Discovery

Mass Spectrometer

Getting Started Guide

Revision G Issued October 2015

Notice

The material contained in this manual, and in the online help for the software used to support this instrument, is believed adequate for the intended use of the instrument. If the instrument or procedures are used for purposes other than those specified herein, confirmation of their suitability must be obtained from TA Instruments. Otherwise, TA Instruments does not guarantee any results and assumes no obligation or liability. TA Instruments also reserves the right to revise this document and to make changes without notice.

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Introduction

Important: TA Instruments Manual Supplement

Please click the TA Manual Supplement link to access the following important information supplemental to this Getting Started Guide:

- TA Instruments Trademarks
- TA Instruments Patents
- Other Trademarks
- TA Instruments End-User License Agreement
- TA Instruments Offices

Notes, Cautions, and Warnings

This manual uses NOTES, CAUTIONS, and WARNINGS to emphasize important and critical instructions.

NOTE: A NOTE highlights important information about equipment or procedures.

CAUTION: A CAUTION emphasizes a procedure that may damage equipment or cause loss of data if not followed correctly.

UNE MISE EN GARDE met l'accent sur une procédure susceptible d'endommager l'équipement ou de causer la perte des données si elle n'est pas correctement suivie.

A WARNING indicates a procedure that may be hazardous to the operator or to the environment if not followed correctly.

Un AVERTISSEMENT indique une procédure qui peut être dangereuse pour l'opérateur ou l'environnement si elle n'est pas correctement suivie.

Regulatory Compliance

Safety Standards

For Canada

CAN/CSA-C22.2 No. 61010-1, third edition including Amendment 1 or a later version of the same standard incorporating the same level of testing requirements.

For European Economic Area

EN 61326-1:2006 Electrical equipment for measurement, control, and laboratory use. In accordance with Council Directive 2004/108/EEC Electromagnetic Compatibility Directive.

EN 61010-1:2012 Safety requirements for electrical equipment for measurement, control, and laboratory use. In accordance with Council Directive 2006/95/EC Low Voltage Directive.

For United States

UL61010-1:2012 Electrical Equipment for Laboratory Use; Part 1: General Requirements.

UL61010A-2-010:2002 Particular requirements for laboratory equipment for the heating of materials + Amendments.

Electromagnetic Compatibility Standards

For Australia and New Zealand

AS/NZS CISPR11:2004 Limits and methods of measurement of electronic disturbance characteristics of industrial, scientific and medical (ISM) radio frequency equipment.

For Canada

ICES-001 Issue 4 June 2006 Interference-Causing Equipment Standard: Industrial, Scientific, and Medical Radio Frequency Generators.

For the European Economic Area

(In accordance with Council Directive 2004/108/EC of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility.)

EN61326-1:2006 Electrical equipment for measurement, control, and laboratory use-EMC requirements-Part 1: General Requirements. Emissions: Meets Class A requirements per CISPR 11. Immunity: Per Table 2.

For the United States

CFR Title 47 Telecommunication Chapter I Federal Communications Commission, Part 15 Radio frequency devices (FCC regulation pertaining to radio frequency emissions).

Safety

Do not attempt to service this instrument, as it contains no user-serviceable components.

Instrument Symbols

The following label is displayed on the instrument for your protection:

Symbol	Explanation
	This symbol on the instrument indicates that you should read this Getting Started Guide in its entirety. This guide contains important warnings and cautions related to the installation, operation, and safety of the instrument. Ce symbole indique que vous devez lire entièrement ce guide de démarrage. Ce guide contient d'importants avertissements et mises en garde relatifs à l'installation, à l'utilisation et à la sécurité de l'instrument/l'accessoire.
	This symbol indicates that a hot surface may be present. Take care not to touch this area or allow any material that may melt or burn to come in contact with this hot surface. Ce symbole indique la présence possible d'une surface chaude. Prenez soin de ne pas toucher cette zone ou de laisser un matériau susceptible de fondre ou de brûler entrer en contact avec cette surface chaude.
	This symbol indicates that the object is heavy and should be lifted and/or carried by at least two people to avoid injury. Ce symbole indique que l'objet est lourd et doit être soulevé et/ou porté par au moins deux personnes pour éviter des blessures.
	This symbol indicates that you are advised to consult this manual for instructions. Ce symbole indique que nous vous recommandons de consulter ce manuel pour les instructions.

Please heed the warning labels and take the necessary precautions when dealing with these parts of the accessory. This *Getting Started Guide* contains cautions and warnings that must be followed for your own safety.

Warnings

WARNING: Do not obstruct any of the outer ventilation openings. Allow a minimum clearance of 50 mm surrounding the accessory.

AVERTISSEMENT: N'obstruez aucune ouverture d'aération externe. Laissez un dégagement de 50 mm minimum autour de l'accessoire.

WARNING: Do not exceed the maximum operating ambient temperature.

AVERTISSEMENT: Ne dépassez pas la température ambiante de service maximale.

Electrical Safety

Always unplug the instrument before performing any maintenance.

DANGER: Because of the high voltages in this accessory, maintenance and repair of internal parts must be performed by TA Instruments or other qualified service personnel only.

DANGER: À cause de la présence de tensions élevées dans cet accessoire, la maintenance et la réparation des pièces internes doivent être effectuées uniquement par TA Instruments ou tout autre personnel d'entretien qualifié.

WARNING: The control unit and signal ports are designed for connection to TA Instruments accessories via TA Instruments supplied cables. Consult TA Instruments before any non-TA supplied cables or accessories are connected to these ports.

AVERTISSEMENT: L'unité de commande et les ports de signal sont conçus pour être raccordés aux accessoires des instruments TA via les câbles fournis par TA Instruments. Consultez TA Instruments avant de raccorder des câbles ou accessoires non fournis par TA à ces ports.

WARNING: This instrument must be connected to an earthed (grounded) power supply. If this instrument is used with an extension lead, the earth (ground) continuity must be maintained.

AVERTISSEMENT: Cet instrument doit être connecté à une alimentation électrique mise à la terre. Si cet instrument est utilisé avec un fil de rallonge, la continuité de la mise à la terre doit être maintenue.

Usage Instructions

Before connecting the accessory to the instrument, you must ensure that you have read the relevant installation information. Safety of the accessory and instrument may be impaired if the accessory:

- Shows visible damage
- Fails to perform the intended measurements
- Has been badly stored
- Has been flooded with water
- Has been subjected to severe transport stresses.

Maintenance and Repair

CAUTION: Adjustment, replacement of parts, maintenance and repair should be carried out by trained and skilled TA personnel only. The accessory should be disconnected from the mains before removal of the cover.

MISE EN GARDE: Le réglage, le remplacement des pièces, la maintenance et la réparation doivent être effectués par uniquement par le personnel formé et compétent de TA. L'accessoire doit être déconnecté du secteur avant le retrait du couvercle.

WARNING: The cover should only be removed by authorized personnel. Once the cover has been removed, live parts are accessible. Both live and neutral supplies are fused and therefore a failure of a single fuse could still leave some parts live. The instrument contains capacitors that may remain charged even after being disconnected from the supply.

AVERTISSEMENT: Seul le personnel autorisé doit retirer le couvercle. Une fois le couvercle déposé, les pièces sous tension sont accessibles. Les alimentations sous tension et neutres comportent des fusibles et par conséquent la défaillance d'un seul fusible n'empêche pas d'autres pièces d'être encore sous tension. L'instrument contient des condensateurs qui peuvent rester chargés même après leur déconnexion de l'alimentation.

WARNING: Use two people to lift and/or carry the instrument. The instrument is too heavy for one person to handle safely.

AVERTISSEMENT: Demandez à deux personnes de soulever et/ou de porter l'instrument. L'instrument est trop lourd pour qu'une seule personne le manipule en toute sécurité.

WARNING: Always unplug the accessory before performing any maintenance.

AVERTISSEMENT: Débranchez l'accessoire avant de commencer des travaux d'entretien ou de maintenance.

WARNING: Maintenance and repair must be performed by TA Instruments or other qualified service personnel only. It is recommended that this accessory be serviced by trained and skilled TA Instruments personnel at least once a year.

AVERTISSEMENT: La maintenance et la réparation doivent être effectuées uniquement par TA Instruments ou tout autre personnel d'entretien qualifié. Il est recommandé que l'entretien de cet accessoire soit assuré par le personnel formé et qualifié de TA Instruments au moins une fois par an.

Table of Contents

Chapter 1:

Introducing the Discovery MS

Overview

The Discovery Mass Spectrometer (MS) is a benchtop quadrupole mass spectrometer, designed and optimized for evolved gas analysis. It is compatible with all thermogravimetric instruments in the TA Instruments product line, including the Discovery TGA, Q Series TGAs, and the TGA-HP products.

The Discovery MS is configured for the efficient transfer and rapid detection of offgas from the TGA furnace. The quadrupole detection system, which includes a closed ion source, a triple mass filter, and a dual (Faraday and Secondary Electron Multiplier) detector system, ensures parts per billion (ppb) sensitivity.

Control of the experimental parameters and analysis of the mass spectral data is achieved through a recipe-driven software interface. Data collection can be triggered directly from the TGA software, and the resulting MS data can be combined with the corresponding TGA results for direct overlaying and comparison.

Figure 1 Discovery MS with Discovery TGA and Discovery Common Cabinet.

MS System Components

A functional Discovery MS system includes the Discovery Mass Spectrometer and external backing pump. For use with other TA Instruments products, an Interface Kit is also needed.

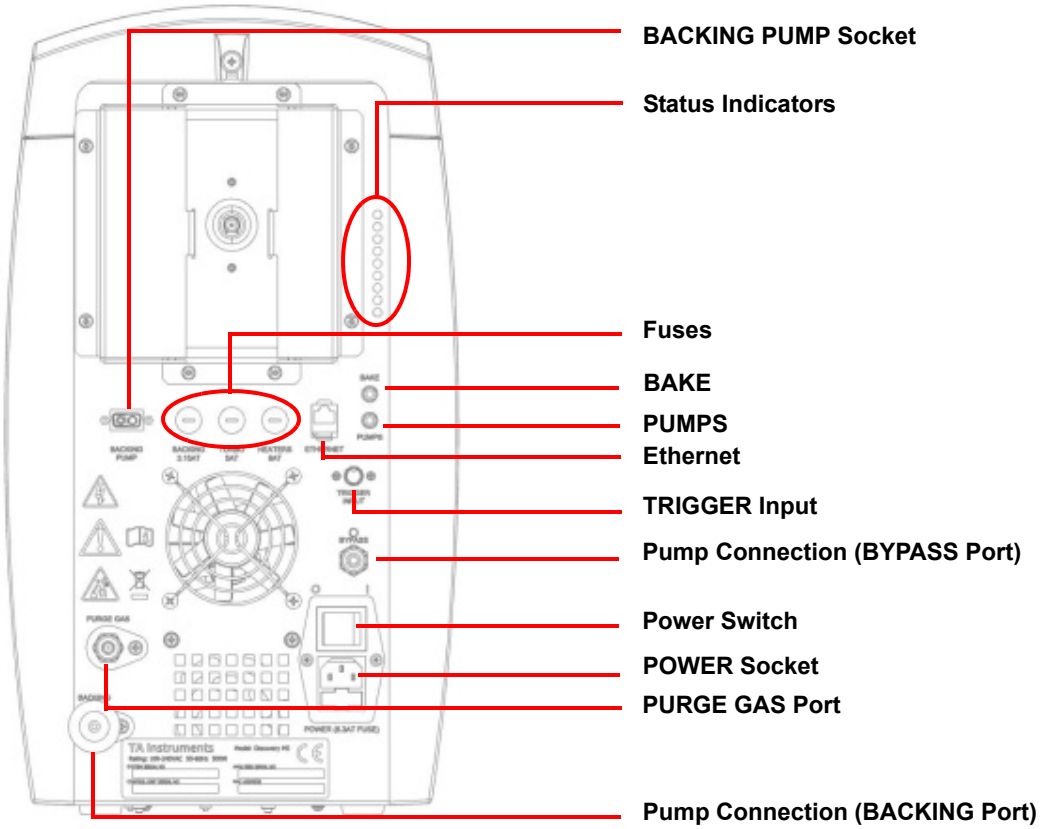


Figure 2 Discovery Mass Spectrometer rear panel connections.

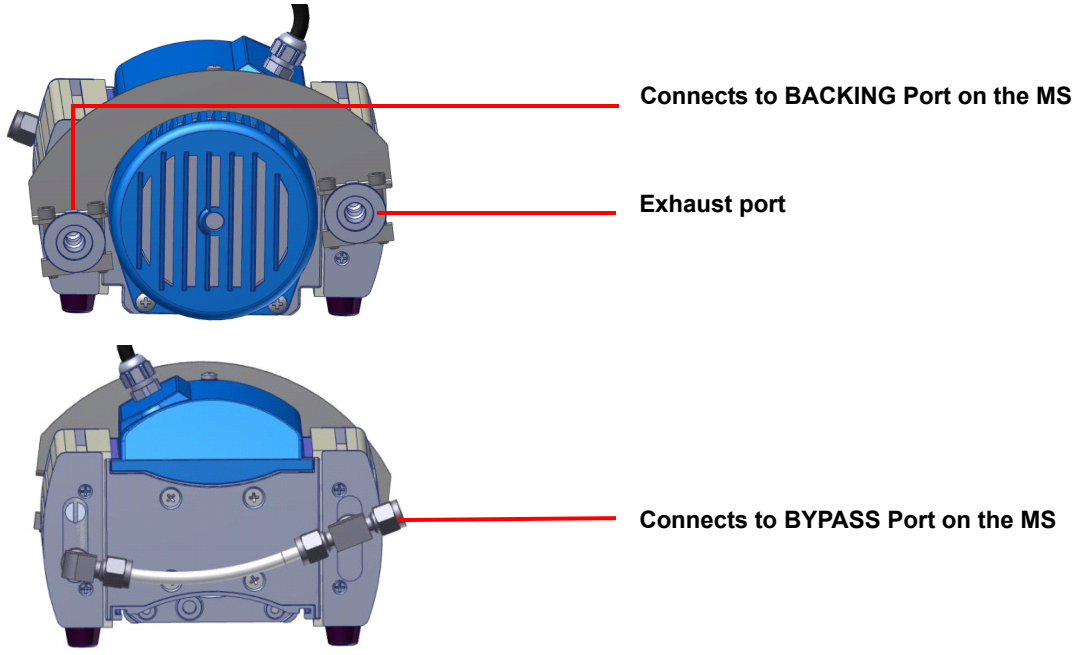


Figure 3 External Backing Pump.

Instrument Specifications

Table 1: MS Technical Specifications

Item/Area	Specification
Instrument compatibility	Discovery TGA, Q Series TGA, TGA-HP
Size (not including capillary) Height Width Depth	 41 cm (16 in) 26 cm (10 in) 61.5 cm (24 in)
Weight	28 kg (62 lbs)
Power Requirements Power ratings Voltage Frequency Wattage User Replaceable Fuses Backing pump Turbo pump Heaters Mains inlet	 100–240 VAC 50–60 Hz 500 W 250 VAC 5x20 mm Ceramic Time Delay 3.15 AT 5.0 AT 8.0 AT 6.3 AT
Mass range (amu)	1–300
Mass Resolution	> 0.5 amu
Sensitivity	< 100 ppb (gas-dependent)
Ionization Source	Electron Ionization
Detector System	Dual (Faraday and Secondary Electron Multiplier)
Sample Pressure	1 atm (nominal)
Data Collection Modes	Bar graph and Peak Jump
Scanning Speed Bar graph Mode Peak Jump Mode	 > 50 amu/sec > 64 channels/sec
Transfer Line Temperature	300°C (fixed)
Filaments	Dual, customer changeable
Capillary	Stainless Steel, changeable
Capillary size	I.D.= 0.22 mm
Inputs	Data collection controlled by TGA Trigger

Chapter 2:

Installing the Discovery MS

Unpacking/Repacking the MS

Normally the installation of your new accessory will be carried out by a member of the TA Instruments sales or service staff, or their appointed agents, and it will be ready for you to use. However, should you need to install or relocate the accessory, this chapter provides the necessary instructions.

Installing the Discovery MS

Before shipment, the MS is inspected both electrically and mechanically so that it is ready for operation upon proper installation. Installation involves the following procedures:

1 Inspecting the accessory for shipping damage and missing parts

2 Choosing a location for accessory installation

3 Installing the Discovery MS

4 Connecting the Discovery MS to the Instrument

5 Setting up System Communication between the Discovery MS and computer (controller)

It is recommended that you have your Discovery MS installed by a TA Instruments Service Representative; call for an installation appointment when you receive your accessory.

CAUTION: To avoid mistakes, read this entire chapter before you begin installation.

Inspecting the System

When you receive your Discovery MS, look over the accessory and shipping container carefully for signs of shipping damage, and check the parts received against the enclosed shipping list.

- If the accessory is damaged, notify the carrier and TA Instruments immediately.
- If the accessory is intact but parts are missing, contact TA Instruments.

Choosing a Location

Because of the sensitivity of experiments using the MS, it is important to choose a location using the following guidelines.

In

- An indoor area only (A clean environment).
- Altitude up to 2000 m.
- A temperature-controlled area (5°C to 40°C).
- An area where the maximum relative humidity is 80% for temperatures up to 31°C, decreasing linearly to 50% relative humidity at 40°C.
- An area with ample working and ventilation space around the instrument, approximately 2 meters in length, with sufficient depth for a computer and its keyboard.

On

- A stable, vibration-free work surface.

Near

- A power outlet. (Mains supply voltage fluctuations not to exceed ±10% of the nominal voltage, installation category II.)
- Your computer for direct connection of a Serial or network port.

Away from

- Dusty environment (pollution degree 2).
- Exposure to direct sunlight.
- Poorly ventilated areas.

Discovery Mass Spectrometer Back Panel

Refer to Figure 2 for an illustration of rear connections.

Table 2: Discovery MS Back Panel Ports and Functions

Port	Function
Status Indicators	**Capillary Interlock**: The capillary heater is on **Bypass Pumping OK**: Bypass pressure has reached acceptable level for the filament to be turned on **RGA OK**: On when the RGA is operating correctly with a filament on **Chamber Cooling**: On when in cool down after baking **Chamber Baking**: On when chamber heater is active **Pumps at Speed**: Pumps have reached sufficient speed **Pumps On**: On when pumping system is active **System Alarm**: Alarm condition **Power On**: Power indicator
BAKE	Momentary push-button switch which cycles the full heaters
PUMPS	Momentary push-button switch which cycles the pumping system power
BACKING PUMP Socket	Pump electrical and control connection
BACKING Fuse	Switched 24VDC supply to external backing pump
TURBO Fuse	Turbo purge gas connection (optional use for corrosive applications)
HEATERS Fuse	Fuse for the capillary heaters.
ETHERNET	Standard 10/100 mbs network interface
TRIGGER INPUT	8-way mini DIN connector
BYPASS Port	Connection to external backing pump
PURGE GAS Port	Connection to purge gas
Power Switch	Powers the MS ON and OFF
POWER Socket	Provides power to the MS
BACKING Port	Connection to external backing pump

Connecting the Backing Pump to the Discovery MS

1 Connect the Backing Pump cable to the top of the backing pump and plug the other end into the "BACKING PUMP" socket on the rear of the MS. Refer to Figure 3 for an illustration.

2 Connect one end of the bellows to the KF16 fitting on the rear of the MS marked "BACKING" and the other end to the KF16 fitting on the front right of the backing pump. Ensure the O-rings are used and the fittings are tightened securely. Refer to Figure 2 and Figure 3 for an illustration of connections.

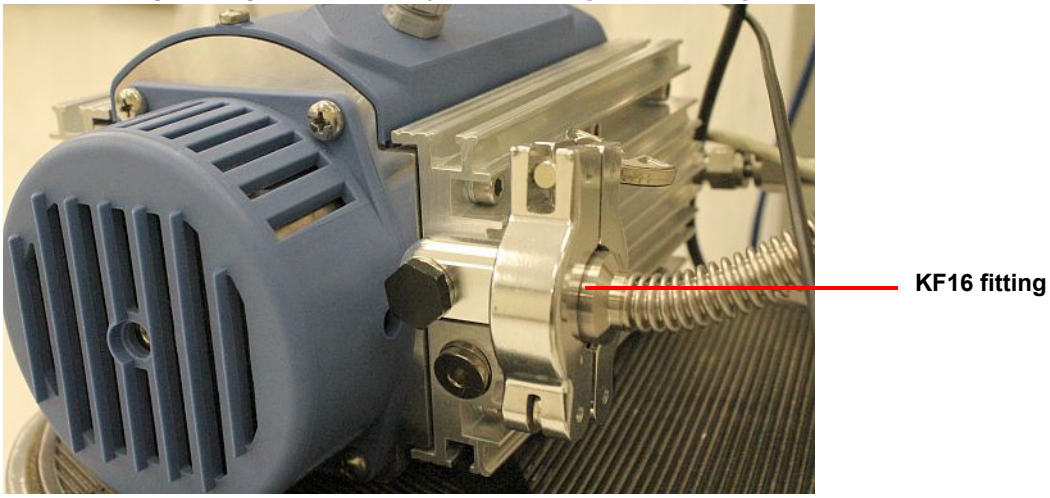


Figure 4 Front right of the backing pump.

3 Connect one end of the flexible tubing to the Swagelok fitting on the rear of the MS marked "BYPASS" and the other end of the tubing to the Swagelok fitting on the back of the backing pump. Refer to Figure 2 and Figure 3 for an illustration of connections.

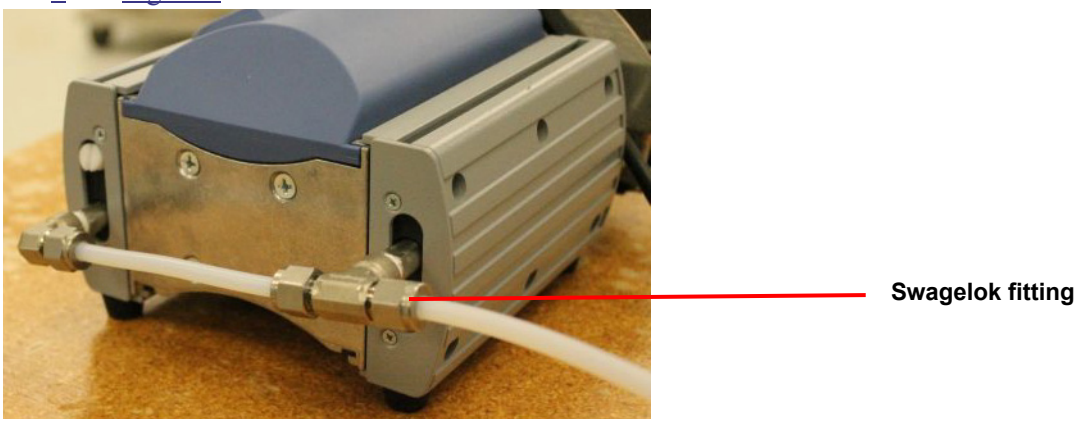


Figure 5 Back of the backing pump.

4 Connect one end of the provided trigger cable to the MS and the other end to the Event socket on the instrument.

5 Connect a standard IEC mains cable to the mains socket; read the next section before applying power or making a connection to the Ethernet port.

WARNING: Do not replace mains cord with an inadequately rated cord. Refer to "Instrument Specifications" for acceptable rating.

AVERTISSEMENT: Ne remplacez pas le câble d'alimentation par le réseau par un câble à la capacité nominale inadéquate. Consultez la section "Instrument Specifications" pour connaître la capacité nominale acceptable.

Connecting the Discovery MS to the Instrument

Refer to the appropriate appendix for instructions on connecting the Discovery MS to your instrument:

- For a TGA/Q5000IR instrument, refer to Appendix A.
- For a Q50/Q500 instrument, refer to Appendix B.
- For a Q600/SDT instrument, refer to Appendix C.

NOTE: When setting up the MS, make sure to position the accessory so that the power switch is easily accessible.

Setting Up System Communication

Start the Process Eye software. If you see a message at the bottom of the screen that states "No Instruments Currently Connected," then follow the procedure outlined below.

1 Click on **Instruments** and select **Run Device Manager**. A Run Device Manager dialog box displays, which shows all devices found on the network.

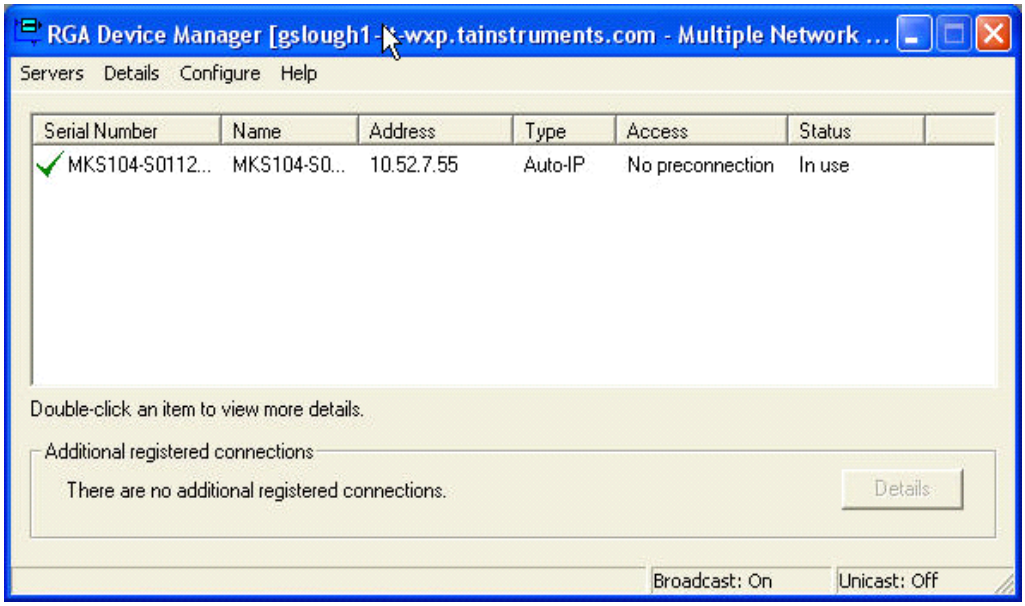


Figure 6 RGA Device Manager.

2 Click on **Configure** and then select **Access** to set the access to the instrument. Close this window after configuring the access.

NOTE: It is recommended that the access be set so that the computer connects to the MS on startup.

3 Click **Instruments** and then select **Connections**. The following window displays:

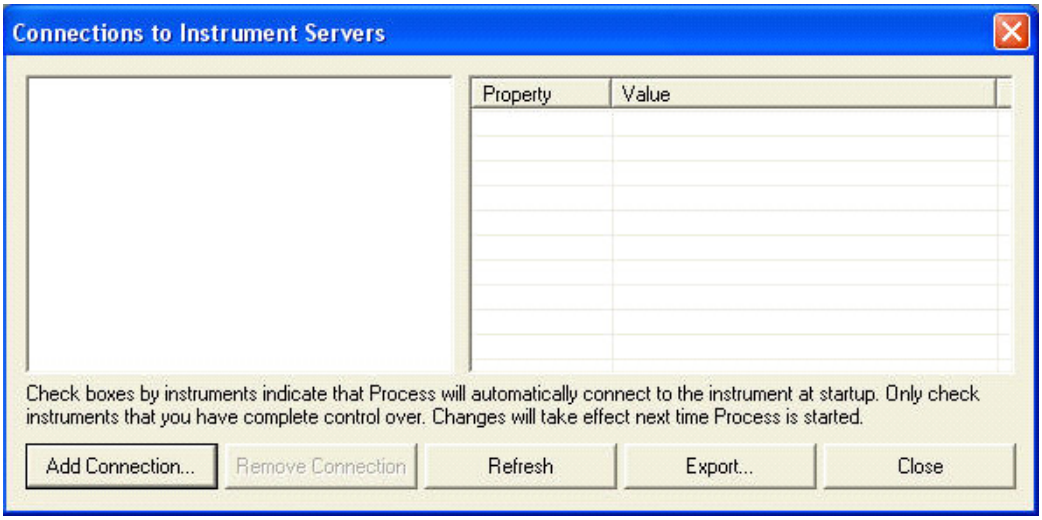


Figure 7 Connections to Instrument Servers.

4 Click **Add Connection...** An Add Connection dialog box displays. Select the box for the instrument found earlier by the Device Manager, and then click **OK**.

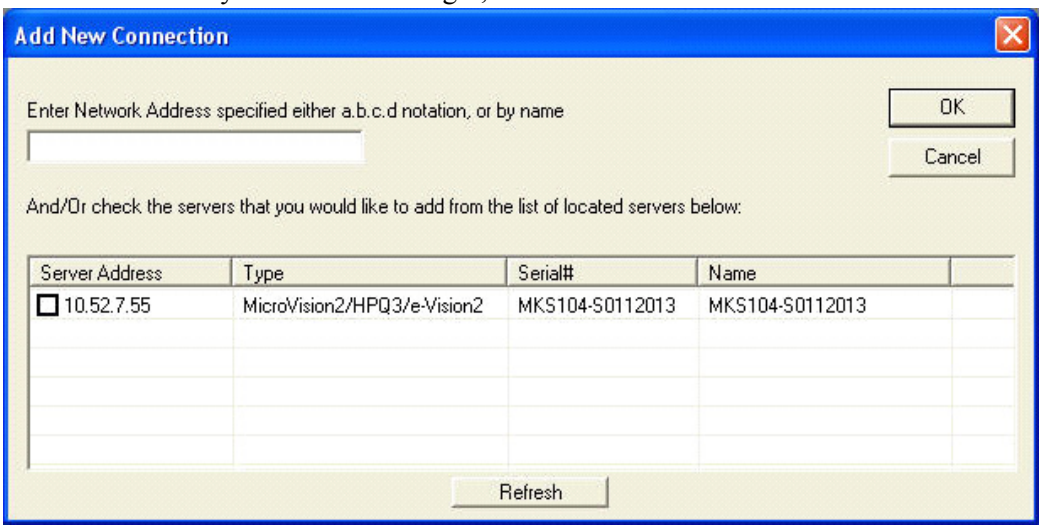


Figure 8 Add New Connection.

5 The Connections to Instrument Servers window now displays the connection information. Select the box next to the instrument and then click **Close**. Close Process Eye and reopen. A connection to the instrument should now exist.

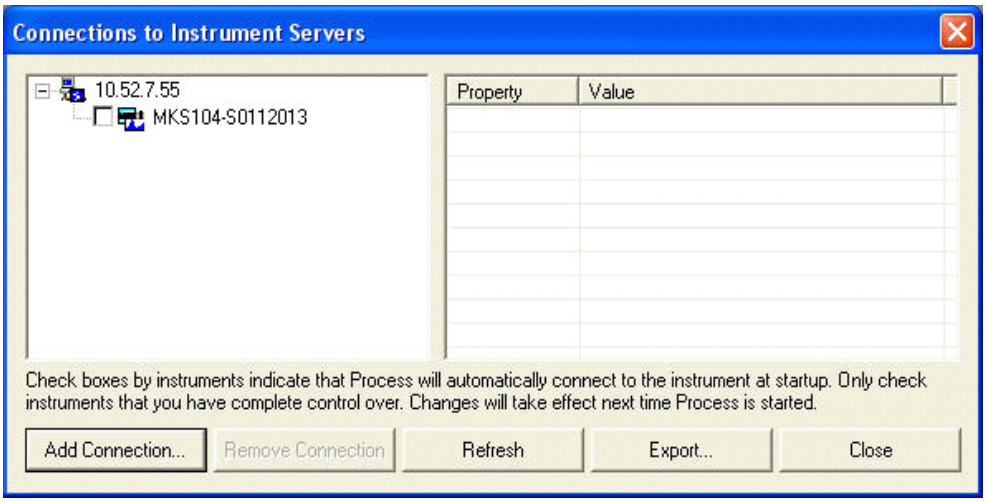


Figure 9 Connections to Instrument Servers.

Check Instrument Status

You can check the status of the instrument by using the RGA Device Manager application on the supplied MKS Utilities CD.

1 Double-click the RGA Device Manager icon to start the application.

2 After a few moments, the following dialog displays a list of all discovered MKS RGAs. Ensure you choose the correct instrument from the list.

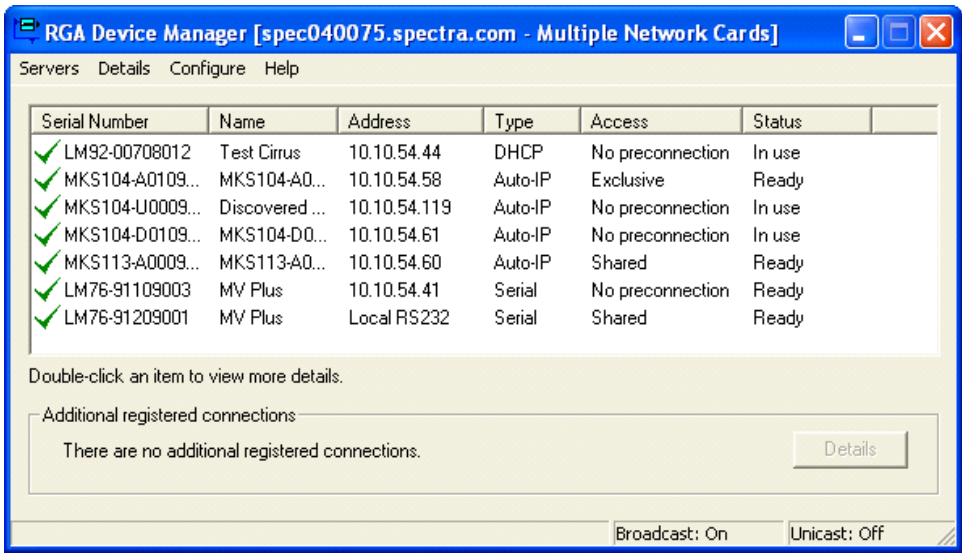


Figure 10 RGA Device Manager showing available RGAs.

3 The status, current IP address, and type of IP addressing can be checked in this dialog. Once “Ready” displays in the Status field, you can close RGA Device Manager and begin using the RGA. If the unit needs to be connected, it may have a red X beside it. Check instrument connections.

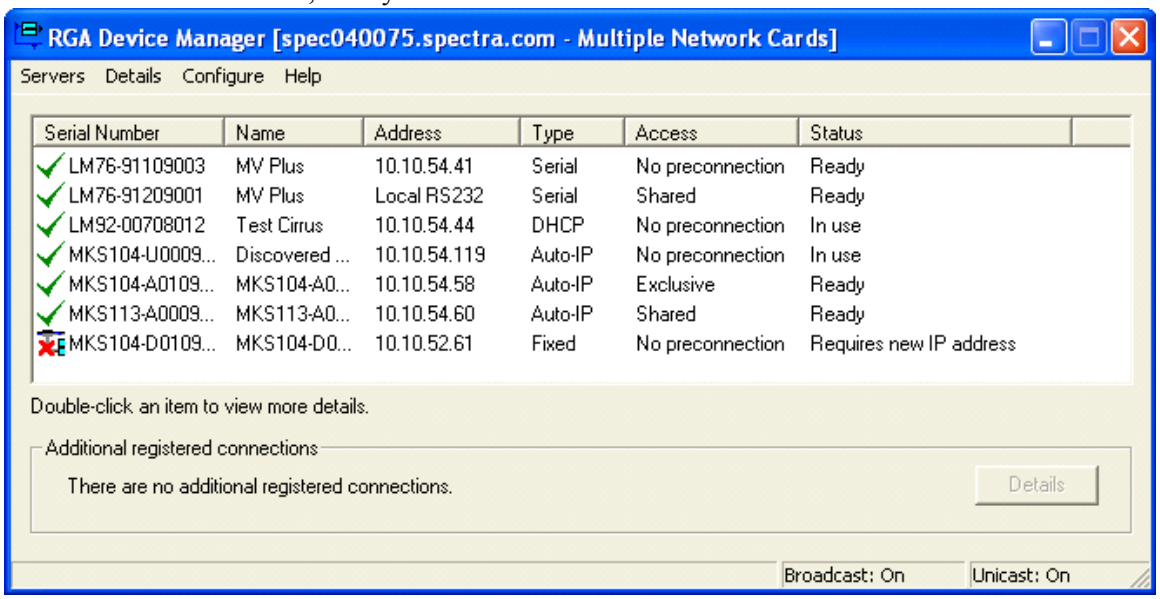


Figure 11 Instrument needs connection.

Starting the Discovery MS

The power switch is located on the back panel of the Discovery MS and is used to power the MS on and off.

To power on the system:

1 Check all connections between the Mass Spectrometer and the instrument. Make sure each component is plugged into the correct connection port. Refer to Figure 2 for an illustration of connections.

2 Set the MS power switch to the ON (right) position. The power switch will light.

To turn on the backing pump:

3 Press the **Pumps** switch located on the rear of the unit (refer to Figure 2) to start the backing pump and turbo pump. The **Pumps** indicator will light (refer to Figure 12 below). The pump can also be started via the software.

4 Once the turbo has reached maximum speed, the **Turbo Ready** indicator on the back of the MS will light. When the vacuum system is ready, the two **VAC OK** indicators on the back of the MS will light, indicating the unit is ready for use.

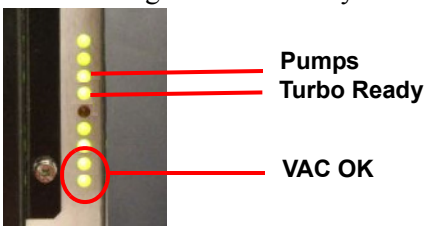


Figure 12 Status indicators.

Shutting Down the Discovery MS

Before powering down the instrument, the filaments must be allowed to cool for at least 10 minutes as the system will vent shortly after power down, exposing hot filaments to atmosphere.

To turn off the backing pump:

1 Once adequate time has been given for the filaments to cool, press the **Pumps** switch on the rear of the unit (refer to Figure 2) to stop the internal and external pumps (this can also be done via the software).

2 After 30 seconds or so, the system will vent. Do not move the unit until the venting process has finished and the turbo pump is at a complete stop or catastrophic failure of the pump may occur.

To power down the system:

3 Set the MS power switch to the OFF (left) position.

Chapter 3:

Operating and Maintaining the MS

Using the Discovery MS

Starting a Discovery MS Experiment

After connecting the instrument and installing the Process Eye Professional software, start the Process Eye program. The following screen displays, which shows the TA Recipe Controls and the TA System Controls in the panel to the left of the screen.

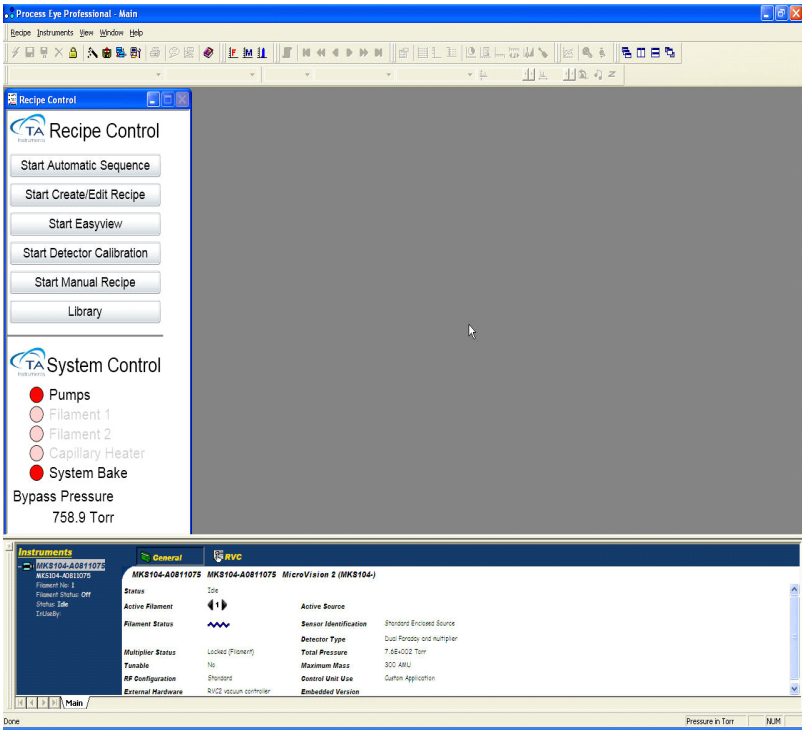


Figure 13 Process Eye Professional main screen.

TA System Control Panel - Instrument Control

Use the TA Systems Control panel to control various instrument functions on the mass spectrometer.

- **Pumps** - The pumps button turns both the mechanical and the turbomolecular pump off and on. System bypass pressure is indicated below the switches on the control panel.
- **Filament Switches** - The filament switches allow you to turn either filament on and off, and to switch between them. These buttons only become active once the system is pumped down.
- **Capillary Heater** - The capillary heater switch turns the capillary heater on and off. This button only becomes active once a filament is on.

- **System Bake** - The system bake turns on the internal heaters to bake out the system, if necessary.

TA Recipe Control Panel - Starting and Stopping an Experiment

Use the TA Recipe Control window to set up and control mass spectrometer experiments.

Start Automatic Sequence (Triggered Runs)

Clicking **Start Automatic Sequence** allows you to execute Peak Jump or Barchart recipes created using the Create/Edit Recipes option (detailed below). All recipes run through this area are triggered runs; a trigger signal from the instrument is required to begin data collection.

1 Click **Start Automatic Sequence**. The below window displays.

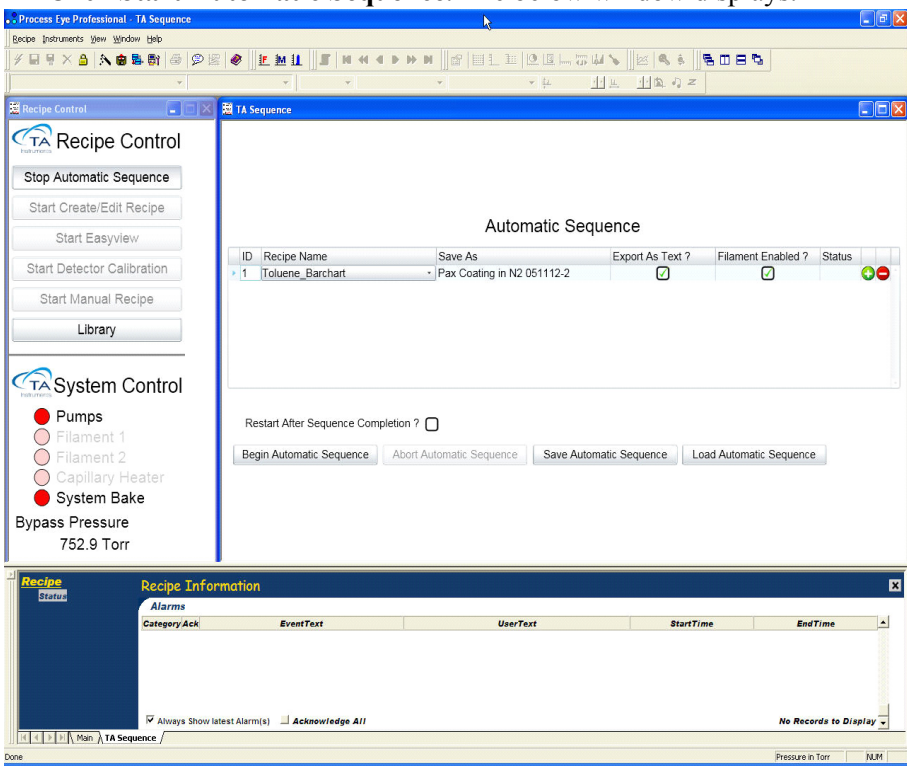


Figure 14 Automatic Sequence window.

2 Select an available recipe from the Recipe Name drop-down list.

3 Type a name for the file in the Save As text field. Data files are saved in the directory Process Eye\Data in a folder of the same name as the loaded recipe. If a folder with this name does not exist, the Process Eye software will create it.

4 If you would like the file to be compatible with TRIOS or Universal Analysis, check the **Export As Text** option. The file will be exported in an ASCII text format at the end of the run. Refer to the section "Analyzing Data with Universal Analysis or TRIOS" for instructions on importing data.

5 To add additional runs to the sequence, click on the green plus symbol. Click the red minus symbol to remove the row. Each run line should be associated with a run within a TGA sequence. As the TGA sequence of runs is executed, the MS runs are also executed in turn.

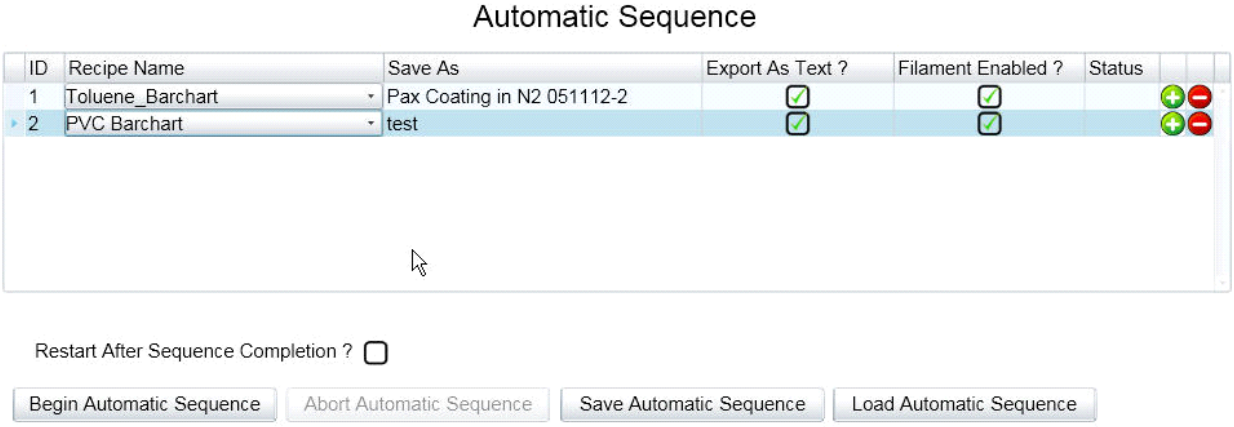


Figure 15 Additional recipe added.

6 Once you've finished creating the sequence, click **Begin Automatic Sequence**. The MS will initialize and begin waiting for a trigger signal from the instrument. The Recipe Information pane at the bottom of the screen displays information about the status of the MS, as shown in the figure below.

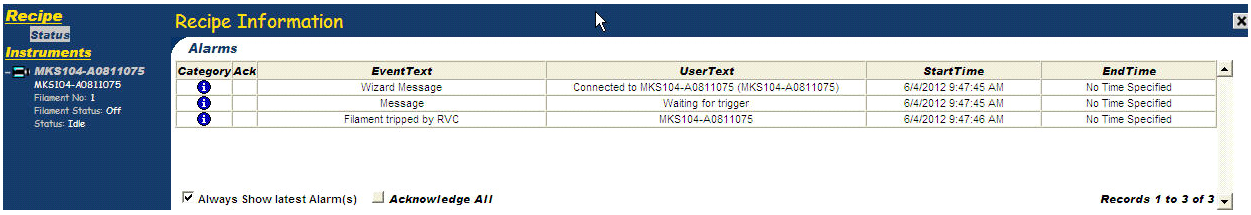


Figure 16 Recipe Information pane.

Once a sequence has started it can be aborted by clicking **Abort Automatic Sequence**. Sequences can be saved by clicking **Save Automatic Sequence** or loaded by clicking **Load Automatic Sequence**.

Start Create/Edit Recipes

Clicking **Start Create/Edit Recipes** allows you to create a new mass spectrometer recipe or edit an old recipe. These recipes can be executed using an Automatic sequence.

1 Click **Start Create/Edit Recipes**. The below screen displays.

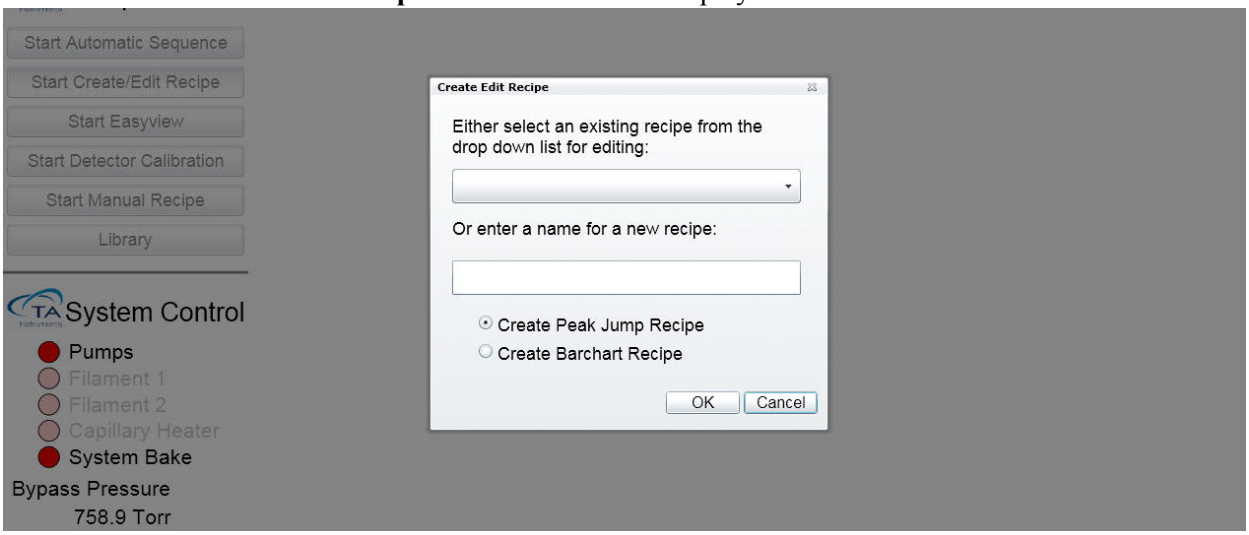


Figure 17 Create Edit Recipe.

2 Select an existing recipe from the drop-down list or type a new recipe name in the text field. Then select to create either a Peak Jump or Barchart Recipe and click **OK**.

Peak Jump Recipe

A Peak Jump recipe scans only a set of pre-selected mass peaks that you have chosen. If a Peak Jump recipe is chosen, the following screen displays.

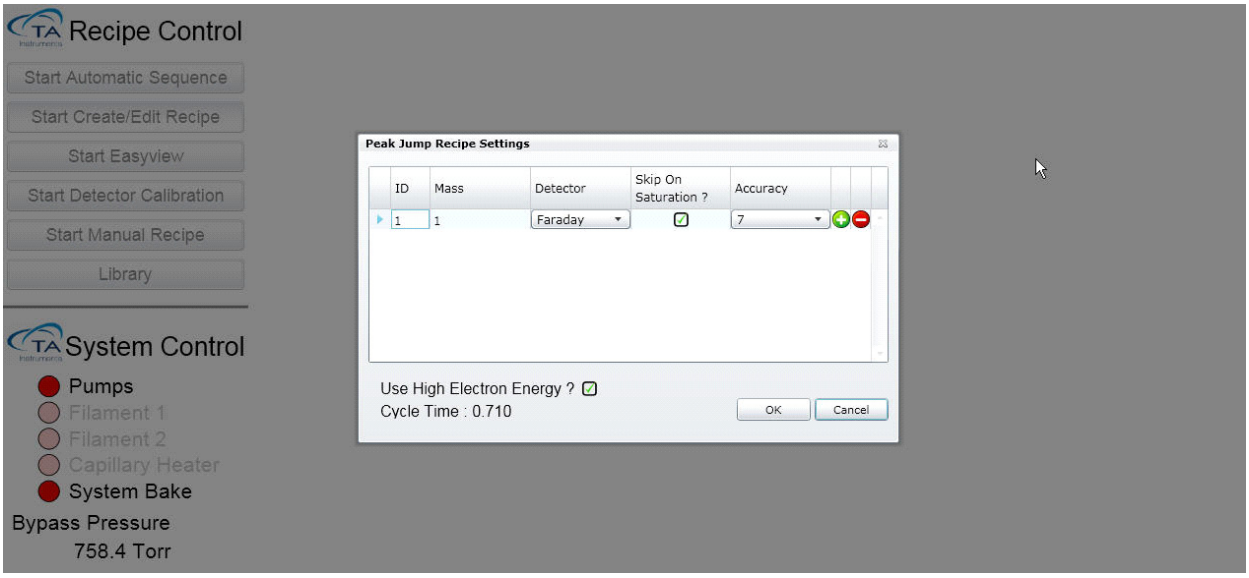


Figure 18 Peak Jump Recipe.

The Peak Jump recipe is created for each mass of interest:

1 Type the first mass of interest into the Mass field.

2 Select the desired detector (Faraday, Mult1, Mult2, or Mult3) from the **Detector** drop-down menu.

NOTE: The values for Mult1, Mult2, and Mult3 are set during Detector calibration.

3 Select the **Skip on Saturation?** check box to skip a mass if the signal becomes saturated (recommended).

4 Select the desired accuracy from the **Accuracy** drop-down list. This field controls the dwell time of the detector. The higher the accuracy, the longer the dwell time and the longer the time to complete a scan.

5 Click the green plus symbol to create a new line for another mass. Click the red minus symbol to erase the current line.

6 To use High Electron Energy (70 eV) for an experiment, select the **Use High Electron Energy?** check box. If this box is left unchecked, then the default electron energy of 40 eV is used.

NOTE: The time required to cycle through the masses one time displays under the **Use High Electron Energy?** check box.

7 Click **OK**.

Barchart Recipe

A Barchart recipe scans all the masses between a selected start and a selected end mass. If a Barchart recipe is chosen, the following screen displays.

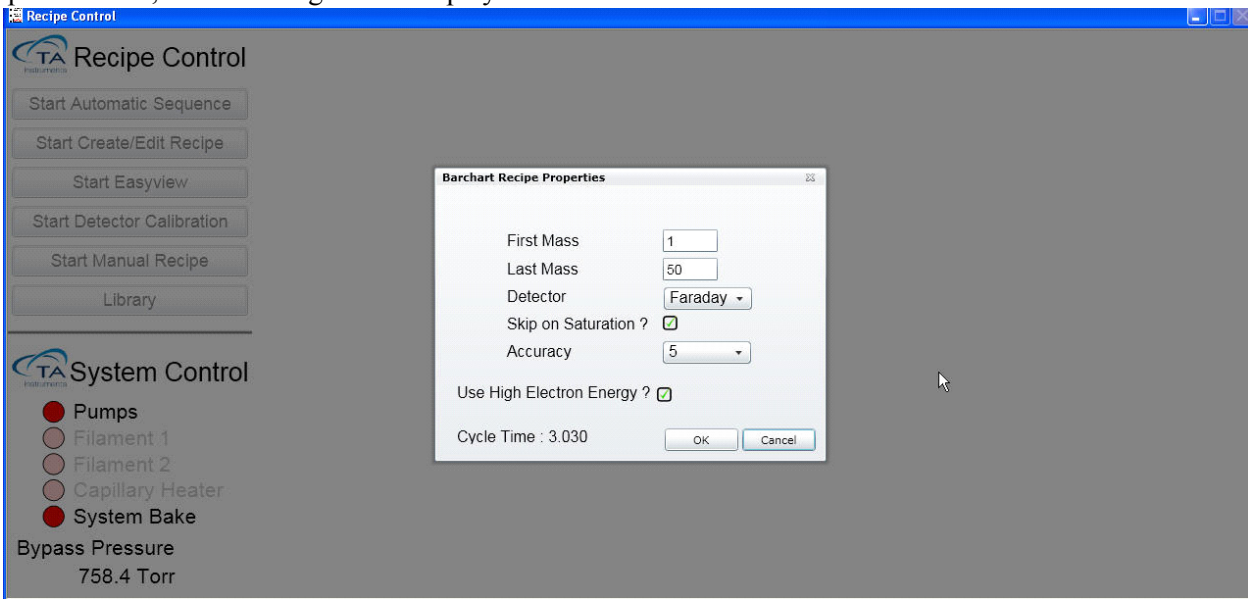


Figure 19 Barchart Recipe.

1 Type the first mass of the experiment into the First Mass field.

2 Type the last mass of the experiment into the Last Mass field.

3 Select the desired detector (Faraday, Mult1, Mult2, or Mult3 from the **Detector** drop-down menu.

NOTE: The values for Mult1, Mult2, and Mult3 are set during Detector calibration.

4 Select the **Skip on Saturation?** check box to skip a mass if the signal becomes saturated (recommended).

5 Select the desired accuracy from the **Accuracy** drop-down list. This field controls the dwell time of the detector. The higher the accuracy, the longer the dwell time and the longer the time to complete a scan.

6 To use High Electron Energy (70 eV) for an experiment, select the **Use High Electron Energy?** check box. If this box is left unchecked, then the default electron energy of 40 eV is used.

NOTE: The time required to cycle through the masses one time displays under the **Use High Electron Energy?** check box.

7 Click **OK**.

Start EasyView (Untriggered Runs)

Click **Start EasyView** to start and stop manual (untriggered) methods. EasyView allows you to not only perform Peak Jump and Barchart scans, but also Analog scans. In addition, experienced users can use the system as a leak detector. It is important to note that scans collected using EasyView cannot be imported into Universal Analysis; only those scans collected through the Automatic Sequence have this ability.

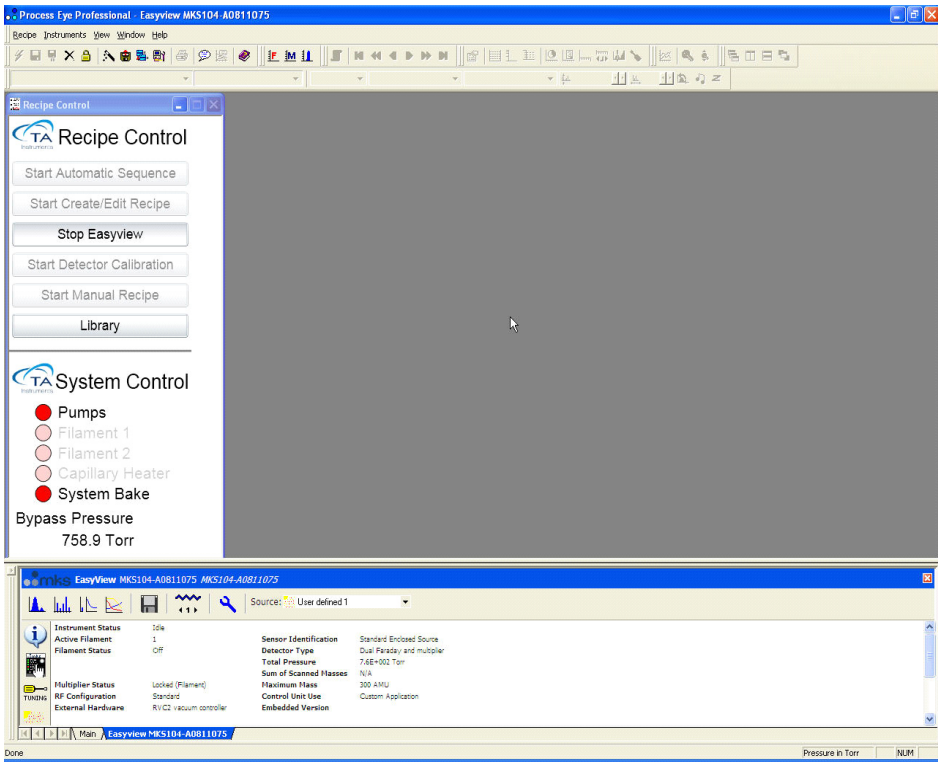


Figure 20 Start and Stop EasyView.

The control panel at the bottom of the screen allows you to manually run (no trigger signal from the TGA required) various types of recipes. Click **Stop EasyView** to exit this mode.

EasyView Toolbars

There are two EasyView toolbars; the **Mode** Toolbar is the horizontal toolbar across the top of the EasyView status page.

Figure 21 Mode Toolbar.

Analog Mode button starts (or stops if already running) the Analog mode.

 **Barchart Mode** button starts (or stops if already running) the Barchart mode.

 **Leak check Mode** button starts (or stops if already running) the leak check mode.

 **Peak Jump Mode** button starts (or stops if already running) the peak jump mode.

 **Disk Store** starts (or stops if already storing to disk) storing data to disk

 **Filament Select** chooses the current active filament. Clicking on one or other of the arrows toggles the active filament between filament 1 and filament 2

 **Filament Status** shows the current status of the filament. Blue represents a filament that is off.

 Red represents a filament that is on. Clicking the icon will toggle the filament between off and on.

 **Diagnostics** runs the diagnostic program on display the diagnostic report on the screen.

The **Page Selection** toolbar is the vertical toolbar along the side of the status page; it has the following buttons:

 **Information** returns the status window display to the general information page.

Tuning opens the tuning page in the status window. This page has the controls that enable you to adjust the tuning of the RGA (peak alignment and resolution).

 **Calibration** opens the calibration settings page in the status window. You can calibrate your RGA based on the settings you select on this page.

 **Peak Jump Settings** is only visible when EasyView is in Peak Jump mode. Clicking on this button brings up the Peak Jump settings page in the status window.

The **Cirrus** button is only visible when the control unit is associated with a Cirrus benchtop analytical RGA system. Clicking this button brings up the Cirrus information and control page.

The **Degas** button opens the Degas Settings page. You can degas the ion source of selected MKS RGA's based on the settings you enter on this page.


The **RVC** button opens the RVC settings and status page. You use this page to manage the vacuum hardware when fitted.

The **Source** button displays the ion source configuration page where changes to the source parameters can be made.

Analog Mode

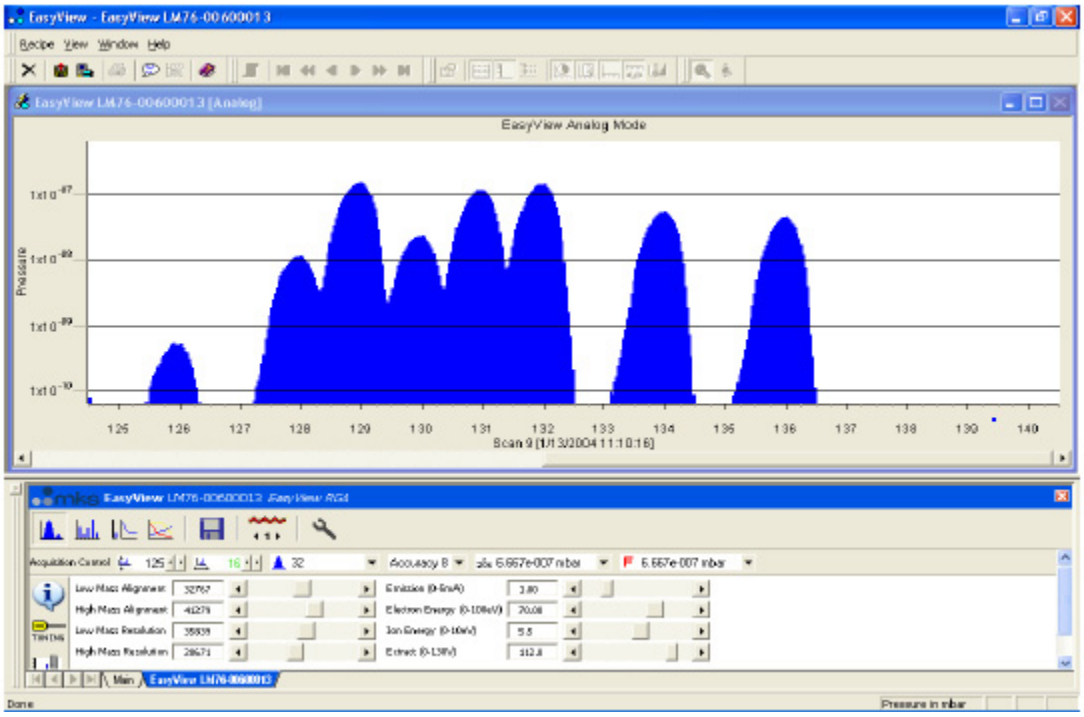


Figure 22 Analog Mode.

The above screen is displayed by clicking the **Analog Mode** button in the **Mode** toolbar and selecting the **Tuning** button in the **Page Selection** toolbar.

The Analog view is displayed and the interactive analog control toolbar will appear in the status window.

Use this toolbar to change the scan parameters; each of the functions are explained below:

Start Mass: To change the start mass of the scan, either enter a number directly into the box, or click on the arrows to increase or decrease the mass number. Note that the first mass cannot be less than 1 and that the first mass plus the mass span, cannot exceed the maximum mass allowed by the control unit.

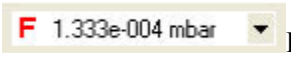
Mass Span: To change the mass span of the scan, either enter a number directly into the box, or click on the arrows to increase or decrease the mass span.

Note that the first mass plus the mass span cannot exceed the maximum mass allowed by the control unit.

Accuracy: Scan accuracy determines the amount of averaging carried out for each reading. A high accuracy number provides a clean scan but increases scan time. The accuracy ranges available are from 0 to 8.

Points per peak: The number of measurements each full mass is divided into 8, 16 or 32. The higher the number of points-per-peak selected, the better the representation of peak shape. However, scan time and the amount of data generated will increase. If the data is to be imported into Excel for instance, choose a lower value.

Electronic Gain: The electronic gain of the pre-amplifier can be changed by selecting one of the values from the drop down list. The lowest electronic gain appears first in the list. The pressure indicates the maximum value that can be measured using that range. The higher the gain selected, the smaller the partial pressure that can be measured, this may cause peaks of a higher partial pressure to saturate.



Detector: The detector type used for the scan can be changed. Depending on the type of instrument, the options are Faraday, Multiplier 1, Multiplier 2 and Multiplier 3. Multiplier 1, 2 and 3 refer to the same physical detector, but using three separate calibration values that provide successively greater amplification of the ion current.

Barchart Mode

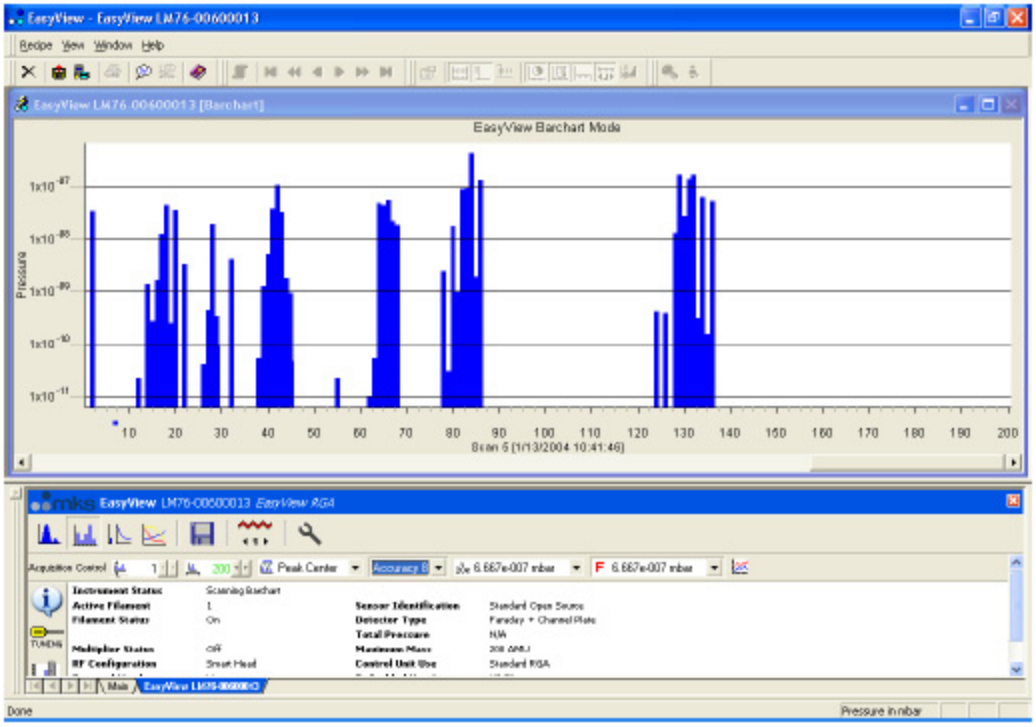


Figure 23 Barchart Mode.

The Barchart view is displayed and the interactive Barchart control toolbar will appear in the status window.

Figure 24 Barchart toolbar

Use this toolbar to change the scan parameters; each of the functions are explained below:

Start Mass: To change the start mass of the scan, either enter a number directly into the box, or click on the arrows to increase or decrease the mass number. Note that the first mass cannot be less than 1 and that the first mass plus the mass span, cannot exceed the maximum mass allowed by the control unit.

Mass Span: To change the mass span of the scan, either enter a number directly into the box, or click on the arrows to increase or decrease the mass span.

Note that the first mass plus the mass span cannot exceed the maximum mass allowed by the control unit.

Scan Mode: The scan mode is the method used to report the peak height. The options are Peak Centre, Peak Max or Peak Average.

Accuracy: Scan accuracy determines the amount of averaging carried out for each reading. A high accuracy number provides a clean scan but increases scan time. The accuracy ranges available are from 0 to 8.

Electronic Gain: The electronic gain of the pre-amplifier can be changed by selecting one of the values from the drop down list. The lowest electronic gain appears first in the list. The pressure indicates the maximum value that can be measured using that range. The higher the gain selected, the smaller the partial pressure that can be measured, this may cause peaks of a higher partial pressure to saturate.

Detector: The detector type used for the scan can be changed. Depending on the type of instrument, the options are Faraday, Multiplier 1, Multiplier 2 and Multiplier 3. Multiplier 1, 2 and 3 refer to the same physical detector, but using three separate calibration values that provide successively greater amplification of the ion current.

Add Trend: Click this button to add or remove a trend view in addition to the Barchart view. This tend can be edited in the same way as any normal trend view.

Leak Check Mode

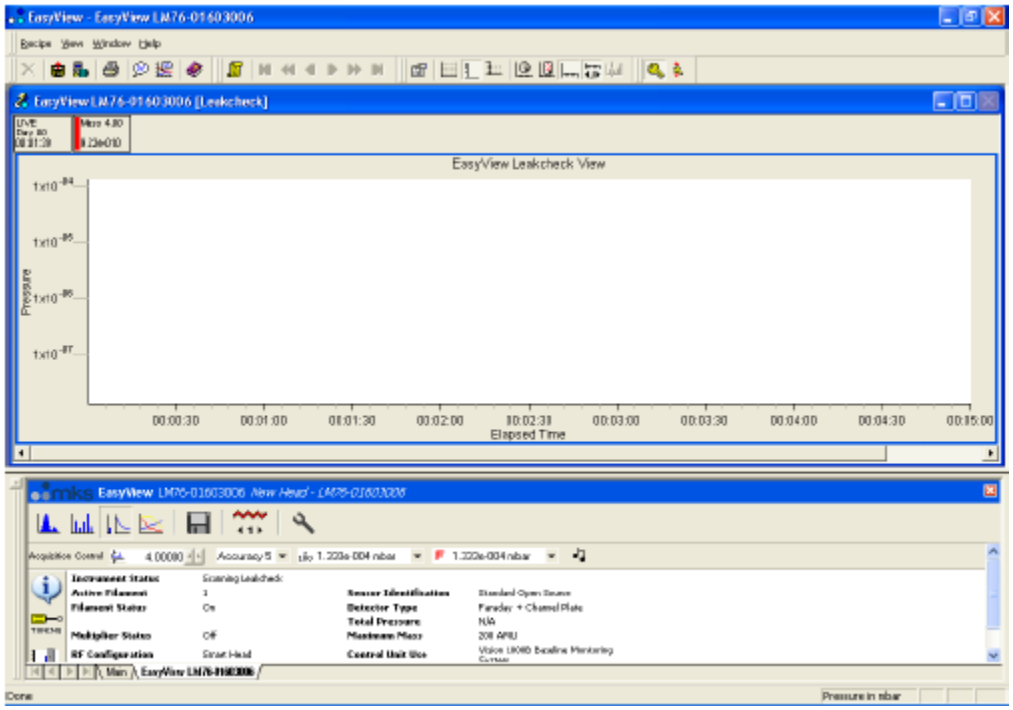


Figure 25 Leak Check Mode.

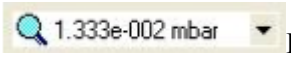
The Leak Check view is loaded and the interactive Leak Check control toolbar appears in the status window.

Figure 26 Leak Check toolbar

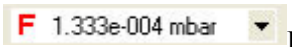
Use this toolbar to change the scan parameters; each of the functions are explained below:

Probe Mass: To change the probe mass of the scan, either enter a number directly into the box, or click on the arrows to increase or decrease the mass number. In contrast to the other modes that require whole number masses, leak check mode permits fractional masses, but you cannot enter a mass that exceeds the maximum mass allowed by the control unit.

Accuracy: Scan accuracy determines the sampling amount carried out on each reading. A high accuracy number provides a clean scan but increases scan time. The accuracy ranges available are from 0 to 8.



Electronic Gain: The electronic gain of the pre-amplifier can be changed by selecting one of the values from the drop down list. The lowest electronic gain appears first in the list. The pressure indicates the maximum value that can be measured using that range. The higher the gain selected, the smaller the partial pressure that can be measured, this may cause peaks of a higher partial pressure to saturate.



Detector: The detector type used for the scan can be changed. Depending on the type of instrument, the options are Faraday, Multiplier 1, Multiplier 2 and Multiplier 3. Multiplier 1, 2 and 3 refer to the same physical detector, but using three separate calibration values that provide successively greater amplification of the ion current.


Audio (*Not supported on certain sensor configurations*): Switches the audio tone on or off. The tone changes in frequency as the measured peak height changes. This is a useful feature if you are unable to see your monitor while leak checking.


Re-zero: The control unit takes a zero measurement before it starts returning the values for the partial pressure of the probe mass. Click this button to force the control unit to take a new zero measurement.

Peak Jump Mode

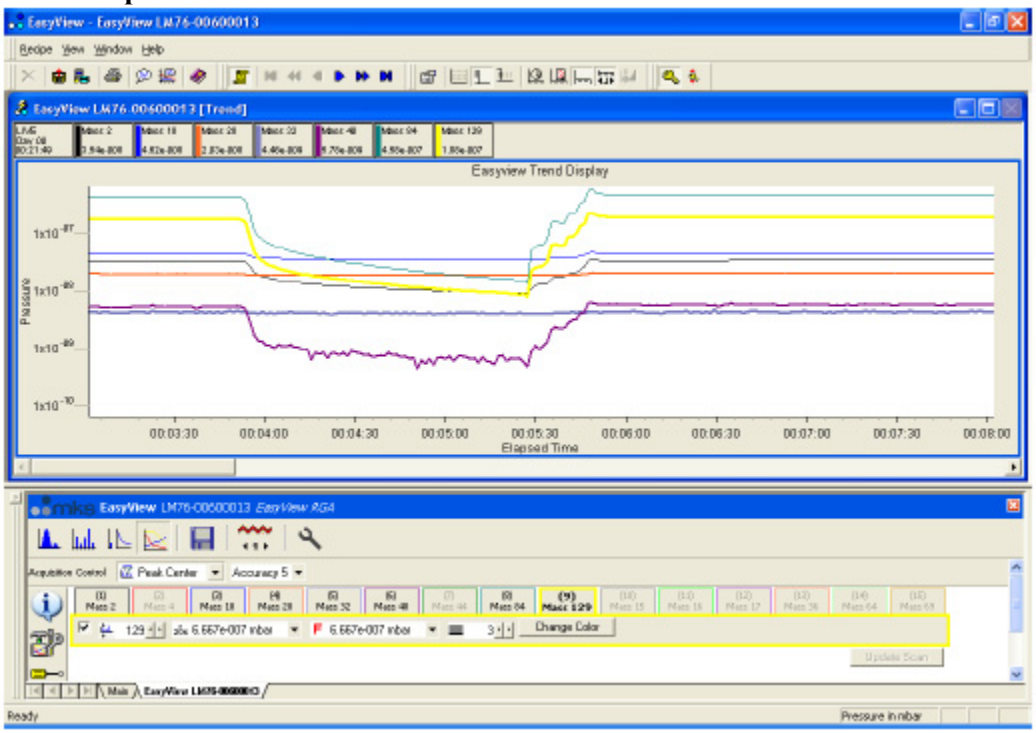
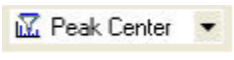


Figure 27 Peak Jump Mode.

In Peak Jump mode an interactive Peak Jump control toolbar appears in the status window and the data is displayed in a trend view window.

Figure 28 Peak Jump toolbar

Use this toolbar to change the scan parameters; each of the functions are explained below:



Scan Mode: The scan mode is the method used to report the peak height. The options are Peak Centre, Peak Max, or Peak Average.

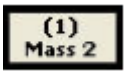
Accuracy: Scan accuracy determines the sampling amount carried out on each reading. A high accuracy number provides a clean scan but increases scan time. The accuracy ranges available are from 0 to 8.

Peak Jump Settings

Use this button to open the Peak Jump settings window shown below.

Figure 29 Peak Jump settings window.

Settings for each of the 15 channels can be edited using this toolbar.

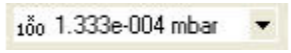


Click on the **Channels** tab to edit the settings for that particular channel.

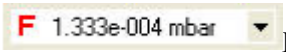

Check the box to enable the channel.

In the above example only channels 1 to 7 are enabled, channels 8 to 15 are disabled.

Scan Mass: Set the particular channels scan mass. Note that the mass cannot be less than 1 and cannot exceed the maximum mass allowed by the control unit.



Electronic Gain: The electronic gain of the pre-amplifier can be changed by selecting one of the values from the drop down list. The lowest electronic gain appears first in the list. The pressure indicates the maximum value that can be measured using that range. The higher the gain selected, the smaller the partial pressure that can be measured, this may cause peaks of a higher partial pressure to saturate.

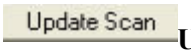


Detector: The detector type used for the scan can be changed. Depending on the type of instrument, the options are Faraday, Multiplier 1, Multiplier 2 and Multiplier 3. Multiplier 1, 2 and 3 refer to the same physical detector, but using three separate calibration values that provide successively greater amplification of the ion current.

Line Thickness: The thickness of the plotted line can be changed to aid visibility

Color: The color of the plotted line can also be changed. Select a color then click **OK** to apply it to the channel.

Figure 30 Select a color.



Update Scan: Changes made to the channels properties are not immediately made to the scan. When all changes required have been made, click Update Scan. The new settings will then be applied.

It will be apparent that the accuracy and scan mode apply to all the scan channels. However, individual channels can use different detectors or electronic gain settings. If you use more than one value for these properties, EasyView groups channels that have common settings together. Otherwise readings are taken in the same order as the channels are displayed.

You do not have to have the mass values in ascending order. Indeed, sometimes it is an advantage not to do so. Peak jump mode is a fast acquisition mode. The RGA may not have time to recover if adjacent channels require it to move from a very high partial pressure to a very low one. Data quality may be improved by thinking carefully about the mass sequence.

Passing over a large reading can be as harmful to data quality as taking a reading at that mass. You may improve data quality by adding one or more ‘throw-away’ channels after the RGA has scanned over a large peak.

Disk Store

Disk Store is available in the Analog, Bar Chart, and Peak Jump scan modes and can be accessed by clicking the button shown.

What to store tab options:

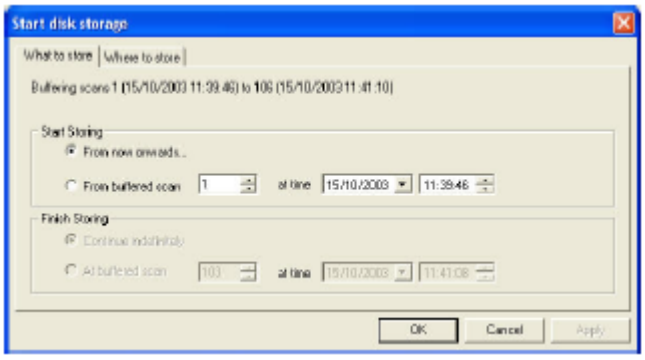


Figure 31 Start disk storage: What to store.

- **From now onwards** starts storing when you click **OK**.
- **From buffered scan** allows you to select a prior scan number or time so you can store data that EasyView is holding in its history buffer. If you enter a scan number, the time will be adjusted to match. If you enter a time, the corresponding scan number will be shown.

NOTE: The buffer is reset if any changes to the current scan are made; otherwise somewhere between 500 and 1000 prior scans are stored in the buffer.

Likewise, you can select to continue storing indefinitely or to finish at one of the scans in the history buffer. You cannot set a particular future scan or time.

Where to store tab options:

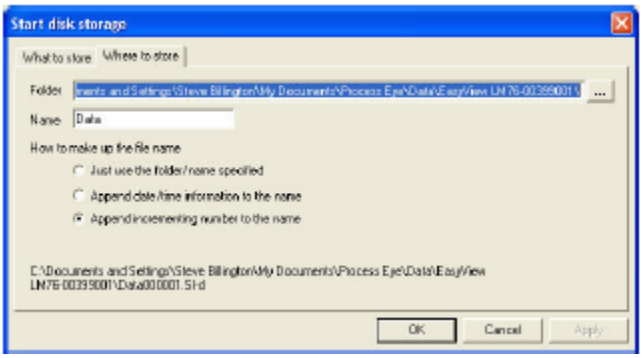


Figure 32 Start disk storage: Where to store.

- **Folder**: Enter the path, or browse to the folder where the scans are to be stored. The default path is:... \Data\EasyViewControlUnitName\
- **Name**: Enter a name for the saved data file, by default this is “Data” but it can be anything you choose. The file name can optionally be amended with other information:
  - **Just use the folder/name specified** creates (in the example shown) the file “data.SI-d”. An existing file of the same name would be overwritten.
  - **Append date/time information to name** adds date and time information to the file and would create the file “DataYYYYMMDDHHmmSS.SI-d” where YYYY is the current year, MM is the current month, DD is the current day, HH is the current hour, mm is the current minute and SS is the current second.
  - **Append incrementing number to the name** adds the next available sequential number to the name and would first create “Data000001.SI-d”; the next would be “Data000002.SI-d” and so on, thus creating a new file each time data is saved.

While storing to disk, the Disk Store toolbar will be visible in the status window. Notice that the disk store icon is no longer available and the path to the disk store file is displayed.

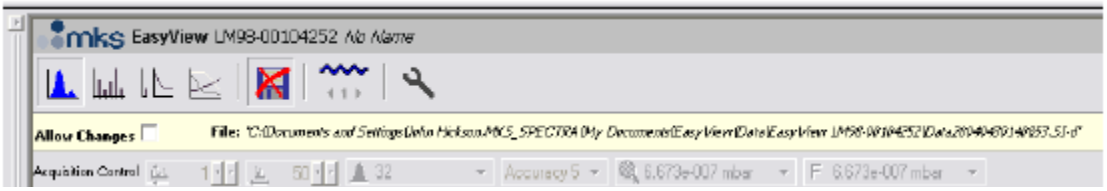


Figure 33 Disk store toolbar.

Checking the **Allow Changes** box pauses the disk store and re-enables the scan toolbar. You can then change the scan properties, un-check the **Allow Changes** option and continue with the Disk Store without having to run through the Start Disk Storage dialog.

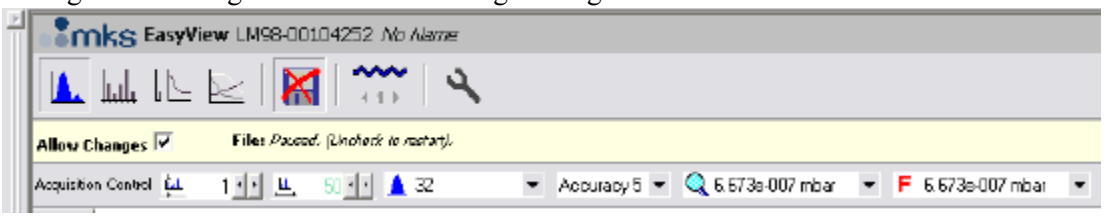


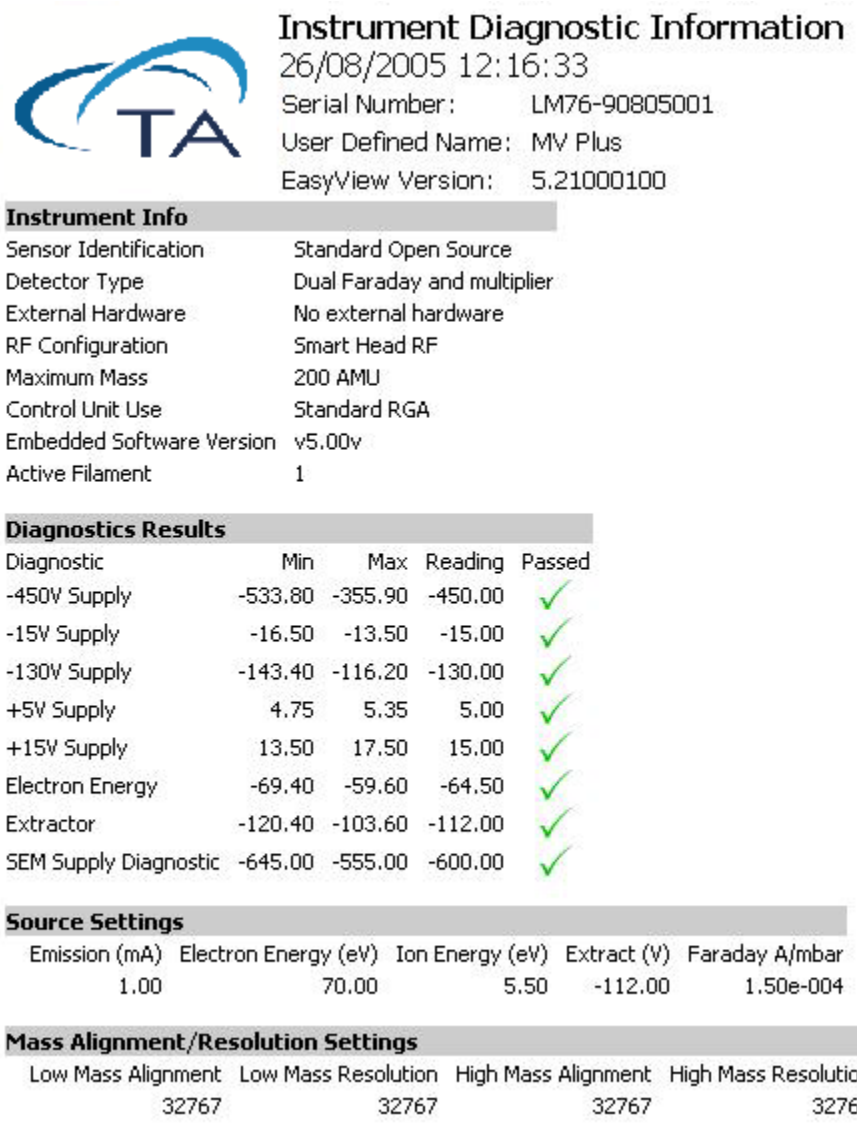
Figure 34 Scan toolbar re-enabled

NOTE: The name of the file will still change. A given data file can only store data for one set of acquisition conditions.

EasyView Diagnostics

Diagnostics mode is only available if there is no scan mode currently selected. If diagnostics is unavailable then the selection is greyed out.

You can create a report in EasyView that displays the control unit configuration, source settings, mass alignment/resolution settings, and power supply levels.



Instrument Diagnostic Information

26/08/2005 12:16:33

Serial Number: LM76-90805001

User Defined Name: MV Plus

EasyView Version: 5.21000100

Instrument Info

Sensor Identification	Standard Open Source
Detector Type	Dual Faraday and multiplier
External Hardware	No external hardware
RF Configuration	Smart Head RF
Maximum Mass	200 AMU
Control Unit Use	Standard RGA
Embedded Software Version	v5.00v
Active Filament	1

Diagnostics Results

Diagnostic	Min	Max	Reading	Passed
-450V Supply	-533.80	-355.90	-450.00	✓
-15V Supply	-16.50	-13.50	-15.00	✓
-130V Supply	-143.40	-116.20	-130.00	✓
+5V Supply	4.75	5.35	5.00	✓
+15V Supply	13.50	17.50	15.00	✓
Electron Energy	-69.40	-59.60	-64.50	✓
Extractor	-120.40	-103.60	-112.00	✓
SEM Supply Diagnostic	-645.00	-555.00	-600.00	✓

Source Settings

Emission (mA)	Electron Energy (eV)	Ion Energy (eV)	Extract (V)	Faraday A/mbar
1.00	70.00	5.50	-112.00	1.50e-004

Mass Alignment/Resolution Settings

Low Mass Alignment	Low Mass Resolution	High Mass Alignment	High Mass Resolution
32767	32767	32767	32767

Figure 35 EasyView Instrument Diagnostic Report.

The filament needs to be switched on in order to test the multiplier. If you run the diagnostics without switching on the filament, the below dialog box appears. Click **No** to run the diagnostics with the filament off, in which case the multiplier voltage will not be tested, or click **Yes** to switch the filament on and then run diagnostics.

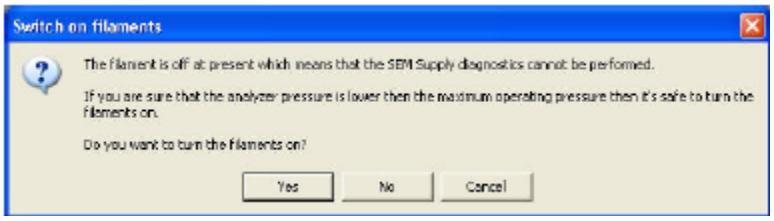


Figure 36 Filaments dialog box.

NOTE: Before switching the filament on, check the vacuum level to make sure it is safe to do so.

Start Detector Calibration

Detector calibration should be performed periodically to check the signal levels for the Faraday detector and the three multiplier levels for the Electron Multiplier detector and to make adjustments to these detectors as necessary.

1 Click **Start Detector Calibration** to display the Calibration screen.

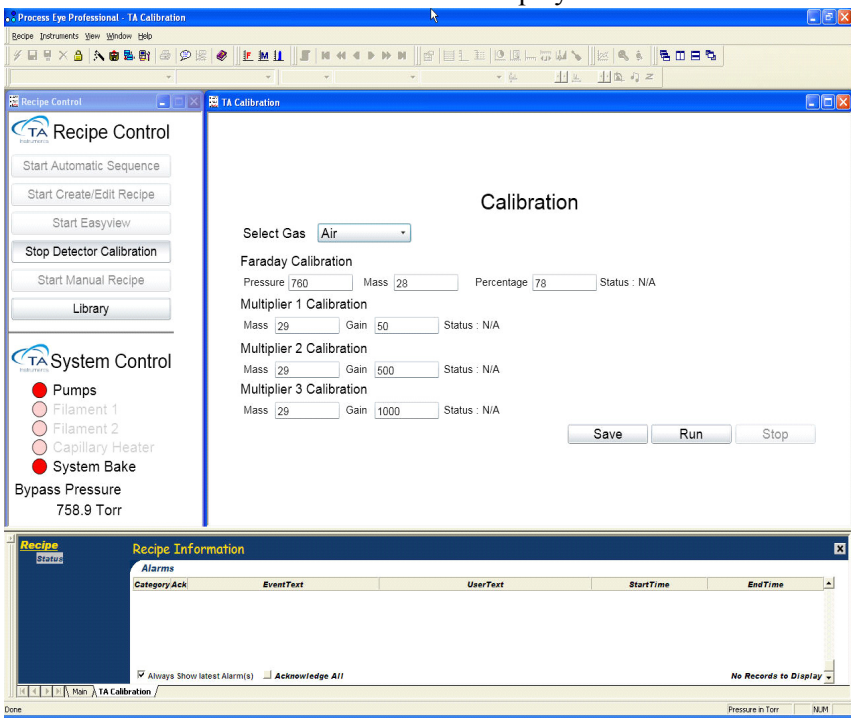


Figure 37 Calibration screen.

2 Select the desired gas for the calibration from the **Select Gas** drop-down list (Air is the default and recommended choice).

3 Adjust the gains for Multiplier 1, Multiplier 2, and Multiplier 3, if necessary.

4 Click **Run** to start calibration. Each detector is calibrated and the result displayed in turn.

5 Once the calibration is complete, click **Save** to save the calibration. To abort a calibration, click **Stop**.

Start Manual Recipe

The Start Manual Recipe button allows you to run pre-installed recipes. Note that data collected in this mode cannot be imported into Universal Analysis; only data collected using the Automatic Sequence has this ability.

1 In the TA Recipe Control Panel, click **Start Manual Recipe**.

2 Select a recipe from the drop-down list and click **Run** These recipes, similar to the recipes in the EasyView window, do not require a trigger signal from the TGA to start, but are controlled manually..

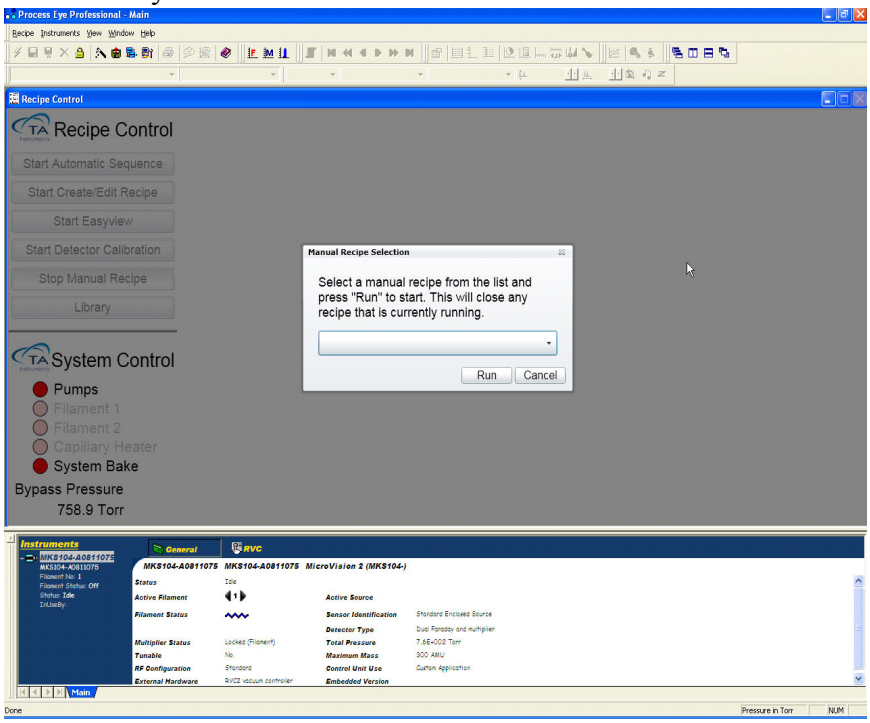


Figure 38 Manual Recipe Selection.

Library

Clicking **Library** opens the internal mass spectral library. The following window displays.

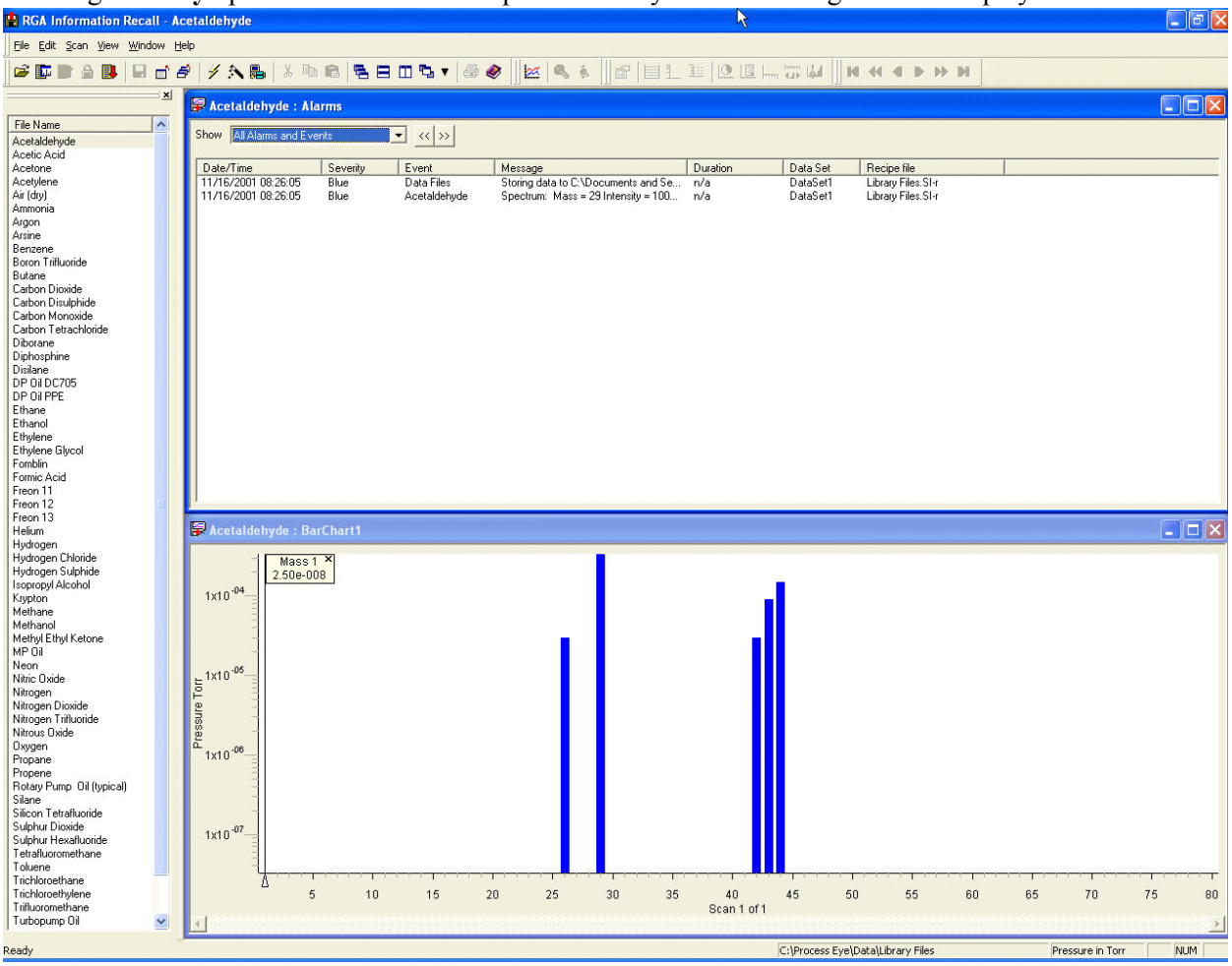


Figure 39 Library.

Double-click on a compound in the panel on the left to display the mass spectrum for that material. Click **File > Exit** to exit the library.

If the **Export As Text** check box in the Automatic Sequence was checked at the time of run execution, a file is generated that can be opened directly into Universal Analysis or TRIOS.

Importing Data into Universal Analysis

Universal Analysis can be used to read MS data from the Discovery MS system. This data can be overlaid on TGA data for TG-MS analysis plots.

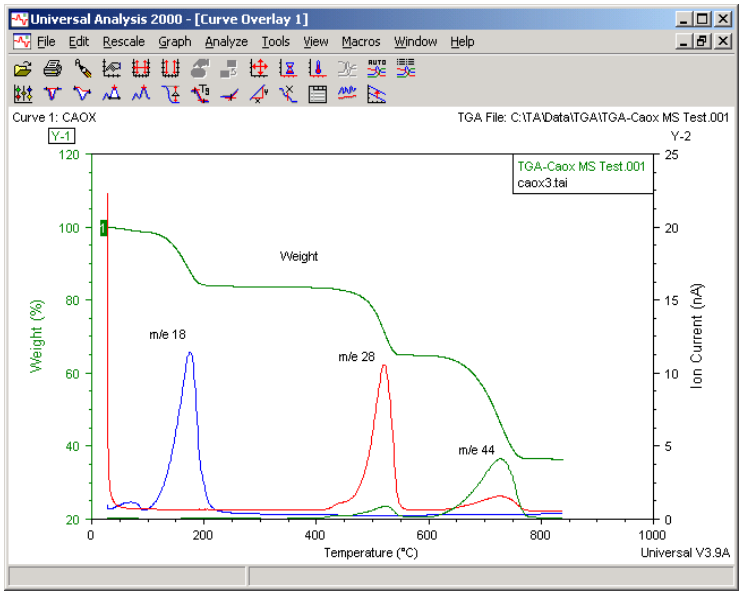


Figure 40 TGA-MS analysis plot.

1 Open Universal Analysis and open the TGA curve from the same run.

2 Open the MS curve by selecting **All Files** as the extension and looking for the.asc file created during the MS run.

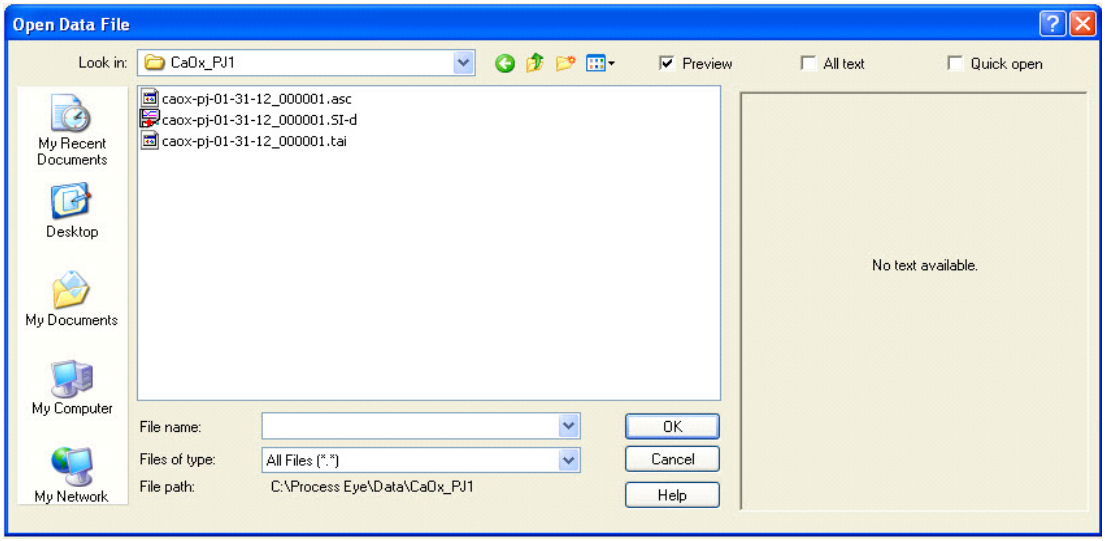


Figure 41 Open Data File.

3 After you click on the file, Universal Analysis will recognize this as a mass spectrometer data file and will request that you save it in a new format.

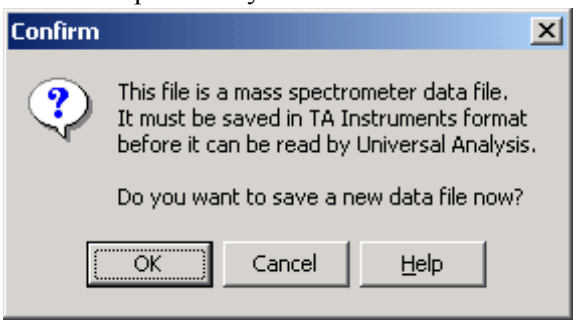


Figure 42 Confirm dialog box.

4 The system will ask if you want to add temp data from an open file. Click **Yes**.

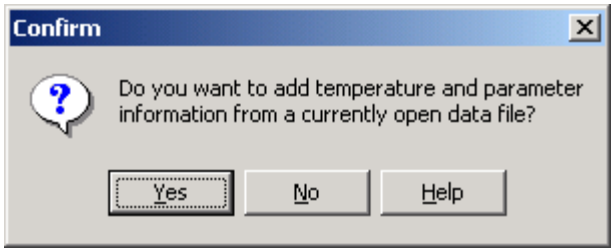


Figure 43 Confirm dialog box.

5 Choose the file to get the info from

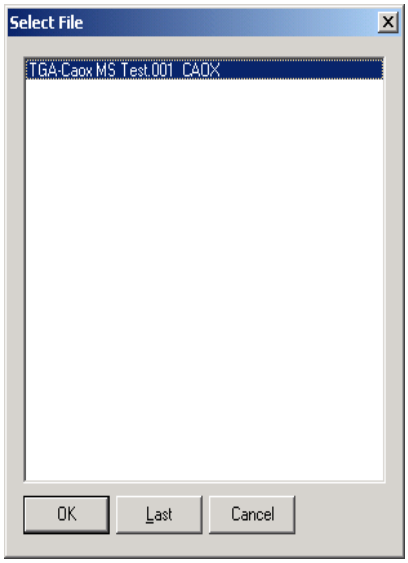


Figure 44 Select File dialog box.

6 Click **Save** to save the file in TAI format (it will put the.tai extension on the file). This file can now be loaded directly into Universal Analysis.

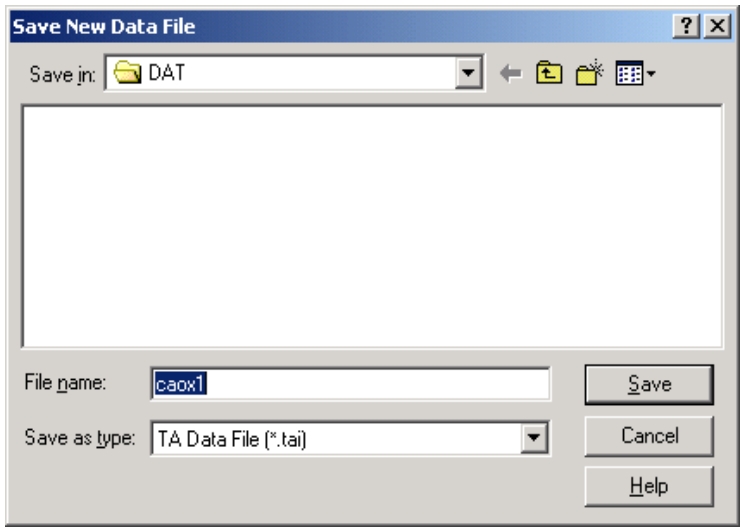


Figure 45 Save New Data File dialog box.

7 To overlay the 2 graphs, select **Graph** > **Overlay** > **Autoconfigure** to see the available graphs to overlay and hit OK.

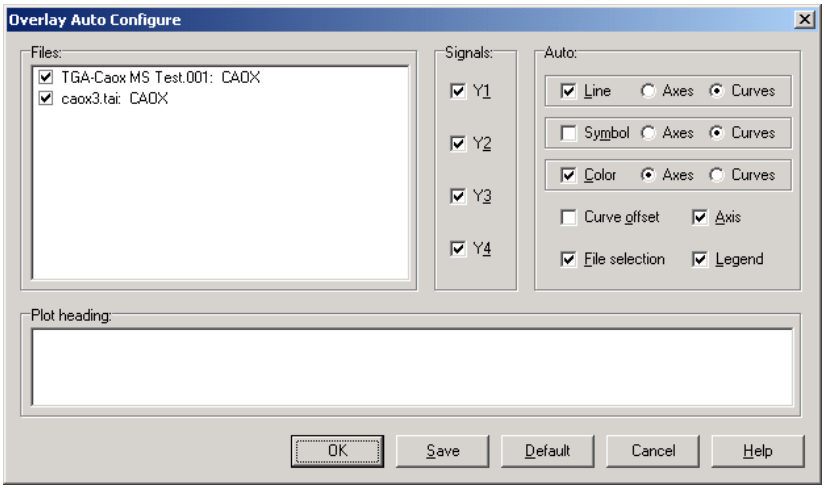


Figure 46 Overlay Auto Configure dialog box.

8 Set multiple colors for the masses by right-clicking on a mass trace and choosing **Graph Options**. Choose **Multi Color** and then click **OK**.

9 Label the mass traces by right-clicking the trace and choosing **Label Point**. Select **m/e** (mass) and click **OK**.

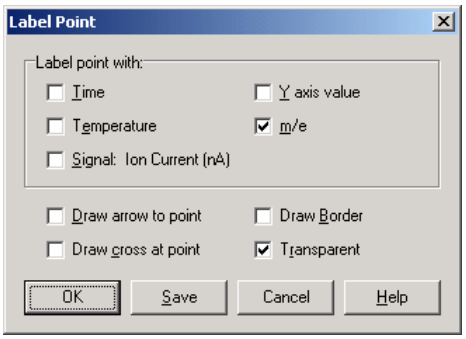


Figure 47 Label Point dialog box.

Importing Data into TRIOS

TRIOS Software can be used to read MS data from the Discovery MS system. This data can be overlaid with Discovery instrument data for TG-MS analysis plots.

1 Open TRIOS software and open the TGA curve from the same run.

2 Open the MS curve by selecting **MS files** as the file type.

3 From the **Home** menu select **New Overlay Document**.

4 Using the File manager, select the TGA and MS files above and select **Send to Graph**.

5 Use the standard **Graph** option to customize the graph and legend.

6 To save the Overlay graph, select **File** > **Save**.

Maintaining the Accessory

This section covers fitting the capillary assembly upon delivery along with capillary maintenance (replacing the capillary liner), and orifice disk replacement.

Fitting the capillary assembly

1 Loosen the four fasteners indicated in the figure below and remove the two side covers from the capillary housing.

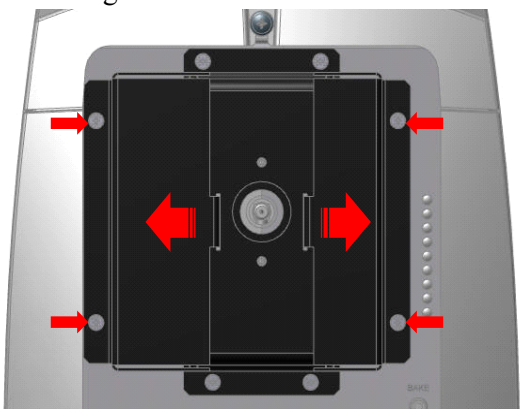


Figure 48 Loosen fasteners and side covers.

2 Loosen the Velcro straps and remove the heater jacket

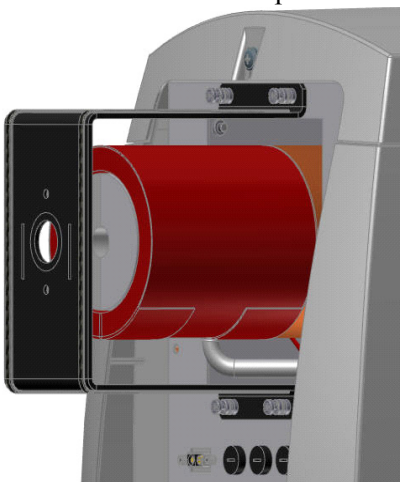


Figure 49 Heater jacket.

3 Remove the cap-head bolt.

Figure 50 Cap-head bolt.

4 Split the two halves of the heater block and remove to allow access to the inlet coupling.

Figure 51 Split heater block (left); heater block removed (right).

5 Feed the capillary heater wires through the hole in the capillary housing and secure the capillary using the two captive fasteners.

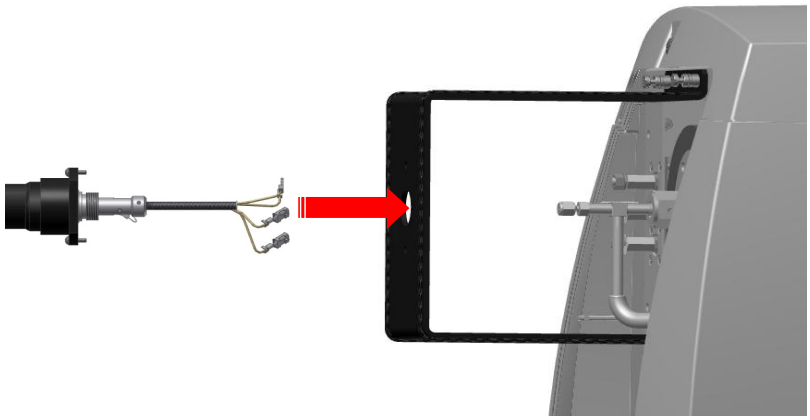


Figure 52 Capillary heater wires.

6 Connect the capillary heater wires to the three terminal posts; the two ringed wires are connected to the uppermost post and the two spaded wires to the lower two posts (there is no polarity on these two lower connections.,

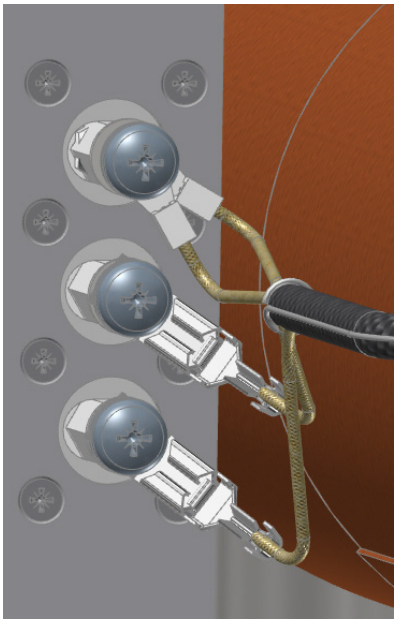


Figure 53 Capillary heater wires connected to terminal posts.

7 Unscrew the ⅛fitting indicated. Be careful not to lose the graphite ferrule that is inside this fitting.

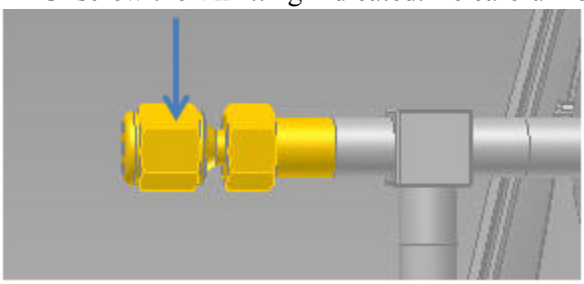


Figure 54 Unscrew the ⅛ fitting.

8 At the sample end of the capillary, insert the liner and while keeping the capillary assembly straight, feed the liner down the assembly. Once the liner appears at the system end, pull it though slightly and slide on the ⅛ nut and the ferrule. Take note of the ferrules orientation from the diagram below and taper towards the inlet. Continue to slowly feed the liner into the inlet assembly until it stops, then withdraw the liner 5 mm.

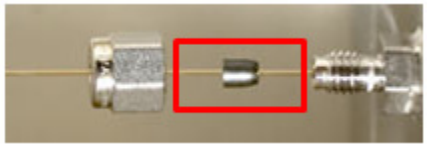


Figure 55 Ferrules.

9 Before re-fitting any covers, perform a leak-check of the system.

10 Tighten the 1/16 nut finger tight and then ½ turn with a suitable spanner. Do not over tighten this fitting as the liner will be crushed. If during a leak check you find this fitting to be leaking, tighten another ¼ turn.

Replacing the Capillary Liner

This section assumes the capillary support housing panels have already been removed.

1 Unscrew the 1/16 nut and withdraw the liner from the sample end of the capillary.

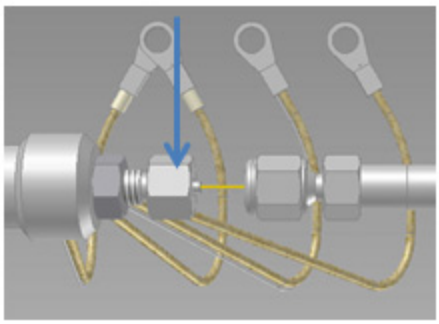


Figure 56 Unscrew 1/16 nut.

2 At the sample end of the capillary, insert the liner and while keeping the capillary assembly straight, feed the liner down the assembly.

3 Once the liner appears at the system end, pull it though slightly and slide on the 1/16 nut and a new ferrule. Take note of the ferrules orientation from the diagram below and taper towards the inlet.

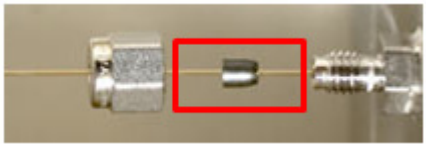


Figure 57 Ferrules.

4 Continue to slowly feed the liner into the inlet assembly until it stops, then withdraw the liner 5 mm.

5 Tighten the 1/16 nut finger tight and then ½ turn with a suitable spanner. Do not over tighten this fitting as the liner will be crushed. If during a leak check you find this fitting to be leaking, tighten another ¼ turn.

Replacing the Orifice Disk

The VCR orifice disk is located in the VCR coupling attached to the inlet flange.

NOTE: Wear gloves when handling the orifice disk.

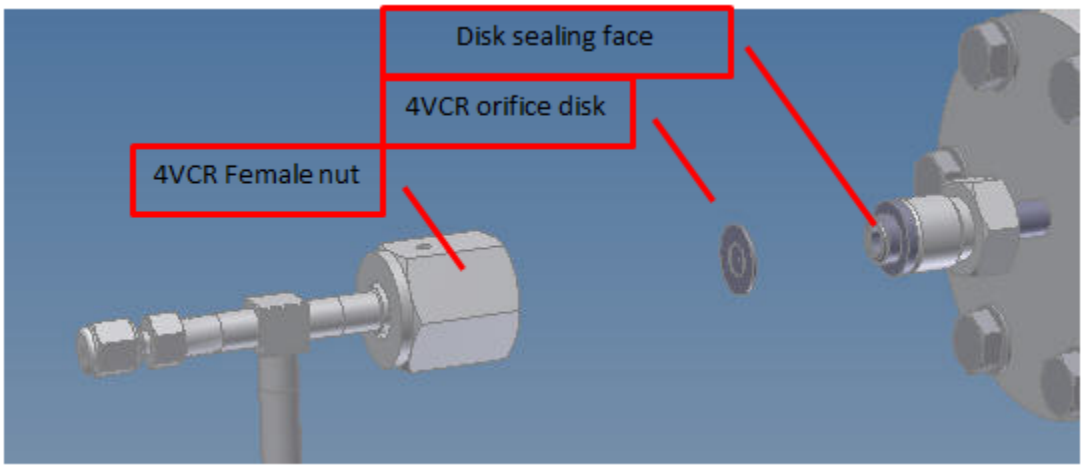


Figure 58 VCR orifice disk location.

1. To access the orifice disk you must first withdraw the capillary liner from the inlet (refer to the steps in the previous section).
2. Once the liner is free of the inlet assembly unscrew the 4VCR nut.

NOTE: You should use two spanners whether you are loosening or tightening this type of fitting.

3. The VCR orifice disk is held in a sprung retainer which clips onto the sealing face of the male half of the fitting. Pull the retainer from the fitting to remove.
4. You may be supplied with disks already fitted inside a retaining clip; in this case, simply push a new disk onto the sealing face. If you are supplied with just disks, you will need to remove the old disk and re-use the retainer.

Cleaning the Outer Cabinet

You can clean the Discovery MS outer cabinet as often as you like. The cabinet should be cleaned with a mild household detergent and soft, damp cloth. Wet the cloth and then wipe off the outer surface as needed.

Replacement Parts

Part Number	Description
202572.002	Capillary for Discovery TGA and Q50
202572.003	Capillary for Q600
202573.001	30 µM VCR Orifice Disk
202574.001	PVD Ion Source Assembly inc Tungsten Filaments
202570.001	FERRULE GRAPH/VESP 1/ 16x0.5MM QTY 10
202571.001	Gasket, Copper 37x48 for 70 OD FL
202569.001	FUSE, 3.15AT 20MM CERAMIC
202569.002	FUSE, 5.0AT 20MM CERAMIC
202569.003	FUSE, 6.3AT 20MM CERAMIC
202569.004	FUSE, 8AT 20MM CERAMIC
PM143740-T	Turbo Oil Wick Operating Fluid Reservoir[1]

1. Refer to the pump user manual for correct maintenance schedule.

Appendix A:
Connecting the MS to a TGA or Q5000 IR

Installation Requirements

If you wish to connect a mass spectrometer to the TA Instruments Discovery TGA or Q5000 IR, use the interface kit described in this set of instructions, PN 957349.901. This interface kit may be used with any mass spectrometer, if the specifications for the capillary interface and transfer line are compatible. To install a mass spectrometer you will need the following:

- 5/64 hex key (Allen wrench)
- Phillips screwdriver
- TA Instruments' Mass Spectrometer Upgrade Kit PN 957349.901
- Mass spectrometer with a transfer line that meets the requirements below.

Transfer Line Requirements

To connect any spectrometer, you will need to use a transfer line (supplied by the spectrometer manufacturer) to transport the gas evolved from the sample to the spectrometer. In order to be compatible with the interface described in this set of instructions, the transfer line should have the following characteristics:

- The dimension specifications should be as follows:

  Transfer Line = maximum diameter of 1.3 inches.

  Capillary Tube = maximum diameter of 0.023 inches.

- The capillary tube should be made of heat-resistant alloy capable of resisting corrosion by the evolved gas and oxidation at temperatures up to 1200°C. The transfer line should be able to withstand temperatures up to 200°C at the interface to the adapter.
- The transfer line must be long enough to allow flexible movement. It must accommodate movement of the furnace up and down 9.5 cm (3 and 3/4 inches) to open and close for sample loading and unloading. (If the transfer line is not long enough, it must be disconnected and reconnected each time the furnace is opened and closed.)

Installing the Mass Spectrometer Interface

To connect your spectrometer to the furnace you will need to remove the furnace exhaust tube assembly and then install the spectrometer interface assembly. Follow the instructions below:

Removing the Furnace Exhaust Tube Assembly

Refer to the figure below for identification of parts when performing the following steps:

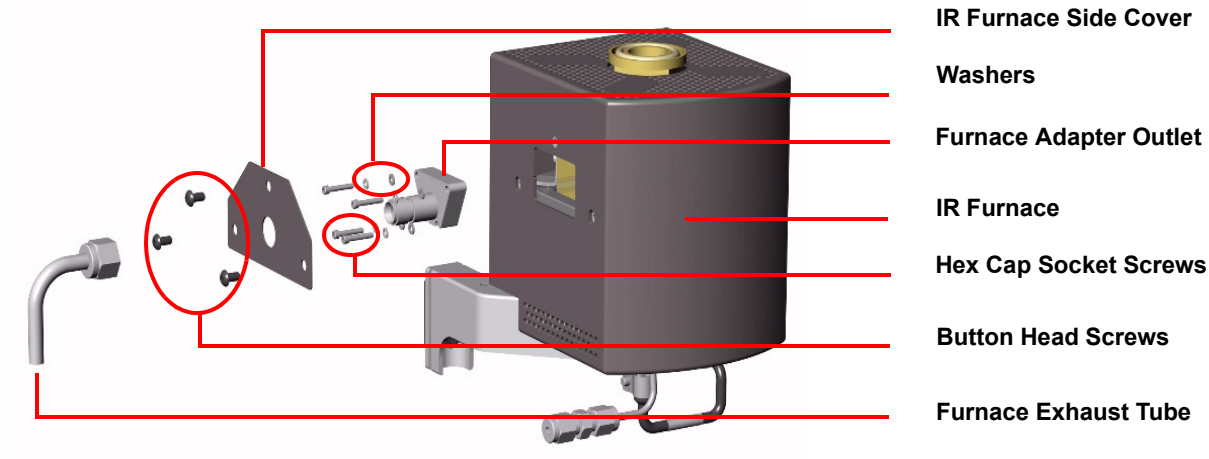


Figure 59

1 Lower the furnace until it reaches the lowest point.

2 Turn off the power switch to the instrument and unplug the power cord from the outlet.

CAUTION: Do not proceed until you have made sure there is no power going to the instrument.

MISE EN GARDE: Continuez uniquement si vous vous êtes assuré que l'alimentation de l'instrument a été coupée.

3 Loosen the outer nut and remove the furnace exhaust tube from the left-hand side of the furnace. Retain the furnace exhaust tube.

4 Use a 5/64-inch hex wrench to remove the three button head screws holding the furnace side cover on. Remove the furnace side cover and retain the three screws for later use. (The cover will not be needed with the mass spectrometer, but you may wish to retain it in the event you remove the mass spectrometer adapter.)

5 Using a 5/64-inch hex wrench, carefully remove the four hex cap socket screws and their washers from the furnace adapter outlet.

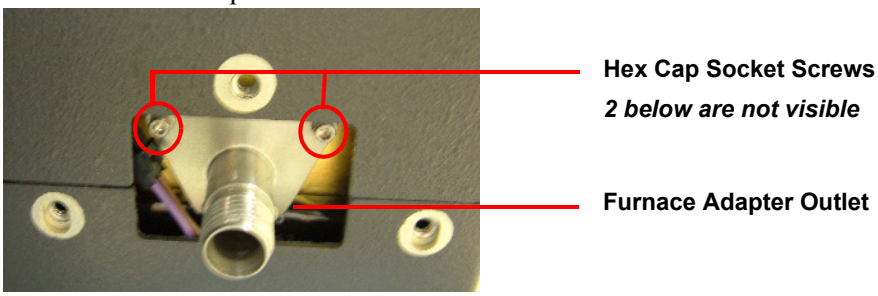


Figure 60

CAUTION: DO NOT allow the screws or washers to fall down inside the furnace.

MISE EN GARDE: NE laissez PAS les vis et rondelles tomber dans le four.

6 Pull the furnace adapter outlet straight out to remove it. Retain the four screws and washers for later use. (The furnace adapter outlet will not be needed with the mass spectrometer, but you may wish to retain it in the event you remove the mass spectrometer adapter.)

7 Place the furnace exhaust tube, cover and furnace adapter in a plastic bag for protection during storage, if desired.

Installing the MS Interface Assembly

Once the furnace exhaust tube assembly has been completely removed, follow the instructions below to install the mass spectrometer interface assembly. DO NOT restore the power until instructed to do so.

Refer to the figure below for identification of parts when performing the following steps:

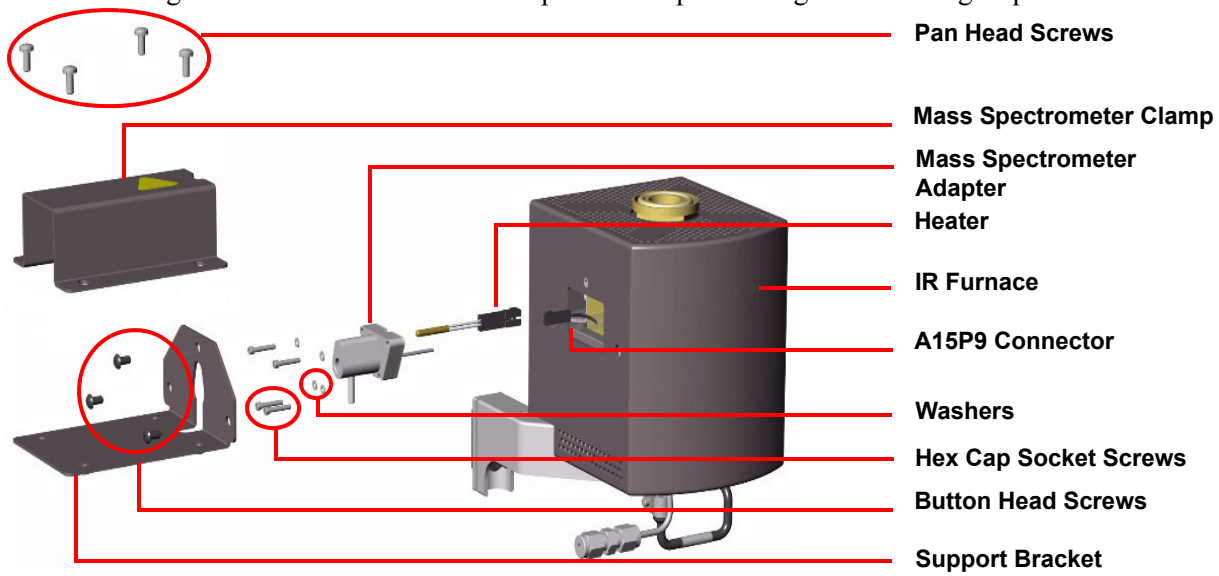


Figure 61

1 Locate the A15P9 connector inside the furnace opening. Using a pair of tweezers, gently grasp the connector and pull it out through the furnace opening.

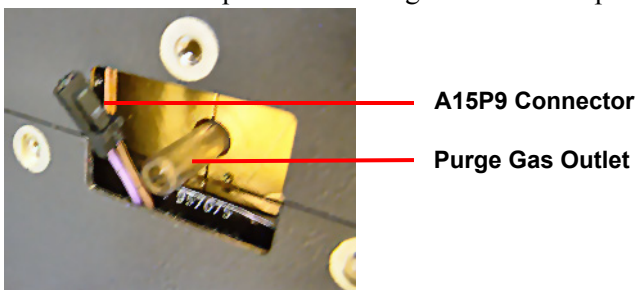


Figure 62

2 Locate the mass spectrometer heater (PN 957208.901) and the mass spectrometer adapter in the kit.

3 Insert the heater end through the opening in the adapter and shape the heater wire around the mass spectrometer adapter as shown in the figure below. This is needed to provide the best routing for the wire once the heater is installed.

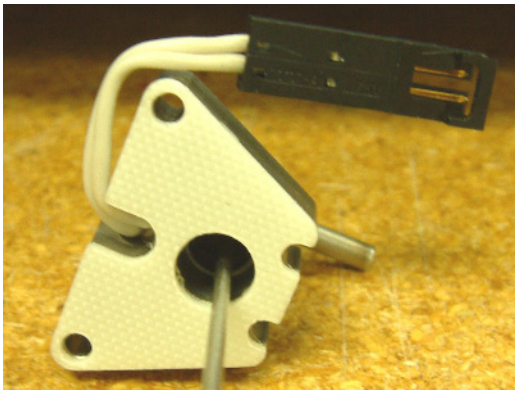


Figure 63

4 Remove the heater from the adapter, leaving the wire in its new shape. Plug the heater into the A15P9 connector. See the figure below.

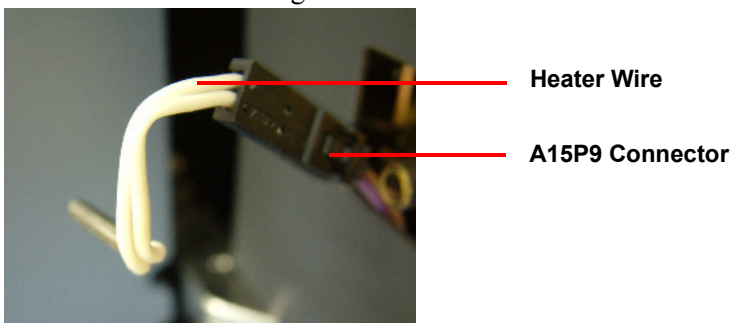


Figure 64

5 Position the heater at the top of the opening and hold it parallel to the furnace quartz tube with a pair of tweezers. Slide the mass spectrometer adapter over the heater until the adapter's thin tube is inserted into the furnace quartz tube and engages with the purge gas outlet.

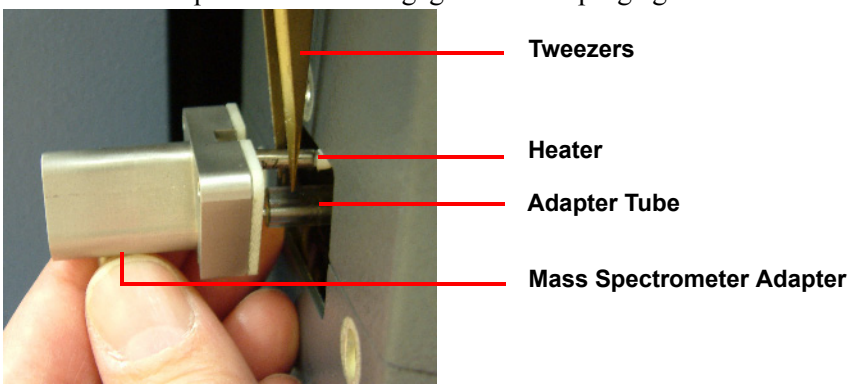


Figure 65

6 Release the tweezers holding the heater and continue to guide the adapter onto the heater and purge gas outlet. Allow the adapter position to be determined by the internal o-ring's contact with the glass tube. Push the adapter all the way in until it rests against the furnace wall.

7 Using a 5/64-inch hex wrench, install the four hex cap socket screws and their washers (removed in step 5 on page 2) to attach the adapter to the furnace as shown in the figure below.

CAUTION: DO NOT allow the screws or washers to fall down inside the furnace.

MISE EN GARDE: NE laissez PAS les vis et rondelles tomber dans le four.

8 Obtain the mass spectrometer transfer line clamp and bracket from the accessory kit. The clamp is shipped assembled. Use a screwdriver to remove the four panhead screws holding the clamp and bracket together.

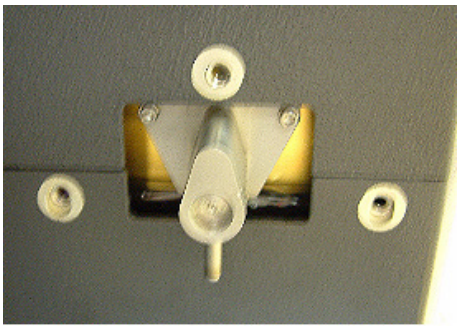


Figure 66

9 Slide the support bracket over the adapter. Center the bracket's opening around the adapter.

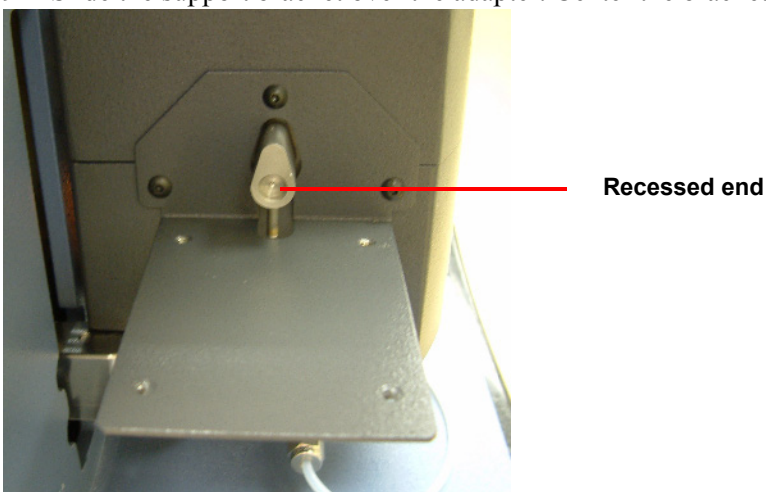


Figure 67

10 Use the three button head screws removed previously (from step 4 on the page 2) to attach the bracket to the side of the furnace. Do not over tighten the screws.

Inserting the Transfer Line

NOTE: Make sure that the end of the capillary is straight and free of oxide deposits before you insert it into the exhaust gas connection.

1 Insert the transfer line capillary into the 0.6-mm (0.025-inch) opening in the mass spectrometer adapter and push the tube all the way to the end of the adapter. The stainless steel nub should sit inside of the adapter's recessed end (Figure 67).

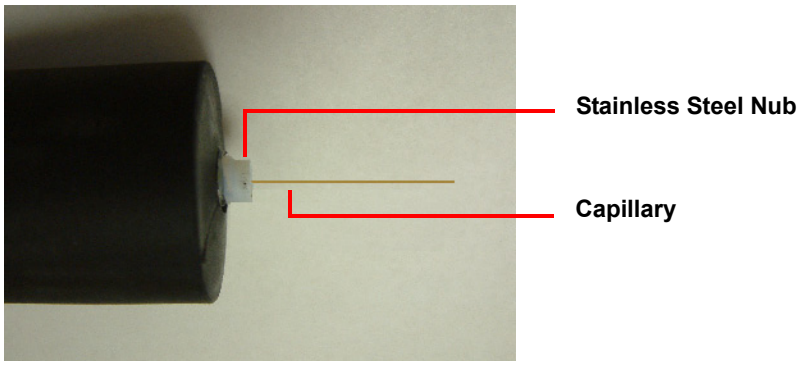


Figure 68

2 Use a mirror to look inside the top of the furnace to ensure that the capillary does not extend into the furnace or it may interfere with the sample pan. (You may need to obtain the assistance of a second person for this operation. One person can look down into the furnace and the other person can adjust the position of the capillary to slide it in or out as needed.) Make sure the stainless steel nub remains inside the adapter's recessed end as directed in step 1.

WARNING: If the transfer line capillary is not straight or has heavy oxide deposits on it, the sample tube may be broken as the line is inserted.

AVERTISSEMENT: Si le capillaire de la conduite de transfert n'est pas droit ou contient de lourds dépôts d'oxyde, le tube à échantillon peut être brisé lors l'insertion de la conduite.

3 Place the clamp over the transfer line and install the four pan head screws. The fully installed mass spectrometer adapter and line will appear.

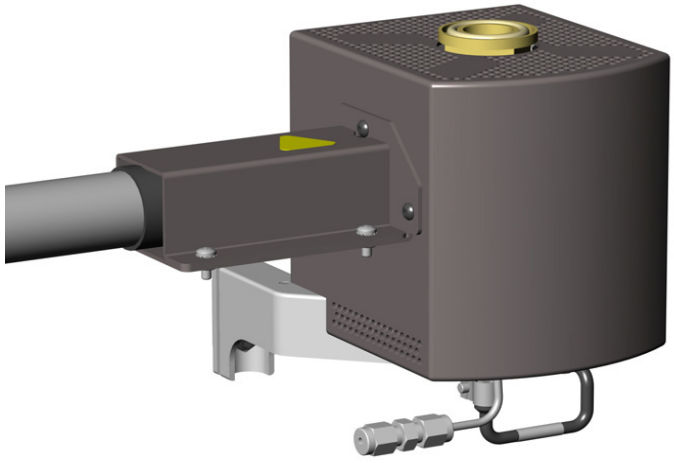


Figure 69

4 Plug the power cord into the outlet and turn on the instrument's power switch.

5 Access the Tools/Instrument Preferences/TGA page and check the Enabled Evolved Gas Heater box to turn on the Evolved Gas Adapter Heater. Enter 90 in the % of Full Power field. (90% is typically used to achieve approximately 200°C). See the online help in the Instrument Control program for more information.

Removing the Mass Spectrometer Interface

CAUTION: Do not proceed until you have made sure there is no power going to the instrument.

MISE EN GARDE: Continuez uniquement si vous vous êtes assuré que l'alimentation de l'instrument a été coupée.

Before removing the mass spectrometer interface, turn off the power to the instrument and unplug the power cord. Then reverse the instructions given in this document to remove the mass spectrometer adapter. Observe all cautions listed. When the original furnace adapter outlet has been reinstalled, make sure that the hex cap socket screws holding it to the side of the furnace are fully tightened to prevent movement. Install the side cover once more and fully tighten the button head screws. Remember to reinstall the furnace exhaust tube as well to restore the Q5000 IR to its original conformation.

Appendix B:

Connecting the MS to a Q50 or Q500

Installation Requirements

If you wish to connect a mass spectrometer to the TA Instruments Q50 or Q5000, use the accessory kit described in this set of instructions. The following items are in the accessory kit:

- Aluminum mounting bracket
- Swagelok brass fitting
- 0.25-inch Vespel-drilled (0.3-mm bore) plug
- Length of stainless steel sheath (not needed for the Discovery MS)
- Event cable
- Optional software

Installing the Mass Spectrometer Interface

Refer to the figure below when following the instructions to install the Q50/Q500 Mass Spectrometer Interface.

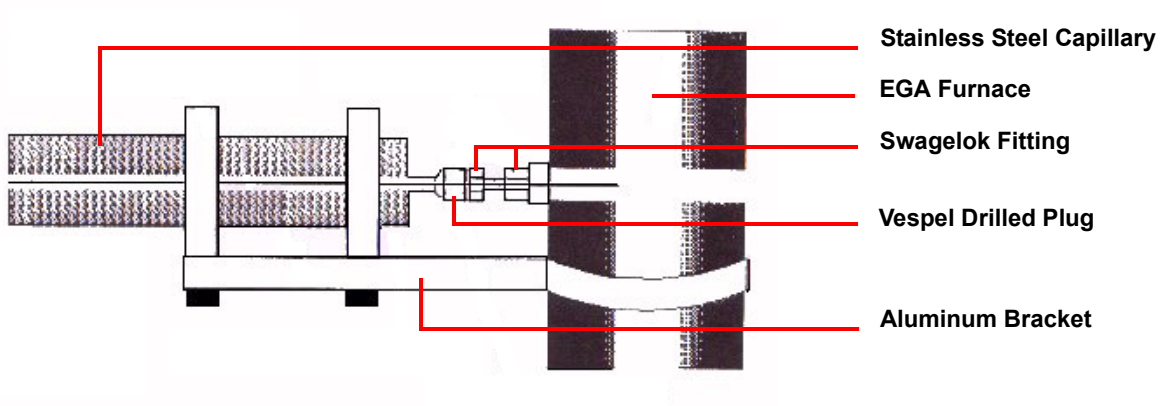


Figure 70

1 Remove any existing brass ferrules from the Swagelok fitting. Then insert the Vespel-drilled plug into the fitting. Install the fitting onto the 1/8-inch fitting on the EGA furnace.

2 Remove the C-clamps from the slots in the aluminum mounting bracket.

3 Loosen the bolt that holds the two pieces of the bracket together. Carefully slide the bracket around the EGA furnace, and raise the bracket as high as possible without interfering with the rubber purge line connected to the right side of the furnace.

4 Check the position of the rectangular port of the clamp (the part with the slots) to make sure it is parallel to the opening of the furnace and to the Swagelok fitting.

5 Tighten the clamp screws so that the clamp fits snugly onto the furnace.

6 Insert the stainless steel capillary into the 0.3-mm hole in the Vespel plug and slide into the furnace until the end of the heated transfer line is flush against the 1/4 inch compression fitting.

7 Install the C-clamps and tighten the thumbscrews until the clamps are loosely installed around the insulated transfer tube.

8 Insert the stainless steel nub into the recessed end of the Swagelok nut. Tighten the thumbscrews.

9 Install the event cable. The cover of the mass spectrometer must be removed to access the interface port of that instrument.

Appendix C:

Connecting the MS to a Q600 or SDT

Installation Requirements

If you wish to connect a mass spectrometer to the TA Instruments Q600 or SDT, use the accessory kit described in this set of instructions. The following items are in the accessory kit:

- Aluminum mounting bracket with two (2) machine mounting screws
- Swagelok brass T-fitting
- 0.25-inch Vespel ferrule
- 0.25-inch Vespel-drilled (0.03-inch bore) plug
- Length of stainless steel sheath (not needed for the Discovery MS)
- Event cable
- Optional software

Installing the Mass Spectrometer Interface

Refer to the figure below when following the instructions to install the Q600/SDT Mass Spectrometer Interface.

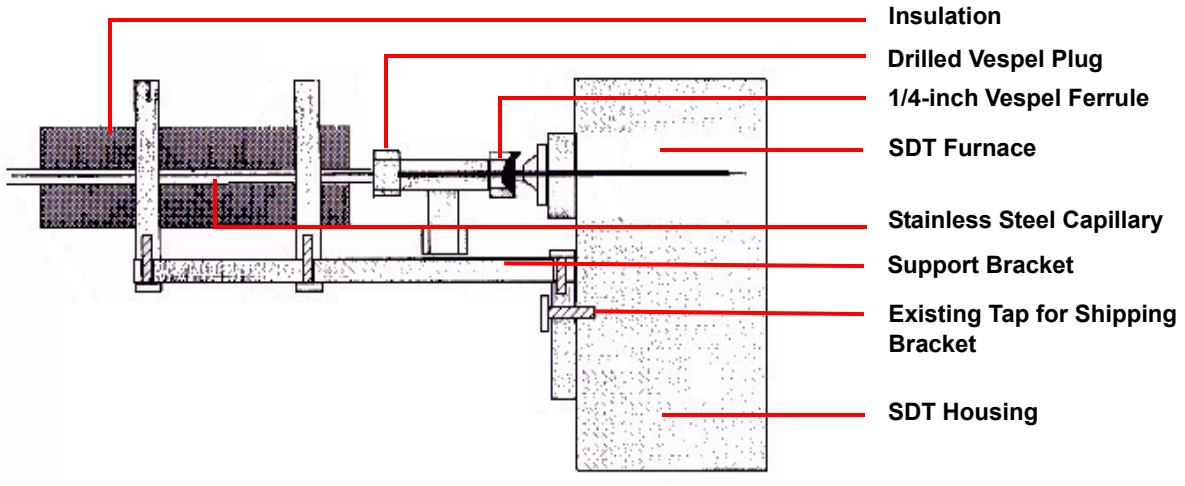


Figure 71

1 Remove any existing brass ferrules from the Swagelok T-fitting.

2 Remove the C-clamps from the slots in the aluminum mounting bracket. Using the machine screws provided and the pre-tapped dies, install the mounting bracket onto the end of the SDT furnace.

3 Insert the stainless steel capillary into the 0.3-mm hole in the Vespel plug. Insert this Vespel plug into one end of the Swagelok T-fitting, and insert the other Vespel ferrule into the opposing end.

4 Tighten the nut around the Vespel plug.

5 Install the opposing end of the Swagelok T-fitting onto the chimney of the SDT furnace, facing the perpendicular fitting toward the rear of the instrument. Be careful not to overtighten as this could crack the end of the furnace tube.

6 Install the C-clamps and tighten the thumbscrews until the clamps are loosely installed around the insulated transfer tube.

7 Insert the stainless steel nub into the recessed end of the Swagelok nut. Tighten the thumbscrews.

8 Install the event cable. The cover of the mass spectrometer must be removed to access the interface port of that instrument.