installed control cable to the control box at the HTR/RTD connection, as displayed in [Figure 3-107](#), following, avoiding the GC oven exhaust path, and then connect the control cable to the control box.



Figure 3-107
Control Cable and Tubing Installed to Control Box

5. Route the LECO factory-installed tubing along the same path as the control cable, and then connect the tubing to the control box, refer to [Figure 3-107](#), previous, and [Figure 3-108](#), following.

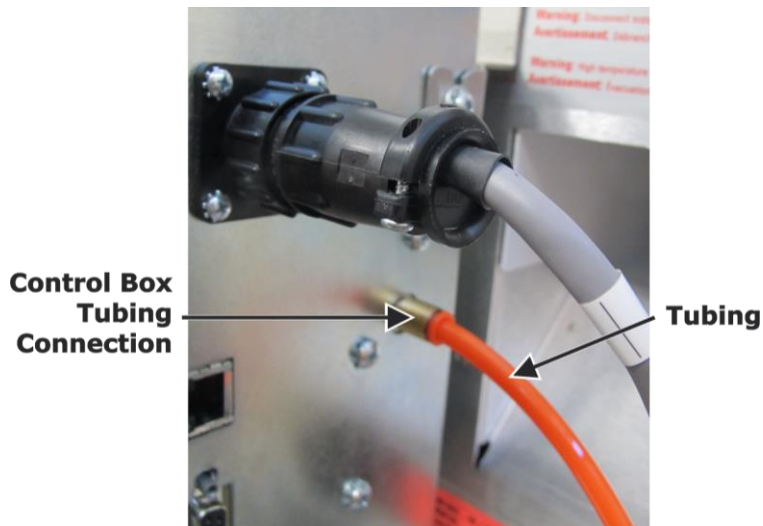


Figure 3-108
Tubing Connected to Control Box

6. If installing an Agilent 8890 GC system, skip to [Installing the 8890 Carrier Gas Connections \(8890 Only\)](#), page 3-86. If installing an Agilent 7890 GC system, proceed to [Installing the 7890 Carrier Gas Connections \(7890 Only\)](#), following.

Installing the 7890 Carrier Gas Connections (7890 Only)

1. Connect a copper carrier gas tube from the carrier gas supply to one end of the copper tee fitting. Refer to [Figure 3-110](#), following.
2. Connect a copper gas tube from one end of the copper tee fitting to the flow modulator pressure control module (PCM) gas inlet port on the back of the GC with a nut. Refer to [Figure 3-110](#), following.
3. Connect a copper gas tube from one end of the copper tee fitting to the carrier gas inlet port on the back of the GC. Refer to [Figure 3-110](#), following.

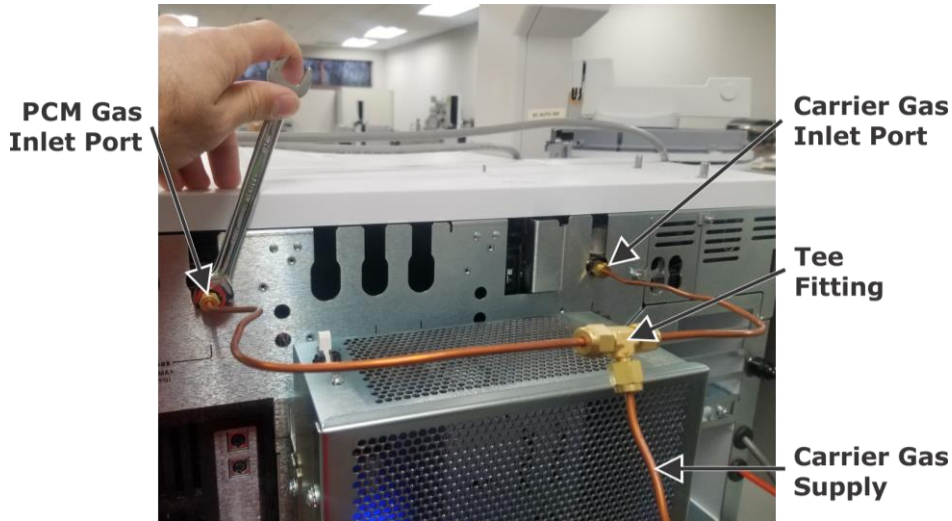


Figure 3-109
Carrier Gas Connections

4. Skip to [Installing the Columns](#), page [3-87](#).

Installing the 8890 Carrier Gas Connections (8890 Only)

1. Connect a copper carrier gas tube (included in the component pack) (from the carrier gas supply to one end of the copper tee fitting (included in the component pack)). Refer to [Figure 3-110](#), following.

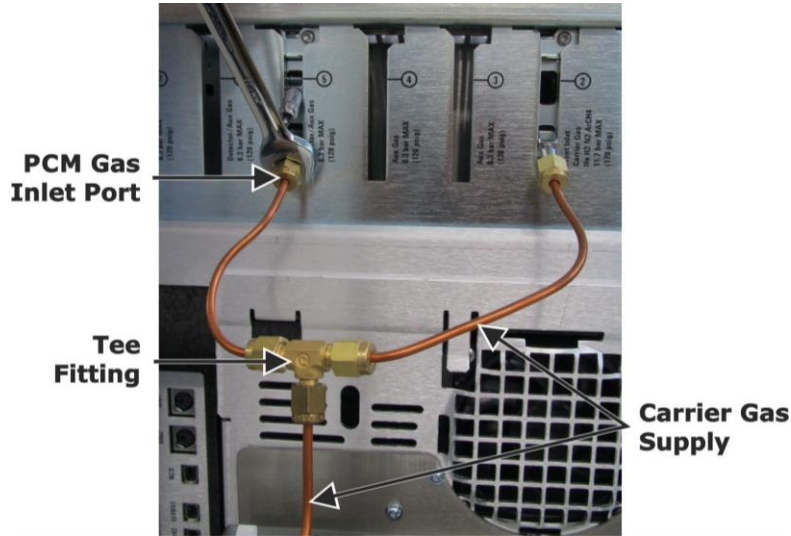


Figure 3-110
Carrier Gas Connections

2. Connect a copper gas tube from one end of the copper tee fitting to the flow modulator pressure control module (PCM) gas inlet port on the back of the GC with the $\frac{7}{16}$ -inch nut included in the component pack. Refer to [Figure 3-110](#), previous.
3. Connect a copper gas tube from one end of the copper tee fitting to the carrier gas inlet port labeled "CH1" on the back of the GC with the $\frac{7}{16}$ -inch nut included in the component pack. Refer to [Figure 3-110](#), previous, and [Figure 3-111](#), following.

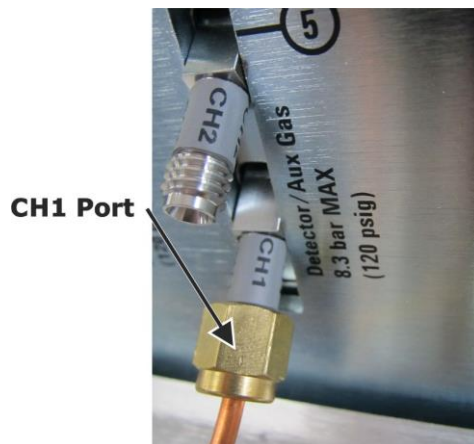


Figure 3-111
CH1 Port on GC

4. Proceed to [Installing the Columns](#), page 3-87.

Installing the Columns



PROTECTIVE GLOVES

Wear protective gloves when handling the column to prevent fingerprints and other contaminants from damaging the column.

1. Insert one end of the secondary column through the bottom of the secondary oven, as displayed in [Figure 3-112](#), following.

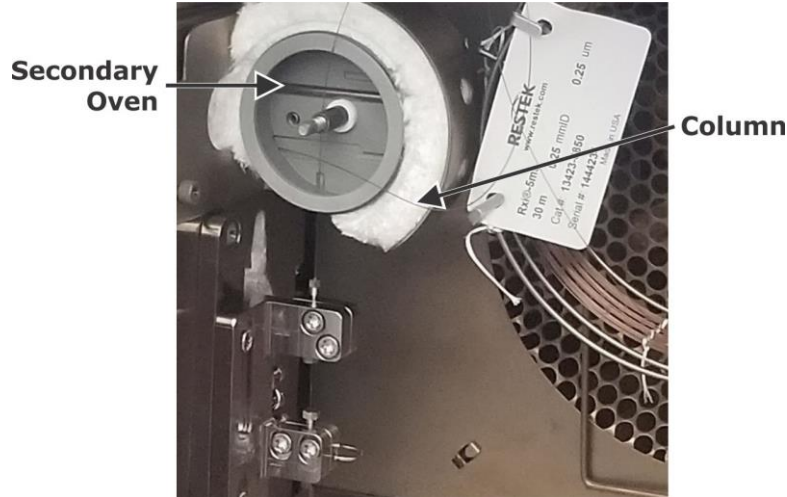


Figure 3-112

Secondary Column Installation in Secondary Oven

2. Loop the column loosely around the secondary oven one time, and then insert the end of the column through the side of the secondary oven and through the side of the GC. Refer to [Figure 3-112](#), previous.
3. Install the secondary column (now protruding outside of the GC side panel) into the transfer line by completing steps [18](#) through [22](#) of [Replacing the Column](#), beginning on page [4-22](#).

4. Install a 360 μm nut and ferrule (included in the component pack) onto the end of the secondary column. Refer to [Figure 3-113](#), following.

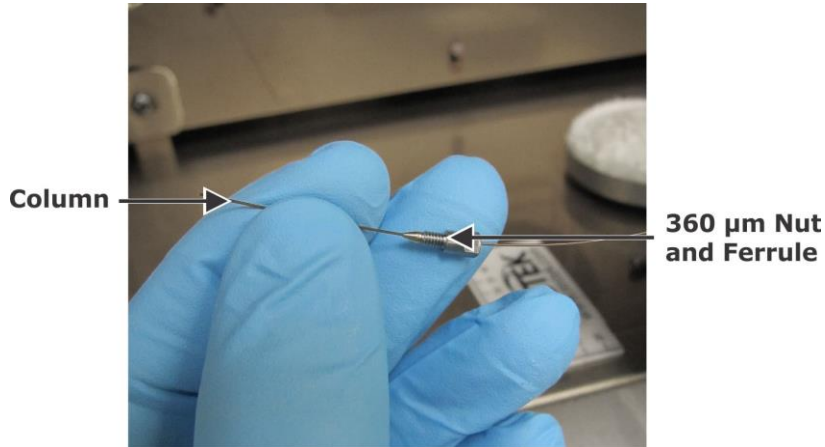


Figure 3-113
Installing 360 μm Nut and Ferrule on Column

5. Position the secondary column adjacent and parallel to the column connecting tube, and line up the end of the column with the crimped section of the column connecting tube. Using an indelible marker, create a line on the column slightly above the bracket marked Divert to indicate roughly how far the column must be inserted. Refer to [Figure 3-114](#), following.



Figure 3-114
Marking Secondary Column Prior to Insertion

6. Insert the secondary column, nut, and ferrule down through the top hole in the divert tee fitting that is mounted to the backside of the divert bracket. Insert the column until it reaches the crimped section of the column connecting tube and cannot be inserted farther. Refer to [Figure 3-115](#), following.

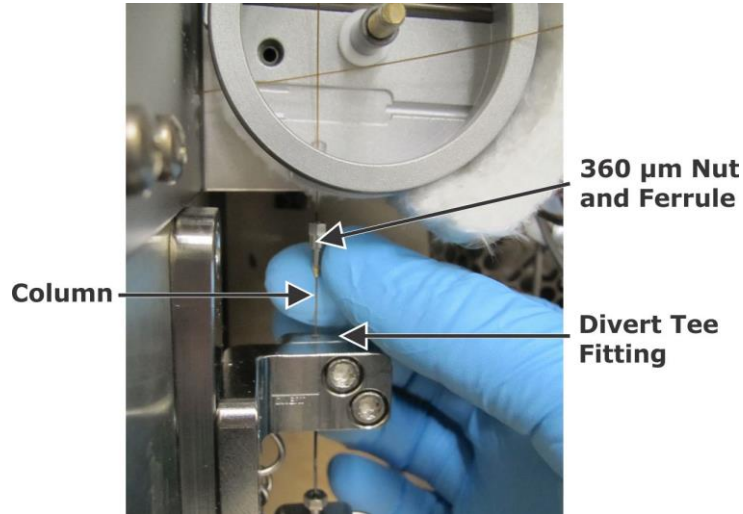


Figure 3-115
Inserting Secondary Column into Divert Tee Fitting

7. Finger-tighten the 360 µm nut and ferrule on the secondary column into the hole on the divert tee fitting. Refer to [Figure 3-116](#), following.

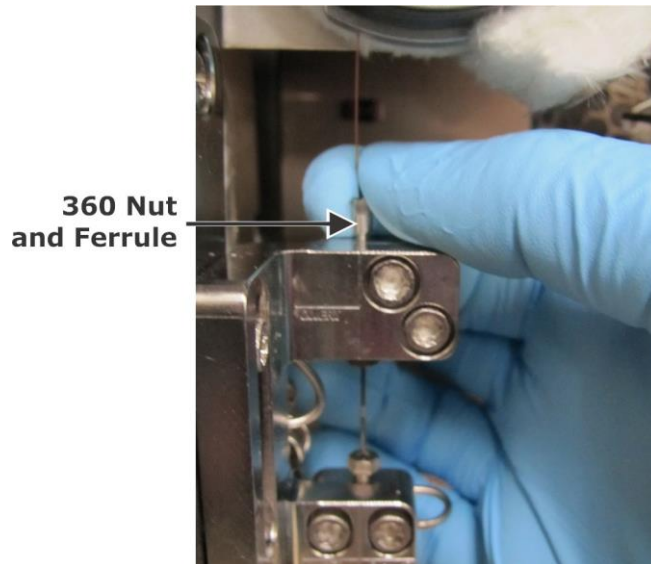


Figure 3-116
Finger-tightening 360 µm Nut and Ferrule into Tee Fitting

8. Fully tighten the 360 μ m nut and ferrule with the 360 column tool included in the component pack. Refer to [Figure 3-117](#), following.



Figure 3-117
Using 360 Column Tool on Secondary Column

9. Install a 360 μ m nut and ferrule (included in the component pack) onto the end of the primary column.
10. Position the primary column adjacent and parallel to the column connecting tube, and line up the end of the column with the crimped section of the column connecting tube. Using an indelible marker, create a line on the column slightly below the bracket marked Inject/Exhaust to indicate roughly how far the column must be inserted.

11. Insert the primary column, nut, and ferrule up through the bottom hole in the cross fitting, which is mounted to the backside of the inject/exhaust bracket. Insert the column until it reaches the crimped section of the column connecting tube and cannot be inserted farther. Refer to [Figure 3-118](#), following.

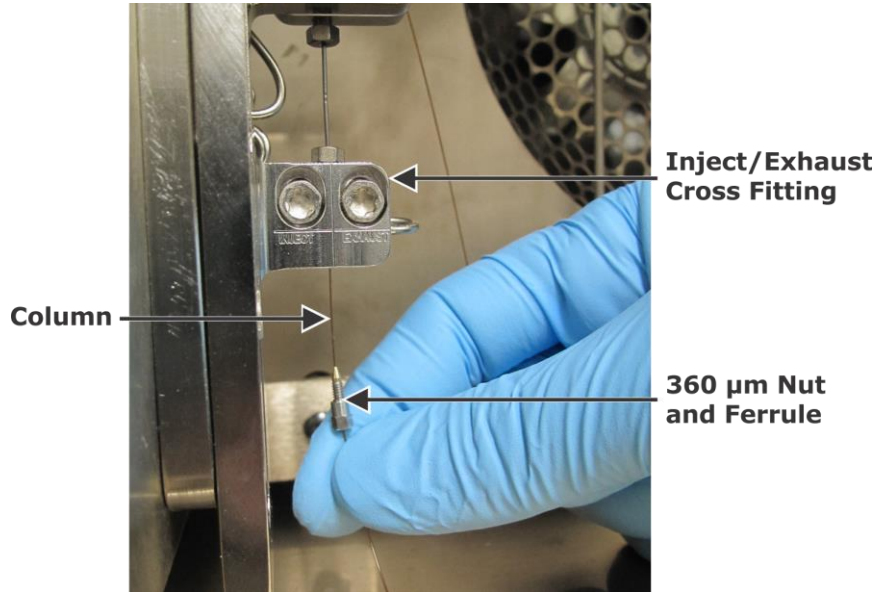


Figure 3-118
Inserting Primary Column into Cross Fitting

12. Finger-tighten the nut and ferrule on the primary column into the bottom hole on the inject/exhaust cross fitting. Refer to [Figure 3-119](#), following.

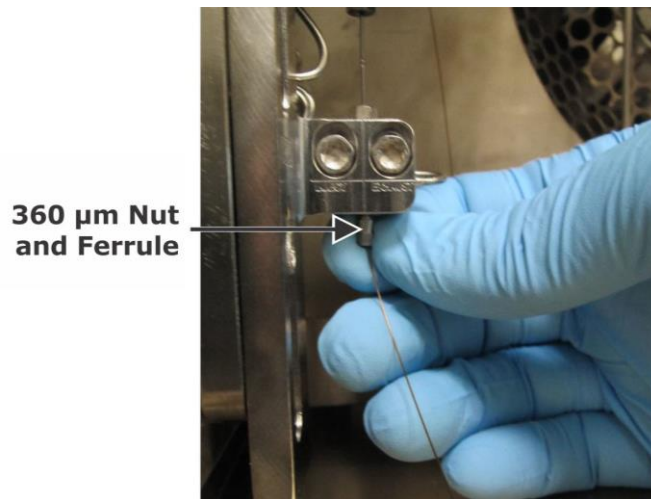


Figure 3-119
Finger-tightening 360 µm Nut and Ferrule into Cross Fitting

13. Fully tighten the nut and ferrule with the 360 column tool included in the component pack. Refer to [Figure 3-120](#), following.

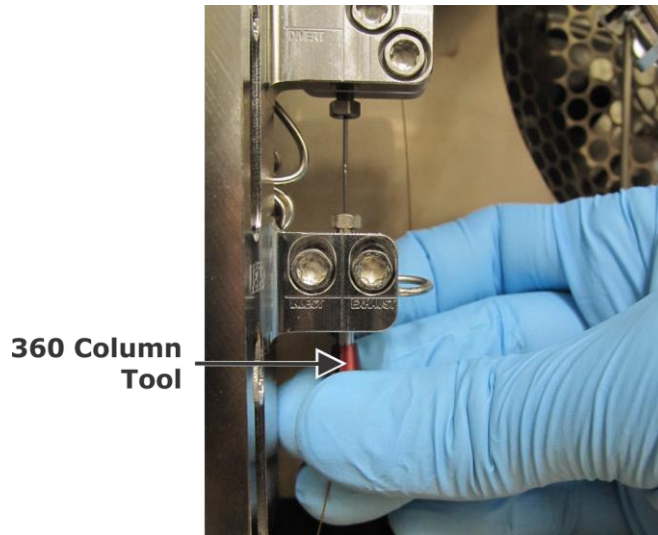


Figure 3-120
Using 360 Column Tool on Primary Column

Installing Additional Connections

1. Connect the incoming compressed air gas line to the port labeled "CA" on the left side of the control box. Refer to [Figure 3-121](#) (7890) and [Figure 3-122](#) (8890), following.

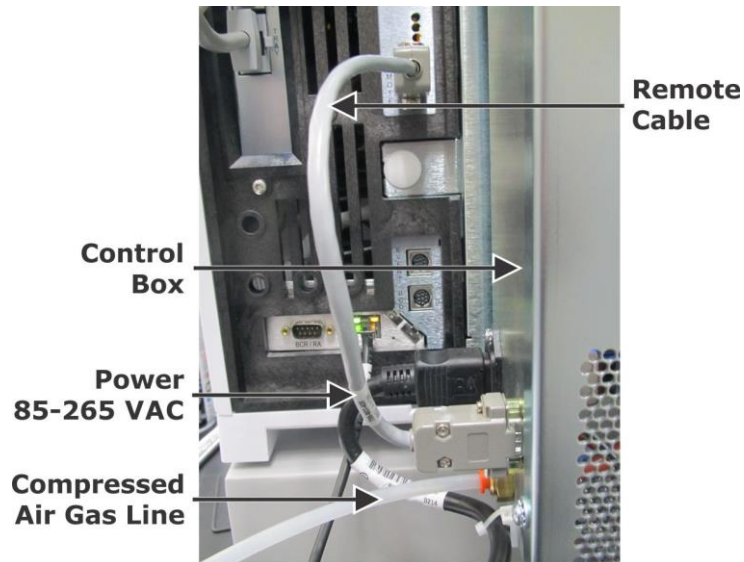


Figure 3-121
7890 Compressed Air Gas Line Connected

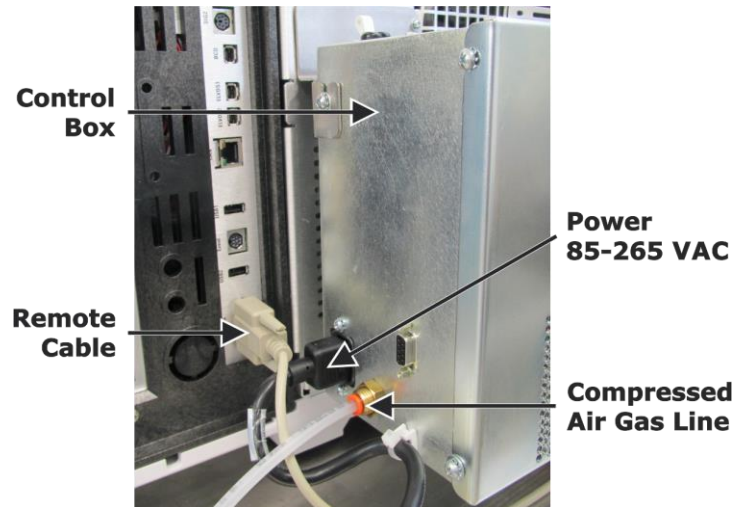


Figure 3-122
8890 Compressed Air Gas Line Connected

2. Connect the remote cable from the GC into the remote cable port labeled "JREM2" on the back of the *Pegasus* BT 4D. Refer to [Figure 3-122](#), previous.



Figure 3-123
Remote Cable Connected

3. Connect the control box power cord from facility power to the left side of the control box. Refer to [Figure 3-122](#), previous.
4. Set the Compressed Air source pressure to 30 psi (2.1 bar).

5. Connect the GCxGC control cable from the control box to the instrument. Refer to [Figure 3-124](#), following.

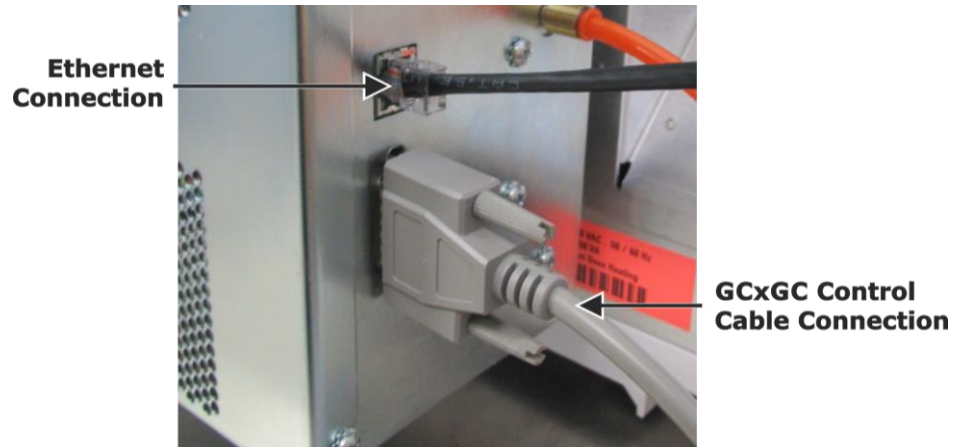




Figure 3-124
Ethernet and Control Cables Connected to Control Box



CAUTION: NETWORK CONNECTION

Connect the Ethernet port on the instrument to the Ethernet port on the control box as instructed in this manual. Connecting the instrument directly to a corporate network (LAN) may result in communication problems.

6. Connect the Ethernet cable from the Ethernet Port  on the control box to the Ethernet Port  on the instrument. Refer to [Figure 3-124](#), previous.

NOTE →

The LECO mass spectrometer instrument, the computer, and the GC installations must be complete and powered On prior to initializing the following steps for learning the secondary oven gas flow.

7. Turn On the control box power breaker. Refer to [Figure 3-125](#), following.



Figure 3-125
Control Box Power Breaker

Learning the Proportional Valve

Learn the secondary oven cooling proportional valve by completing the following steps. Learn Mode determines the power required to open the proportional valve used for cooling the secondary oven during modulation cycles.

1. In the *ChromaTOF* software, select Instrument on the Menu bar, select Diagnostics, and then select the Modulator tab.
2. Select the On (Enable) radio button for the secondary oven.

The screenshot shows the 'Diagnostics' window with the 'Flow Modulator' tab selected. The 'Valve Driver Board Status' is 'Ready' and 'Faults' are 'None'. Under 'Valve State', 'Injection Mode' is unchecked. The 'Cycle Testing' section has 'Modulation Time (sec)' set to 2 and 'Inject Duration (sec)' set to 0.5, with 'Start' and 'Stop' buttons. The 'Secondary Oven' section shows 'Temperature Status' as 'Idle', 'Enable' set to 'On', 'Set Point' at 60, 'Actual' at 60.0, and 'PWM' at 6.0. The 'Proportional Valve Control' section shows 'Air Pressure' at 20.5 psi and 'PWM' at 0.0. The 'Learn Mode' section has a highlighted 'Start' button and a status box displaying 'Learn Mode Passed'.

3. Ensure that the cover is on the secondary oven, and then close the GC oven door.
4. Set the Secondary Oven temperature to 60 °C.
5. Set the GC Oven to 55 °C.
6. Wait for temperatures to equilibrate to the setpoint.
7. Select Start to begin the Learn Mode.

NOTE

This process can take 5 to 60 minutes to complete.

8. "Learn Mode Passed" is displayed in the Status box of the Learn Mode section when complete.

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4 Maintenance

The Maintenance chapter includes procedures that should be performed on a regular basis to improve the instrument's performance and lifespan. The procedures included in this chapter may require disabling power to the instrument and should be performed only by trained personnel.



HAZARDOUS VOLTAGE WARNING

During installation and operation of this instrument, the ON/OFF switch must be easily accessible. This switch is located on the left side panel of the instrument.



PROTECTIVE EYEWEAR/PROTECTIVE GLOVES

Protective eyewear and gloves should be worn when handling chemicals.



Refer to the Safety Data Sheet (SDS) for the specific chemical for additional information.

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Periodic Maintenance Schedule

The following is a list of maintenance procedures that should be performed on a regular basis. Periodic maintenance of the instrument will result in improved instrument performance and will extend the life of the instrument and its assemblies. For more information concerning periodic maintenance and periodic maintenance procedures, refer to the individual topic.

NOTE → Maintenance procedures for pumps and filters, in addition to those listed in the following table, can be found by consulting the other manuals (such as Pfeiffer or Edwards) included as PDFs in the ChromaTOF® help system. Refer to [Accessing the Manual](#), page 1-31.

Frequency	Area	Action
As Needed	Filament	Replace when the filament is broken. Contact LECO Service if you need to purchase new replacement filaments. Refer to Replacing the Filaments , page 4-11.
	Support Gases	Refer to Equipment Packages for the Pegasus BT 4D , page 1-50.
	Column	Refer to Replacing the Column , page 4-15.
	Ion Source	Clean the Ion Source. Contact LECO Service.
	Foreline Trap Sorbent	Use lint-free gloves and wipes when handling filter elements. For maintenance requirements, refer to Replacing Sorbent in the Foreline Trap , page 4-27.
	Detector	When the detector has reached the maximum detector bias voltage and cannot pass Gain Optimization, contact LECO Service to have the detector replaced.
Daily and As Needed	General Leak Testing	Inspect daily and after changing: Column, Filament, Detector, Pumps. Refer to System Leaks , page 4-4.
Daily	Instrument Optimization	Refer to Daily Instrument Check in the <i>ChromaTOF</i> Brand Software Manual.
Monthly	Calibration Compound	Inspect monthly. Replace every six months or when 25% of the compound in the vial is used. Refer to Adding Calibration Compound , page 4-25.
	Roughing Pump	Inspect oil level monthly. For replacing oil, refer to the pump manual.
	Front Panel Filters	Refer to Cleaning the Pegasus BT 4D Filters , page 4-29.

System Leaks

Leaks can occur in the gas chromatograph or the mass spectrometer. The following section identifies typical leak indications and then provides checks and corrective action to resolve leaks.

Leak Indications

- Higher than normal vacuum level
- Excessive background in the mass spectrum
- Characteristic peaks such as m/z 18, 28, 32, and 40
- Poor sensitivity
- Higher than normal turbo pump power or temperature

Leak Trouble Spots

Leaks in the gas chromatograph may allow oxygen into the system, which can damage columns. Leaks in the mass spectrometer can increase pressure and background ions, which can reduce mass spectrometer performance. For the gas chromatograph, refer to the Agilent User Information Guide for further information.

In the gas chromatograph	In the mass spectrometer
<ul style="list-style-type: none">• Check column connections in the oven.• Check inlet septum and change as needed. If septum is leaking helium, then air is leaking in.• Check the GC inlet and the gas connections at installation and whenever lines are disconnected and reconnected, especially if a graphite/vespel ferrule is used.	<ul style="list-style-type: none">• Check the transfer line/column connection/nut periodically. Graphite/vespel ferrule shrinks with temperature cycling and will require periodic tightening.• Check o-ring grooves.• Check surface finishes.• Check pump seals.

Performing a Leak Check

Leak checks can be performed through the QC method or by reviewing the background spectra, explained as follows.

QC Method

Refer to Leak Check in the *ChromaTOF* Brand Software Manual for instructions to schedule a leak check through the QC method.

Review Background Spectra

System leaks can be determined by performing a background check. During a background check, use the Spectra Plot to view the intensities and relative ratios of m/z 18 (water), m/z 28 (nitrogen), m/z 32 (oxygen), m/z 40 (argon) and m/z 44 (carbon dioxide). Also, examine the spectrum for any other prominent ions which would indicate contamination. When a background check is performed daily under the same conditions, it is useful in establishing a baseline level of background ions that can be used to evaluate instrument performance.

Venting the Instrument

Complete the following steps to vent the instrument.

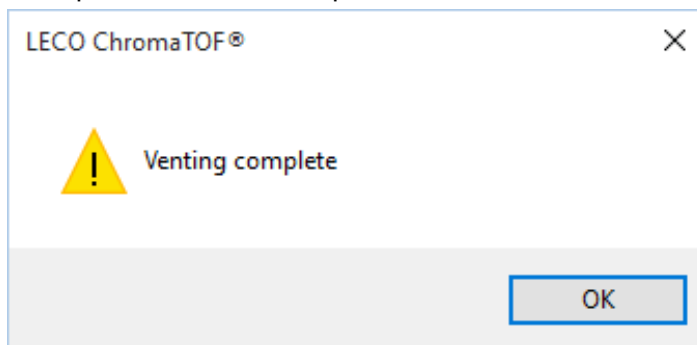
1. Select HV Power in the lower right hand corner of the *ChromaTOF* window, select Power Down from the pop up dialog, and select OK to disable the high voltage.
2. When the "Are you sure you want to disable the high voltage" message displays, select Yes to disable HV.
3. Select the Vacuum tab in Diagnostics dialog window.

The screenshot shows the Diagnostics window with the Vacuum tab selected. The window contains several sections:

- Pressures:** A table with columns Gauge, Pressure (mb), and Expected (mb). The VacuumGauge is at 4.74e-007 mb, with an expected range of 0.00e+000 - 1.00e-005.
- Pumps:** A table with columns Pump, Running, Current, Voltage, Power, Temp., Frequency, and Life. The TurboPump1 is running with a current of 1.2, voltage of 23.1, and power of 25.4.
- Valves:** A table with columns Valve and Status. The TurboPump1VentValve is closed.
- Commands:** Buttons for Vent System and Evacuate System.
- Current action:** Idle
- Current step:** Idle
- Last log message:** --

4. In the Vacuum page, select Vent System and confirm the selection in the pop-up dialog box. Selecting the Stop Action button at any point in the vent procedure will stop the current action and leave the system in the state it is in at the time the Stop Action button was selected. At this point, the Vent System or the Evacuate System buttons can be selected to perform the desired action.
5. Review the Vent/Evacuate Status as follows:
 - The Current Action and Current Step area of the Vacuum page display the status of the vent procedure.
 - The current status and readback parameters of the Turbo Pump are displayed while the vent procedure is in progress. The checkboxes for the Turbo Pump and Roughing Pump indicate whether the pumps are turned On or Off (checked box = pump is On, unchecked box = pump is Off).

6. After venting is complete, a dialog box appears indicating that the vent procedure has completed.



7. Turn Off the main breaker on the back panel, unplug, and power Off the instrument before performing any maintenance on the Pegasus® BT 4D.
8. When the maintenance tasks are completed and the system is ready for evacuation, refer to [Powering Up the Instrument](#), page 4–8.

Powering Up the Instrument

The following procedure explains how to power up the instrument after a shutdown, though it is routinely left running at all times. Also refer to [Venting the Instrument](#), page 4–6.

1. Verify that all cables and power cords are connected and the transfer line is properly installed into the source.
2. Turn On the main power switch located on the back panel of the instrument. The roughing pump starts and the instrument begins the evacuate cycle.
3. Turn On the computer tower and monitor.
4. Select the *ChromaTOF* 5 icon located on the computer monitor's desktop. The Login dialog box opens.
5. Wait until the vacuum status indicator on the lower right-hand corner of the *ChromaTOF* window turns green before enabling the High Voltage. The pressure will be less than 5×10^{-6} mbar. High Voltage cannot be enabled and components will not begin heating up until the vacuum status indicator displays a green light on the Status bar.
6. To enable the high voltage, complete steps A through E, following. Refer to [Figure 4-1](#), following.

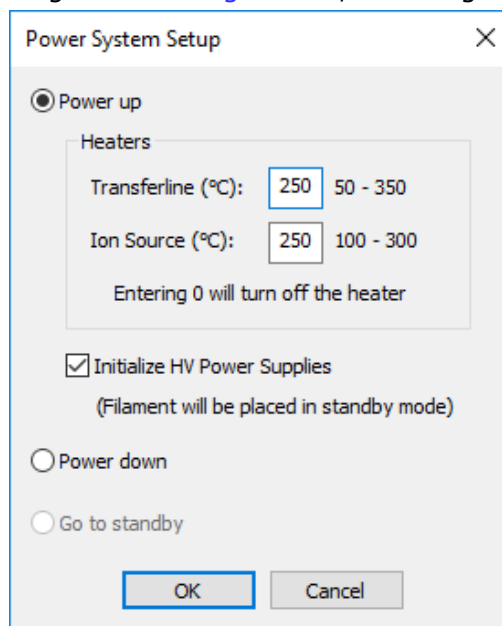


Figure 4-1
Power System Dialog

- A. Select the HV Power button in the lower right hand corner of the *ChromaTOF* window. A dialog box opens.
- B. Select the Power Up radio button.
- C. Enter the desired transfer line and ion source temperatures.
- D. Select the Initialize HV Power Supplies checkbox.
- E. Select OK.

7. The instrument should be allowed a 1-hour stabilization time prior to operation.
8. Perform a Daily Optimization in the *ChromaTOF* Brand Software Manual.

Powering Down the System

It is commonplace for most laboratories to leave the instrument running and under vacuum at all times. But in some circumstances, such as a scheduled power-loss, the *Pegasus* BT 4D must be shut down for an indefinite amount of time.

1. Vent the instrument. For the venting process, refer to [Venting the Instrument](#), page 4–6.
2. Remove the transfer line assembly from the *Pegasus* BT 4D unit. Refer to [Replacing the Column](#), page 4–15.
3. Replace the transfer line with the Pseudo Transfer line that the *Pegasus* BT 4D was originally shipped with by inserting it into the source and fastening it in place.
4. Turn main power Off, and then unplug the electrical supply cable.
5. Remove the column from the transfer line and then plug a septa onto the free end of the column so that minimal oxygen and water enter.
6. On the GC touchscreen/keypad, select COL1 or COL2 and then set the Flow to zero. The instrument is now properly prepared for an indefinite time without vacuum.

Replacing the Filaments



PROTECTIVE GLOVES

Wear protective gloves when handling the filaments to prevent fingerprints and other contaminants.



CAUTION

Before the filament(s) can be removed, the instrument needs to be cooled down and vented.

Complete the following steps to replace the filaments in the *Pegasus* BT 4D system.

1. Vent the instrument by following the procedure outlined in [Venting the Instrument](#), page 4-6.

NOTE

It is not necessary to slide the GC away from the *Pegasus* BT 4D, remove the transfer line, or remove the source in order change the filament(s).

2. Once the instrument is vented, remove the front flange of the vacuum chamber by loosening the four corner screws on the flange using the T25 Torx® driver provided with the instrument.
3. Loosen the filament bracket mounting screw using the T25 *Torx* driver. Refer to [Figure 4-2](#), following.

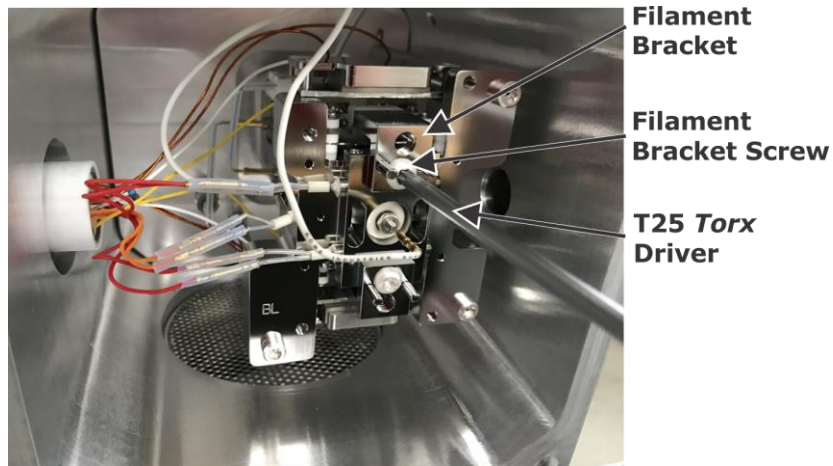
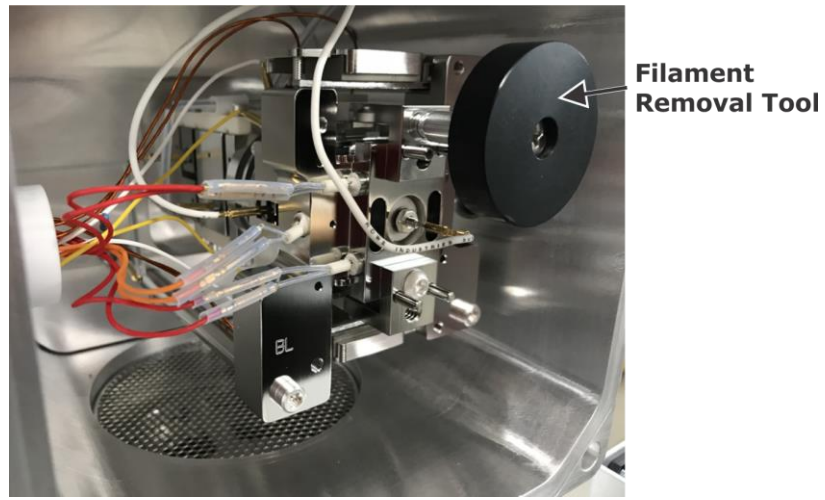


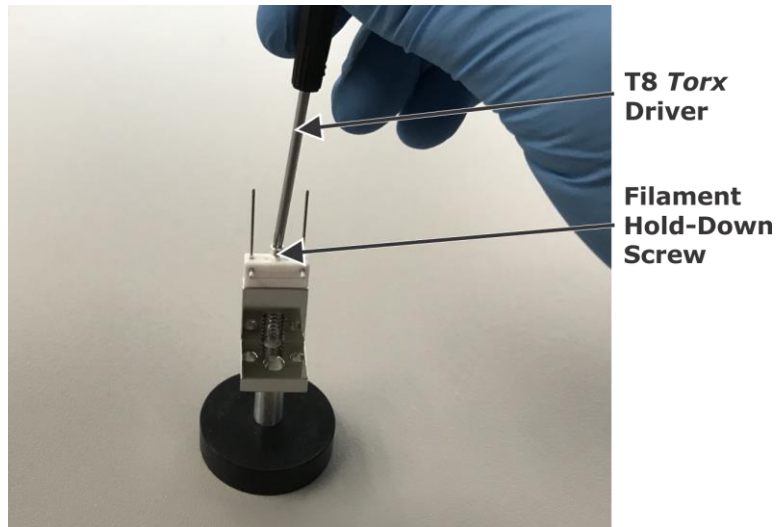
Figure 4-2
Removing Filament Bracket Mounting Screw

4. Screw the filament removal tool into the filament bracket, and then gently pull the filament removal tool and filament bracket out of the source. Refer to [Figure 4-3](#), following.



**Figure 4-3
Filament Removal Tool in Filament Bracket**

5. Set the filament removal tool on the bench, leaving the filament bracket and filament pointing straight up.
6. Remove the filament hold-down screw that holds the filament ceramic block to the filament bracket using the T8 *Torx* driver provided with the instrument. Refer to [Figure 4-4](#), following.



**Figure 4-4
Removing Filament Hold-down Screw**

7. Slide the old filament off of the filament bracket.

8. Install the new filament by sliding it over the guide pins on the filament bracket. Refer to [Figure 4-5](#), following.

NOTE →

Make sure that the new filament is installed with the filament ribbon in the same orientation as the filament that was removed.

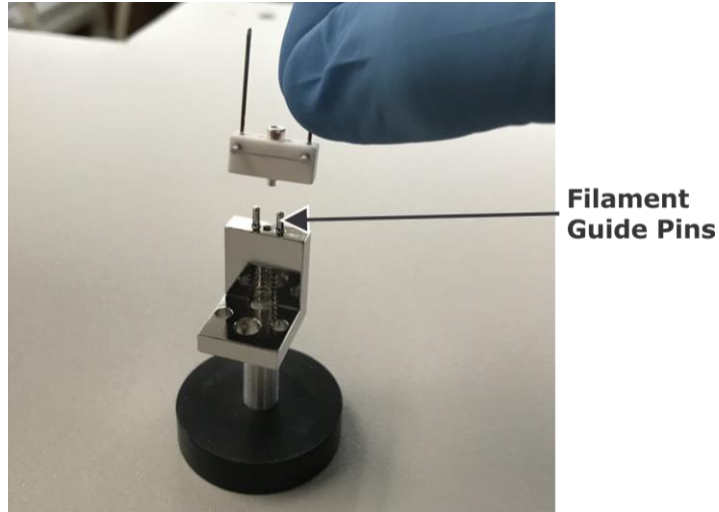


Figure 4-5
Attaching New Filament to Bracket

9. Screw the filament hold-down screw into the filament ceramic block and tighten it with the T8 *Torx* driver.
10. Pick up the filament removal tool and carefully press the filament back into the source. Refer to [Figure 4-6](#), following.

NOTES →

- Ensure that the guide rods on the source base slide into the holes on the filament bracket.
- Ensure that the filament electrical leads are properly engaged in the connection blocks on the source.

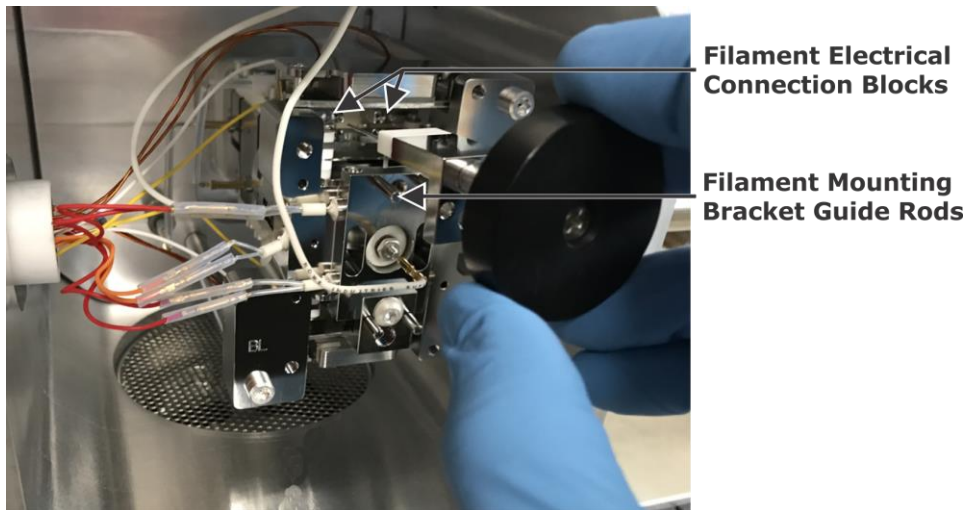


Figure 4-6
Installing New Filament

11. Unscrew and remove the filament removal tool from the filament bracket.
12. Using the T25 *Torx* driver, insert the filament bracket mounting screw to attach the filament bracket to the source base.
13. Screw the filament bracket mounting screw into the filament bracket with the T25 *Torx* driver, attaching the bracket to the source base.
14. Tighten the screws on the front flange into the vacuum chamber using the T25 *Torx* driver.
15. Evacuate the system by following the steps in [Powering Up the Instrument](#), page 4-8.

Replacing the Column

This section outlines the *Pegasus* BT 4D hardware and *ChromaTOF* software procedures to change a column on the *Pegasus* BT 4D.



HIGH TEMPERATURE WARNING/PROTECTIVE GLOVES

The transfer line assembly reaches very high temperatures. Allow the transfer line to cool before handling the column. Do not operate the unit until the transfer line is completely installed and the gas chromatograph is in place.



Wear protective gloves when handling the column to prevent fingerprints and other contaminants from damaging the column.

Materials Needed:

- Inlet Ferrule
- Transfer Line Ferrule
- 1/4-inch Open-End Wrench
- T15 Standard Torque Screwdriver
- Thumb tack or Paperclip
- Column Cutter
- Column Measuring Tool



CAUTION

Proceed with caution. Follow the safety instructions at each step of the installation process. Failure to follow the directions exactly may result in instrument damage.

1. Vent the system by selecting the Diagnostics item found on the System tab of the ribbon. Refer to [Figure 4-7](#), following.

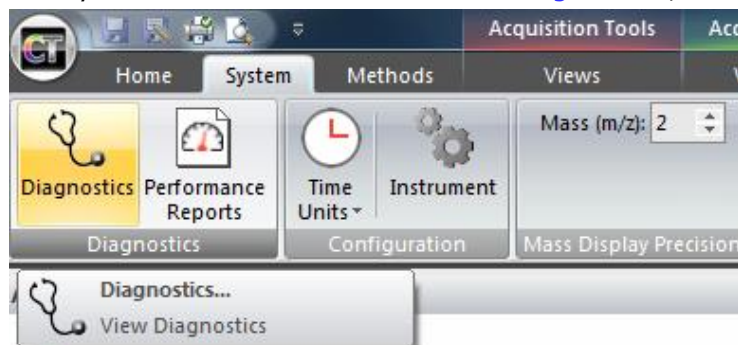


Figure 4-7
Diagnostics Option in System Tab

2. In the Diagnostics window, select the Vacuum tab.

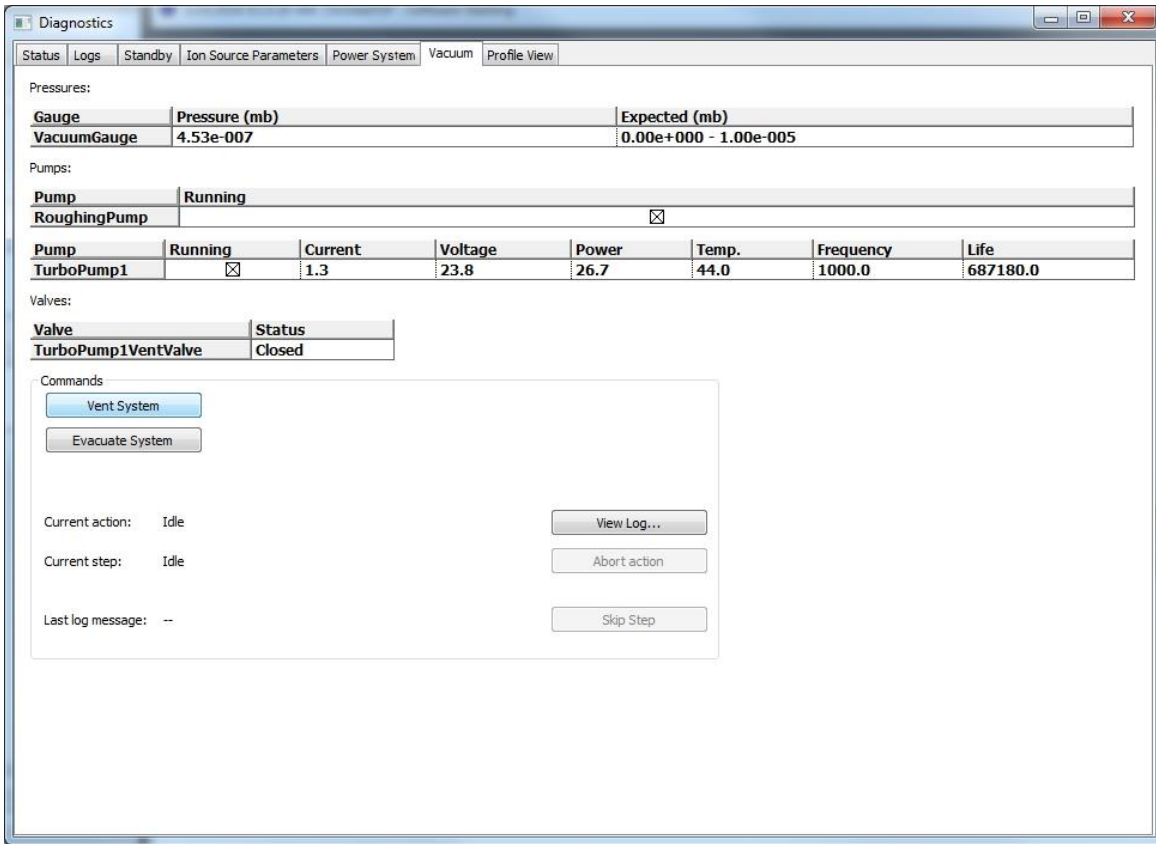


Figure 4-8
Venting System in Vacuum Tab

3. Within the Vacuum tab, select the Vent System button (refer to [Figure 4-8](#), previous), which will trigger the following series of events: The *ChromaTOF* software will power down the high voltage. Once completed, the transfer line and the ion source are allowed to cool. Once they have both cooled to at least 100 °C, the software turns Off the pumps and backfills the system with nitrogen.

- Once the system is completely vented, the *ChromaTOF* software will inform the user with the notification displayed in [Figure 4-9](#), following. Additionally, the system log will be appended with the event.

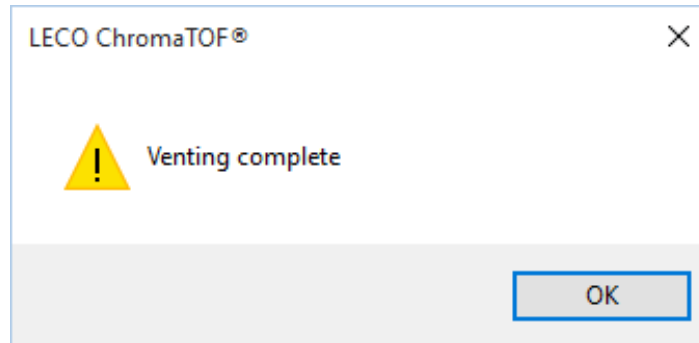


Figure 4-9
Venting Complete Notification

- Next, slide the GC over to the right to access the transfer line. To do this, pull the black knob (refer to [Figure 4-10](#), following) at the bottom of the GC and push the GC from the bottom left corner. Once the “click” sound is heard, the GC is locked and in place. Make sure to push gently to ensure the GC is not pushed passed that locked position.

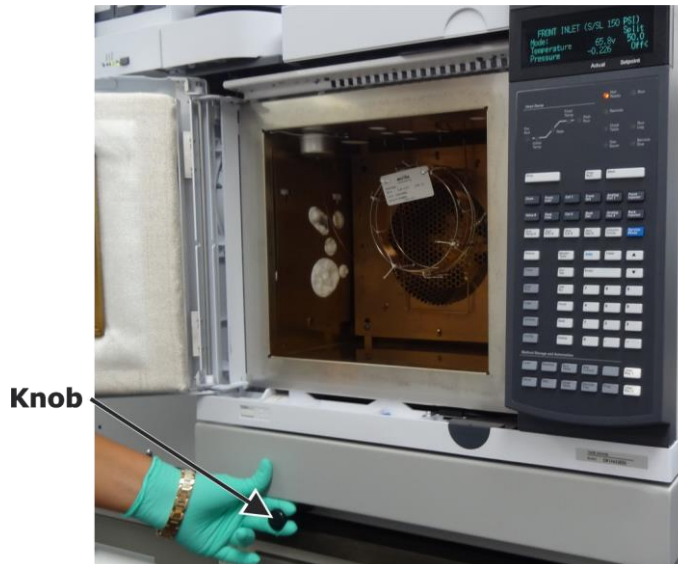


Figure 4-10
Sliding GC Over

6. Unscrew the inlet nut from the inlet using the $\frac{1}{4}$ -inch open-end wrench. Refer to [Figure 4-11](#), following.

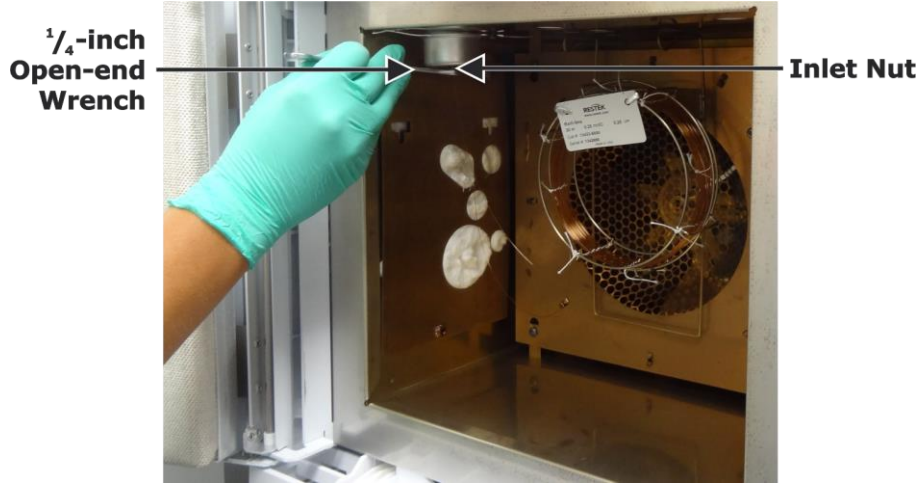


Figure 4-11
Removing Inlet Nut

7. Gently pull the column out of the inlet nut.
8. Remove the inlet ferrule from the inlet nut. This can be done by using a thumb tack or paperclip to dig the ferrule out of the nut. It may be easier to try pushing the thumb tack near the edges of the ferrule to have a better chance of removing the ferrule whole instead of in pieces. Refer to [Figure 4-12](#), following.

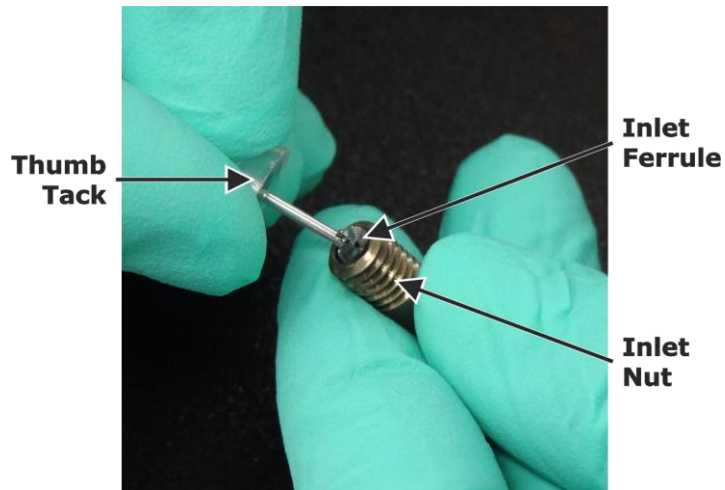


Figure 4-12
Removing Used Inlet Ferrule from Inlet Nut

9. Unscrew the transfer line nut using the $\frac{1}{4}$ -inch open-end wrench. Refer to [Figure 4-13](#), following.

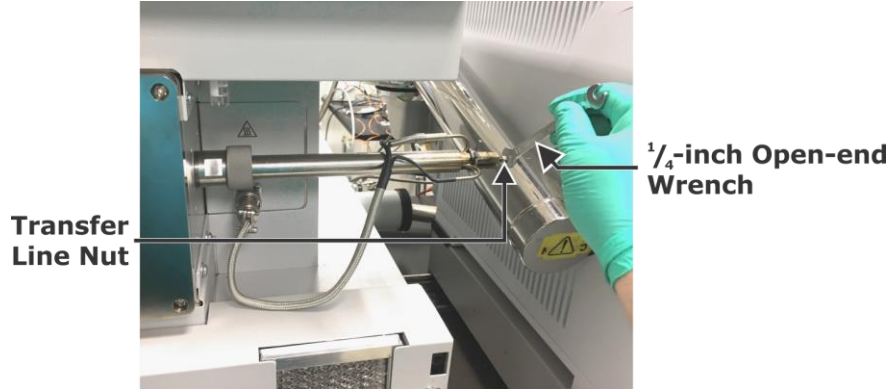


Figure 4-13
Removing Transfer Line Nut

10. Pull the column out of the transfer line nut. This can be done by firmly grabbing the column before the nut to ensure the column doesn't break and tugging on the nut until it starts to move. Refer to [Figure 4-14](#), following.

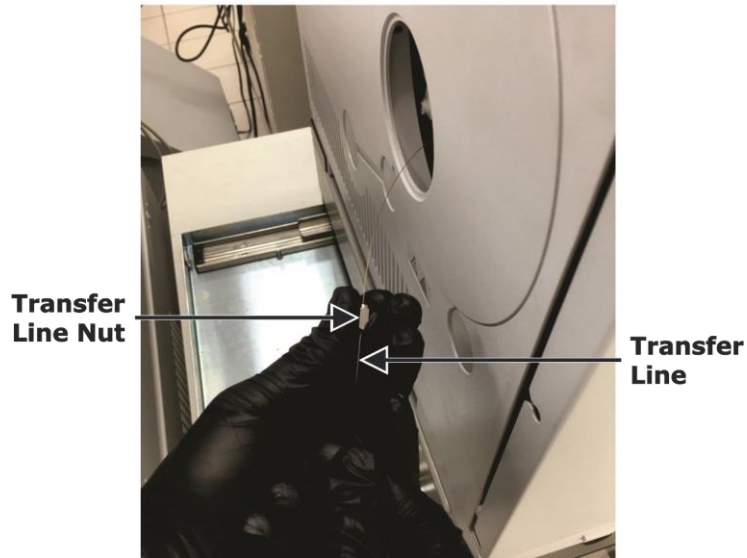


Figure 4-14
Separating Transfer Line Nut and Column

11. Use a thumb tack to take the transfer line ferrule out of the nut. Firmly push the thumb tack into the hole until the ferrule loosens and the thumb tack is completely inside the nut. Refer to [Figure 4-15](#), following.

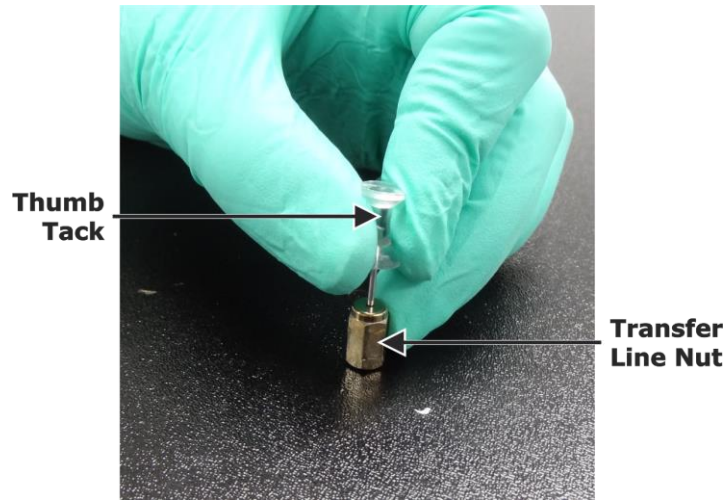


Figure 4-15
Removing Transfer Line Ferrule

12. Remove the old column completely out of the GC.
13. Start attaching the new column by inserting the new column in the inlet nut and the new inlet ferrule. Cut a small piece of the column off of the end (approximately 1 to 2 mm) to prevent any ferrule contamination within the column. Refer to [Figure 4-16](#), following.

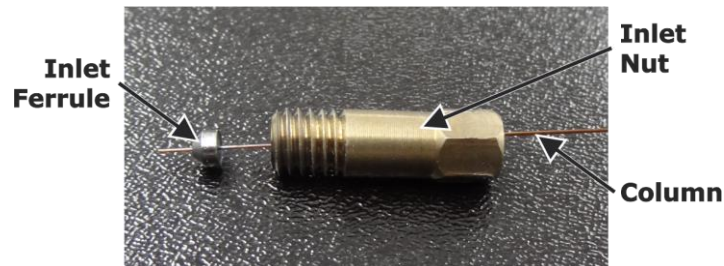


Figure 4-16
Initial Threading of Column

14. Before attaching the inlet nut back onto the inlet, be sure to have extra column coming through the nut. This will allow easier measurement of the inlet source depth.

15. Tighten the nut enough so that you can no longer move the column if you tug on it. Take the inlet nut out and measure 4 to 6 mm for the inlet column depth. Put the nut back in and tighten snugly. Refer to [Figure 4-17](#), following.

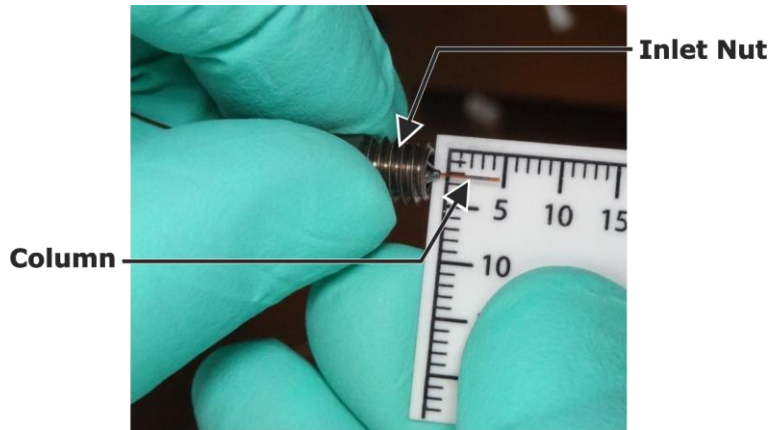


Figure 4-17
Measuring Inlet Column Depth

16. Feed the other end of the column out of the GC through the transfer line opening on the left side of the GC. Ensure that there is ample length to thread through the transfer line and into the mass spectrometer.
17. Remove the transfer line by loosening the compression fitting, as displayed in [Figure 4-18](#), following.

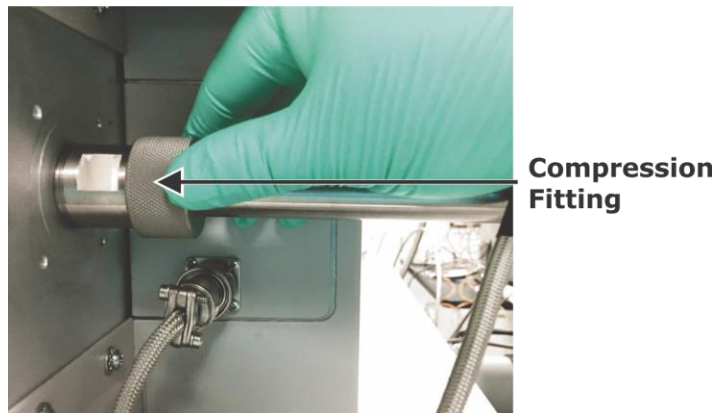


Figure 4-18
Loosening Transfer Line Compression Fitting

18. Feed the column through the transfer line nut, ferrule, and transfer line as indicated in [Figure 4-19](#), following. Push the column through the transfer line until several inches of the column extend out of the opposite end of the transfer line.

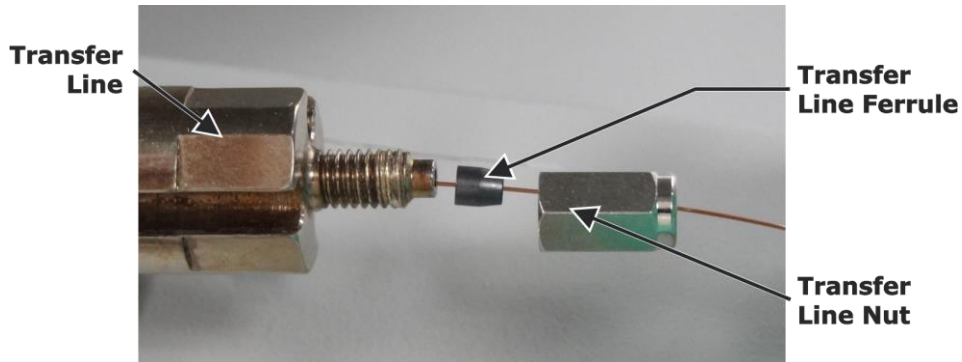


Figure 4-19
Final Threading of Column

19. Very lightly tighten the nut until it is difficult but still possible to move the column if it is pulled toward the GC.
20. Cut a small section of the column off of the end to ensure there is no ferrule contamination in the column. Retract the column slightly back into the transfer line by pulling from the GC side until the column extends 3 to 7 mm beyond the tip of the transfer line. Refer to [Figure 4-20](#), following.

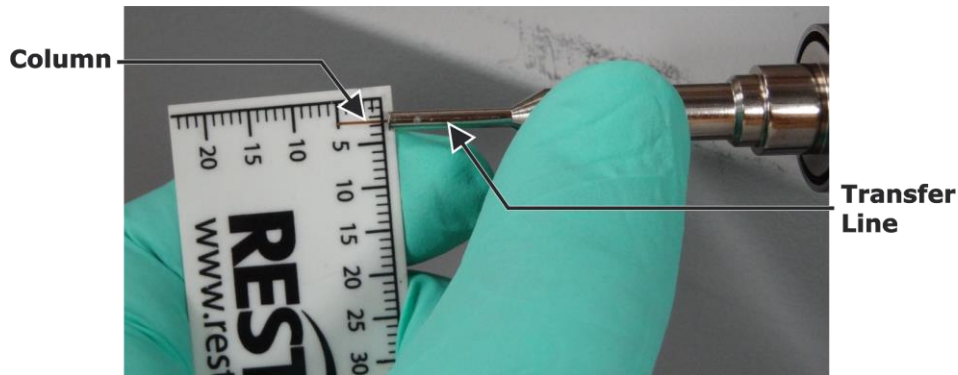
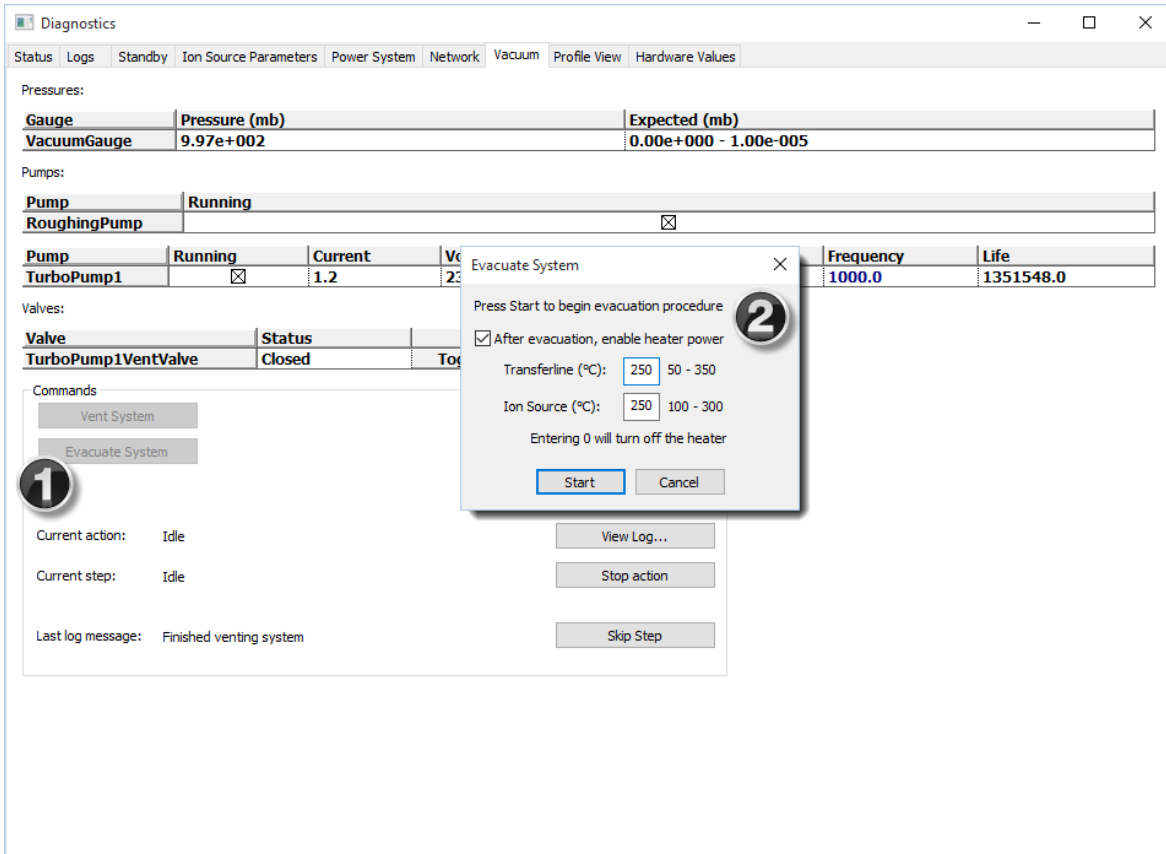


Figure 4-20
Measuring Ion Source Column Depth

21. Carefully reinsert the transfer line back into the mass spectrometer; feed it into the source until it will not move any farther. Tighten the compression fitting by hand. Lightly tighten the transfer line nut until the first squeak is heard.
22. Push the GC to the left back to its original position.

23. Once the column change is finished, return to the Diagnostics screen, select the Vacuum tab, and select Evacuate System. In the pop-up window, select Start. After doing so, the user can elect to enable the heaters once the evacuation is complete. The roughing pump will engage a few seconds after selecting Start. Refer to [Figure 4-21](#), following.



**Figure 4-21
Pumping Down System in Diagnostics Window**

24. Once the pressure is below 9.99×10^7 mb, the source can be powered up. To do this, select the HV Power button on the bottom right corner within the *ChromaTOF* software. An image of this icon is displayed in [Figure 4-22](#), following.



**Figure 4-22
Selecting HV Power button**

25. In the pop-up window, select the Power Up radio button and the Initialize HV Power Supplies checkbox. The user can define the transfer line and ion source temperatures as well, if desired. Refer to [Figure 4-23](#), following.

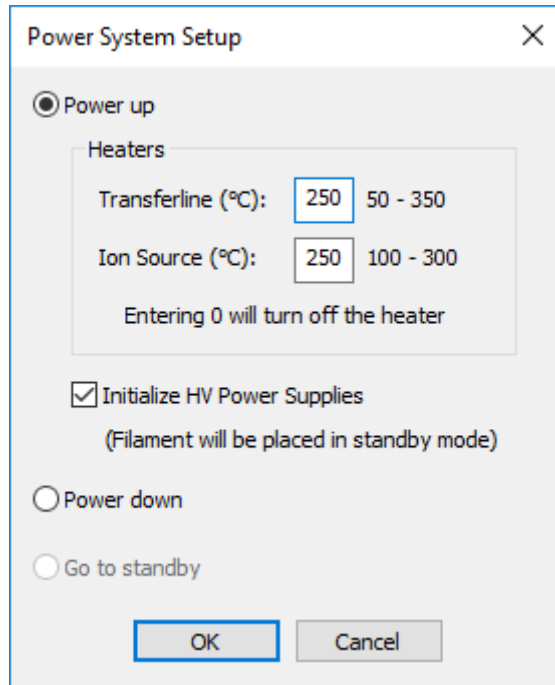


Figure 4-23
Power System Dialog

Adding Calibration Compound



CAUTION

The direct inlet solenoid valve must be Off while installing or checking the calibration compound vial.

1. From the System Ribbon bar, select Diagnostics.
2. On the Ion Source Parameters tab, verify that the Tune Compound Valve is set to Closed.
3. Select HV Power in the lower right hand corner of the *ChromaTOF* window, select Power Down from the pop up dialog, and select OK to disable the high voltage.
4. Open the *Pegasus* BT 4D's front panel by quickly applying and then releasing pressure to the panel.
5. By carefully twisting and slightly pulling down, remove the glass vial located at the direct inlet slot. Refer to [Figure 4-24](#), following.



Figure 4-24
Direct Inlet Assembly

6. Carefully pull down on the glass vial that contains the calibration compound located above the transfer line until the vial and o-ring that is around the neck of the vial disengages from the manifold.
7. Using a 0.5 to 1.0 mL syringe, transfer the calibration compound provided with the instrument into the vial. (Make sure the syringe is clean before use.)
8. Insert the vial into the manifold by twisting the vial as you press it up into the manifold. The o-ring around the neck of the vial makes a radial seal with the surface of the manifold.
9. Close the ion source door.
10. Perform an instrument check. Refer to Daily Instrument Check in the *ChromaTOF* Brand Software Manual.

11. To power up the instrument, complete steps A through E, following.
 - A. Select the HV Power button in the lower right hand corner of the *ChromaTOF* window. A dialog box opens.
 - B. Select the Power Up radio button.
 - C. Enter the desired transfer line and ion source temperatures.
 - D. Select the Initialize HV Power Supplies checkbox.
 - E. Select OK.
12. Record this maintenance in the Maintenance Log.

Replacing Sorbent in the Foreline Trap



CAUTION

Refer to the Edwards FL20K Foreline Trap Instruction Manual for any hazards and warnings regarding the sorbent prior to handling the sorbent.

Refer to [Figure 8-1](#), page [8-3](#), for an illustration of the foreline trap. Refer to the FL20K Foreline Trap Instruction Manual for maintenance requirements and procedures. Refer to [Accessing the Manual](#), page [1-31](#), for instructions on accessing the manual.

Replacing the Mist Filter

Check the mist filter elements and replace them when a persistent odor exists. It is more likely that these elements will require replacement when frequently exposed to atmosphere.

NOTE →

Use lint-free gloves and wipes when handling filter elements.

1. Power down and vent the instrument. Refer to [Venting the Instrument](#), page 4-6.
2. For maintenance instructions, refer to the Oil Mist Filter instruction manual, available in the *ChromaTOF* software. Refer to [Accessing the Manual](#), page 1-31, for access instructions.
3. Power up the instrument. Refer to [Powering Up the Instrument](#), page 4-8.
4. Record this maintenance in the maintenance log.

Cleaning the *Pegasus* BT 4D Filters

The panel filters should be checked at least monthly and cleaned if there is residue.

1. Open the *Pegasus* BT 4D's front panel by quickly applying and then releasing pressure to the panel. Refer to [Figure 4-25](#), following.
2. Slide each filter up and out of its holder.



Figure 4-25
Filter Locations

3. Clean the filters by completing the following instructions:
 - A. Place the filters with the residued side face down.
 - B. Rinse the filters with warm water or blow filters with compressed air.
4. Allow the filters to dry thoroughly.
5. Reinstall the filters by sliding the filters into the holders.
6. Close the *Pegasus* BT 4D's front panel by quickly applying and then releasing pressure to the panel.

Changing the GC Carrier Gas



FLAMMABLE/HEALTH HAZARD/HARMFUL PROTECTIVE GLOVES/PROTECTIVE EYEWEAR

Hydrogen is commonly used as a carrier gas in GCs and associated equipment. Hydrogen accumulations, or leaks in GCs and any associated equipment, can potentially be explosive and dangerous, and hydrogen should be used only as a carrier gas in accordance with all applicable installation, maintenance, and use instructions.

Failure to follow instructions may result in serious injury or death. This manual is not intended as a complete guide to the proper and safe use of hydrogen as a carrier gas. In addition to the following information and instructions, refer to the **Agilent Hydrogen Carrier Gas Safety Guide** and to applicable **Agilent GC User Information Guides and Safety Manuals** (or other GC manufacturers' instructions), as well as any hydrogen generator or gas supplier instructions, for more information.



CAUTION

Hydrogen carrier gas cannot be used with the FLUX™ GCxGC Flow Modulator.

1. From the Ion Source Parameters tab in Diagnostics, turn Off the ion source and transfer line heaters by changing both temperature zone setpoints to "0."
2. Use the GC touchscreen/keypad to set the GC oven temperature to a setpoint that is below 100 °C, and then turn Off the inlet temperature.
3. Wait until all temperatures (GC inlet, GC oven, transfer line, and ion source) are below 100 °C.
4. From the GC touchscreen/keypad, turn Off the flow of the GC inlet.
5. Close the valve on the top of the tank of the empty GC carrier gas.
6. Remove the regulator from the empty GC carrier gas tank.
7. Install the protective cover on the empty GC carrier gas tank, making the tank safe to move.
8. Move the empty GC carrier gas tank away from the instrument, and place the new GC carrier gas tank into place next to the instrument.
9. Connect the regulator to the new GC carrier gas tank.
10. Open the valve on the new GC carrier gas tank.

11. Using a $\frac{1}{2}$ -inch wrench, slightly loosen the fitting on the GC carrier gas line where it connects into the GC's EPC module until you hear gas leaking from the connection. Be careful not to loosen the fitting too much so that it becomes fully disconnected. Allow the line to bleed for approximately 5 minutes to remove all room air from the lines. Re-tighten the GC carrier gas fitting at the EPC to stop the gas bleeding.
12. From GC touchscreen/keypad, turn On the flow of the GC inlet.
13. From the GC touchscreen/keypad, turn the GC oven temperature and inlet temperature back to the desired setpoint.
14. From the Ion Source Parameters tab in diagnostics, turn on the ion source and transfer line temperatures by setting them to the desired temperature setpoints.
15. Wait for one hour after the temperatures reach their setpoints before running the instrument to ensure uniform temperature stability in the system.

Changing the Exhaust Chemical Trap

NOTE → This section applies only to *Pegasus* BT 4D systems with the *FLUX* GCxGC Flow Modulator installed.

The chemical trap on the flow modulator's exhaust will need to be replaced periodically. It is located on the rear left corner on the top of the GC, as shown in [Figure 4-26](#), following. Refer to the Restek Replacement Chemical Trap Installation Instructions for instructions on changing the chemical trap.

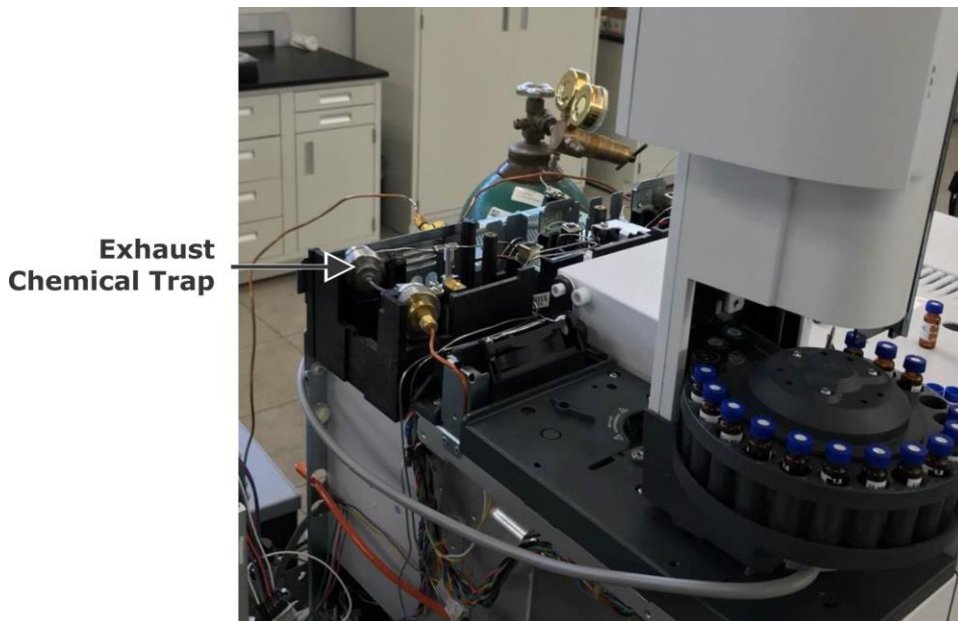


Figure 4-26
Exhaust Chemical Trap Location on Top of GC

Changing the Column Connecting Tube

Complete the following steps to change the column connecting tube.

1. Unwind the column from the secondary oven. Refer to [Figure 4-27](#), following.

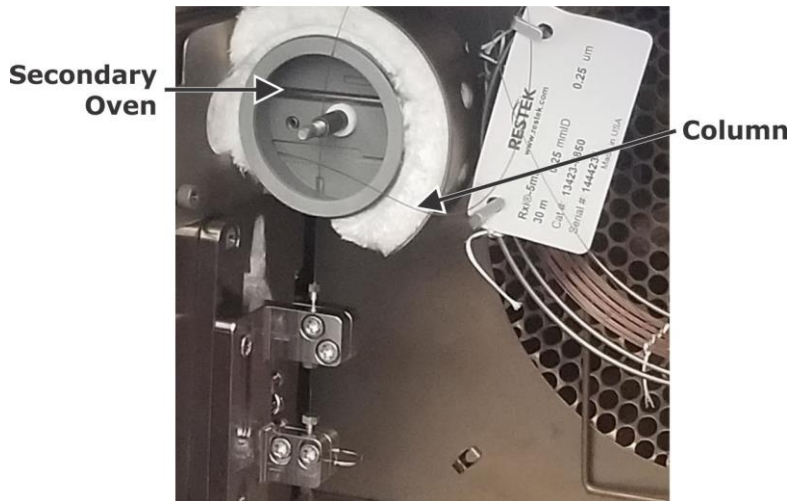


Figure 4-27
Column Unwound from Secondary Oven

2. Loosen the two screws holding the modulator assembly to the modulator mounting bracket with a *Torx* T20 screwdriver, and then slide the modulator assembly down until it can slide no farther. Refer to [Figure 4-28](#), following.

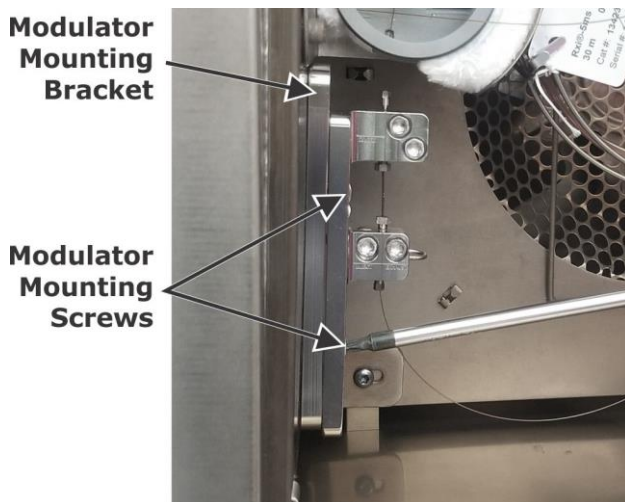


Figure 4-28
Loosening Modulator Bracket Screws

3. Turn Off auxiliary gas flow by completing the following steps:
 - A. On the GC touchscreen/keypad, select AUX EPC.
 - B. Using the down arrow key, scroll to AUX Pressure.
 - C. Select the Off/No button.
4. Loosen the 360 μm nut and ferrule on the secondary column with the 360 column tool (included in the component pack), and remove the secondary column from the flow modulator assembly. Refer to [Figure 4-29](#), following.



Figure 4-29
Removing 360 μm Nut and Ferrule from Secondary Column

5. Loosen the 360 μm nut and ferrule on the primary column with the 360 column tool (included in the component pack), and remove the primary column from the flow modulator assembly. Refer to [Figure 4-30](#), following.



Figure 4-30
Removing 360 μm Nut and Ferrule from Primary Column

6. Loosen the nuts and ferrules on the connecting tube with a $\frac{3}{16}$ -inch open-end wrench. Refer to [Figure 4-31](#), following.

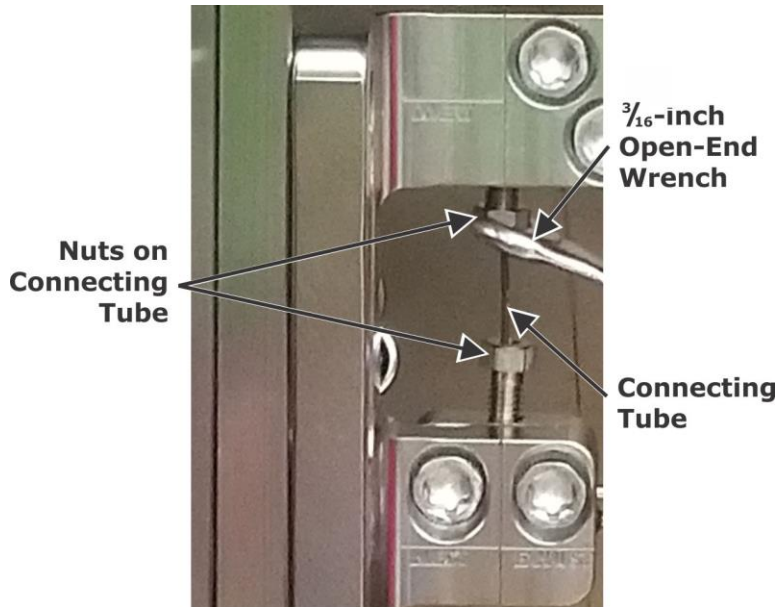


Figure 4-31
Loosening Nuts on Connecting Tube

7. Remove the two screws connecting the divert tee fitting to the modulator assembly with a *Torx* T20 screwdriver. Refer to [Figure 4-32](#), following.



Figure 4-32
Loosening Screws on Divert Tee Fitting

8. Slightly loosen, but do not remove, the two screws connecting the inject/exhaust cross fitting to the modulator assembly with a *Torx* T20 screwdriver.

9. Lift the divert tee fitting upward until it is no longer attached to the connecting tube, and then bend the tee fitting slightly toward the back of the GC oven.
10. Remove the connecting tube from the inject/exhaust cross fitting.
11. Obtain a new connecting tube, and install two sets of $\frac{1}{32}$ -inch stainless steel nuts and ferrules (included in the component pack) on each end of the tube, as displayed in [Figure 4-33](#), following.

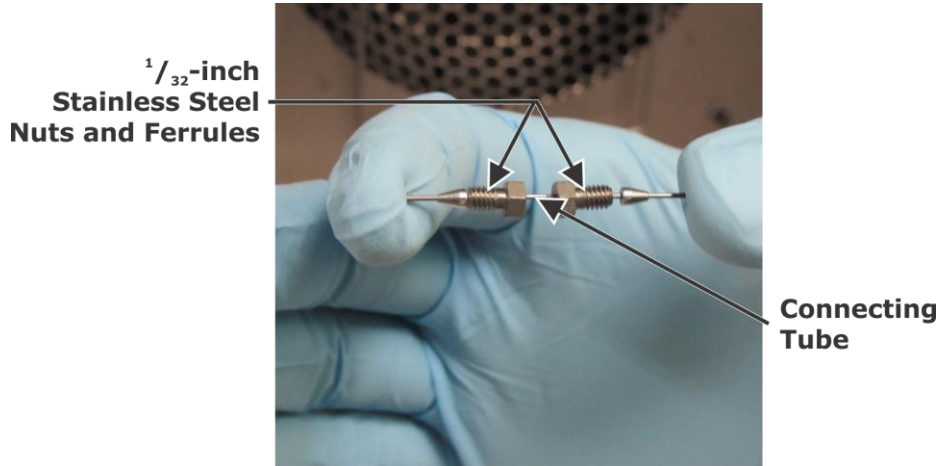


Figure 4-33
Nut and Ferrule Attached to New Connecting Tube

12. Place one end of the connecting tube into the hole on the top of the inject/exhaust cross fitting.
13. While pushing down on the connecting tube, finger-tighten the nut closest to the cross fitting, and then fully tighten the nut with a $\frac{3}{16}$ -inch open-end wrench. Refer to [Figure 4-34](#), following.

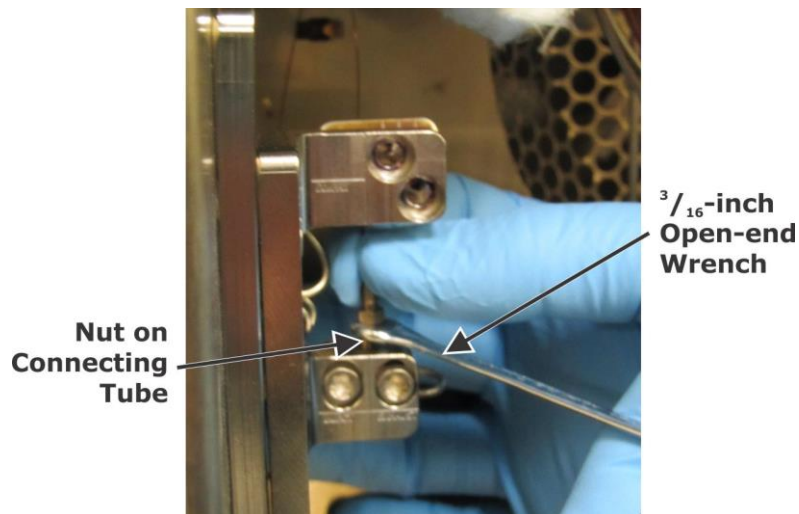


Figure 4-34
Installing Nut and Ferrule to Inject/Exhaust Cross Fitting

14. Bring the divert tee fitting close to its original position, and then slide the tee fitting onto the connecting tube via the hole on the bottom of the tee fitting.
15. Reinstall the screws removed in step 7, page 4-35, with a *Torx* T20 screwdriver.
16. Tighten the screws loosened in step 8, page 4-35, with a *Torx* T20 screwdriver.
17. Slide the top nut and ferrule, installed in step 11, previous, up into the divert tee fitting, and then tighten the nut and ferrule with a $\frac{3}{16}$ -inch open-end wrench. Refer to Figure 4-35, following.



Figure 4-35
Inserting Nut and Ferrule into Divert Tee Fitting

18. Reinstall the primary and secondary columns by completing the steps in [Installing the Columns](#), page 3-87.
19. Slide the modulator assembly loosened in step 2, page 4-33, up to its original position, and then tighten the two screws holding the modulator assembly to the modulator mounting bracket with a *Torx* T20 screwdriver.
20. Using the GC touchscreen/keypad, select On/Yes to turn the AUX Pressure back on.
21. Perform a leak check on all connections. Refer to [Performing a Leak Check](#), page 4-5.

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5 Theory of Operation

The Theory of Operation chapter provides an overview of the Pegasus® BT 4D instrument's operation from a theoretical perspective.

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***Pegasus* BT System (GC-TOFMS)**

The *Pegasus* BT system combines gas chromatography and mass spectrometry, two very powerful analytical techniques.

Gas chromatography (GC) is an analytical technique for the separation of volatile and semi-volatile components in chemical mixtures. Mass spectrometry (MS) is a universal, specific, and very sensitive detection technique for measuring the mass and quantity of ions. Mass spectrometry can provide unambiguous information about the identity and quantity of individual components in a mixture. Common to all mass spectrometers are four main operational steps: sample introduction, ionization in ion source, mass analysis, and ion detection.

GC-TOFMS

There are several types of mass spectrometers available for conventional GC/MS analysis including quadrupole, ion trap, and magnetic sector; however, the *Pegasus* BT uses a very non-traditional type of mass spectrometer: a TOF (time-of-flight) mass spectrometer. A TOF mass spectrometer (TOFMS) offers tremendous benefits for analysis; most notable are a dramatically reduced analysis time and an improved quality of the analytical results. This is because the TOFMS acquires mass spectral information very fast and orders magnitude faster than other types of mass spectrometers. Combining GC with TOFMS (GC-TOFMS), the *Pegasus* BT can analyze the chemical composition of volatile and semi-volatile mixtures, providing quantitative and qualitative information on the individual components of the mixture.

Using GC-TOFMS, the *Pegasus* BT is able to acquire full-range spectra at high data rates (up to 50 spectra/sec) without any loss of data quality. This data acquisition speed allows for faster separations than conventional GC/MS; however, it also produces large amounts of data in a short period of time. To handle the large amounts of data, the ChromaTOF® software has highly automated data processing routines to aid the user in the analysis of complex samples. In addition to data processing, the *ChromaTOF* software also includes instrument control, data acquisition, and data reporting. Refer to [Figure 5-1](#), following.

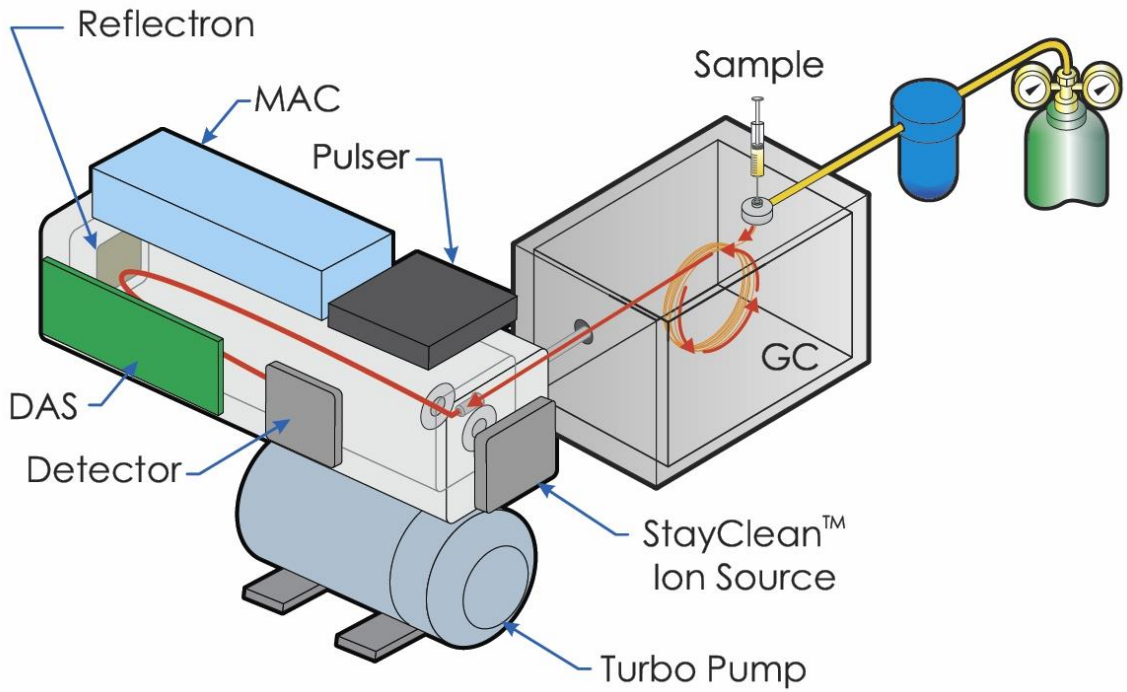


Figure 5-1
Pegasus BT Diagram

Analysis Process

The following section explains the main steps in a *Pegasus* BT GC-TOFMS analysis.

Sample Introduction into Gas Chromatograph

The sample is injected into a heated injection port, vaporized, and carried into a capillary column by a carrier gas such as helium or hydrogen.

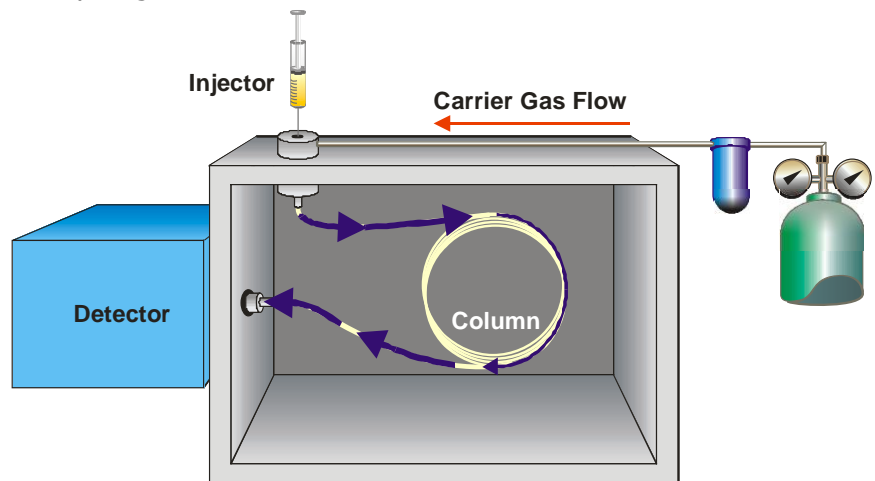


Figure 5-2
Gas Chromatograph Diagram

Separation

In the capillary column, the components of the mixture are separated in time by their different migration rates through the column. The capillary column is a fused silica tube (e.g. 30 m x 0.25 mm x 0.25 μm HP-5MS) with a protective polyamide coating on the outside surface for mechanical protection. The inner surface of the capillary column is coated with a specially formulated stationary phase. Sample molecules interact with this stationary phase as they are moved through the capillary by the flow of the carrier gas. Interaction between the sample molecules and stationary phase results in retention of the sample molecules in the stationary phase. The duration of such retention depends on the type of analyte molecule, type of stationary phase, column temperature, type of carrier gas, and flow rate. Separations occur through multiple events of retention and desorption during sample movement through the column in the carrier gas stream.

Ideally, the chemical components comprising the sample elute from the column separated in time. The degree of this separation defines the chromatographic resolution.

When using a non-specific detector, retention times under constant GC conditions are used to identify the eluting components based on comparisons to standards, as displayed in [Figure 5-3](#), following.

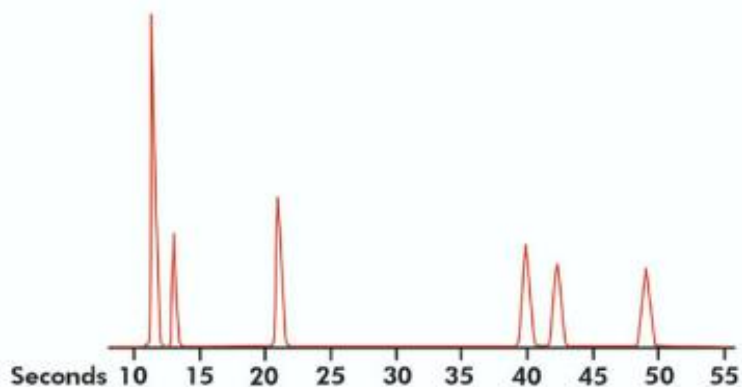


Figure 5-3
Chromatogram

Sample Introduction into Ionization Source

In the *Pegasus* BT instrument, analytes eluting from the Gas Chromatograph column are introduced directly into the electron ionization source. This is accomplished by passing the outlet end of the GC column through an independently heated transfer line, which connects the column oven of the GC to the ion source of the mass spectrometer. The vacuum system allows carrier gas flow rates of up to 5 mL/min.

Ionization in Electron impact Ion Source

Ions are created in the ion source by bombarding the entering molecules with a beam of electrons (~70 eV energy). This beam of electrons is formed by a set of electrodes with corresponding voltages and a pair of permanent magnets (as displayed in Ion Source), which focus electrons emitted from a heated filament.

The initially created molecular ions (molecule with an electrical charge) may then break apart due to excessive internal energy acquired during the ionization process. This fragmentation results in various fragment ions of lower masses and varying amounts. This fragmentation pattern (relative amount vs. mass/charge ratio) is called a mass spectrum and is unique to the molecule. Refer to [Figure 5-4](#), following. Thus, the mass spectrum provides analyte-specific information about the sample. By recording the individual mass spectra of compounds as they elute one at a time from a GC column, unknown sample compounds can be identified by comparison to standard spectra in a library. Refer to [Figure 5-5](#), following.

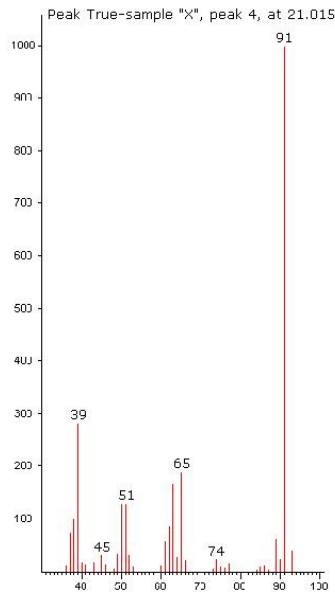


Figure 5-4
Mass Spectrum

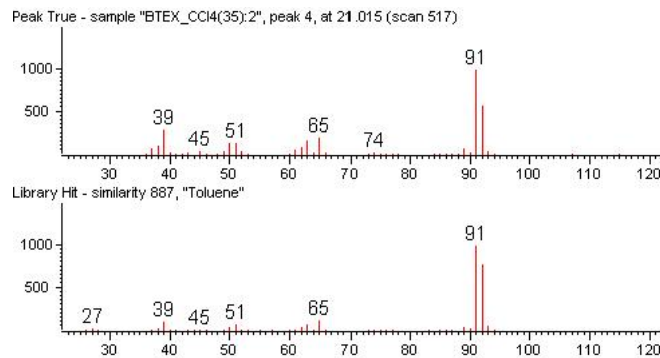


Figure 5-5
Mass Spectrum Comparison

Mass Analysis

Once ions are created in an ion source, they are transferred through the interface ion optics into the orthogonal accelerator and are mass analyzed. In a time-of-flight mass spectrometer, the m/z of an ion is determined by measuring its time-of-flight (i.e. its travel time from the ion source to the detector). Because the ions all travel the same distance from the orthogonal accelerator to the detector and they all have essentially the same kinetic energy, their travel time is proportional to $m/z^{1/2}$ where "m" is ion mass and "z" is ion's electrical charge. Thus, ions of different m/z ratios arrive at the detector at different times because separation is based on their m/z ratios; the heavier the ion, the longer its time-of-flight.

Ions created in the ion source enter an orthogonal accelerator and are pushed out of the accelerator by applying an electrical pulse to the Push and Pull Pulse Electrode as displayed in Figure 5-6, following. The difference in electrical potential created between the push pulse and the drift region electrode creates an electrical force, which accelerates the electrically charged ions. All of the ions accelerate almost simultaneously and leave the accelerator with essentially the same kinetic energy as displayed in Figure 5-7, following. They then enter a drift region where their energy remains constant as displayed in Figure 5-8, page 5-8. Their velocities depend only on their mass to charge ratio (m/z) as displayed in Figure 5-9, page 5-8.

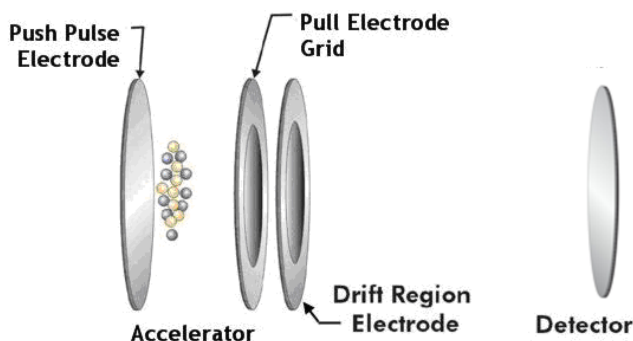


Figure 5-6
Ions Pulsed from Accelerator

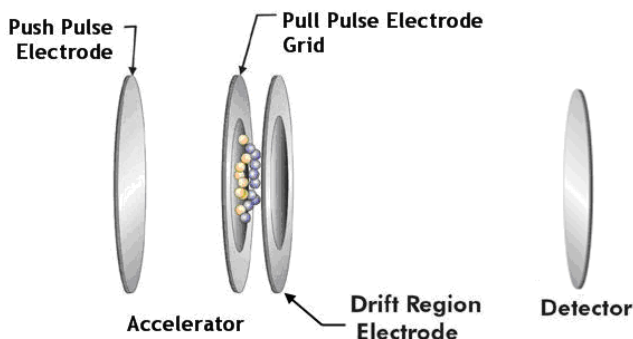


Figure 5-7
Ion Acceleration

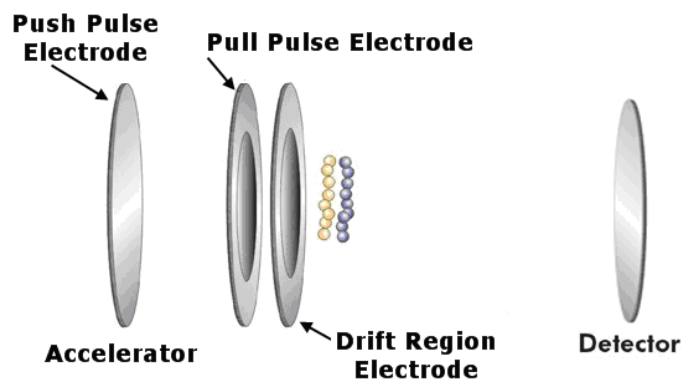


Figure 5-8
Ions in Drift Region

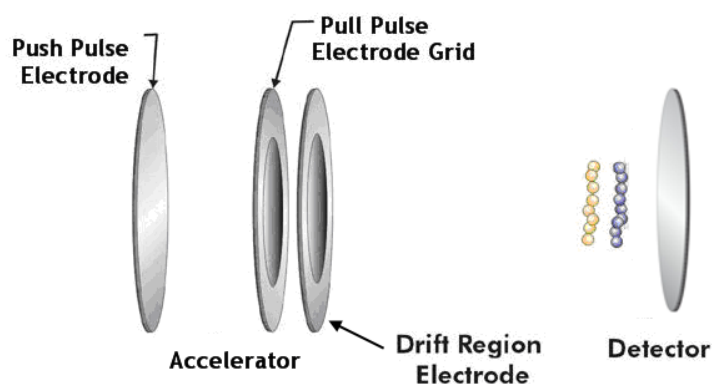


Figure 5-9
Ions Separate According to m/z

All of the ions pulsed from the ion source have a range of kinetic energies depending on several factors. This spread of energy results in differences in the time-of-flight of ions with the same m/z ratio, which in turn, affects the mass resolution of the mass spectrometer. To reduce these differences in the times-of-flight and thus improve mass resolution, an electrostatic device called a reflectron or ion mirror is placed in the drift region of the instrument. Another benefit of the reflectron is that it reduces the overall length of the mass spectrometer while maintaining a particular distance from the ion source to the detector as displayed in the *Pegasus* BT Diagram.

The m/z of each ion is determined by its measured time-of-flight and equation:

$$t = \text{Slope} * (m/z)^{1/2} + \text{Offset}$$

Slope and Offset are constants specific to a particular mass spectrometer and its operating parameter values. Before determining the m/z ratio from the equation, slope and offset values must be determined first using a mass calibration standard. This calibration is done automatically by the mass calibration routine of the *ChromaTOF* software.

During this routine, the valve connecting the Ion Source to the vial with calibration compound (PFTBA) is opened. The vapors of the calibration compound are introduced into the Ion Source and a mass spectrum of the calibration compound is obtained. Because the mass fragmentation pattern of the calibration compound is well known, the time-of-flight for each known mass is measured. This data is then used to calculate the slope and offset values automatically by solving a system of linear equations.

Because the probability of creating multiply charged ions by electron impact ionization with electrons of 70 eV energy, as used in the ion source, is very low, almost all of the ions created are singly charged ($z=1$). Thus, the m/z values calculated from the time-of-flight equation give the masses of the ions directly. The time-of-flight is measured as the time between the moment when the push pulse is triggered and the moment when the signal maximum from the corresponding ion packet is detected. The time-of-flight of the heaviest ion possible for detection ($m/z=1500$) is approximately 50 μsec . This is the time required to acquire the complete mass spectrum of the sample ionized in the ion source and introduced into the orthogonal accelerator. In addition, the complete mass spectrum is obtained by sampling all ions in the orthogonal accelerator simultaneously. These two important features, simultaneous sampling of all ions for each mass spectrum and a very short acquisition time for the mass spectrum, create the advantage that Time-of-Flight Mass Spectrometry has over other mass spectrometry techniques.

Vacuum System

Ions travel in the mass spectrometer more than 1 meter, which is quite a long distance. In order to survive on their way to the detector, ions must travel in a vacuum. To avoid ion loss due to scattering, moderating and charge exchange, the average ion path until collision with a residual gas molecule, l , the mean free path, has to be much longer than the travel distance L , displayed as $l \gg L$. This defines, in general, what vacuum level is required for the operation of the mass spectrometer. There are also vacuum requirements for reliable operation of filaments and detector. The optimal performance of the *Pegasus* BT 4D is achieved at residual gas pressure below 1×10^{-6} mbar.

All of the elements of the mass spectrometer are enclosed within a vacuum chamber that is internally separated into two different pressure regions, the Ion Source Chamber and the Analyzer Chamber.

The vacuum system includes one multi-inlet, turbomolecular vacuum pump specifically suited for pumping out light gases, such as helium or hydrogen. This turbomolecular pump is backed by a mechanical rotary vane vacuum pump. The pumping speed of the turbomolecular pump corresponds with the desired maximum carrier gas flow rate. The residual gas pressure is measured by a wide-range vacuum gauge attached to the analyzer chamber.

Ion Detection

In the *Pegasus* BT, a micro-channel plate (MCP) chevron stack is used for ion detection. Ions striking the MCP channel surface knock out several electrons due to the Ion-electron Emission Effect. These created electrons, called secondary electrons, are accelerated by the electrical field applied to the MCP, collide with the MCP channel surface and create even more electrons through an electron-electron emission effect. Then new electrons are accelerated again and strike the MCP channel surface to create another generation of electrons. This process is repeated many times, creating an avalanche of electrons that result from a single ion strike. Thus, the signal from the single ion is amplified up to 10^7 times, which makes it much easier to detect ions in order to electronically process the resulting signal.

The amount of amplification, also known as the detector gain, depends upon the detector voltage applied across the detector and the condition of the surface of the MCP channels, that is, the ability of the channel surfaces to generate enough secondary electrons in ion-electron and electron-electron events. This ability to generate electrons may change due to surface degradation and modification from the bombardment by charged particles, adsorption of residual gas molecules, or moisture adsorption and contamination.

The degree and rate of such degradation, also known as detector aging, depends upon detector usage conditions. In order to prevent exposing the ion detector to the highly abundant ions created from the carrier gas and residual gas, all undesirable, low m/z ions are deflected by applying an electrical pulse to a deflection plate, located after the ion source. The electrical pulse has an appropriate delay and duration (set automatically by the software) after each sampling of the ion source in order to deflect all undesired, low m/z ions.

High-Speed Data Acquisition System

The speed with which a TOFMS can generate data has proven to be a challenge for data acquisition systems. Large quantities of data are generated, which need to be transferred to the host computer. This data transfer, without any loss and in a very fast manner, is especially important when transient data (data that changes in time) are acquired, as in a GC/MS analysis. A GC-TOFMS data acquisition system must record a large quantity of data on a fast chromatographic timescale with no loss of the chemically relevant information contained in rapidly varying elution profiles. In order to solve this problem, the *Pegasus* BT and the *ChromaTOF* software data system use a specially designed Data Acquisition System (G2DAS).

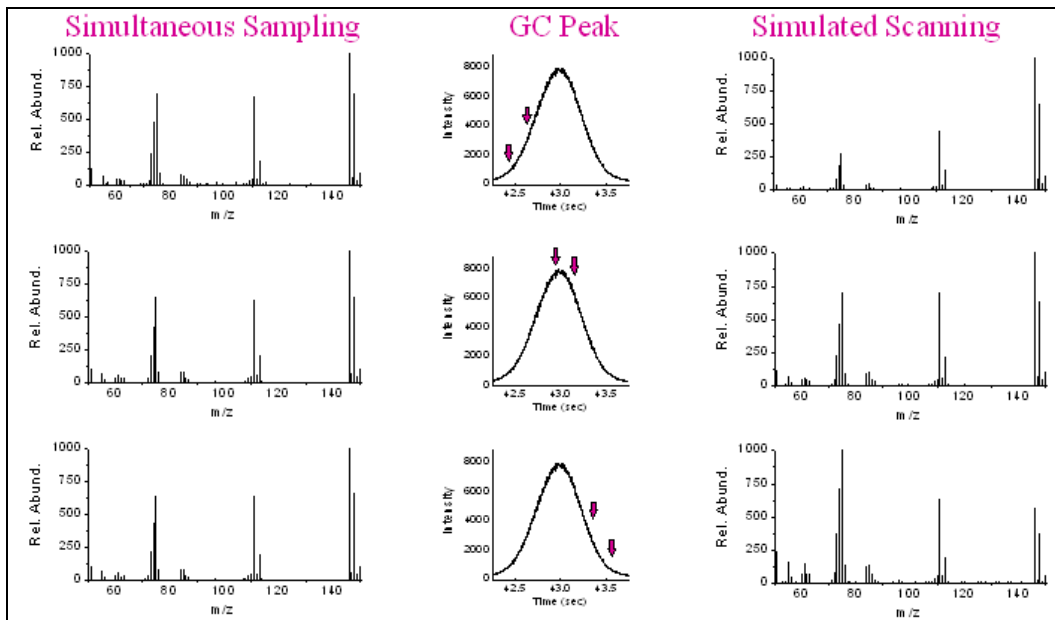
In the G2DAS approach, signals from the detector are sampled by two parallel analog to digital converters (ADCs), operated with one as a low gain channel and the other as a high gain channel. The two channels are then overlapped to create 15 bits of vertical resolution. An adaptive threshold is then applied to the overlapped data to remove electronic noise from the data. The transient data (i.e. mass spectral data from a single ion source pulse) are then stored on the internal memory of the G2DAS. Subsequent transients are summed together, with the number of sums dictated by the ion source extraction frequency and the spectral acquisition rate. For example: in an acquisition with a 30kHz extraction frequency (i.e. 30,000 ion source extraction pulses per second) and a spectral acquisition rate of 50 spectra per second, 600 sums are performed, and the summed profile spectra are transferred to the *ChromaTOF* software on the PC. The *Pegasus* BT ion source can be pulsed from 15kHz up to a maximum of 35kHz, and the G2DAS can transfer up to 50 complete profile mass spectra per second continuously (until the hard drive of the computer is filled) without loss of any analytically useful data.

After the data are transferred to the PC, a LECO proprietary signal processing algorithm compresses the data and writes it to the PC's hard drive without losing any analytically useful data. The result is the storage of profile data that can be accessed after collection for further data processing, including peak finding with NonTarget Deconvolution® (NTD®).

Data Processing and Peak Deconvolution

Acquired data can be automatically processed immediately after acquisition or at a later time. The Data Processing (DP) Method requires relatively little input from the analyst for automatic processing. Refer to Data Processing Method Parameters in the *ChromaTOF* Brand Software Manual.

In addition to the typical data processing routines of a GC/MS, the *ChromaTOF* software utilizes *NonTarget Deconvolution (NTD)* to mathematically separate, or deconvolve, overlapping spectra of co-eluting chromatographic peaks. This means that, in many instances, it is not necessary to completely resolve chromatographic peaks in order to obtain reliable results. Refer to [Figure 5-10](#), following. Examples are presented in [Figure 5-11](#) and [Figure 5-12](#), page 5-13.



TOFMS: Simultaneous spectral recording	Scanning Mass Spectrometers: Sequential spectral recording
<p>Produces a true (accurate) spectrum because the entire mass range is sampled from the ion source at the same instant in time.</p>	<p>Produces a skewed spectrum because only one m/z is sampled from the ion source at one instant in time. Therefore, as the instrument scans across the entire m/z range in time, the concentrations of the ions in the ion source are changing.</p>
<p>Deconvolution is straightforward because each analyte's spectrum is the same across its entire chromatographic peak.</p>	<p>Deconvolution is made more difficult by convolution of the skew with the true spectra.</p>

Figure 5-10
NonTarget Deconvolution (NTD)

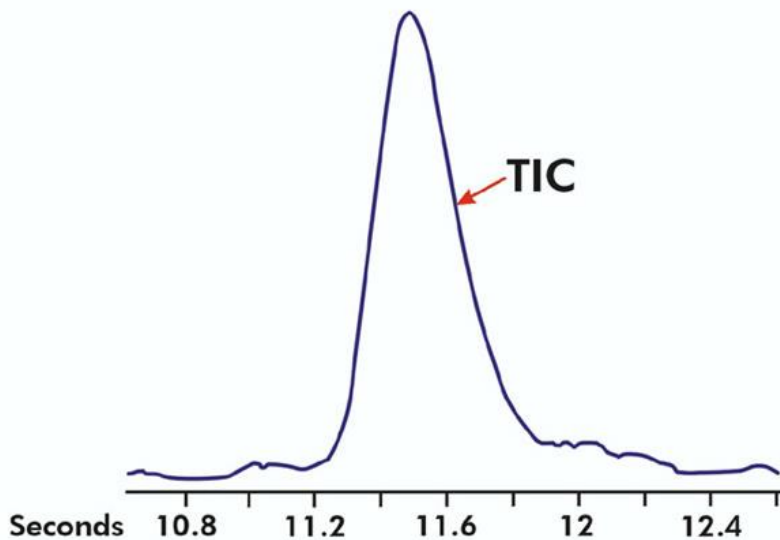


Figure 5-11
Peak A

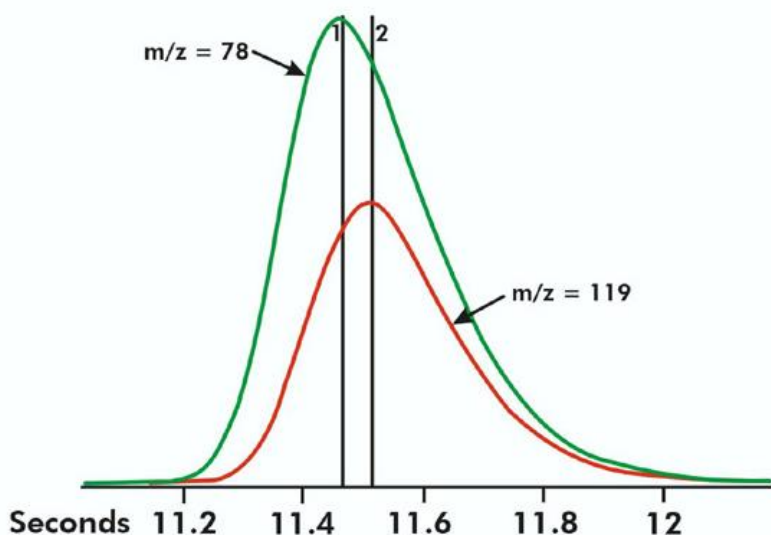
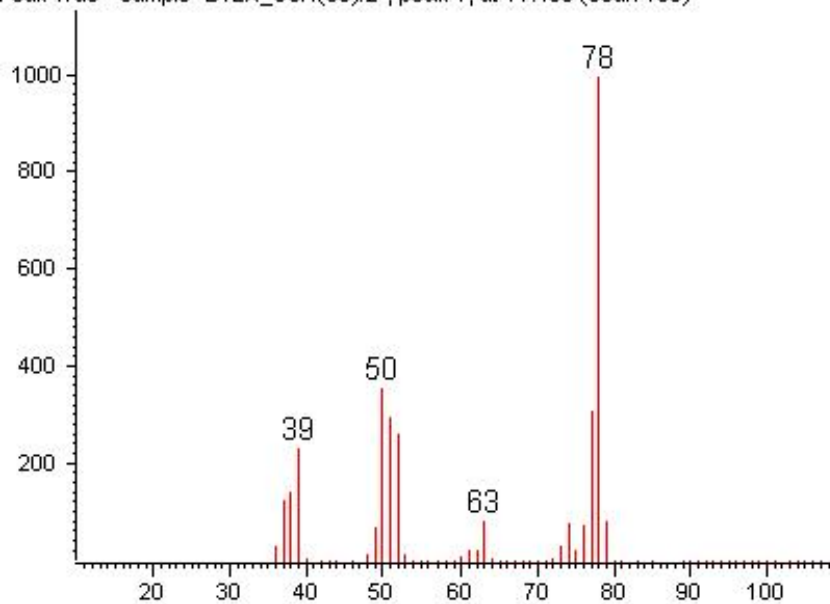


Figure 5-12
Peak B

The total ion chromatogram in [Figure 5-11](#), page 5-13, indicates only one peak, presumably only one component. However, the ion signal plots in [Figure 5-12](#), previous, display two peak apexes for $m/z=78$ and $m/z=119$ separated by 0.05 seconds. For scanning GC/MS systems that can skew spectra across narrow chromatographic peaks, such a small degree of separation may be insufficient to distinguish peaks or to deconvolute individual component mass spectra. However, the *Pegasus* BT with the *ChromaTOF* software provides enough high quality data points to automatically find apexes and identify components using deconvoluted mass spectra and a library database. Refer to [Figure 5-13](#), page 5-14, and [Figure 5-14](#), page 5-15.

Peak True - sample "BTEX_CCl4(35):2", peak 1, at 11.465 (scan 135)



Library Hit - similarity 828, "Benzene"

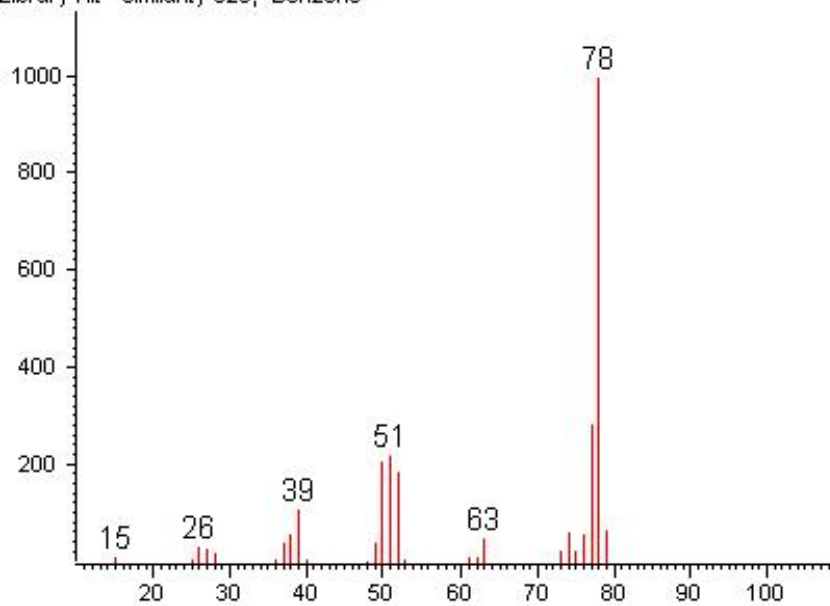


Figure 5-13
Spectra Plots C

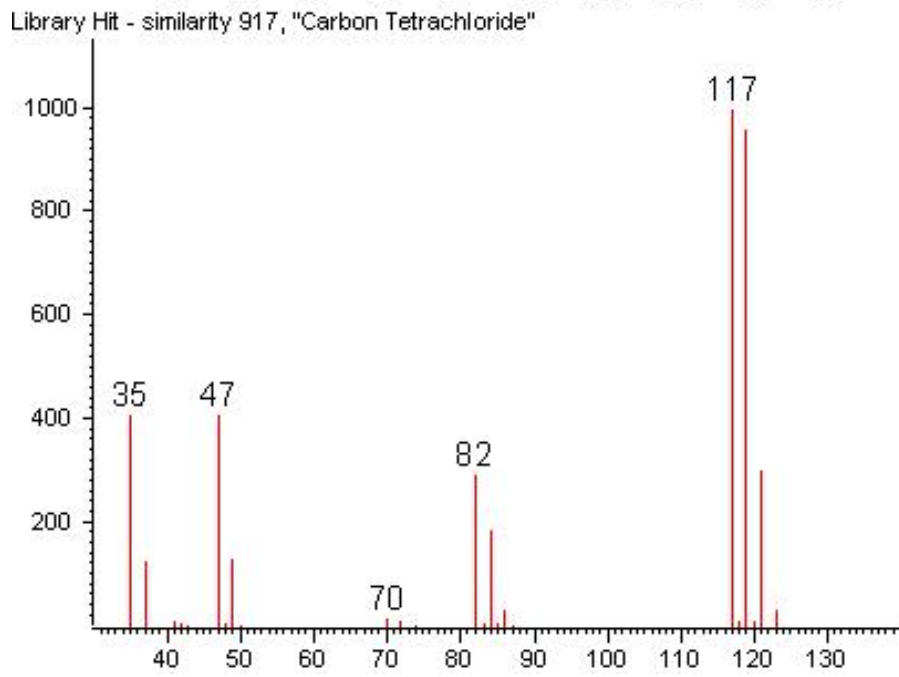
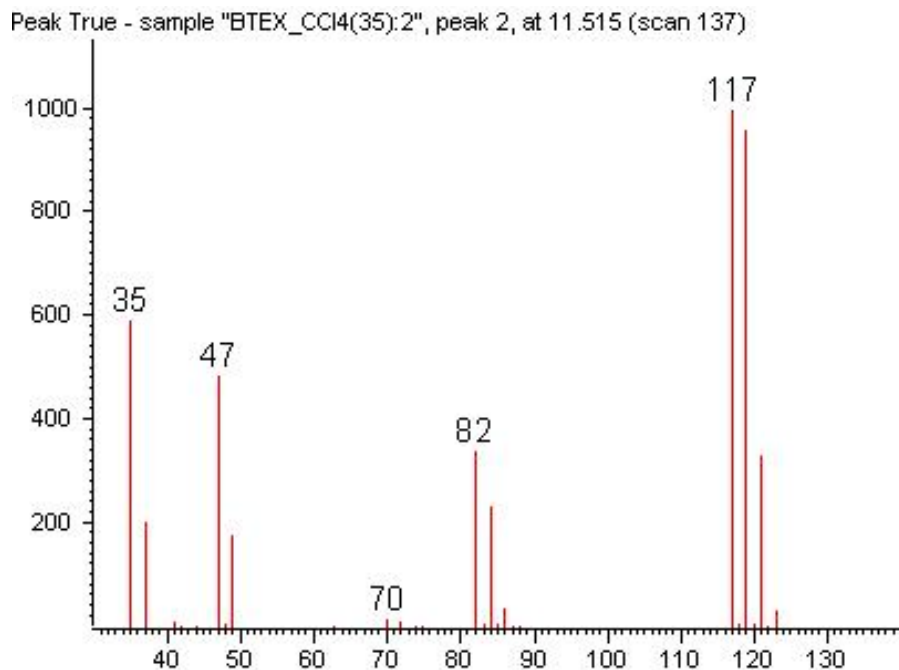


Figure 5-14
Spectra Plots D

With such deconvolution capabilities, the need for complete chromatographic resolution is decreased greatly. By decreasing the chromatographic resolution requirements and acquiring enough sample points across narrow peaks, chromatographic separation times can be decreased. Traditional Naphtha Analysis, [Figure 5-15](#), following, displays a Chromatogram obtained by conventional GC/MS. The analysis time is over 2 hours. Using the *Pegasus* BT with the *ChromaTOF* software and its deconvolution capabilities, this analysis can be performed 25 times faster while still maintaining data quality. Refer to [Figure 5-16](#), [page 5-17](#).

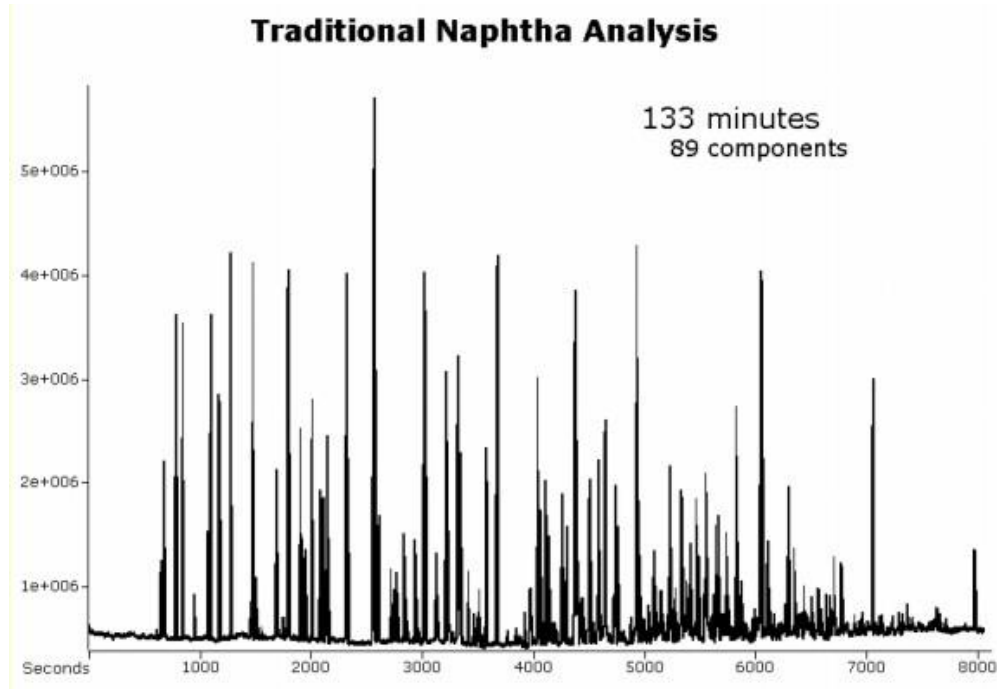


Figure 5-15
Traditional Naphtha Analysis

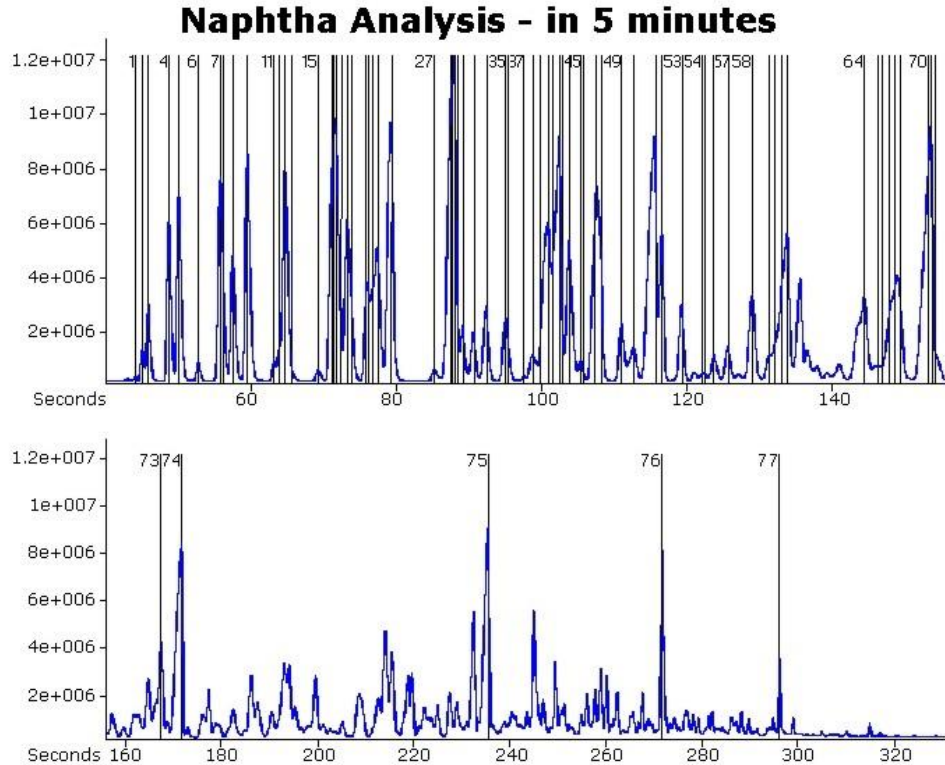


Figure 5-16
Naphtha Analysis - 5 Minutes

Signal to Noise (S/N)

Conventional S/N definitions that estimate noise from a segment of “flat” baseline adjacent to the peak of interest may suffer limited applicability within regions of extreme chromatographic density, within regions of zero baseline, or where the baseline may contain zeroes. Such conventional approaches may also suffer compromised robustness due to arbitrary selection of the noise sample. In the *ChromaTOF* software, the traditional S/N metric has been modified to permit consistent application to zero noise and non-zero noise extracted ion chromatograms, and to chromatographically dense regions lacking any segment of flat baseline.

In the *ChromaTOF* software, $S/N = (S)(N_B + N_D)^{-1}$, where:

Signal (S) = Integrated area under the chromatographic trace and above the integration baseline, if there is a baseline, expressed as number of ions.

Background noise (NB) = Square root of the integrated area under the integration baseline, if there is a baseline, expressed as number of ions. Expressing the value as the number of ions permits valid estimation of baseline variance from mean baseline amplitude where Poisson statistics hold.

Ion distribution noise (ND) = A fraction of the number of ions required to confidently conclude that the observed trace represents a chromatographic event, not a non-chromatographic event. The temporal distribution of chromatographically delivered ions is expected to be approximately bi-Gaussian with a predictable, finite full width at half maximum height (FWHM). Smaller numbers of ions in a chromatographic peak will yield extracted ion chromatograms of larger relative variance from the model chromatographic profile. Below a threshold number of ions, the observed chromatographic profile has a significant likelihood of being effectively indistinguishable from non-chromatographic events, such as persistent isobaric baseline that intermittently wanders into the m/z window of the extracted ion chromatogram, or non-persistent events registered by the detector, such as lost ion arrivals. Power of discrimination from persistent and non-persistent non-chromatographic events is highest at the optimal sampling rate, and is diminished by oversampling or undersampling the chromatographic peak. Thus, this term's minimum is at the optimal sampling rate, but this term is always positive and non-zero, permitting application of the same S/N metric to zero baseline and non-zero baseline cases. In zero baseline cases, increased S/N reflects increased likelihood that the observed profile could not have arisen by chance from a combination of one or more non-chromatographic events. As persistent baseline noise increases above zero, the NB term will eventually dominate the ND term, and the reported S/N will approximate the traditionally defined S/N that is based on amplitude of baseline variance.

Pegasus BT 4D Theory of Operation

The following section provides an overview of the operation of the *Pegasus* BT 4D, which is the *Pegasus* BT system combined with the GCxGC accessory option.

Introduction to the GCxGC Technique

GCxGC is a relatively new technique noted for its ability to analyze complex mixtures.

Single column separations, as with traditional GC/MS, often suffer from coelutions for samples containing more than 150 compounds. GCxGC, however, provides a comprehensive two-dimensional separation where the entire sample is separated on two different columns. All information gained during the first separation is retained during the second separation. The result can be expressed as $N_1 \times N_2$, where N_1 is the peak capacity of the first column and N_2 is the peak capacity of the second column. Therefore, GCxGC is a particularly useful technique for analyzing components in complex matrices.

The sample is first separated on a column that typically provides a non-polar stationary phase (typical dimensions are 15 to 30 m x 0.25 to 0.32 mm ID x 0.1 to 1 μ m). The second column is typically the same bore as the first or narrower and typically has a polar stationary phase to provide an extremely fast separation. A device such as a thermal modulator or flow modulator is placed between the columns to separate the effluent from the first column into a large number of smaller portions. Each portion is properly focused prior to being introduced to the second column. The separations performed in the two columns are independent and produce very structured chromatograms that make it possible in many mixtures to identify all of components with good reliability. The 2nd dimension column can be housed in a secondary oven to enhance the separation ability of this column.

The *Pegasus* BT 4D and *ChromaTOF* software combined with the GCxGC accessory option provide an innovative analysis technique. The narrow peak widths that emerge from the 2nd dimension GCxGC column require a detection system capable of a data acquisition speed of at least 100 Hz. With data acquisition speeds up to 500 spectra/sec, the *Pegasus* BT 4D complements these narrow peak widths at the same time that spectral quality is maintained. The *Pegasus* BT 4D also relies on either a quad jet two stage modulator or FLUX™ GCxGC Flow Modulator and secondary oven. Locating the 2nd dimension column in a secondary oven increases the column's separation capability by offering independent temperature programming. The secondary oven is discussed in more detail in [Secondary Oven](#), page 5–28.

The *ChromaTOF* software offers many ways to work with the data from a GCxGC analysis. In addition to the discussion of the *ChromaTOF* software in High-Speed Data Acquisition, the software has additional capabilities for a GCxGC analysis. Briefly, the *ChromaTOF* software displays the results of a GCxGC analysis in a two-dimensional chromatogram where one dimension represents the retention time on the first column and the second dimension represents the retention time on the second column. A visual representation of the chromatogram is available in a three dimensional plot that displays different contrast and color shadings to represent the separation of major and minor peaks. Because the outcome of a GCxGC analysis often means chemically related compounds show up as ordered structures, classifications, in which these chemically related compounds are grouped, can be created using the 3D plot. The software is discussed in the *ChromaTOF* Brand Software Manual. Further information about the GCxGC technique can be found in the scientific literature. For example, refer to the following articles:

Klee, Cochran, Merrick, Blumberg. Evaluation of conditions of comprehensive two-dimensional gas chromatography that yield a near-theoretical maximum in peak capacity gain. *Journal of Chromatography A* 1383 (2015) 151-159.

J.A. Murray, Qualitative and quantitative approaches in comprehensive two-dimensional gas chromatography, *J. Chromatogr. A* 1261 (2012) 58-68.

P.J.C. Marriott, S. -T. Maikhunthod, B. Hans-GeorgSchmarr, S. Bieri, Multidimensional gas chromatography, *TrAC* 34 (2012) 1-21.

J.V. Seeley, S.K. Seeley, Multidimensional gas chromatography: fundamental advances and new applications (review), *Anal. Chem.* 85 (2013) 557-578.

Benefits of LECO's Pegasus BT 4D – TOFMS System

The *Pegasus* BT 4D offers several benefits including increased peak capacity. The following section provides an overview of these benefits.

Increased Peak Capacity

Increased peak capacity means improved chromatographic resolution for complex mixtures. Improved resolution is achieved by sampling the effluent from the first column and then separating the components in that sample on a second column of a different stationary phase before taking the next sample from the first column. Unlike coupled columns, GCxGC can preserve the resolution achieved on the first column as it performs the separation on the second column. This results in a separation plane, which has an approximate peak capacity equal to the peak capacity of the first column multiplied times the peak capacity of the second column.

Thermal Modulation

The *Pegasus* BT 4D uses a two-stage thermal modulator. The two-stage thermal modulator consists of two cryogenic-traps in series. The first stage traps the sample from the first column and then releases it to the cold second stage. The second stage then holds the sample while the first stage cools. Once the first stage is cold, the second stage releases the sample. The second stage cools, and then the first stage releases the next trapped sample slice. This cycle repeats, continuously sampling slices on the order of third of a peak width from the first dimension.

When the thermal modulator traps sample from the first column and introduces it to the second column, it can be done at a sampling frequency that preserves the resolution achieved on the first column, typically three to four samples per 1st dimension peak width. Each of these samples is referred to as a slice or modulation. This sampling period is equal to the period of modulation and the separation time on the 2nd dimension column. For optimized conditions and to preserve as much of the first dimension resolution as possible, the modulation period should be 1 to 3 seconds. This means the second column is relatively short (0.3 to 1 m). With such a short separation time in the 2nd dimension, the separation is essentially isothermal even during a 1st dimension temperature program.

Signal-to-noise (S/N) enhancement is a frequently described benefit of thermal modulators. This enhancement is described as the improvement in S/N for a given amount of analyte on column when going from detection of a GC peak to a GCxGC peak. S/N enhancement is usually achieved by the focusing of the sample in the modulator and then injecting the sample into the 2nd column as a very narrow injection band. The faster spectral acquisition rate of GCxGC experiments required to get 12 points across the GCxGC chromatographic peak full-width half-height (FWHH) means that fewer TOF extractions are summed together to create a single spectral data point on the GCxGC chromatogram. Therefore, less noise, either electrical or chemical, from the data acquisition system is summed into the single spectrum. This fact, combined with the increased signal from the time-compressed analyte peak, causes an enhancement in analyte S/N ratio. However, this enhancement is dependent on the type of detection system. In the case of the *Pegasus* BT 4D, the detection system is different than conventional systems in that there is a significant reduction in electronic noise. Often, the only source of noise on a mass channel (XIC) is chemical background noise, and in these cases where chemical noise exists within an XIC, S/N enhancement may be observed when comparing GC and GCxGC peaks. However, the presence and intensity of chemical noise present on the *Pegasus* BT 4D data acquisition system decrease as m/z increases. Thus, at higher masses, there may be little to no noise on an XIC channel, and in these zero (or near-zero) noise cases, there is no observed S/N enhancement, because the GC peak and GCxGC peak for the same analyte and the same on-column amount produces approximately the same number of ions, which are detected in either GC or GCxGC mode. So, the detection limit of the same on-column

amount, sampled at the same frequency (12 points across a peak's FWHH) in GC mode and GCxGC mode is essentially the same.

The following figures illustrate conceptually how the acquisition rate of the *Pegasus* BT 4D functions and its effect on how GC and GCxGC peaks compare for the same amount injected on column. The following peaks are simulated. In a TOFMS (refer to [GC-TOFMS](#), page 5-3), ions formed in the ionization source are accelerated into the mass analyzer in discrete ion packets. Each of these ion packets are referred to as an extraction or transient. For the *Pegasus* BT 4D, a 32 kHz extraction frequency is typical. This means that the direct extraction ion source is emptied into the flight tube at a frequency of 32 kHz to record a full mass spectrum. [Figure 5-17](#), following, shows simulated chromatographic peaks, a 1-sec-wide GC peak and a 0.1-sec-wide GCxGC peak. Each is collected at the same data rate, 1 kHz, that is one spectrum every 0.001 sec. The plots are scaled the same on both axes to demonstrate what will be observed on the system. The GCxGC peak is ten times narrower, so its height is ten times taller.

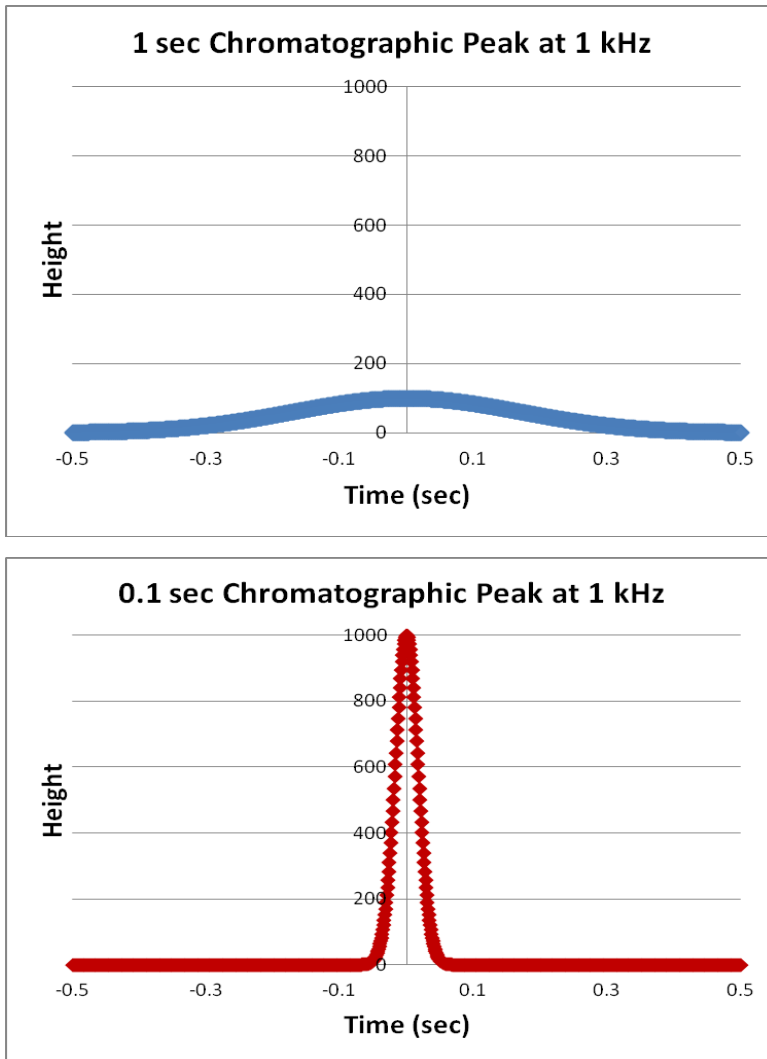


Figure 5-17
Simulated GC Peak and GCxGC Peak

To improve the signal characteristics across a chromatographic peak, the spectra are summed over an interval or binned to give a certain number of spectra across the peak. In this example, the data will be summed (binned) so the result provides 10 spectra across each peak. [Figure 5-18](#), following, shows the same peaks shown in [Figure 5-17](#), previous, after summing (binning). In [Figure 5-17](#), the peaks had different heights because of the peak width compression going from GC to GCxGC and the same data acquisition rate (1 kHz). However, because the amount of analyte is the same in both cases, the peak heights in [Figure 5-18](#) are the same after binning, because the peak is divided among the same number of bins. At the same data acquisition rate, the GC peak is wide and short. However, when binned, with 100 spectra per bin, the signal height becomes the same as the GCxGC peak, which has its spectra summed at 10 spectra per bin. Note that if the peak width compression ratio—(width of GC peak) / (width of GCxGC peak, assuming the GC peak is one modulation)—is different from the data acquisition ratio—(data acquisition rate of GCxGC peak) / (data acquisition rate of GC peak)—the heights will not be the same. If the peak width ratio is smaller—wider GCxGC peak—than the data acquisition ratio, the GCxGC peak height will be shorter compared to the GC peak, but the areas will still be equal within experimental variation.

If this is taken one step further, and all of the data in the peak (each peak has the same amount of analyte) is binned, there is a total area (area is the sum of all heights defining the chromatographic curve) that is equal for the two peaks. Refer to [Figure 5-18](#), following, for an example of Binned data from [Figure 5-17](#), page 5-22, of the simulated 1 sec wide GC peak (top) and 0.1 sec wide GCxGC peak (bottom).

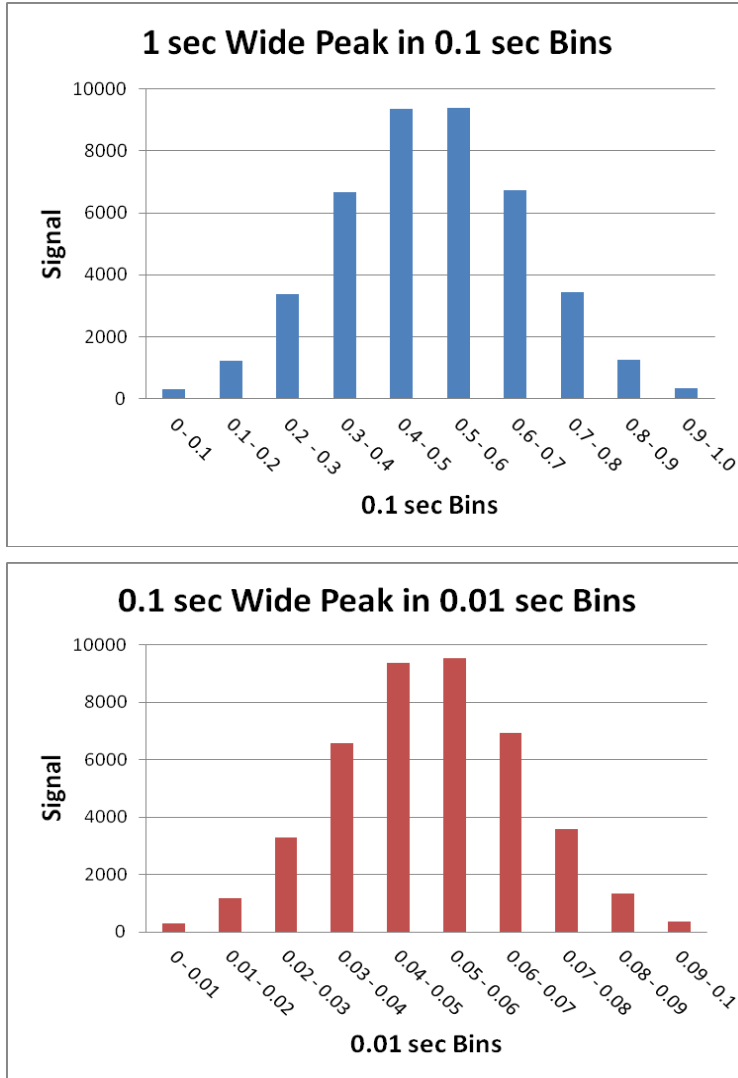


Figure 5-18
Binned Data from [Figure 5-17](#)

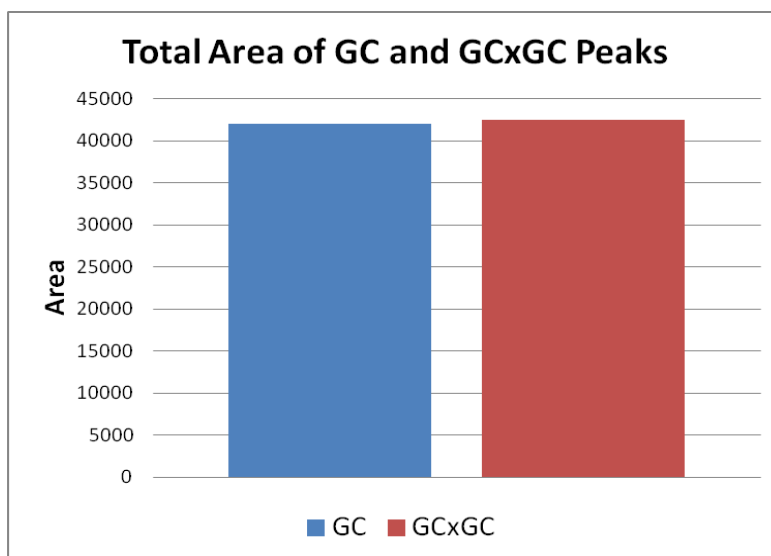


Figure 5-19
Simulated Peak Areas for a GC and GCxGC

In cases where there is no chemical background at a selective mass window, the detection limits of GC and GCxGC on the *Pegasus* BT 4D are essentially the same. However, in the case where chemical noise is present and a baseline exists, the S/N can be different between GC and GCxGC and this will impact the detection limit. Generally, the background baseline of GCxGC is lower in noise, which may provide a S/N improvement.

Flow Modulation

Flow modulation, like thermal modulation, is a way to reinject a GC peak into a second column after being separated in the first column to undergo a second separation prior to detection. The *Pegasus* BT-4D *FLUX* GCxGC Flow Modulator uses a universal flow modulator design, operated in diverting mode, based on John Seeley's work. Seeley's initial work describing the modulator can be found in the following articles:

A. Ghosh, C. T. Bates, S. K. Seeley, J. V. Seeley, *J. Chromatography A*, 1295 (2013) 146-154 "High Speed Deans Switch for Low Duty Cycle Comprehensive Two-Dimensional Gas Chromatography"

J.V. Seeley, N. E. Schimmel, S. K. Seeley, *J. Chromatography A*, Volume 1536, (February 2018) Pages 6-15, "The multi-mode modulator: A versatile fluidic device for two-dimensional gas chromatography"

The *Pegasus* BT-4D flow modulator is shown in [Figure 5-20](#), following. It consists of two custom fittings: a cross (four way) and a tee (three way), and a solenoid valve. The modulator operates in two states:



Figure 5-20
Flow Modulator Installed

- **Inject State**—uses a narrow injection period where the effluent from column one is injected into column 2, while the high flow rate switching flow gas is sent directly to waste. Refer to [Figure 5-21](#), following.

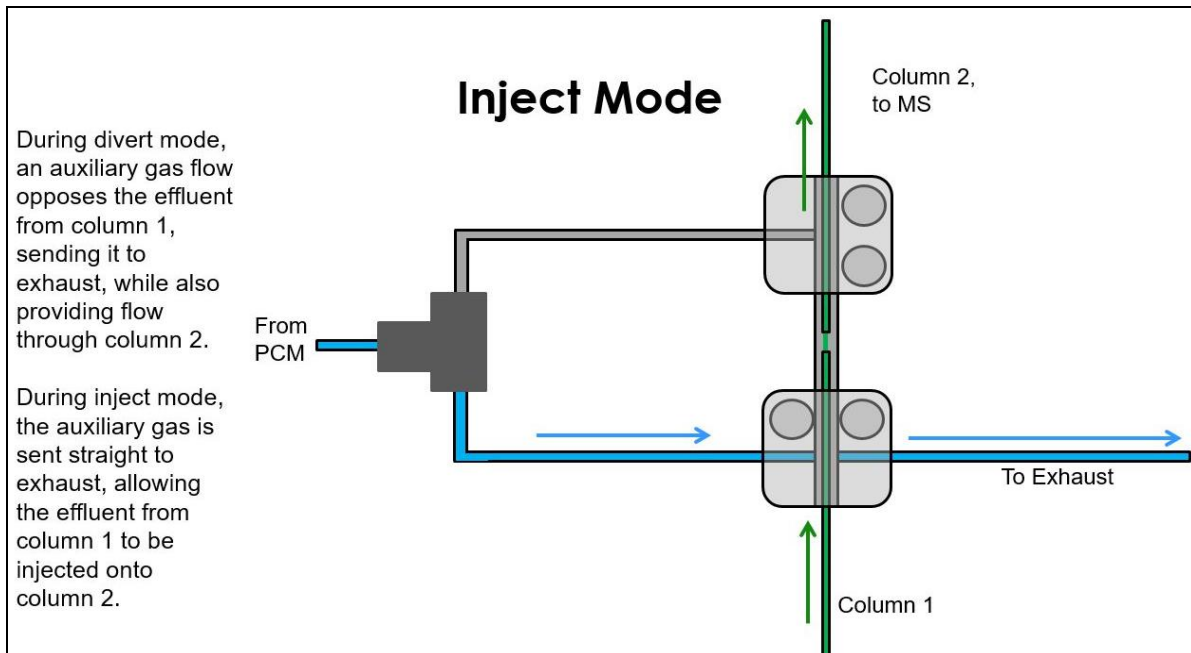


Figure 5-21
Inject State of the Flow Modulator

- Divert State**—where the valve changes the switching flow gas to flow in opposition to column one, carrying the effluent to waste while also supplying column 2 with clean carrier gas. This cycle of a brief inject state followed by a longer divert state occurs continuously throughout the run, modulating the effluent from the primary column. Refer to [Figure 5-22](#), following.

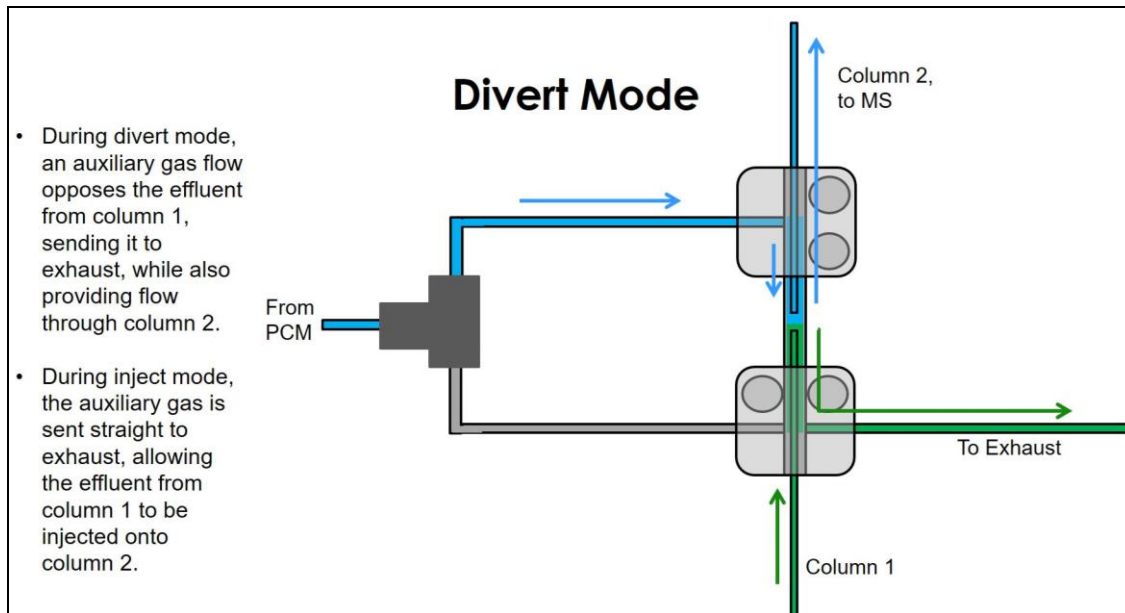


Figure 5-22
Divert State of Flow Modulator

The combined time of the inject and divert states is the modulation period (Second Dimension Time), or the amount of time for the second dimension separation to occur.

This flow modulator uses flow rates that are amenable to mass spectrometric detection and optimal gas chromatography. There is no need to split the flow from column two, which is a necessity for differential flow modulators due to the high flow rates in the secondary column. The inject and divert states are cycled at intervals throughout the run determined by the Modulation Period (Second Dimension Time), which, along with the Inject Time (Injection Duration), are set points in the Chromatographic Method.

Flow modulation in general holds several advantages over thermal modulation. However, flow modulation also has several shortcomings when compared to thermal modulation. Therefore, it is important for the user to know these advantages and disadvantages before choosing the modulation system that is right for them. The advantages of flow modulation are: low cost of operation (it does not require cryogenics), no analyte volatility constraints (thermal modulation may have breakthrough for extremely volatile early eluting compounds), and no additional space requirements (LN₂ tanks or a chiller need additional lab space for thermal modulation). Drawbacks to flow modulation include: an inherent loss in sensitivity for flow modulation and wider injection widths onto the secondary column (less peak capacity than what can be achieved via thermal modulation).

Secondary Oven

An important factor in optimizing a GCxGC separation is the retention of the analytes in the 2nd dimension. The temperature at which the analytes elute from the first column determines the temperature of the 2nd dimension separation. If this temperature is too low, the analytes elute slowly from the second column during subsequent slices. This is called "wrap around" because peaks wrap around in the 2nd dimension and display in later slices. These late eluting peaks can be identified by their peak width. Because of their longer retention, they will be broader. If the 1st dimension elution temperature is too high, there will be little retention, and thus little separation in the 2nd dimension. To address this problem, a secondary oven can be used, which allows the temperature to be programmed appropriately for the 2nd dimension separation. With the *Pegasus* BT 4D system, the secondary oven can only be programmed at a higher temperature than the GC oven. The significance of this is that the 1st dimension can be operated at optimal conditions and the 2nd dimension retention can be adjusted to the optimal modulation period (Second Dimension Time).

Additional Method Parameters for GCxGC

Data Processing and reporting for the *Pegasus* BT 4D system occurs in much the same way as in the *Pegasus* BT system, but due to the use of a modulator and secondary oven, additional parameters are required for the Data Processing Method and Gas Chromatograph Method. These additional parameters are explained in the following section.

Gas Chromatograph Method

Refer to Gas Chromatograph Method Parameters in the *ChromaTOF* Brand Software Manual for the steps to enter the parameters in a Gas Chromatograph Method.

Important parameters for GCxGC in the Gas Chromatograph Method include the flow mode, temperatures of the thermal modulator and secondary oven, and the modulation timing parameters.

The differences between the GC and GCxGC with regard to flow are worth noting. The four Agilent 7890/8890 GC flow modes available are: constant pressure, constant flow, ramped pressure, and ramped flow. These modes are appropriate for GC mode. In GCxGC mode, there are two different columns and different temperature zones. Because of these different conditions, none of the 7890/8890 GC flow modes are appropriate, except for constant pressure mode if one chooses to operate in constant pressure mode. However, the GC Method has a corrected constant flow mode for GCxGC, which is recommended. This mode takes into account the different columns and temperature zones, and calculates a pressure program that approximates constant flow. This pressure program is downloaded to the GC automatically when corrected constant flow mode is selected.

An offset is entered for the thermal modulator temperature. This offset is relative to the secondary oven. This offset is maintained by the modulator temperature tracking the temperature program of the GC.

The recommended value is +15 °C. This is generally good for most cases. The higher temperature produces better 2nd dimension peaks by quickly releasing the trapped sample bands.

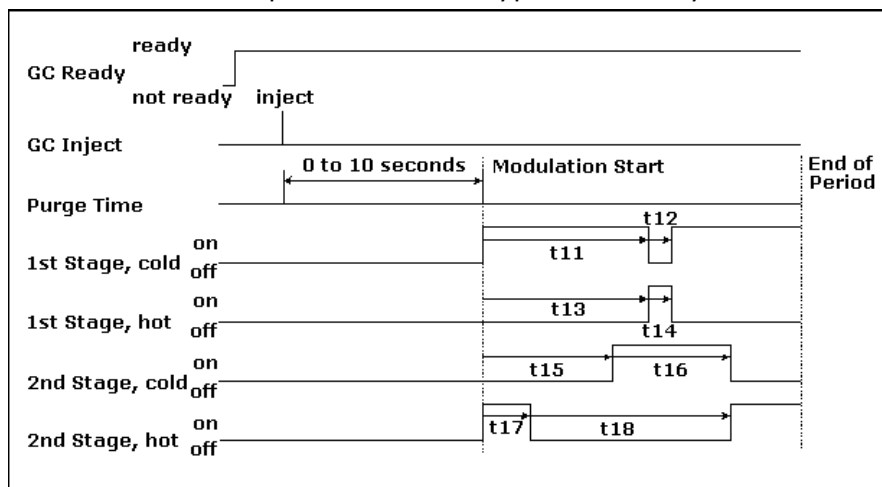
NOTE →

The flow modulator is not actively heated, so this offset applies to the thermal modulator only.

The secondary oven is temperature programmed in the same way as the GC oven, but the two ovens have independent temperature programs. The secondary oven can operate only above the temperature of the GC oven, because the secondary oven has no active cooling. The secondary oven temperature program must be at least 5 °C above the temperature program of the GC oven, because heat from the modulator and transfer line will affect the secondary oven's operation. The temperature can be programmed or simply set at some offset relative to the temperature program of the GC oven. Typically, the offset ranges between 5 °C and 40 °C.

Thermal Modulation

For the modulation timing parameters, setting the simplified parameters is sufficient. The simplified parameters require only two inputs: the second dimension separation time and the hot pulse time. The illustrations of the timing parameters, [Table 5-1](#) and [Table 5-2](#), following, do not account for the acquisition delay or filament On/Off parameters. The parameters for the acquisition delay and filament On/Off are entered in the Mass Spectrometer Method. With these parameters, the *ChromaTOF* software provides flexibility in coordinating the acquisition period with the activity of the filament. When there is no acquisition delay and the filament is Off, the modulation or purge time starts at the time of the injection. When there is an acquisition delay, the modulation or purge time starts at the end of the acquisition delay. To allow for sufficient initial cooling of the cold jets, the acquisition delay may have to be shortened by several seconds relative to the acquisition delay typically used for a one-dimensional separation as in a typical GC analysis.



Parameter	Time Period
t11	Time from start of modulation period to time 1 st stage cold jet is turned Off
t12	Time 1 st stage cold jet is Off
t13	Time from start of modulation period to time 1 st stage hot jet is turned On
t14	Time 1 st stage hot jet is On
t15	Time from start of modulation period to time 2 nd stage cold jet is turned On
t16	Time 2 nd stage cold jet is On
t17	Time from start of modulation period to time 2 nd stage hot jet is turned Off
t18	Time 2 nd stage hot jet is Off

**Table 5-1
Advanced Timing Parameters**

Parameter	Calculation
t12=t14=t15=t17	Program one parameter in GC Method and all parameters are calculated accordingly.
t11=t13	Modulation Period divided by 2
t16=t18	Modulation Period subtracted by Hot Pulse Time

**Table 5-2
Hot Pulse / Modulation Period Timing Parameters**

Flow Modulation

Since only a portion of the sample is injected onto the secondary column, it is important to have proper Second Dimension Time and Injection Duration settings. In order to avoid undersampling the column 1 peaks, the modulation ratio (number of slices across a peak) should be greater than 2.5. Therefore, having at least 3 strong slices per peak is desirable. Thus, it is recommended to first run your sample via 1D GC to determine the average peak widths coming from column 1 so you can set your Second Dimension Time appropriately. If peak widths vary significantly throughout the first dimension separation, the use of variable modulation periods may be appropriate. For an example of selecting the desired modulation period (Second Dimension Time): if the first dimension peak is 2 seconds wide at base, the Second Dimension Time should be about 0.6 second. The top chromatogram is the 1D peak with a peak width of ~ 2 seconds. Dividing 2 by 3 $\sim 0.6 - 0.7$ seconds. The bottom chromatogram shows a Modulation Period=0.6 seconds with 3 healthy slices. Refer to [Figure 5-23](#), following.

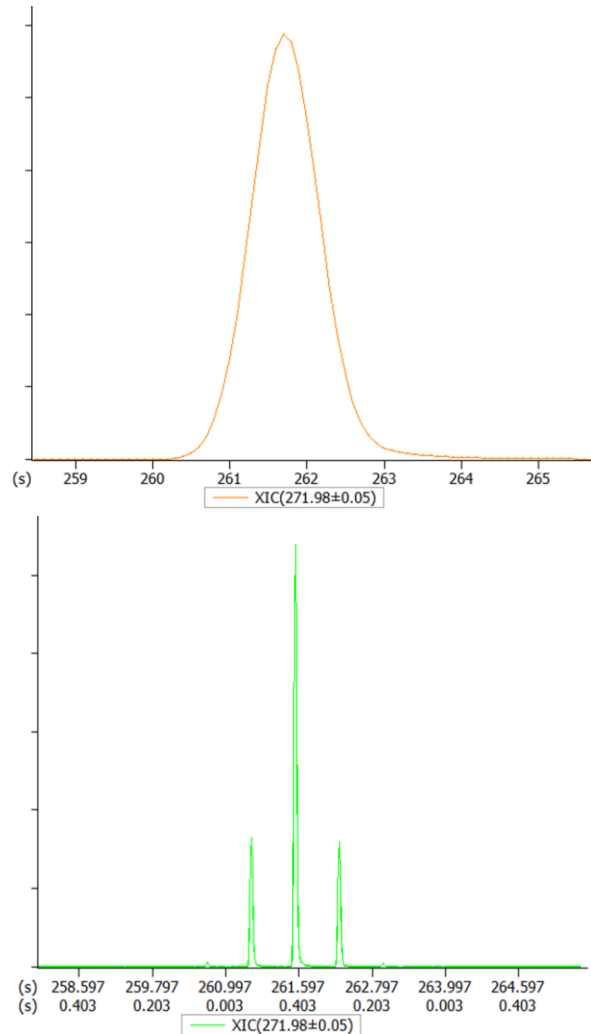


Figure 5-23
Setting an Appropriate Modulation Period

There are three selections for injection duration in [Table 5-3](#), following.

Injection Duration (sec)	Result
0.03	Increased Peak Capacity, Lower Sensitivity
0.05	Default, Average Peak Capacity, Average Sensitivity
0.08	Increased Sensitivity, Lower Peak Capacity

Table 5-3
Hot Pulse / Modulation Period Timing Parameters

Injection Duration Options

0.05 sec is the default setting and will be the best option for most analysis. For those users who desire increased peak capacity and are not concerned with sensitivity loss, 0.03 sec can be chosen, which results in narrower peaks. For other users who are trying to get the highest sensitivity and are not concerned with less peak capacity, 0.08 sec is also an option. Refer to [Table 5-3](#), previous.

Data Processing Method

Data Processing Method parameters are explained in the Data Processing Method Parameters section in the *ChromaTOF* Brand Software Manual. The following parameter in the Data Processing Method is of particular importance for a GCxGC analysis: Spectral Match Required to Combine. For this parameter, the *ChromaTOF* software must recognize that analytes are possibly split into several modulated peaks and combine them for qualitative and quantitative reasons. The combining is done in part by comparing mass spectra and this is why the software requires a parameter entered in the Match Required to Combine box.

Column Calculator

The column calculator (for thermal modulation only) provides a way to calculate a column's void time, flow velocity, and required input pressure based on the parameters entered for the 1st dimension column, the 2nd column, and the 3rd column (transfer line). The column calculator can also be used to determine an appropriate 2nd dimension column length based on parameters entered for the 1st dimension column, the 2nd dimension column, and the 3rd column (transfer line). Refer to Column Calculator in the *ChromaTOF* Brand Software Manual. Also refer to the article on optimized conditions for GCxGC, referenced on page [5-20](#).

Simply GCxGC™

Simply GCxGC from LECO is a free tool designed to walk users through the steps of creating an optimized GCxGC method for complex samples. Create a GCxGC method from scratch, or convert an existing 1D method to GCxGC. The tool provides logical, step-by-step instructions to determine the secondary oven offset, second dimension column length, and experimentally evaluate stationary phases and peak capacity. *Simply GCxGC* takes a simple approach to GCxGC, helping avoid unnecessary testing and streamlining method development cycle. Visit <https://www.leco.com/simply-gcxgc> for more information.

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6 Diagnostics

The Diagnostics chapter explains how to monitor and check the operation of the instrument hardware, which can help determine if the instrument is operating properly. Use Diagnostics to check switches and solenoids and to monitor various system hardware parameters.

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System Status LED

The Pegasus® BT 4D has a system status LED built into the front panel of the instrument. This LED has three status modes to give users a visual indication of the status of the system.

Off: The LED is Off when the HV Power in the system is turned Off.

On: The LED is On when the HV Power is enabled and free of system faults or errors that would prevent data from being collected.

Flashing: The LED will flash when HV Power has been enabled but there is an error or warning in the system that requires user attention. Examples of such errors and warnings are: voltage setpoint errors, vacuum system communication errors, over pressure warnings, etc. When the LED is observed to be blinking, refer to the System Log to look for warnings and/or errors that will give further information on which aspect of the system is in need of attention.

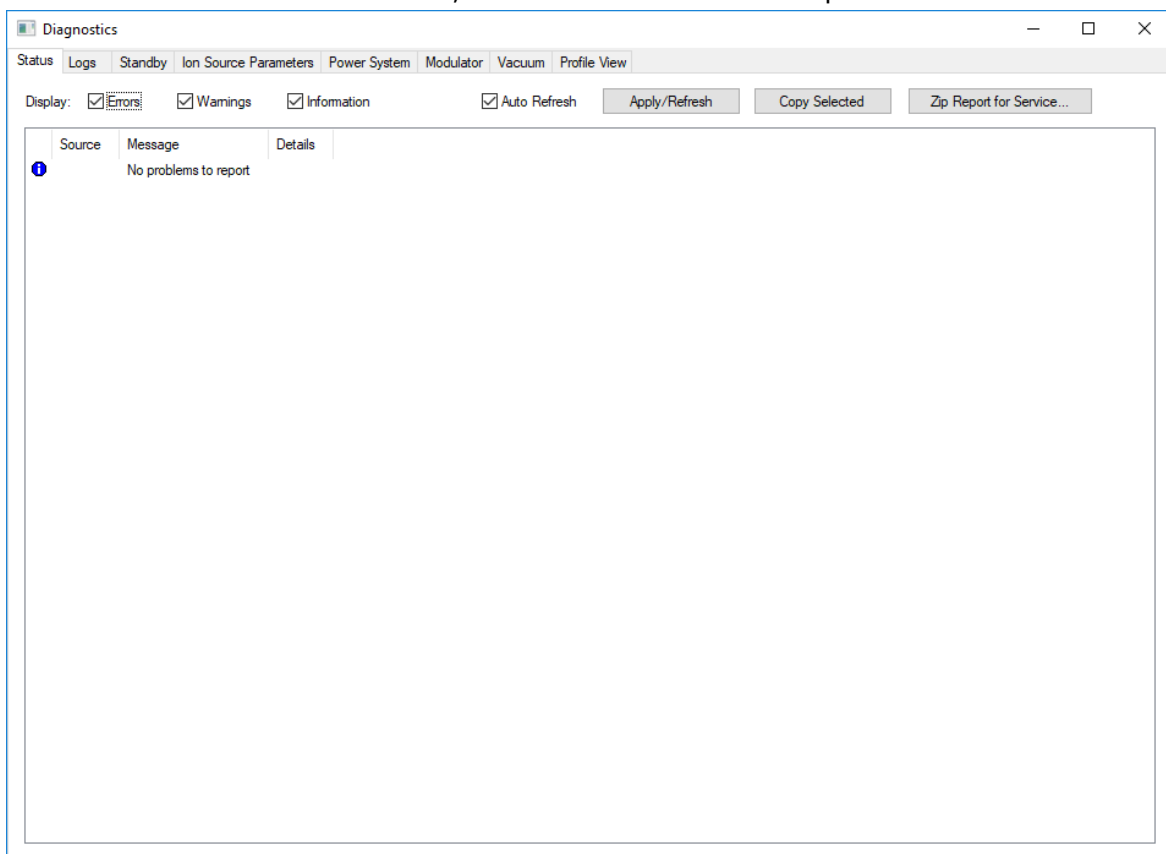
A successful power up or power down of the instrument will stop the LED from flashing.

Diagnostics Dialog Box

The Diagnostics dialog box serves as a means to monitor, evaluate, and/or test the instrument for proper operation. Check the Diagnostics dialog box after any warning messages or after any routine maintenance. Also check the status bar. Refer to Diagnostics in the ChromaTOF® Brand Software Manual.

System Status

The System Status tab indicates the location of faults in the system. Any warning or error message that could prevent the *Pegasus* BT 4D system from collecting data will be displayed on this page. If the errors cannot be resolved, contact LECO's Service Department.



Logs

The Logs tab will display the Instrument Log. Informational, warning, and error messages will be stored in the Log in reverse chronological order, with the newest message at the top of the Log.

The Zip Report for Service button can be used to create a zip file of the log to send to the LECO Service Department to help diagnose issues with the instrument.

Log: System log

From: 2/2/2018 9:58:30 AM To: 2/2/2018 9:58:30 AM

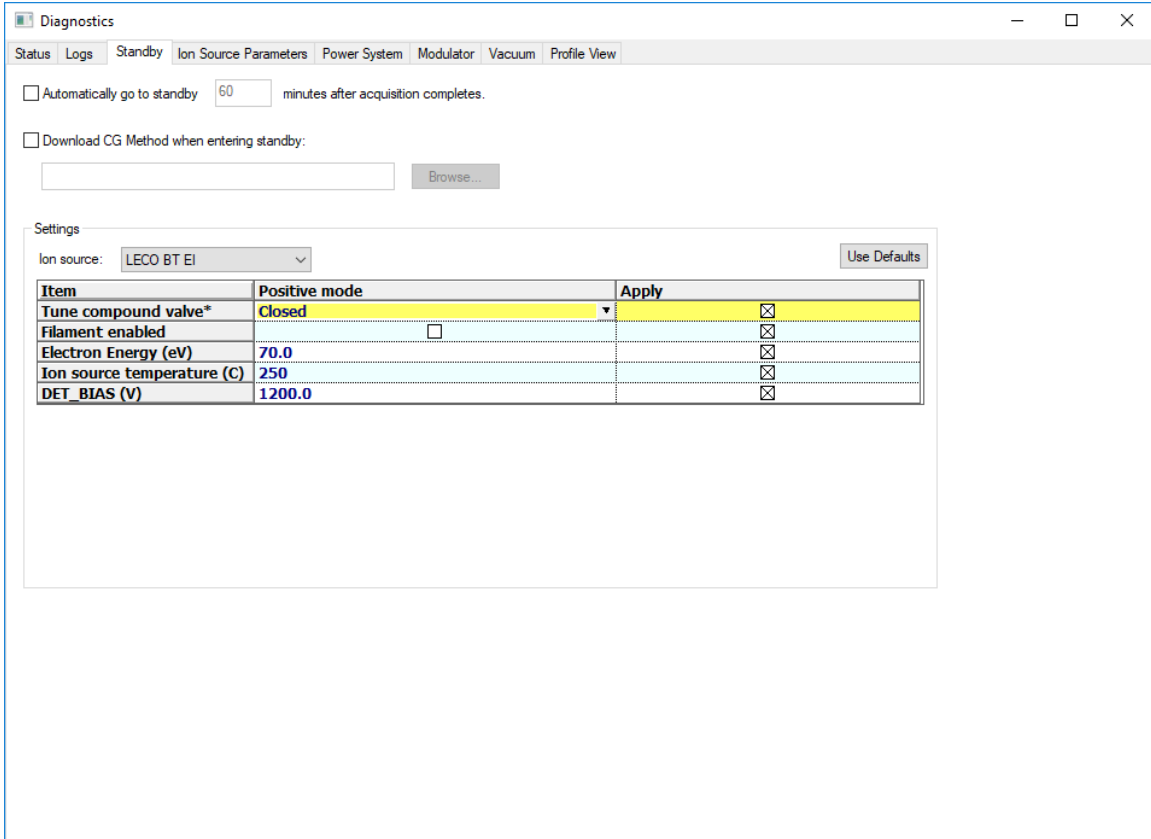
Display: Errors Warnings Information Auto Refresh

Only Display Entries That Contain:

Time	Object	Action
2/1/2018 7:10:26 PM	Filament schedule	Turning filament on
2/1/2018 7:05:36 PM	Tune compound valve schedule	Setting tune compound valve state to Closed
2/1/2018 7:05:36 PM	Filament schedule	Turning filament off
2/1/2018 6:52:27 PM	Power System	Finished switching to operational mode
2/1/2018 6:52:08 PM	Power System	Began switching to operational mode
2/1/2018 6:51:59 PM	Acquisition	Collection conditions are incompatible with Mass Calibration,Source and Analyzer Focus tune results. It is recommended that
2/1/2018 6:36:06 PM	Filament schedule	Turning filament on
2/1/2018 6:35:16 PM	Tune compound valve schedule	Setting tune compound valve state to Closed
2/1/2018 6:35:16 PM	Filament schedule	Turning filament off
2/1/2018 6:22:17 PM	Power System	Finished switching to operational mode
2/1/2018 6:21:58 PM	Power System	Began switching to operational mode
2/1/2018 6:21:48 PM	Acquisition	Collection conditions are incompatible with Mass Calibration,Source and Analyzer Focus tune results. It is recommended that
2/1/2018 6:05:45 PM	Filament schedule	Turning filament on
2/1/2018 6:05:05 PM	Tune compound valve schedule	Setting tune compound valve state to Closed
2/1/2018 6:05:05 PM	Filament schedule	Turning filament off
2/1/2018 5:52:11 PM	Power System	Finished switching to operational mode
2/1/2018 5:51:47 PM	Power System	Began switching to operational mode
2/1/2018 5:51:43 PM	Acquisition	Collection conditions are incompatible with Mass Calibration,Source and Analyzer Focus tune results. It is recommended that
2/1/2018 5:36:09 PM	Filament schedule	Turning filament on
2/1/2018 5:34:59 PM	Tune compound valve schedule	Setting tune compound valve state to Closed
2/1/2018 5:34:59 PM	Filament schedule	Turning filament off
2/1/2018 5:34:02 PM	Power System	Finished switching to operational mode
2/1/2018 5:33:46 PM	Power System	Began switching to operational mode
2/1/2018 5:33:45 PM	Acquisition	Collection conditions are incompatible with Mass Calibration,Source and Analyzer Focus tune results. It is recommended that
2/1/2018 4:57:25 PM	Filament schedule	Turning filament on
2/1/2018 4:56:16 PM	Tune compound valve schedule	Setting tune compound valve state to Closed

Standby

Use the Standby tab to set some of the instrument parameters during extended inactive periods. Users can set the length of time after the last acquisition completes, before the instrument goes into standby; a GC method can be selected when entering standby to set the GC conditions. Each of the parameters' setpoints can be adjusted, and the checkboxes in the Apply column determine whether their respective parameters are adjusted when entering standby. A checked box will apply that parameter during standby, while an unchecked box will not apply that parameter during standby.



Ion Source Parameters

The Ion Source Parameters tab can be used to monitor or adjust parameters of the ion source, transfer line, and tune compound valve. Changing the tune compound valve state, turning the filament emission On and Off, adjusting the ion source and transfer line temperatures, and selecting the desired active filament can all be accomplished by changing the value in the Target column. If there is an error on any of the ion source parameters, the target and readback values will differ, and the readback value will appear **red**. The instrument can be powered up and powered down via the buttons in the lower section of this tab. Additionally, any actions that the instrument is doing will be displayed in the lower section of this tab.

Diagnositics
— □ ×

Status
Logs
Standby
Ion Source Parameters
Power System
Modulator
Vacuum
Profile View

LECO BT EI - Positive polarity

Item	Target	Readback	Deviation
Tune compound valve	Closed	Closed	No
Filament enabled	<input type="checkbox"/>	<input type="checkbox"/>	No
Transferline temperature (C)	330	330	-0
Active filament	-	Filament 2	-
Emission current (mA)	-	0.0594361	-
Electron Energy (eV)	-	70.1	-
Desired filament	Filament 2	Filament 2	No
Ion source temperature (C)	250	250	0

Commands

Current action: Idle View Log...

Current step: Idle Abort action

Last log message: -- Skip Step

Power System

Use the Power System tab to monitor the voltages applied to the instrument. If the Target and Readback for any voltage differ, the Readback will appear **red**. This indicates a voltage fault.

If a voltage fault occurs, power down the instrument (refer to [Powering Down the System](#), page 4-10) and then power the instrument back up (refer to [Powering Up the Instrument](#), page 4-8). If the voltage fault remains, there is a chance that a voltage short has occurred inside the vacuum system. Power down the instrument and contact the LECO Service Department.

NOTE → The voltage setpoints cannot be changed from this tab.

The screenshot shows a software window titled "Diagnostics" with several tabs: Status, Logs, Standby, Ion Source Parameters, Power System (selected), Modulator, Vacuum, and Profile View. The window is tracked since Feb 02, 10:00:06 AM. The main content is a table with the following data:

Power Supply	Target	Readback	Min	Max	Current	Setpoint	Deviation
ACTIVE_REPELLER	-200.0	-200.9	-200.9	-200.9	-	-200.0	-0.9
ACTIVE_EXTRACTION	10.0	10.7	10.7	10.8	-	10.0	0.7
INACTIVE_EXTRACTION	300.0	301.5	301.5	301.5	-	300.0	1.5
ACTIVE_FILAMENT_BIAS	-70.0	-70.1	-70.1	-70.1	-	-70.0	-0.1
INACTIVE_FILAMENT_BIAS	-100.0	-99.4	-99.4	-99.3	-	-100.0	0.6
PUSH	850.0	853.3	853.3	853.3	-	850.0	3.3
PUSH_OFFSET	5.5	5.6	5.6	5.6	-	5.5	0.1
PULL_OFFSET	10.0	10.2	10.2	10.2	-	10.0	0.2
PULL	-1400.0	-1443.2	-1443.2	-1443.0	-	-1400.0	-43.2
DRIFT	-2500.0	-2476.8	-2476.8	-2476.8	-	-2500.0	23.2
Y_STEERING	-2495.1	-2480.0	-2480.0	-2480.0	-	-2495.1	15.1
Z_STEERING_DEFLECT_LS	-2597.8	-2579.2	-2579.2	-2579.2	-	-2597.8	18.6
DEFLECTOR_HS	499.0	495.3	495.3	495.8	-	499.0	-3.7
MODERATOR	-346.4	-339.2	-339.2	-339.2	-	-346.4	7.2
REFLECTOR	1250.0	1251.2	1251.2	1251.2	-	1250.0	1.2
DET_IN	-2600.0	-2579.2	-2579.2	-2579.2	-	-2600.0	20.8
DET_BIAS	1847.8	1840.8	1840.8	1840.8	-	1847.8	-7.0
POSITIVE_HV_RAIL	3800.0	3778.2	3778.2	3778.2	-	3800.0	-21.8
NEGATIVE_HV_RAIL	-3800.0	-3776.3	-3776.3	-3776.3	-	-3800.0	23.7

Below the table is a section for "Item" and "Readback" with the following values:

Item	Readback
Tune compound valve	Closed
Filament enabled	<input type="checkbox"/>
Transferline temperature (C)	330
Active filament	Filament 2
Emission current (mA)	0.058762
Electron Energy (eV)	70.1
Desired filament	Filament 2
Ion source temperature (C)	250

At the bottom of the window, there are buttons for "Save", "To/From File" (with a dropdown arrow), "Reset Tune", and "Maintenance".

Modulator Tab (Thermal System)

Use the Modulator tab to monitor the status of the thermal modulator and secondary oven.

The screenshot shows the 'Diagnostics' window with the 'Modulator' tab selected. The interface is organized into several sections:

- Top Status:** Valve Driver Board Status: Ready; Coolant Status: Liquid N2; Faults: None.
- Modulator Section:**
 - Temperature Status: Idle
 - Enable: Off, On
 - Set Point: 59, Actual: 59.0, PWM: 1.8
- Secondary Oven Section:**
 - Temperature Status: Idle
 - Enable: Off, On
 - Set Point: 44, Actual: 44.0, PWM: 1.4
- Jet Status Section:**
 - Stage 1 Cold Jet: Stage 2 Cold Jet:
 - Stage 1 Hot Jet: Stage 2 Hot Jet:
 - Cold Jet Pressure: 11.7 psi
 - Hot Jet Pressure: 25.8 psi
- Proportional Valve Control:** PWM: 0.0
- Learn Mode:** Start, Abort buttons; Status: Learn Mode Passed
- Cycle Testing:** Modulation Time (sec): 2; Valve Timing..., Start, Stop buttons

Modulator

Within the Modulator section, the temperature of the modulator can be turned On or Off by selecting the On or Off radio buttons next to Enable, and the temperature can be manually set by entering a value in the Set Point field. The temperature read back is displayed next to Actual. The value next to PWM displays the duty cycle of the heater circuit used to control the modulator temperature.

Jet Status

Within the Jet Status section, the four jets in the modulator can be manually turned On and Off by selecting or deselecting the checkbox next to each jet. This feature can be used to ensure that the jets are functioning by turning On one jet at a time and feeling for gas flow at the jet nozzles in the modulator. The pressure of the gases for the jets is displayed after the "Cold Jet Pressure" and "Hot Jet Pressure" labels.

Secondary Oven

Within the Secondary Oven section, the temperature of the secondary oven can be turned On or Off by selecting the On or Off radio buttons, and the temperature can be manually set by typing a value into the Set Point field. The temperature read back is displayed next to Actual. The value after the "PWM" label displays the duty cycle of the heater circuit used to control the secondary oven temperature.

Proportional Valve Control

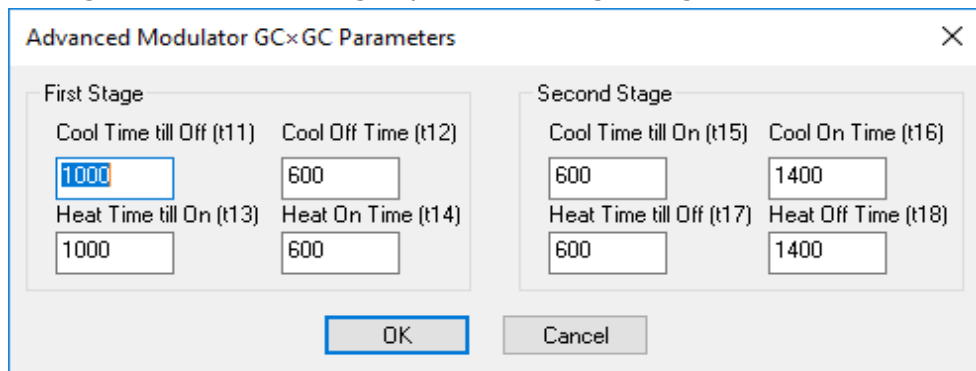
Within the Proportional Valve Control section, there is a gas jet in the back of the secondary oven that is used to cool the secondary oven after the GC oven ramp of a sample acquisition ends. The PWM value displayed is the duty cycle of the gas valve that controls this cooling gas flow.

Learn Mode

The Learn Mode section is used to calibrate the cooling gas flow for the secondary oven. This calibration is done on new systems as part of the installation process by a qualified LECO Service Engineer. If the valve requires re-calibration, refer to the Diagnostics chapter in the *ChromaTOF* Brand Software Manual.

Cycle Testing

The modulator can be tested manually by entering a desired modulation period in the Modulation Time (sec) field and then selecting Start. This will start the modulator jets firing as they would during a sample acquisition. To stop the modulator jets, select Stop. The timing of the modulator jets can be manually adjusted by selecting the Valve Timing button, which brings up the following dialog box.



The dialog box, titled "Advanced Modulator GCxGC Parameters", contains two main sections: "First Stage" and "Second Stage". Each section has four input fields for timing parameters in milliseconds. The "First Stage" parameters are: Cool Time till Off (t11) = 1000, Cool Off Time (t12) = 600, Heat Time till On (t13) = 1000, and Heat On Time (t14) = 600. The "Second Stage" parameters are: Cool Time till On (t15) = 600, Cool On Time (t16) = 1400, Heat Time till Off (t17) = 600, and Heat Off Time (t18) = 1400. At the bottom of the dialog are "OK" and "Cancel" buttons.

First Stage		Second Stage	
Cool Time till Off (t11)	Cool Off Time (t12)	Cool Time till On (t15)	Cool On Time (t16)
1000	600	600	1400
Heat Time till On (t13)	Heat On Time (t14)	Heat Time till Off (t17)	Heat Off Time (t18)
1000	600	600	1400

The jet timing is adjusted by changing the input values. All times in this dialog box are in milliseconds.

Modulator Tab (Flow System)

Use the Flow Modulator tab to monitor the status of the modulator and secondary oven.

The screenshot shows the 'Flow Modulator' tab in a software interface. At the top, there are navigation tabs: Status, Logs, Standby, Ion Source Parameters, Power System, Flow Modulator (selected), Vacuum, and Profile View. Below the tabs, the 'Valve Driver Board Status' is 'Ready' and 'Faults' are 'None'. The 'Valve State' section has an 'Injection Mode' checkbox that is unchecked. The 'Cycle Testing' section has 'Modulation Time (sec)' set to 2 and 'Inject Duration (sec)' set to 0.5, with 'Start' and 'Stop' buttons. The 'Secondary Oven' section has 'Temperature Status' set to 'Idle', 'Enable' radio buttons for 'Off' and 'On' (with 'On' selected), 'Set Point' set to 60, and 'Actual' temperature at 60.0 with a 'PWM' of 6.0. The 'Proportional Valve Control' section shows 'Air Pressure' at 20.5 psi and 'PWM' at 0.0. The 'Learn Mode' section has 'Start' and 'Abort' buttons, and the 'Status' is 'Learn Mode Passed'.

Valve State

This checkbox indicates whether or not the modulator is in Injection Mode. Select the checkbox to put the valve in Injection Mode.

Cycle Testing

The modulator can be tested manually by entering the modulation time in the Modulation Time (sec) field and entering the inject duration in the Inject Duration (sec) field, and then selecting Start. This will start the modulator toggling between Divert and Inject state as it would during a sample acquisition. To stop the modulator, select Stop.

Secondary Oven

Within the Secondary Oven section, the temperature of the secondary oven can be turned On or Off by selecting the On or Off radio buttons, and the temperature can be manually set by typing a value into the Set Point field. The temperature read back is displayed next to Actual. The value after the "PWM" label displays the duty cycle of the heater circuit used to control the secondary oven temperature.

Proportional Valve Control

Within the Proportional Valve Control section, there is a gas jet in the back of the secondary oven that is used to cool the secondary oven after the GC oven ramp of a sample acquisition ends. The PWM value displayed is the duty cycle of the gas valve that controls this cooling gas flow.

Learn Mode

The Learn Mode section is used to calibrate the cooling gas flow for the secondary oven. This calibration is done on new systems as part of the installation process by a qualified LECO Service Engineer. If the valve requires re-calibration, refer to the Diagnostics chapter in the *ChromaTOF* Brand Software Manual. Refer to [Learning the Proportional Valve](#), page 3–95.

Vacuum Tab

Use the Vacuum tab to monitor the vacuum system pressure, roughing pump and turbo pump states, and turbo pump operating readbacks.

If there is a problem with the turbo pump, the readbacks will be significantly different than those displayed in the following screenshot. The most common issue will be the turbo pump temperature being higher than normal. This could indicate that the cooling fan filters at the front of the instrument need to be cleaned.

Another common issue is the turbo pump power is significantly higher than displayed; a possible cause of this is an atmospheric leak in the system.

The system can be vented or evacuated from this this tab. Refer to [Venting the Instrument](#), page 4–6, for further instruction.

The screenshot shows the 'Diagnostics' window with the 'Vacuum' tab selected. The interface is divided into several sections: Pressures, Pumps, Valves, and Commands.

Pressures:

Gauge	Pressure (mb)	Expected (mb)
VacuumGauge	2.91e-07	0.00e+00 - 1.00e-05

Pumps:

Pump	Running
RoughingPump	<input checked="" type="checkbox"/>

Pump	Running	Current	Voltage	Power	Temp.	Frequency	Life
TurboPump1	<input checked="" type="checkbox"/>	1.0	23.8	20.4	43.0	1000.0	1086190.0

Valves:

Valve	Status
TurboPump1VentValve	Closed

Commands:

Vent System
Evacuate System

Current action: Idle View Log...
Current step: Idle Stop action
Last log message: -- Skip Step

Profile View Tab

The Profile View tab can be used to run a live acquisition for diagnostic purposes. Any data collected from the Profile View tab in Diagnostics will not be stored on the hard drive of the PC. Select an MS Method that will be used to run the profile acquisition. Also select whether the tune compound valve should be open or closed during the acquisition.

Profile acquisitions are most commonly used to manually leak check the system. Select an MS method that collects down to m/z 10, and start the acquisition. Using a can of compressed air, while monitoring the intensity of m/z 51, slowly spray the compressed air around the ion source flange, PFTBA vial, transfer line flange, and transfer line nut. If the intensity of m/z 51 spikes while spraying compressed air, there is a leak in the area being sprayed. Vent the system (refer to [Venting the Instrument](#), page 4–6) and fix the leak.

The screenshot shows the 'Diagnostics' software window with the 'Profile View' tab selected. The interface includes several control panels and a large data display area.

- Ms Method:** A text input field.
- Status:** A text input field.
- Start/Stop:** Two buttons located below the Status field.
- Tune Compound Valve:** A section with a 'Browse...' button and two radio buttons: 'Opened' (selected) and 'Closed'.
- Resolution:** A text input field.
- ToF:** A text input field.
- Intensity:** A text input field.
- FWHH:** A text input field.
- Width at 1%:** A text input field.
- Asymmetry:** A text input field.
- Left tail:** A text input field.
- Right tail:** A text input field.

The main area of the window is a large, empty rectangular box, likely intended for displaying a mass spectrum or acquisition data.

7 Service

The Service chapter contains common service procedures that may correct operational problems with the instrument. The procedures included in this chapter may require disabling power to the instrument and should be performed only by trained personnel. If you are still experiencing difficulties after referencing the service information, please contact the LECO Service Department at 269-982-5497 for assistance.

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Remote Diagnostics

For a quick response to potential problems, LECO offers Smartline® Remote Diagnostic Software. This enhanced diagnostic feature allows LECO to connect with your instrument upon your request and help you diagnose potential instrument problems from anywhere in the United States and Canada. For customers outside the United States and Canada, please contact your LECO representative or subsidiary to check on the availability of *Smartline*.

A broadband internet connection is needed and no additional software is required. A separate phone line is preferable, although *Smartline* does offer a chat feature that can be used to communicate with LECO Service. The chat feature is a secure connection that allows you and LECO Service to implement various security options. For more information, contact LECO Service or refer to the LECO Service Handbook.

Frequently Asked Questions

Topic	Question	Answer
Archive	I cannot archive.	Archives can be created or restored with entries in the Acquisition Queue and Data Processing Tasks Table, but these queues must be paused to perform archive tasks.
Calibration	In a Calibration I want to assign an internal standard to an analyte, but the internal standard list is empty. What do I do?	Select the Type column of the Calibration Table and then select the arrow to change the type to Internal Standard.
Chromatogram	I want to change the properties of the real-time Chromatogram view but it is always grayed out.	Pause the Acquisition Queue when the real-time Chromatogram is displayed to bring up the real-time Chromatogram properties.
Export	We have multiple instruments and would like the data to go to a central location.	Refer to Automatically Export Data after Acquisition in the ChromaTOF® Brand Software Manual.
Filament Bias Voltage	Why change the filament bias voltage?	<p>Sometimes total signal intensity can be traded for enhanced relative abundance of high mass and molecular ions to provide more accurate analyte identification. These higher mass fragments, and especially molecular ions, can provide more analyte specific information for more accurate library search results and mass spectral interpretations. If the analyte is present at the near the detection limit of the instrument, overall signal intensity cannot be sacrificed for the sake of higher mass information.</p> <p>Detecting the analyte becomes the most important factor and the filament bias should be set to the default setting. If sufficient signal is available, a small sacrifice of this total signal can provide improved identification accuracy.</p>

Topic	Question	Answer
Library	I need to change a library entry in a user library. How can this be done?	User library entries cannot be edited at this time. You can delete the entry and then add the correct entry back in, the entry is added to the end and has a different ID number.
Peak Find	I am searching for components in a complex matrix. Can I peak find only the masses of the components I am interested in?	Yes, but interfering compounds that have no masses specified as masses of interest will not be found. Therefore, interfering peaks will not be deconvoluted, which leads to poor library matches.
Peak Table	Which column in the Peak Table is used for the quant mass in a calibration?	The column titled Quant Masses displays quant mass entered.
Voltage Tolerance	How is Voltage Tolerance Calculated?	$(\text{Max Voltage} - \text{Min Voltage}) \times \text{Tolerance} = \text{allowed variation from setpoint.}$

General Troubleshooting

Area	Symptom	Action
Leak Check (applies only to <i>ChromaTOF</i> software versions 5.03 and later)	Leak check failure reported in the instrument log	<p>If mass 28 is \geq 500% of mass 32, check for leaks in the GC carrier gas supply line.</p> <p>If mass 28 is $<$ 500% of mass 32, check the vacuum system for leaks in the following areas:</p> <ul style="list-style-type: none"> • Ion source flange • Transfer line flange • Transfer line nut and ferrule • GC inlet • PFTBA vial o-ring
Chromatogram or Spectra Plot	Poor signal from Calibration Sample (PFTBA)	<p>Perform Source and Analyzer Focus, Mass Calibration, and Gain Optimization.</p> <p>Vent system, remove ion source flange, inspect all ion source lead wire for loose or broken connections, and inspect filaments for signs of contamination.</p>
	Poor Mass Resolution	<p>Perform Source and Analyzer Focus, Mass Calibration, and Gain Optimization.</p> <p>Verify that there are no vacuum leaks. Refer to System Leaks, page 4-4.</p> <p>Check that cable connectors are attached properly to the rear analyzer flange, detector flange, and ion source connector.</p> <p>Vent system, remove ion source flange, inspect all ion source lead wire for loose or broken connections, and inspect filaments for signs of contamination.</p>
	Strange PFTBA pattern	<p>Perform Source and Analyzer Focus, Mass Calibration, and Gain Optimization.</p> <p>Vent system, remove ion source flange, inspect all ion source lead wire for loose or broken connections, and inspect filaments for signs of contamination.</p>
Power System	Communications cannot be established.	<p>Check the Ethernet connection between the PC tower and instrument.</p> <p>Check the log. Refer to View Log in the <i>ChromaTOF</i> Brand Software Manual.</p> <p>Check that Interlock is not tripped.</p>

Area	Symptom	Action
HV Power	Cannot Enable	Check System Log for message. Refer to System Log in the <i>ChromaTOF</i> Brand Software Manual.
Ion Source Example:	Temperature fault	Check that the Ion Source 19-pin connector is attached to the feedthrough on the side of the ion source vacuum chamber. Check if RTD leads are shorted on the ion source inside the vacuum chamber.
Transfer Line Example:	Temperature fault	Verify that the transfer line power cord is connected to the unit.

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8 Illustrations

The Illustrations chapter can assist in procedures, verify information during setup, and help to locate parts within the instrument and part numbers.

NOTE →

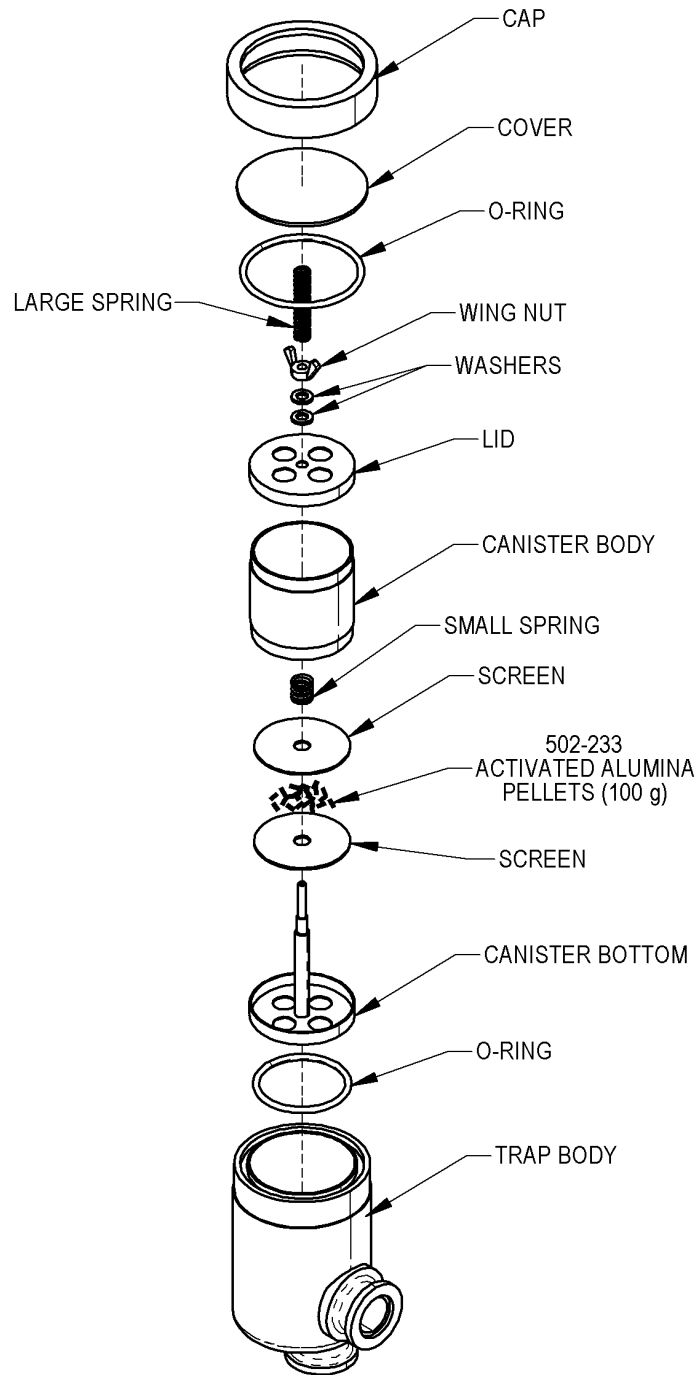
The following items listed are subject to revision. Confirm the current parts and part numbers before ordering.

To place an order by phone, call our customer service department toll-free in the United States at 1-800-292-6141 or 269-985-5496.

Orders may also be sent by fax to 269-982-8977.

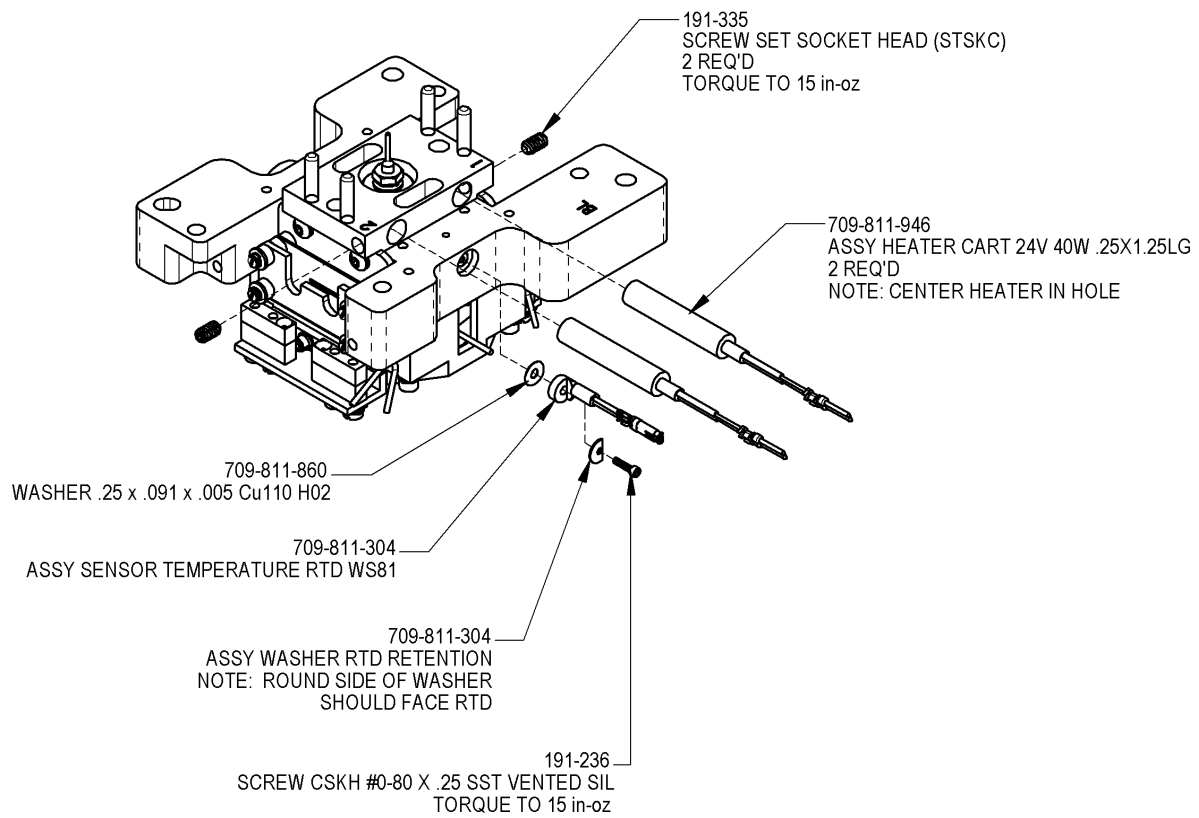
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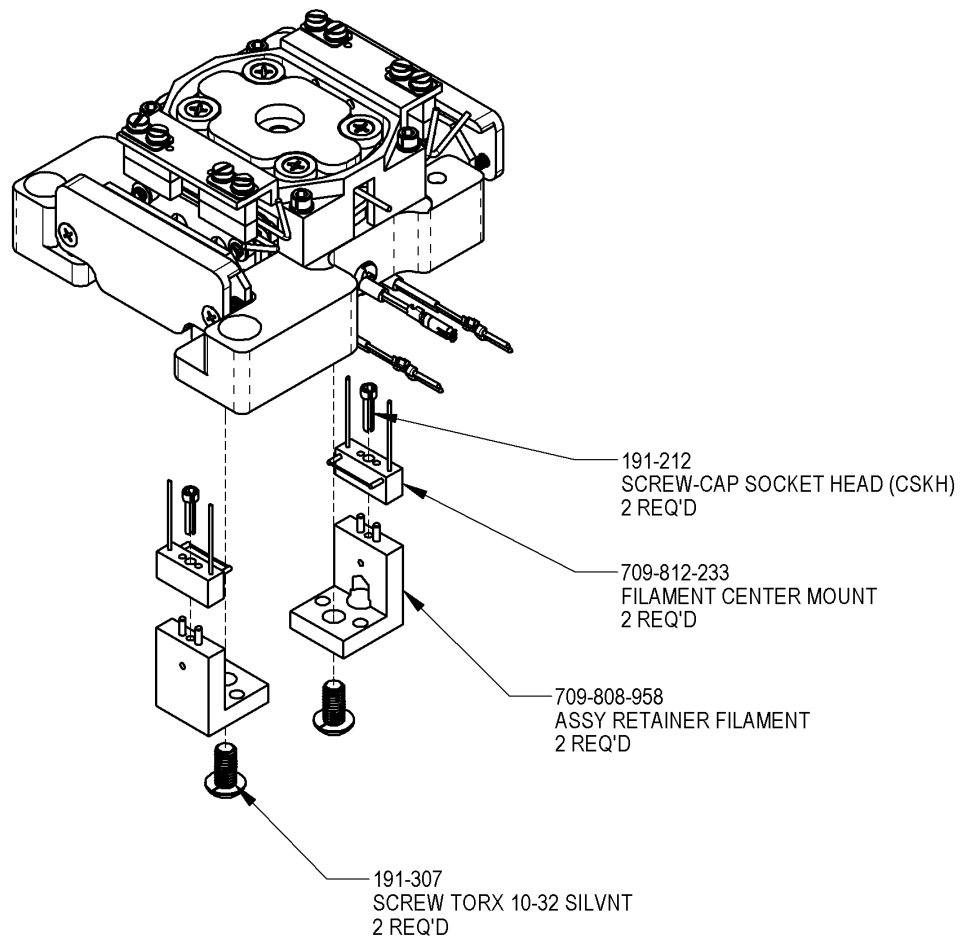
607-111-ILS-A

Figure 8-1
Foreline Trap-Exploded View



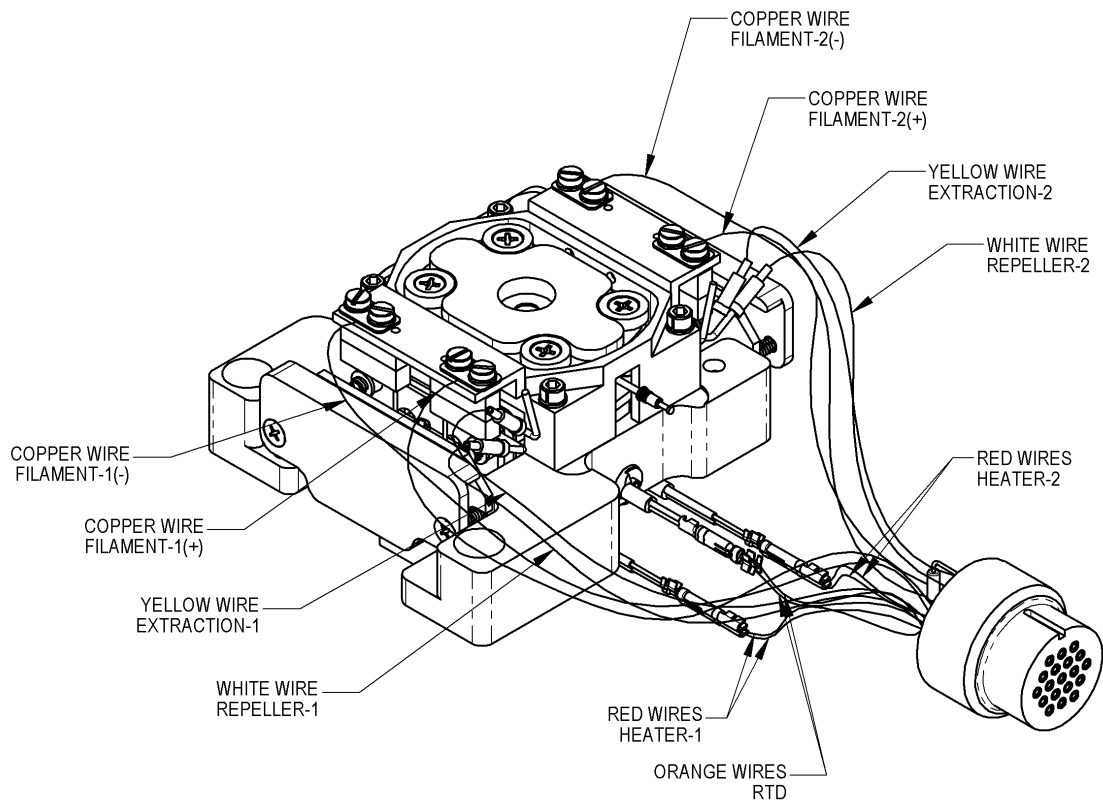
709-813-283-ILS-D
SHEET 1 OF 3

Figure 8-2
Ion Source Chamber 1 of 3



709-813-283-ILS-D
SHEET 2 OF 3

Figure 8-3
Ion Source Chamber 2 of 3



709-813-283-ILS-D
SHEET 3 OF 3

Figure 8-4
Ion Source Chamber 3 of 3

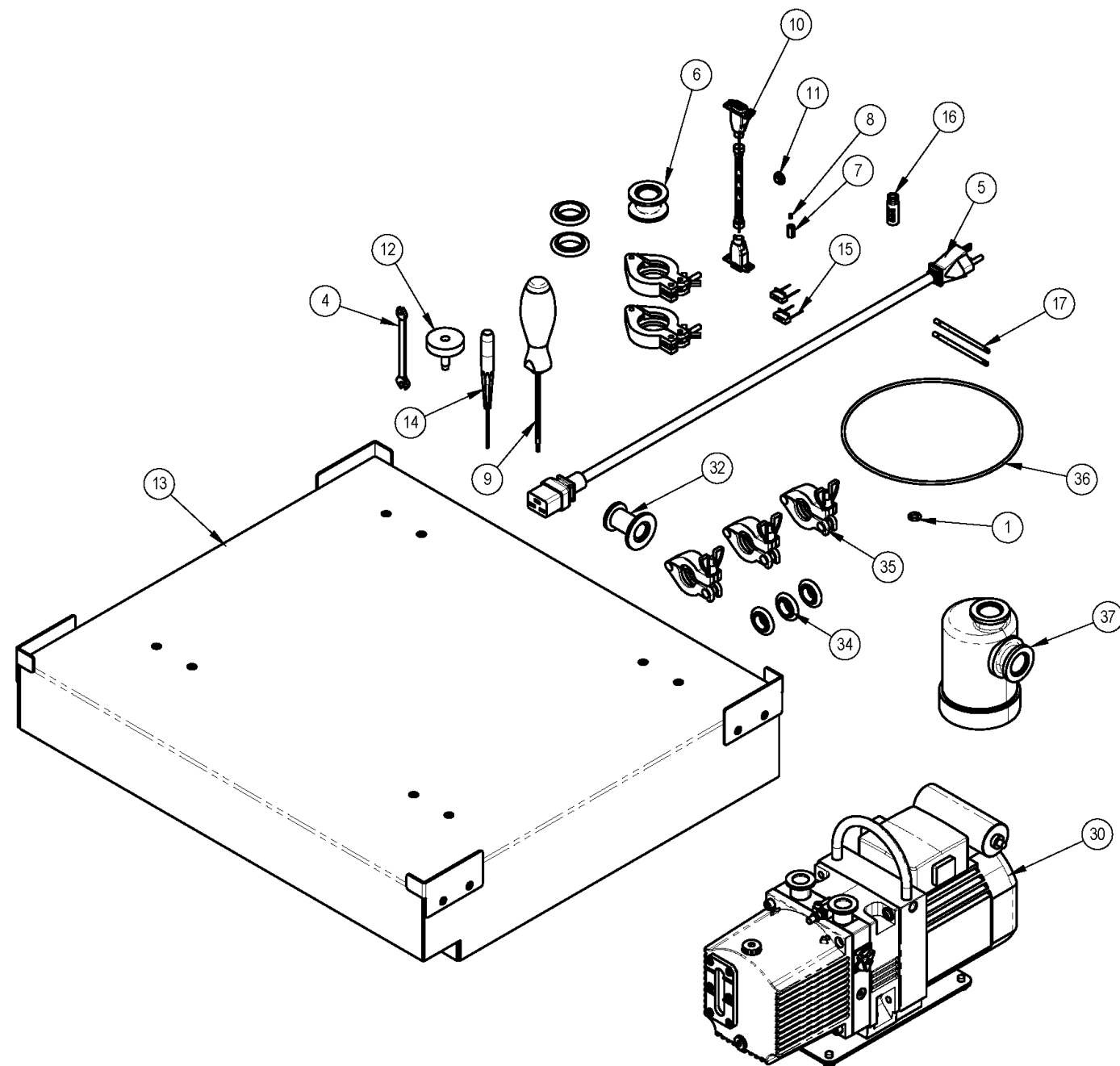


Figure 8-5
7890 Component Pack Assembly

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	603-433	O-RING 109 .299X .505X.103V	1
2	615-341	CLAMP FTG FLANGE NW25	2
3	615-343	FTG-RING SEAL CENTERING WITH O-RINGS	2
4	621-605-748	WRENCH OPEN END 3/16 X 1/4 ST CP	1
5	709-806-720	POWER CORD ASSEMBLY	1
6	709-807-453	FLANGE FTG ADPTR NW25 X NW25	1
7	709-809-220	FTG NUT HEX 1.2mm DIA	1
8	709-809-221	FITTING FERRULE	1
9	709-809-334	SCREWDRIVER T25 TORX BALL	1
10	709-809-347	ASSY CABLE REMOTE DSUB M-M 5 FT	1
11	709-810-251	INSULATOR REPELLER	1
12	709-811-524	ASSY TOOL REMOVAL FILAMENT PEG BT	1
13	709-814-247	ASSY BASE SLIDING GC STEPPED TOP 8890	1
14	709-812-181	WIHA Hex 5/64" (2mm)	1
15	709-812-233	FILAMENT CENTER MOUNT	2
16	709-812-589-110	VIAL 11mm CRIMP TOP	1
17	709-812-641	ROD ALIGNMENT	2
*18	200-999-017	MANUAL INSTR PEGASUS BT	1
*19	200-999-025	MANUAL INSTR HRT CHROMATOF SOFTWARE	1
*20	502-233	ALUMINA A PELLETS 1LB	1
*21	502-349	SAMPLE CAL PFTBA MS 35G	1
*22	619-590-809	CABLE ASSY CAT 5E 7FT RJ-45	3
*23	709-566	FOAM NON-SKID NS901 3.0 PSA	1
*24	709-802-132	TUBE CU GC TO HELIUM SUPPLY	1
*25	709-809-663	DRIVE USB FLASH 8GB	1
*26	709-809-198	KIT MODIFY 7890B GC PEGNT/PEGHRT	1
*27	709-809-508	COLUMN 30M X 0.25MM X 0.25 UM RXI-5	1
*28	711-690	CORD POWER 3X100MM 10A 8FT	1
*29	711-887	TUBING FLX POLYU C .062IDX.031W	1
30	723-101-278	PUMP VANE ROTARY 230-240V 50/60 Hz	1
*31	723-101-279	INLET ELIMINATOR MIST OIL OME 16S	1
32	612-240	Reducer_NW16-NW25	1
*33	709-809-394	HOSE VACUUM KF16	1
34	615-344	FTG-RING SEAL CENTERING WITH O-RINGS	3
35	615-342	CLAMP FTG FLANGE NW16	3
36	709-812-554	O-RING 260 6.484 X 6.762 X .139 V	1
37	607-111	TRAP-OIL VAPOR WITH NW25 TERMINATIONS	1
*38	203-505-548	FORM PEGASUS BT INSTALLATION CHECKLIST	1

*PARTS NOT SHOWN HERE

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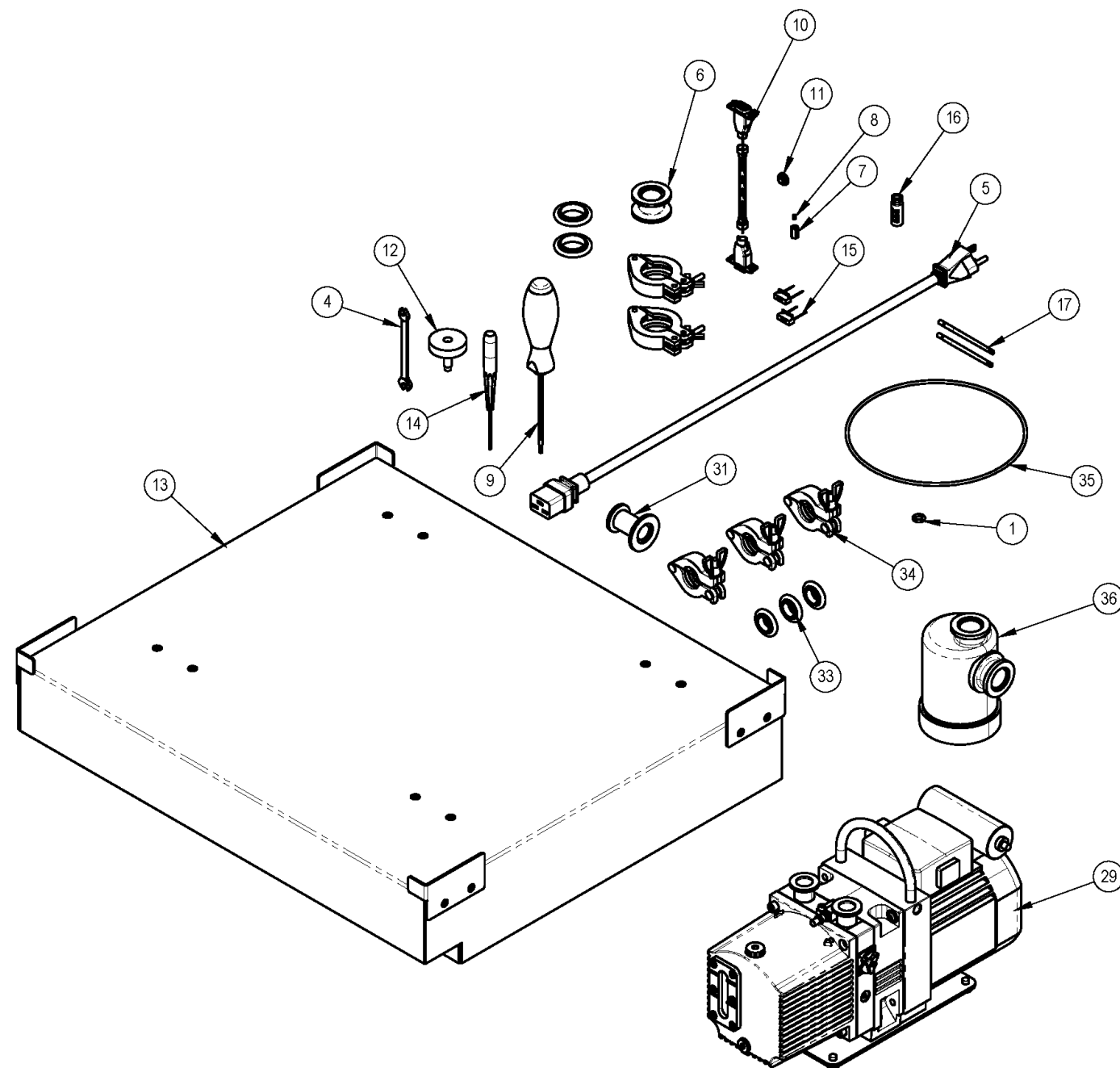
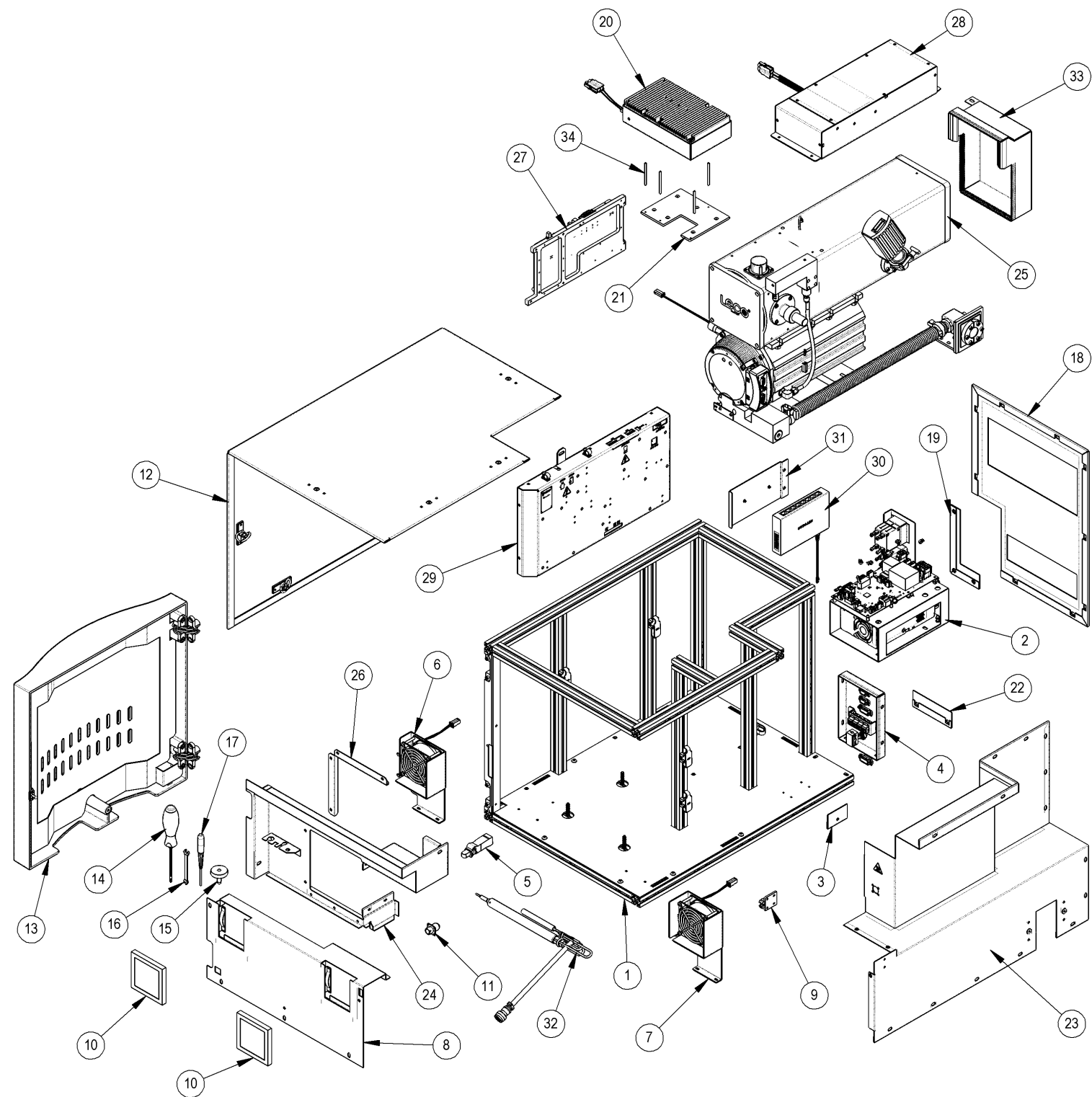


Figure 8-6
8890 Component Pack Assembly

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	603-433	O-RING 109 .299X .505X.103V	1
2	615-341	CLAMP FTG FLANGE NW25	2
3	615-343	FTG-RING SEAL CENTERING WITH O-RINGS	2
4	621-605-748	WRENCH OPEN END 3/16 X 1/4 ST CP	1
5	709-806-720	POWER CORD ASSEMBLY	1
6	709-807-453	FLANGE FTG ADPTR NW25 X NW25	1
7	709-809-220	FTG NUT HEX 1.2mm DIA	1
8	709-809-221	FITTING FERRULE	1
9	709-809-334	SCREWDRIVER T25 TORX BALL	1
10	709-809-347	ASSY CABLE REMOTE DSUB M-M 5 FT	1
11	709-810-251	INSULATOR REPELLER	1
12	709-811-524	ASSY TOOL REMOVAL FILAMENT PEG BT	1
13	709-814-247	ASSY BASE SLIDING GC STEPPED TOP 8890	1
14	709-812-181	WIHA Hex 5/64" (2mm)	1
15	709-812-233	FILAMENT CENTER MOUNT	2
16	709-812-589-110	VIAL 11mm CRIMP TOP	1
17	709-812-641	ROD ALIGNMENT	2
*18	200-999-017	MANUAL INSTR PEGASUS BT	1
*19	200-999-025	MANUAL INSTR HRT CHROMATOF SOFTWARE	1
*20	502-233	ALUMINA A PELLETS 1LB	1
*21	502-349	SAMPLE CAL PFTBA MS 35G	1
*22	619-590-809	CABLE ASSY CAT 5E 7FT RJ-45	3
*23	709-566	FOAM NON-SKID NS901 3.0 PSA	1
*24	709-802-132	TUBE CU GC TO HELIUM SUPPLY	1
*25	709-809-663	DRIVE USB FLASH 8GB	1
*26	709-814-451	KIT MODIFY 8890 GC PEG HRT+/BT2	1
*27	711-690	CORD POWER 3X100MM 10A 8FT	1
*28	711-887	TUBING FLX POLYU C .062IDX.031W	1
29	723-101-278	PUMP VANE ROTARY 230-240V 50/60 Hz	1
*30	723-101-279	INLET ELIMINATOR MIST OIL OME 16S	1
31	612-240	Reducer_NW16-NW25	1
*32	709-809-394	HOSE VACUUM KF16	1
33	615-344	FTG-RING SEAL CENTERING WITH O-RINGS	3
34	615-342	CLAMP FTG FLANGE NW16	3
35	709-812-554	O-RING 260 6.484 X 6.762 X .139 V	1
36	607-111	TRAP-OIL VAPOR WITH NW25 TERMINATIONS	1
*37	203-505-548	FORM PEGASUS BT INSTALLATION CHECKLIST	

* PARTS NOT SHOWN HERE

614-720-074-ILS-A



**Figure 8-7
Top Level View**

ITEM NO.	PART NUMBER	DESCRIPTION	QTY
1	709-813-141	ASSY FRAME PEGASUS BT	1
2	709-811-888	ASSY AC/DC DISTRIBUTION	1
3	709-811-862	BRACKET COVER ROUGHING PUMP VAC MANIFOLD SATURN	1
4	709-813-367	ASSY BULKHEAD 4D	1
5	709-812-210	FINGER SOFT CLOSE	1
6	709-812-565	ASSY FAN AND BRACKET LEFT	1
7	709-812-564	ASSY FAN AND BRACKET RIGHT	1
8	709-813-570	ASSY PANEL INNER FRONT REMOVABLE	1
9	709-812-148	LATCH NON-MAGNETIC	1
10	709-811-959	FILTER-AIR 3.98x3.98x0.47	2
11	709-812-208	CONNECTOR MB1 TYPE	1
12	709-813-706	ASSY PANEL SIDE AND TOP 4D	1
13	709-813-510	ASSY DOOR PEG BT 4D	1
14	709-809-334	SCREWDRIVER T25 TORX BALL	1
15	709-811-524	ASSY TOOL REMOVAL FILAMENT PEG BT	1
16	621-605-748	WRENCH OPEN END 3/16 X 1/4 ST CP	1
17	709-812-181	WIHA Hex 5/64" (2mm)	1
18	709-813-143	PANEL BACK 4D	1
19	709-812-930	FILLER CORNER REAR	1
20	709-809-398	ASSY PULSER TRIPLE	1
21	709-814-185	PLATE SPACER TP MACHINED	1
22	709-813-435	REAR PANEL FILLER	1
23	709-813-458	ASSY PANEL SIDE 4D	1
24	709-813-147	ASSY PANEL FRONT TOP 4D	1
25	709-813-542	ASSY FLIGHT TUBE W/HOUSING BT	1
26	709-813-151	GASKET LEDGE 90	1
27	666-748X210	ASSY G2 DAS CARD	1
28	709-809-668	CONTROLLER HV MASS ANALYZER PGM	1
29	709-809-353	CONTROLLER HV ION SOURCE PGM	1
30	709-812-618	ASSY ETHERNET SWITCH WITH CABLE	1
31	709-811-879	ASSY BRACKET ETHERNET SWITCH	1
32	709-812-189	ASSY TRANSFER LINE SHORT EXTENDED TIP	1
33	709-813-833	ASSY ENCLOSURE RF ANALYZER	1
34	709-814-176	THRD ROD 4-40 X 2 1/2LG 18-8 SST	4

614-720-010-ILS-F

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9 Index

Index provides page numbers for topics throughout the manual. In the electronic manual available through the software, the page numbers in the index provide a hyperlink to the corresponding topic.

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