Cirrus2
Hardware Manual

Cirrus2 Hardware Manual - SP101017.107

April 2013

As part of our continuous product improvement policy, we are always pleased to receive your comments and suggestions about how we should develop our product range. We believe that the manual is an important part of the product and would welcome your feedback, particularly relating to any omissions or inaccuracies you may discover.

You can send your comments to:-

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Technology for Productivity
Spectra™ Products

Declaration of Conformity

Cirrus2 (LM118)

Declaration:

MKS Instruments UK Ltd. hereby declares that the Cirrus2 (LM118) product complies with the EMC and LVD directives and the following standards:

2004/108/EEC ELECTROMAGNETIC COMPATIBILITY DIRECTIVE

The item detailed above has been tested in accordance with:

EN 61326-1:2006 - Electrical equipment for measurement, control & laboratory use

2006/95/EC LOW VOLTAGE DIRECTIVE

The item detailed above has been tested in accordance with:

EN61010-1:2010 (3rd Edition) Safety requirements for electrical equipment for measurement, control & laboratory use

The technical documentation required to demonstrate the product meets with the requirements of the directives is available for inspection by the relevant authorities.

I hereby declare that the Cirrus2 (LM118) product meets with the requirements of the above referenced European Standards and complies with the referenced European Directives.

Signed:

Stephen Drysdale
General Manager
22 March 2013

CE 13

Overview

The Cirrus2 is a purpose built bench top quadrupole mass spec for gas monitoring at atmospheric pressure.

Incorporating the latest Cirrus2 hardware, the Cirrus2 has been designed to meet all the traditional requirements for a bench top RGA sensor, but offers data collection speeds in the milliseconds, even over the full dynamic range - unachievable with previous technologies.

Analogue and digital interfaces are provided for integrated systems and future technologies.

The Cirrus2 is designed to be operated in several ways:

From a host computer – an IBM compatible PC or MAC running the MKS Process Eye Professional or EasyView software package.

PC or MAC using a web browser such as Internet Explorer or Safari, or,

Integration into existing systems controlling through the use of the ASCII protocol command set.

This manual focuses on the Cirrus2 hardware and should be used in conjunction with the relevant user interface manual during installation.

Any required network communications cards should be installed and configured prior to installing the Cirrus2, or RGA software if supplied.

1. Specifications

Mechanical

Cirrus2

Dimensions:

430mm wide x 670mm deep (plus 100mm for connections) x 420mm tall

Weight:

34.5 kg

Analyser

Triple mass filter, 1-6amu, 1-200amu or 1-300amu, Faraday and SEM detector

Electrical

Power Inlet

100 – 240VAC, 50-60Hz @ 6.3A rms, 800W
Installation category (over voltage category) II to IEC664
Insulation Class I to IEC536

Fuses

Located on rear panel
All fuses are 20mm x 5mm H.R.C ceramic, 250VAC, characteristic (T) and compliant with IEC127

Environmental

Temperature range

0 to 40^{0}C, 80%RH non-condensing, operating and storage
Pollution degree 2 to EN61010
Enclosure IP20 to EN60529

Safety

IP20 to EN60529
The protective earth conductor of the power cord must be connected to the power source protective earth terminal.
There are no operator replaceable parts within the Cirrus2 unit.
The Cirrus2 must be used only in the manner specified in this document.

Connectors

The connectors for external circuits are for use only with MKS equipment, or equipment which has no accessible hazardous live parts.

The external circuits must comply with the requirements of EN61010-1 section 6.6.1.
Ports for connection of accessories do not carry hazardous potentials.

Do not position the Cirrus2 so that it is difficult to unplug the supply power cord.
Installation Category II comprises mains powered, local level appliances.
Use only an approved and correctly rated replacement mains cable.

Warning labels

Risk of electric shock

Affixed to the rear panel refer to:
Hazardous internal voltages that are exposed when the cover is removed

Risk of danger or malfunction

Read all instructions carefully before use
The control unit and signal ports are designed for connection to MKS accessories via MKS supplied cables

There are no accessible hazardous voltages or currents on these ports, MKS must be consulted before any non-MKS supplied cables or accessories are connected to these ports

Hot surface

Affixed internally refers to hot surfaces around the oven

Heavy object

This equipment weighs in excess of 18kg and should be lifted by at least two people.
To avoid muscle strain and or back injury, movers should employ lifting aids and the correct lifting techniques

Ventilation

Do not obstruct any of the outer cover ventilation openings.
Allow a minimum clearance of 50mm all round.

Do not exceed the maximum operating ambient temperature.

Additional Installation Maintenance and Operating Instructions

In order to comply with European regulations, the following procedures must be followed:

A) INSTALLATION

1. The installation procedures given in the operating and technical manuals must be followed in addition to these instructions.

2. The mains power cable must conform to local regulations and must have a protective earth (PE) conductor securely connected to the power plug protective earth contact.

3. Cables attached to all other ancillary signal and control ports must have a length of less than 3 meters. If greater length is required, MKS Instruments Ltd. must be contacted for technical guidance on possible EMC and safety issues.

4. The vacuum system on which the analyser/RF head is mounted must be earthed, to a protective earth, preferably to the same protective earth as the control unit.

B) OPERATION

1. The equipment is not authorised for use as a critical component in a life support or safety critical system without the express written approval of MKS Instruments Ltd.

2. All instructions given in the operating manual must be followed.

3. Adjustments are strictly limited to those accessible from the control panel and computer keyboard and only when running software supplied by MKS Instruments Ltd.

C) MAINTENANCE

WARNING-DANGEROUS VOLTAGES EXIST INSIDE THE EQUIPMENT

1. Maintenance functions must only be carried out by competent persons.

2. During the warranty period, faulty equipment must be returned to MKS Instruments, Spectra Products Ltd., unless special arrangements are made.

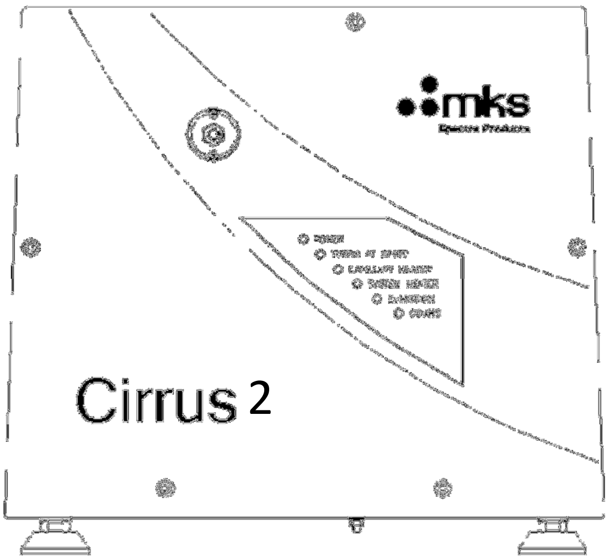
3. There are no user serviceable parts in the electronic equipment. Certain components are EMC and safety critical and must not be substituted. Replacement parts are available from MKS Instruments UK Ltd.

4. Equipment enclosures embody certain special fastenings and bonding devices that affect EMC and safety performance. These must be correctly re-fitted after servicing.

2. Connections and Indicators

Front Panel

Along with the capillary inlet, the front panel incorporates a bang of six status indicators to assist in the operation of the Cirrus2.



Power

The indicator is green when power is supplied to the Cirrus2 unit.

Turbo at Speed

The indicator is amber while the turbo molecular pump accelerates, changing to green when it has reached normal operating speed.
The filament protect trip is interlocked to this signal to prevent operation of the filament before a suitable chamber pressure has been obtained.

Capillary Heater

The indicator is amber when the capillary heating element is on.

System Heater

The indicator is amber when the heater temperature is set to 80degC “Heat”, and red when at the 180degC setting “Bake”.

Emission

The indicator is green when a filament is active and operating correctly.

Coms

This indicator blinks green when communications have been established with the Cirrus

Rear Panel

The rear panel incorporates all of the external connections required by the Cirrus2, as well as exhaust purge connections.

A description of each of the connectors can be found below.

The signal and data ports must not be connected to ports that could become hazardous live.

RGA Coms

A standard RJ45 type 10/100 Base-T Ethernet connector used to connect the Cirrus2 to a host PC, hub, switch or network.

Ensure you read through the network scenarios starting on Page 18 before connecting the unit to your network

Power

The mains power switch and fused IEC socket for connection to the local mains supply.

Analogue I/O Connector

A standard 15-way D-type socket used for interfacing with external equipment.
This may be already in use depending on the type of RGA system purchased.

This interface offers the following functionality:

Two analog outputs 0 to +10V 12bit
Four, quasi-differential analog inputs, -11 to +11V, with a maximum voltage on the return of ±0.5V

±15V power outputs both fused at 120mA, fuses are self resetting.

Pin	Function	Description
1	-15V	-15V supply output, fused at 120mA
2	Analogue Input 4 Return	
3	Analogue Input 3 Return	
4	Analogue Input 2 Return	
5	Analogue Input 1	±11v
6	Composite Return	Differential Output Return
7	Electrometer Differential Output	Direct Electrometer output from 50Meg feedback resistor
8	0V	
9	+15V	+15V supply output, fused at 120mA
10	Analogue Input 4	±11v
11	Analogue Input 3	±11v
12	Analogue Input 2	±11v
13	Analogue Input 1 Return	
14	Analogue Output 2	0 – 10v
15	Analogue Output 1	0 – 10v

NOTE:

The 120mA maximum load for the power supply outputs is shared between the Digital and Analogue connectors.

* Analog input 1 and Analog input 1 return are reserved for use with the internal cold cathode gauge.

Digital I/O Connector

See Interfacing Notes on Page 16 before making connections to this interface.

A standard 25-way D-type socket used for interfacing with external equipment. This may be already in use depending on the type of RGA system purchased, otherwise it is used to connect accessories such as a Remote Vacuum Controller.

The Digital I/O connector can also be used to provide alarm output signals and process trip signals.
This interface offers the following functionality:

16 configurable I/O lines
+3.3V power output fused at 120mA, fuses are self resetting
±15V power output fused at 120mA, fuses are self resetting
+24V power output fused at 120mA, fuses are self resetting

Pin	Function	Description
1	Multiplier Trip	Dedicated to Multiplier Trip
2	PA1	
3	PA3	
4	PA5	
5	PA7	
6	PB1	
7	PB3	
8	PB5	
9	PB7	
10	0V Digital	
11	0V Analogue	
12	-15V	-15V supply output, fused at 120mA
13	+15V	+15V supply output, fused at 120mA
14	PA0	
15	PA2	
16	PA4	
17	PA6	
18	PB0	
19	PB2	
20	PB4	
21	PB6	
22	+3.3V fused	+3.3V supply output, fused at 120mA
23	Not Connected	
24	GND	
25	+24V	+24V supply output, fused at 120mA

Note: The total power consumption on each rail (+3.3V, ±15V & +24V) for both the Analog and Digital I/O ports must not exceed 120mA.

Important Interfacing Notes

The Cirrus2 digital I/O is based on 3.3V logic. Interfacing to other voltages such as 5V should be done with careful consideration:

Logic High Output
There is a pull up / current source on all inputs/outputs to the local +3.3V supply rail. This current source is rated at 30µA minimum (300µA maximum). Therefore it will need to be buffered if an output capable of sourcing more current than 30µA is required.

Logic Low Output
In the logic low state the output will sink up to 10mA. Exceeding this value may cause damage to the instrument.

Inputs
The 30-300µA pull up / current source is always active regardless of whether the port is an input or output. As such it may be driven by an open drain / collector / contact closure output. This is the recommended way to use the inputs. However the inputs may also be driven by 3.3V logic. A voltage < 0.99V will be interpreted as a logical low. A voltage > 2.31V will be interpreted as a logical high.

Notes
a) Where appropriate, arrange the hardware/software configuration so that an input HIGH state is a safe condition. This ensures that if a connection should be unplugged the system will go into a fail-safe state.
b) In cases where the external equipment is a distance away or is likely to have a different ground potential, the fitting of opt couplers on the interface should be implemented.

WARNING
DO NOT DRIVE THE INPUTS ABOVE +3.8V OR BELOW -0.5V OR DAMAGE TO THE INSTRUMENT WILL OCCUR.

Exhaust Purge IN/OUT

You may want to connect the Cirrus to a nitrogen purge system, or vent the exhaust gas to an extractor system. You may have been advised whether we feel for your particular application nitrogen purging is necessary, desirable or absolutely vital.

Optional: The Cirrus includes the facility to purge the turbo pump bearings and vent the vacuum chamber with nitrogen. This feature is usually used when the unit is likely to be exposed to corrosive and/or toxic gases.

Flushing the pump exhaust

Connect a dry nitrogen supply at a pressure of 1 - 2 p.s.i. above atmospheric pressure to the IN port to improve detection levels.
Connect a second pipe to the port labeled OUT to exhaust the dry nitrogen safely. The exhaust nitrogen may now contain corrosive/toxic gases.

Exhaust the pump only

Even if you are not using nitrogen purge you MUST connect the Cirrus to an exhaust system.
Blank off the port marked IN and use only the OUT to exhaust the pump.

The standard configuration of Cirrus does not use rotary pumps, so there will be no hydrocarbon vapors emitted by the vacuum pumping.
However, options are available that may use external rotary pumps. These should always be vented into an exhaust system.

It is important that the pumps exhaust gases are ALWAYS vented safely. Even if they are not toxic or corrosive, they may cause asphyxiation.

Never block, or obstruct any pump exhaust, as this may cause dangerous internal pressure buildup.

3. Installation

The Cirrus2 should be installed on a flat, level bench top with adequate ventilation as specified in Specifications section of this manual. Periodic maintenance will be required during the lifetime of the unit, with this in mind some thought should be given to the location.
All connections should be easily accessible, with the Cirrus2 positioned so that strain is not placed on any of the cables or connectors.

Connecting to the Ethernet Port

Overview

Before connecting a cat5 patch lead to the socket marked “ETHERNET” please take the time to read through the following sections.
If the Cirrus2 is to be installed on your company network, then there are a number of different network configurations that must be considered before you continue.
There are four main network technologies employed in the distribution of network addresses (IP addresses) to network devices, the Cirrus2 can be configured to use any of the following:

Auto-IP
A mechanism where in the absence of a DHCP or BOOTP server on the network, network entities can obtain their unique IP addresses by a process of arbitration between devices. If a DHCP or BOOTP server is present on the network, Auto-IP will obtain an IP address from the server.

DHCP
Short for Dynamic Host Configuration Protocol, a server running on the network is responsible for assigning dynamic IP addresses to devices on a network.

BOOTP
Short for Bootstrap Protocol, an Internet protocol that enables a diskless workstation to discover its own IP address and the IP address of a BOOTP server on the network.

Static
Each address is issued manually to each device by the network administrator.

By default the Cirrus2 is configured for Auto-IP which is by far the simplest method if you are new to networking, or are installing the Cirrus2 into an existing Auto-IP or DHCP network.

If you intend to connect a Cirrus2 to an existing network, then you <u>must</u> consult your IT Specialist for advice on how the network assigns IP addresses.

<u>Do not continue until you are certain of your network configuration</u>

The following sections describe the different network connection options available to the user when installing the Cirrus2.

The Cirrus2 is to be connected to a network running **Auto-IP** or **DHCP**
Option - Use Auto-IP

If the Cirrus2 is to be connected to a network where existing devices obtain their IP address automatically, then no further configuration is required.
You can safely connect the Cirrus2 to your network.

The Cirrus2 is to be connected to a network running **BOOTP**
Option - Use Auto-IP

If the Cirrus2 is to be connected to a network running BOOTP, then your IT Specialist will need to perform certain tasks on the BOOTP Server to complete the installation.

Do not connect the Cirrus2 to your network without involving your IT specialist.

The Cirrus2 is to be connected to a network using **Static IP** addressing
See the Static IP Addressing section

For details on how to assign a static IP address to the Cirrus2, please see the guide on Page 23.
You will need to be allocated an IP address for use by your IT Specialist, or have them perform the installation for you.

Directly connecting to the Cirrus2

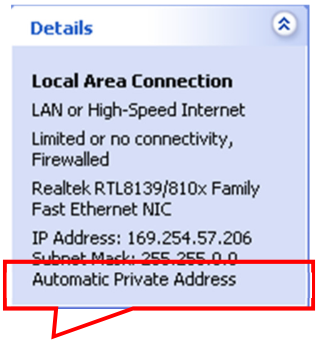
If your PC or MAC is not part of a network, you may choose to connect the Cirrus2 directly to the Ethernet port or a local hub. The following section describes what is required to get your unit up and running.

As stated earlier, the Cirrus2 is configured to use Auto-IP by default, all that is left to do is to ensure your PC or MAC is configured the same way.

Connect the Cirrus2 to your PC, MAC or hub with a standard Cat5 STP cable (there is no need to use a dedicated cross-over cable) and power on the Cirrus2

Next you need to check if your PC or MAC is configured for Auto-IP; most are by default.

Windows PC
Start / Connect To / Show All Connections
Click once on the connection hosting the Cirrus2
Note the information displayed in the Task Pane



If the text **"Automatic Private Address"** is displayed, then the PC is ready to begin communications with the Cirrus2 unit.

If the text **"Obtaining an IP address"** is displayed, then please wait a few moments for the sequence to complete.

If any other text is displayed, then you will need to make changes to the way your PC obtains IP addresses.

MAC
Apple Menu / System Preferences / Network
Ethernet / Configure
The option "**Using DHCP**" or "**Using Auto-IP**" should be displayed.

If your PC or MAC is not configured for Auto-IP, you can make the following changes to enable the function. You will need to have Administrative privileges.

Windows PC
Control Panel / Network Connections
Double-click the **Local Area Connection** used to host the RGA
Properties
Double-click **Internet Protocol (TCP/IP)** from the list.

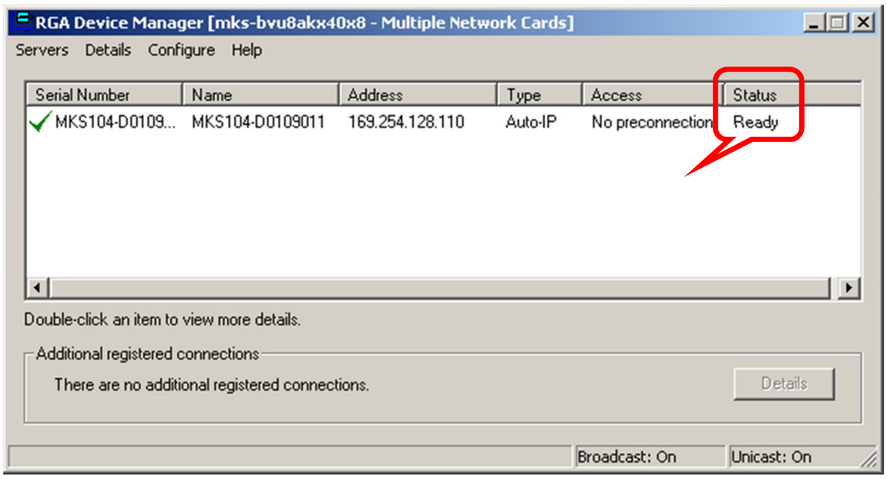
Choose the following options:
Obtain an IP address automatically
Obtain DNS server address automatically
Click **OK**

MAC
Apple Menu / System Preferences / Network
Ethernet / Configure
Choose the option "**Using DHCP**" or "**Using Auto-IP**"
Click Apply

While the PC or MAC is generating its automatic IP address, the Cirrus2 will be attempting to generate a compatible address.

You may need to wait 30 seconds after the PC or MAC has an IP address before the Cirrus2 is ready.

If you have already installed Process Eye Professional you can check the status of the Cirrus2 by launching the “RGA Device Manager” (see your Process Eye Professional user manual)
Double-click the RGA Device Manager icon to start the application. After a few moments the following dialog appears displaying a list of all discovered MKS RGA’s.



You can see that there is only one RGA displayed in the example, if you have more than one RGA on your network, this view may contain many entries.

Ensure you choose the correct instrument from the list.

The status, current IP address and type of IP addressing can be checked in this dialog. Once “Ready” is displayed you can close RGA Device Manager and begin using the RGA.

Assigning a static IP Address

If you are connecting to a network where static IP addresses are used, or connecting directly to your PC or MAC and wish to use fixed addressing, you will need to assign an address to the Cirrus2
To help you understand this scenario, the following explanation may be of use:

You have your standalone or networked PC / MAC configured to use a fixed IP address, for example 192.168.0.1. When the Cirrus2 is connected to the network, it will "ask" to be assigned an IP address from a DHCP server, as one will not be present in this type of network, the Cirrus2 will use a default address in the range 169.254.xxx.xxx.
Because the host PC and Cirrus2 are on entirely different IP ranges, communication between the two is impossible. We must issue the Cirrus2 with an IP address in the same range as the host PC.

> You will need to ask for an IP address and Subnet from your IT Specialist if you are installing on a network.

This is done using the RGA Device Manager Application found on the supplied MKS Utilities CD. This application does not require installation, but you will require administrative privileges to make changes to the Windows Firewall exceptions for the application to function correctly.

The RGA Device Manager application is designed to locate and retrieve information from any MKS RGA instrument, networked or otherwise. It does this by sending out a network broadcast, asking for information from any MKS RGAs discovered. It matters not that the host PC / MAC may be on an entirely different IP range than the Microvision2 . Once connected by RGA Device Manager we can assign a new IP address to the Microvision2 .

Double-click the RGA Device Manager icon to start the application. After a few moments the following dialog appears displaying a list of all discovered MKS RGA's.
You will need to ask for an IP address and Subnet from your IT Specialist if you are installing on a network.

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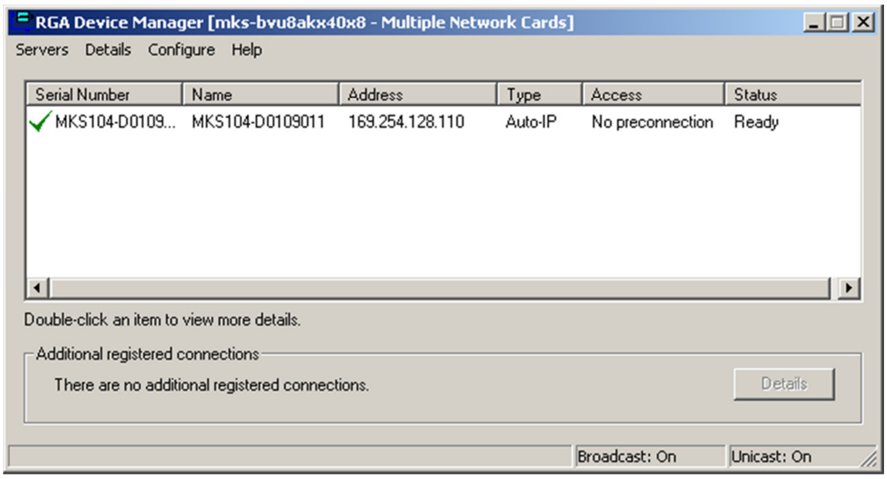
Double-click the RGA Device Manager icon to start the application. After a few moments the following dialog appears displaying a list of all discovered MKS RGA's.



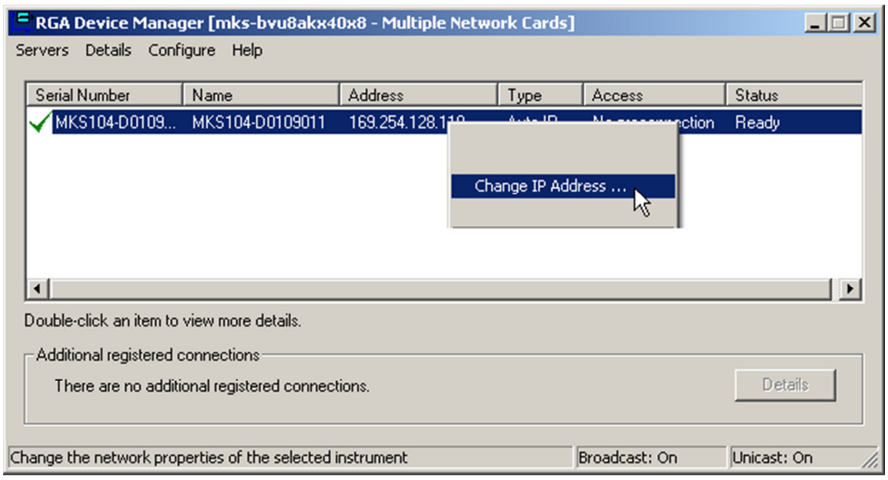
You can see that there is only one RGA displayed in the example, if you have more than one RGA on your network, this view may contain many entries.

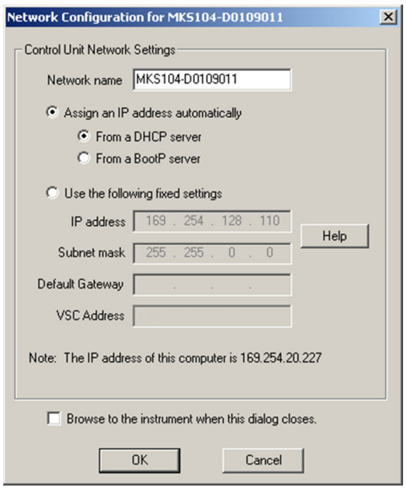
Ensure you choose the correct instrument from the list.

You can see that Device Manager displays all the pertinent information on the RGA, of particular interest are the "Address" and "Type" fields:

The "Address" field is the currently assigned IP address of the Cirrus2
The "Type" field describes the scheme the Cirrus2 is currently using to obtain an address.

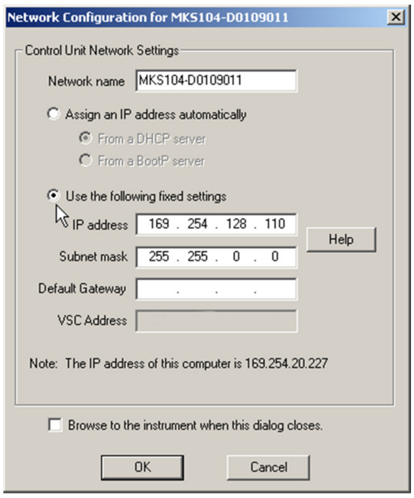
Right-click the instrument and select "Change IP Address".





You can see that the Cirrus2 is configured to receive an IP address.

We must change this option to continue.



Select the "Use the following fixed settings" option.

Enter the IP address and the Subnet issued to you by your IT Specialist.

The "Default Gateway" is used in situations where multiple networks exist, or for connection to the Cirrus2 from outside its local network. Your IT Specialist will instruct you on what to enter here, otherwise leave it blank.

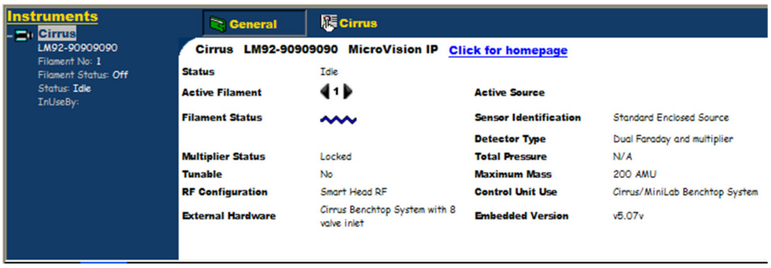
Once the relevant information has been entered, click OK to store and commit the changes to the Cirrus2 .

Powering up

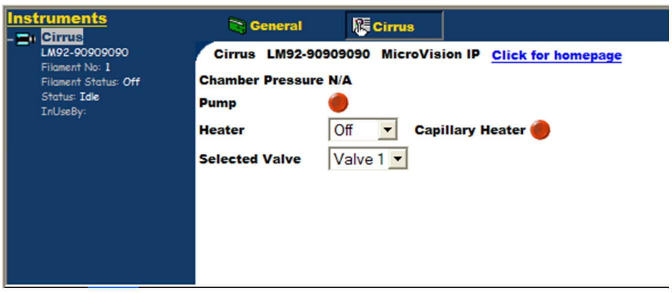
Switch on the Cirrus.
The internal cooling fans will start, but none of the pumps should be running, the only indicators lit on the front panel should be “Power” and a blinking “Comms” Led. This is due to interlocking preventing the powering up of components until the turbo pump is switched on and is up to speed.

Use the RGA Device Manager to locate and install your unit ready for use. This is explained in the Process Eye Professional User Manual.

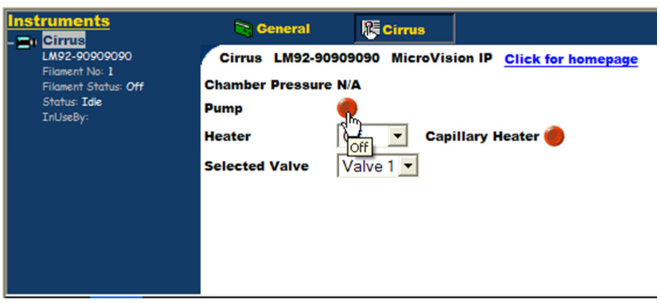
Once the unit has been installed, start the Process Eye software, once loaded you will see the unit information is displayed.



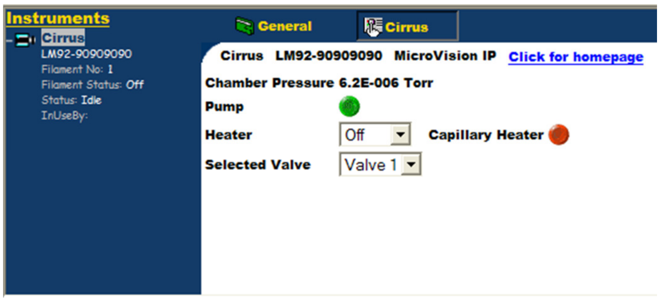
Clicking on the Cirrus tab allows control of the unit



To start the unit pumping, click the “Pump” button



Once the turbo pump is up to speed, the indicator will change to green in the software interface and on the front panel of the Cirrus2.



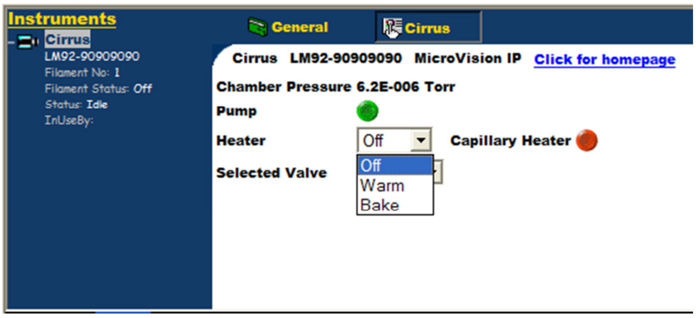
Starting the Quad

The quadrupole's filaments are interlocked with the internal pressure gauge, you will only be able to start the filament once the chamber has reached its operating pressure.

Baking

Before you can start to use the system properly, it will need to be run for sufficient time to allow the background peaks to drop. This amount of time can be significantly reduced by baking the system.

From the Heat/Bake pull-down list, choose the Bake option. A dry, inert gas should be flushed continuously through the capillary inlet during bake out. The quadrupole should be running with the filament on but only using the faraday detector.



The multiplier detector will be unavailable during baking

The total pressure should gradually start to rise as the system outgases and you should bake the system at least until the pressure starts to fall. In normal operation an initial bake of at least 24 hours is required, although in general the longer the system is baked the better.

To improve the background further, it is recommended that you run and degas both filaments. The amount of time spent in reducing the background peaks depends entirely on the application and is left to the discretion of the customer. If the Cirrus is switched off, it will vent to atmosphere introducing water vapour and should be baked again.

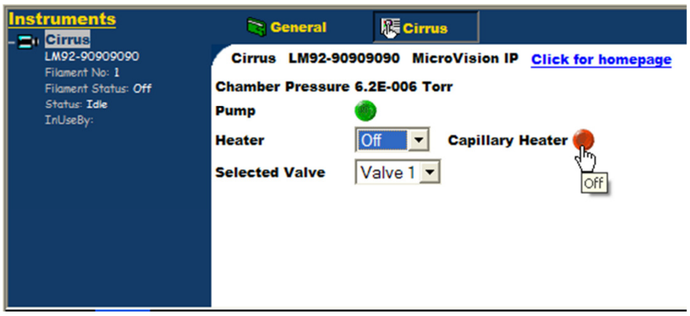
Temperature Settings

The Heat/Bake option should be set to Bake for the initial bake out to reduce the water background. After this period, running at the lower temperature of Heat is adequate in preventing the condensation of vapours in the vacuum chamber which could lead to memory effects.

Often it is not necessary to have the system heater on at all, but this will depend on the application.
The Cirrus is designed to allow continuous operation using the Faraday detector, with the system heater on Bake or Heat.

Capillary Heater

Use the Capillary Heater to lessen the chance of vapour condensing in the capillary leading to memory effects, or even blockage. Whether you need to heat the capillary or not depends on the application and the nature of the gases being sampled.
The Cirrus2 is designed to allow the capillary heater to be run continuously.



Shutting Down

The Cirrus2 should be left to run continuously unless it is not to be used for an extended period of time, or it needs to be shut down for maintenance.

To shut down the Cirrus2:

1. Switch off the Capillary and System heaters.
2. Switch off the quadrupole filaments.
3. Wait 10 minutes to allow the filaments to cool.
4. Stop the turbo by clicking the “Pump” button, you should be able to hear the pumps stop and the vent valve open.
5. Wait 5 minutes for the system to cool further and come to a full stop.

5. Maintenance

Overview

Periodic maintenance of your Cirrus2 will be required to ensure optimal performance. The following sections provide detailed information on filament replacement, ion-source cleaning or replacement and capillary maintenance.
If you feel uneasy about tackling any of the following maintenance topics, please contact us for advice or to arrange an on-site service visit where we will carry out the work.

Quadrupole Ion Source

The ion source contains two filaments, only one of which will be in use at any one time. The filament is heated to approximately 2000 degK at which temperature it emits electrons, which are used to produce the ions required by the quadrupole filter. At this high temperature, there are two deleterious effects;
The filament material slowly evaporates and condenses upon the surrounding surfaces. This effect is extremely slow but would require, from time to time, the cleaning of the surrounding source plates and ceramics and the replacement of the filaments.
The second effect is similar to the first except that the vacuum, under which the source is operating, has either a high oxygen or water content. Then instead of metal being deposited upon the surrounding source plates, layers of metal oxides are deposited. Being insulators, these have a far more noticeable effect upon the performance of the source and therefore a more frequent cleaning program should be adopted.

Capillary Inlet

The Cirrus system uses a capillary inlet to admit sample gas into the chamber for analysis. MKS Spectra produce a variety of capillary inlets but the Flexil capillary is dealt with in this manual.
The Flexil capillary inlet assembly consists of a white PTFE tube containing a fine bore stainless steel tube, down the centre of which is threaded a 0.32mm I.D. fused silica tube.
A low voltage power supply is connected across the stainless steel tube to provide heating of the fused silica tube.
You may need to replace the fused silica capillary tube which forms part of the capillary inlet assembly, if it has been damaged or becomes blocked.
Frequent baking can cause the flexsil liner to become brittle and break at even less than acute angles and over time, a build-up of particulates can leak to a blockage.

Orifice Disk

A pressure reducing orifice disk is fitted to the inlet flange of the RGA chamber, a build-up of particulates can block the holes in this disk.

Pumping System

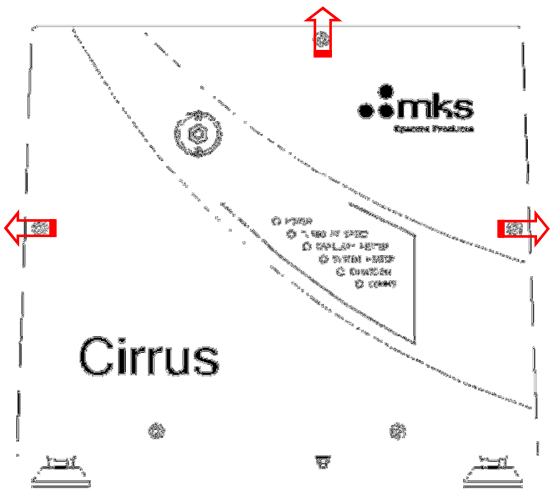
The turbo pump utilizes a “wet bearing” and <u>must</u> be serviced yearly to avoid premature failure. The internal diaphragm pump must also be included in your service plan.
Details of servicing are provided in the relevant pump user manuals supplied with your Cirrus2.

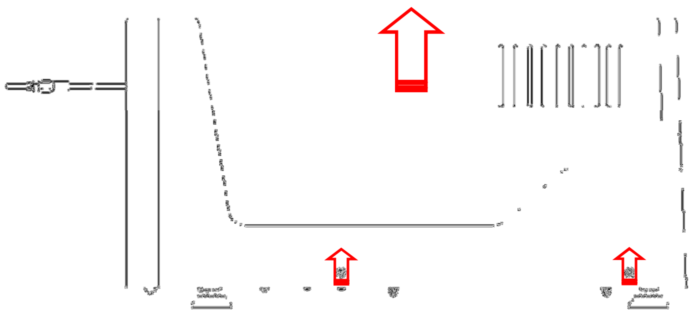
Removing the cover

These are not operator functions, only competent persons may carry out these operations

Before removing any of the Cirrus covers, ensure the unit is disconnected from the mains supply and has had adequate time to cool.
When removing parts from the system, ensure all fixings such as screws and washers are accounted for, any lost fixings could cause sevre damage when power is turned back on by shorting across electrical components

To remove the outer cover, remove the three Allen head bolts indicated from front panel.

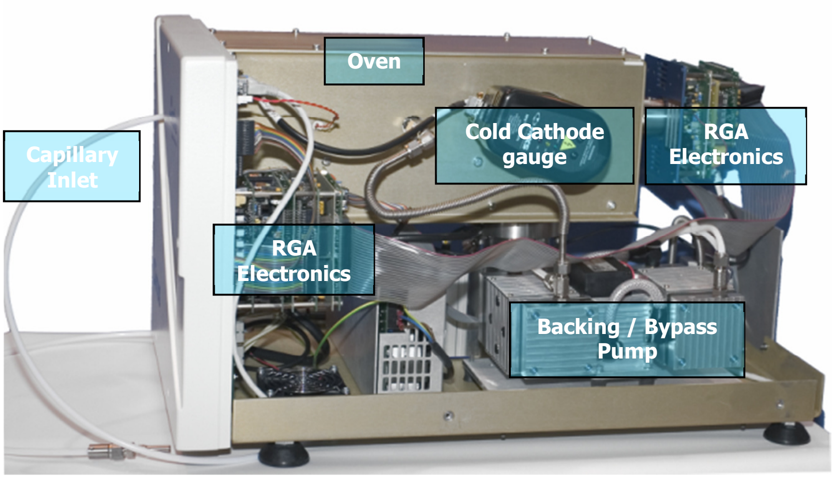




Remove the two Allen head bolts from either side of the outer cover.

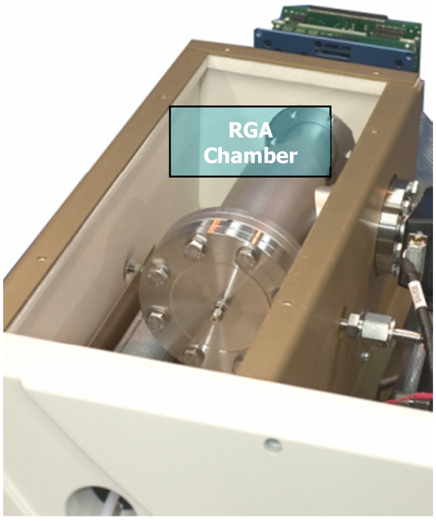
Gently remove the outer cover vertically from the chassis.

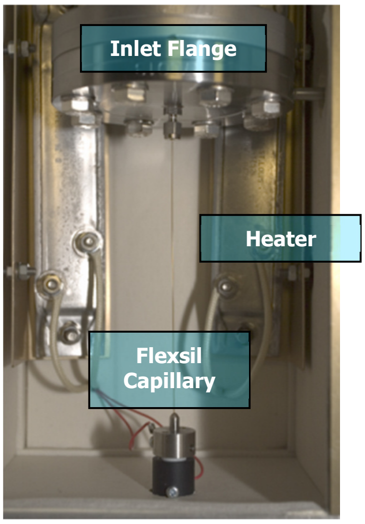
Internal Components



Before removing the oven top plate, ensure the oven has had adequate time to cool after baking.

To remove the oven plate, remove the eight Philips screws and lift the plate clear of the oven.





Capillary Inlet

Before carrying out ANY operations that involve the capillary system, take precautions to prevent contact with any hazardous substances that may have been sampled. Allow all parts of the inlet and oven to cool before commencing.
Wearing suitable protective eyewear is recommended.

The Cirrus2 system uses a capillary inlet to admit sample gas into the chamber for analysis. MKS Spectra produce a variety of capillary inlets but the Flexil capillary is dealt with in this manual.

The Flexil capillary inlet assembly consists of a white PTFE tube containing a fine bore stainless steel tube, down the centre of which is threaded a 0.32mm I.D. fused silica tube.

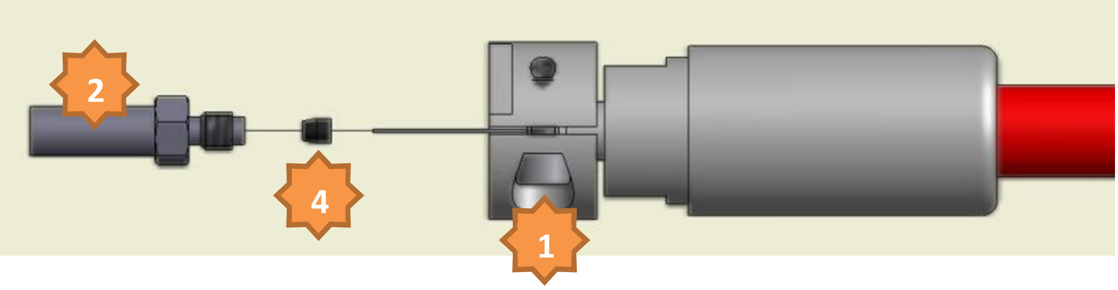
You may need to replace the fused silica capillary tube which forms part of the capillary inlet assembly, if it has been damaged or becomes blocked.

Removing the liner

1. Shut down the Cirrus by following the instructions in Shutting Down then disconnect from the mains supply. Remove the outer cover.

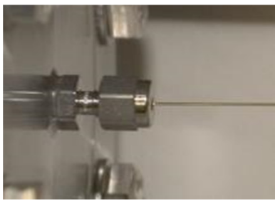
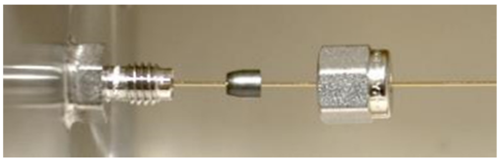
2. Disconnect the high pressure end of the capillary from the gas source. If there is a shut off valve, remember to close it.

3. Begin with the sample end of the capillary. Loosen the M4 cap-head bolt (1) on the Inlet Connector Clamp until you can rotate the stub-tube (2). Completeley remove the stub-tube and the graphite ferrule.



4. Remove the oven lid.

5. In the oven compartment, use a 5/16 inch spanner to undo the nut on the inlet flange and slide it, and the ferrule, along the fused silica tube towards the front of the oven.

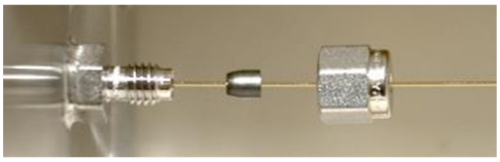
6. Carefully slide the fused silica tube down the capillary assembly away from the inlet flange and remove the nut and ferrule.

Once the fused silica capillary appears at the high pressure end you can pull it out of the assembly.

Fitting a new liner

1. Take the cassette of fused silica tubing and carefully feed one end down the capillary assembly from the high pressure end. The fused silica tubing is quite fragile but should slide freely down the inner bore of the capillary assembly. Continue to feed the tube down the capillary until it emerges inside the oven.

2. Thread the Swagelok nut and then a <u>new</u> ferrule onto the silica tubing as shown below.



Note the orientation of the ferrule

3. Thread the fused silica tube into the Swagelok reducer and continue until you feel it butt up against the vacuum chamber inlet, then withdraw the fused silica tube by 5mm.
Slide the ferrule into place then tighten the nut FINGER TIGHT. With a 5/16 inch spanner tighten the nut a further 1/4 TURN only.

4. At the high pressure end of the capillary, leave ½” of liner beyond the fitting and carefully cut. Ensure the cut is clean and the tubing has not been crushed.

5. Fit a new ferrule (note orientation) and slide the stub-tube onto the liner.

6. Tighten the stub-tube and retighten the Inlet Connector Clamp.

7. Perform a Leack Check of the system before fitting the oven lid or covers. See your RGA Software User Guide for details on the Leak Check function.

Replacing the Orifice Disk – Type 1 Disk

Before carrying out ANY operations that involve the orifice disk, take precautions to prevent contact with any hazardous substances that may have been sampled.

Allow all parts of the inlet and oven to cool before commencing.

You may need to replace the orifice if it becomes blocked or, more likely, you wish to fit a different size orifice in order to monitor an environment operating at a different pressure.

The orifice is a small disc, with a number of holes in it, which is fitted into a holder machined into the CF flange.

The inlet flange is mounted on the end of the quadrupole vacuum chamber opposite to the analyser flange. The flange is held in place by eight M8 stainless steel bolts.

The analyser in your Cirrus2 will almost certainly be fitted with a PVD source, so there will be a ceramic coupling which mates with the gas inlet tube on the top of the analyser. You may wish to remove this to get easier access to the orifice holder, although it is not essential.

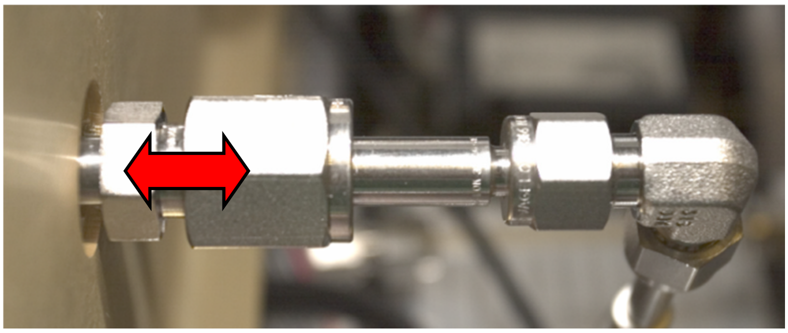
1. Shut down the Cirrus2 by following the instructions in Shutting Down then disconnect from the mains supply. Remove the outer cover.

2. Disconnect the high pressure end of the capillary from the gas source. If there is a shut off valve remember to close it.

3. Remove the oven lid.

4. Remove the capillary inlet as described on the previous page

5. Using both a 5/8” and ¾” spanner, separate the bypass joint on the cold side of the oven.

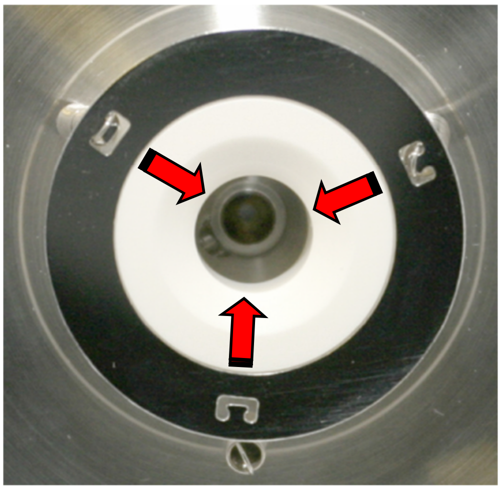


6. Using a ½" spanner, remove the eight bolts which secure the CF inlet flange to the vacuum chamber. Gently free the inlet flange from the chamber and slide out the bypass line through the oven wall.

You can now see the ceramic coupling, which sits over the PVD inlet of the quadrupole.

In order to use the orifice disk insertion and removal tools, this coupling must be removed from the inlet flange.

7. Remove the springs from the retention plate, by pushing them towards the centre of the inlet.



8. Remove the retaining plate and ceramic coupling from the inlet flange.

The ceramic coupling and retaining ring are held in place on the inlet flange by three springs fixed to threaded grub screws. The grub screws are then screwed into the flange.

Once all three springs have been removed we can proceed to remove the orifice disk using the removal tool.

Orifice Disk Tools

Orifice disk insertion and removal tools are supplied as part of the Cirrus2 toolkit. Do not attempt to remove or insert an orifice disk without using these tools. If they are missing from your toolkit, please contact your local MKS Spectra facility for replacements.
Clean each tool before use using IPA.

Tool Guide

The “Tool Guide” is fixed to the inlet flange using the three screws supplied, replacing the ceramic coupling assembly, and acts as the name suggests, as a guide for either the removal or insertion tools.

Removal Tool

The removal tool has a smaller diameter head than the insertion tool, this is to deform the orifice disk and allow easy removal from the tapered hole into which the orifice disk is fitted.

Insertion Tool

The insertion tool has a head slightly less in diameter than the orifice disk itself, and is used to fit the orifice disk into the tapered hole.

Fitting the Tool Guide

Fit the Tool Guide to the inlet flange using the three screws supplied.

Removing the Orifice Disk

Insert the Removal Tool into the guide and push the tool into the orifice disk. Press firmly until the tool bottoms against the guide.

Remove the tool and up-turn the inlet flange, the orifice disk will drop out.
DO NOT RE-USE THE ORIFICE DISK

Fitting a new Orifice Disk

Ensure you have purchased the correct size orifice disk, which should be a 15 Micron, 4-hole array.
P/N. 800010079

Keep the disk in its original packaging until needed.
Do not handle the Orifice Disk, use tweezers gently as not to deform or scratch the disk.

Pay particular attention to the side of the disk that has a black mark, this mark indicates the high pressure side of the disk.

Offer the new disk to the tapered hole in the inlet flange, marked side facing into the inlet flange, this should be done with the Tool Guide removed, as the disk needs to be offered as squarely as possible to the hole to avoid fouling.

Without disturbing the new Orifice Disk, carefully re-fit the tool guide to the inlet flange.
Once the guide is secured, check again that the new Orifice Disk is lying squarely in the tapered hole. If not, it must be re-positioned.

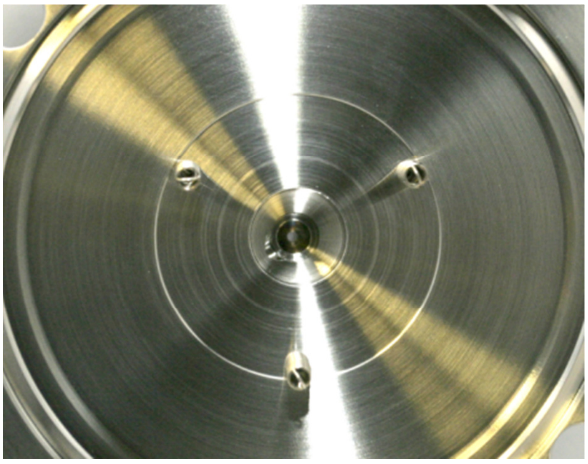
Use the Insertion Tool to push the Orifice Disk into the tapered hole. Some resistance will be felt as the disk seats into position. Push the insertion tool fully into the tool guide.

Once the disk has been pushed fully home, remove the Insertion Tool and Tool Guide.
Inspect the orifice disk for correct seating, with no gaps visible around the disks edge.

Note: The disk will be slightly cupped after correct fitting.

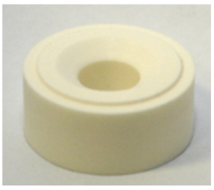
Reassembly

1. Re-fit the springs to the Inlet Flange, ensuring that they are not cross-threaded and inserted until the uppermost face of the grub screw is flush with the face of the Inlet Flange.

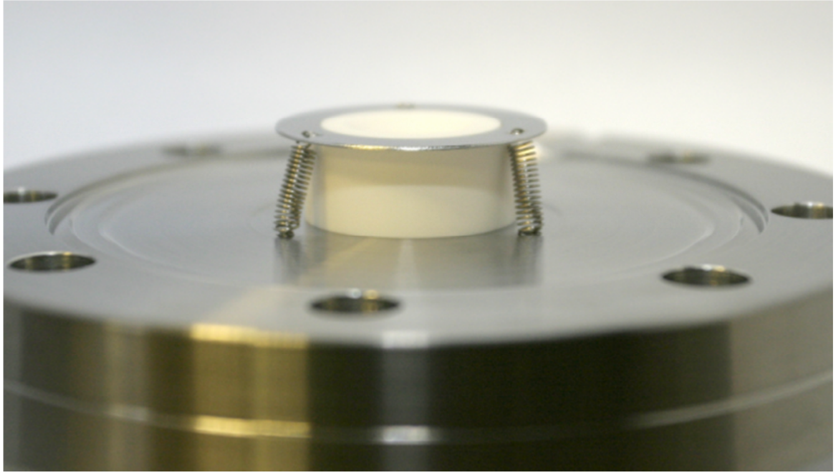


2. Secure the Retaining Ring by using two of the three springs.

3. From the side without a spring fitted, slide the Ceramic Coupling under the Retaining Ring, paying attention to the couplings orientation, which should be with the shouldered face uppermost.



4. Once the Ceramic Coupling is in place, check that the Retaining Ring is seated correctly around the shoulder of the Ceramic Coupling.



5. Clean all handled parts with a suitable solvent and re-fit the Inlet Flange to the chamber using a new copper gasket, by firstly sliding the bypass connection through the oven wall and then carefully locating the Ceramic Coupling over the PVD ion-source of the quadrupole.

6. Re-fit and tighten the eight M8 bolts to secure the Inlet Flange to the chamber.

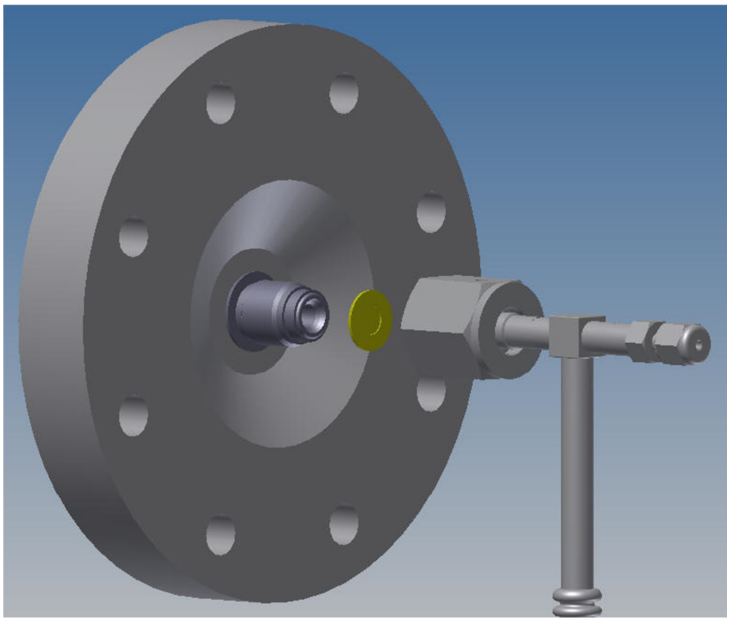
7. Re-connect the bypass line and tighten up the connectors.

8. Re-start the Cirrus2 and perform a leak check before re-fitting the oven lid and outer cover.

Replacing the Orifice Disk – Type 2 VCR

Later versions of the Cirrus 2 utilise a VCR orifice disk which makes replacement easier as there is no need to remove any vacuum flanges.

Disk part number – 800010097



To replace the disk, follow the steps on removing the outer cover detailed in the preceeding section to allow access to the inlet flange.

Loosen the VCR fitting using a ¾" spanner, the disk is fitted into a formed holder which is clipped onto the machined face of the inlet flange. Remove the old disk and replace with the new part, refit the holder to the inlet flange and retighten the VCR fitting.

. Analyser Maintenance (PVD and Open Source)

Before carrying out ANY operations that involve the analyser, take precautions to prevent contact with any hazardous substances that may have been sampled.

Allow all parts of the inlet and oven to cool before commencing.

Overview

The quadrupole analyser is the front end of your mass-spectrometer, it produces electrical signals which, when presented to your electronics, display the contents of your vacuum chamber in a meaningful fashion.

The analyser can be broken down into four separate areas by virtue of their function.

1. The ion source or ioniser

This is located at the top (furthest from the flange) of your analyser and its function is to take a representative sample of molecules and atoms from your vacuum chamber, convert them into ions and present them to the quadrupole filter.

2. The quadrupole filter

This is the centre section of your analyser. Its function is to take the ion beam generated in the source and separate the various ions by their mass to charge ratio (m/e) and present the single selected m/e to the collector.

3. The detector

This area of your quadrupole analyser is "hidden" inside the flanged housing. Its function is simply to convert the filtered ion beam presented by the quadrupole filter into a small electrical current, which can be passed to the electronics for amplification and subsequent display to the outside world.

4. The flanged housing

This is the only part of your analyser that you will see under normal operating conditions. Comprising of an industry standard 2.75" Conflat® flange with an electrical feedthrough, which carries the various supplies and signals to and from the quadrupole analyser.

All quadrupole analysers require periodic maintenance, the regularity of which is determined by its use. The cleanliness of the vacuum, hours of operation and the type of sample being analysed all have an effect on the analyser’s performance.

Apart from these considerations there are times when the analyser will require maintenance and these are when accidents happen i.e. the vacuum is vented with the filaments on, or someone forgets to turn on the water cooling for the oil diffusion pump.

Routinely there is only one area of the analyser that requires any maintenance, this is the ion source. The ion source contains two filaments, only one of which will be in use at any one time. The filament is heated to approximately 2000 deg K at which temperature it emits electrons, which are used to produce the ions required by the quadrupole filter. At this high temperature, there are two deleterious effects.

The filament material slowly evaporates and condenses upon the surrounding surfaces. This effect is extremely slow but would require, from time to time, the cleaning of the surrounding source plates and ceramics and the replacement of the filaments.

The second effect is similar to the first except that the vacuum, under which the source is operating, has either a high oxygen or water content. Then instead of metal being deposited upon the surrounding source plates, layers of metal oxides are deposited. Being insulators, these have a far more noticeable effect upon the performance of the source and therefore a more frequent cleaning program should be adopted.

CAUTION

THE QUADRUPOLE'S FILTER IS ACCURATELY ALIGNED BY SKILLED PERSONNEL USING SPECIALIST TOOLS AND JIGS.

UNDER NO CIRCUMSTANCES SHOULD THE FILTER ASSEMBLY BE DISMANTLED.

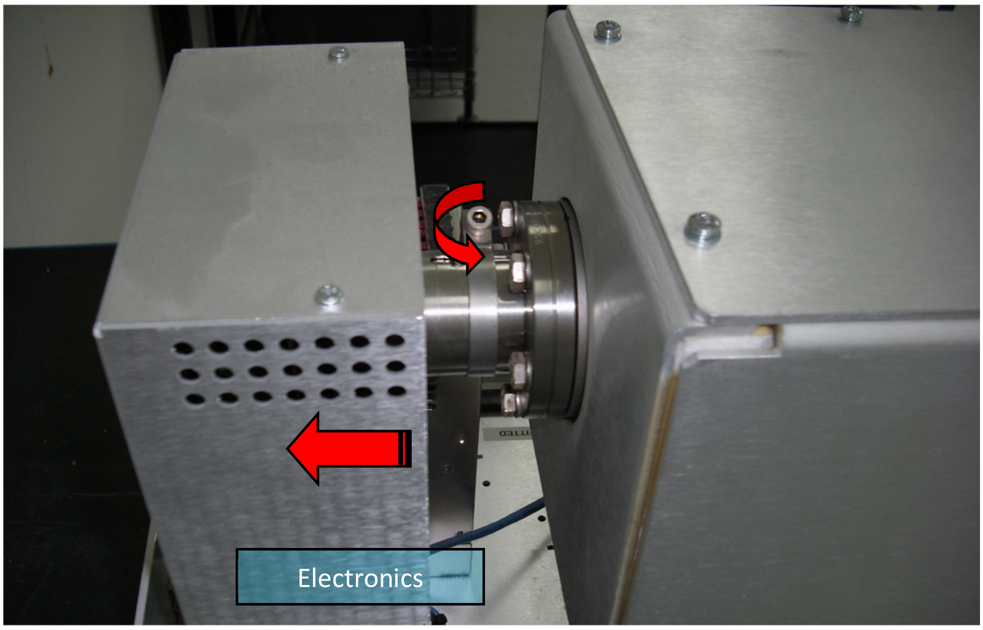
IF YOU ARE IN ANY DOUBT WHEN SERVICING YOUR ANALYSER, PLEASE CONTACT YOUR LOCAL SERVICE CENTRE.

Removing the Analyser

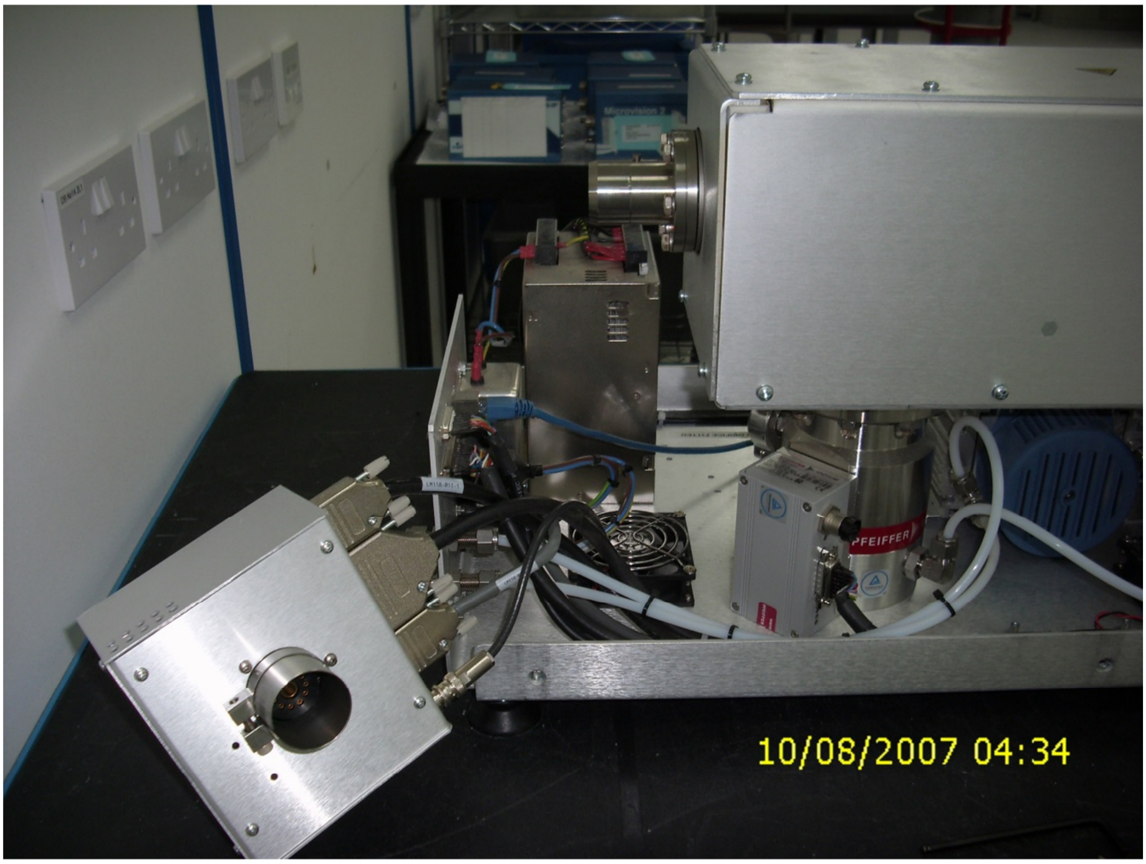
Ensure the Cirrus is disconnected from the mains supply, the turbo has stopped and the oven has had adequate time to cool.

When removing parts from the system ensure all fixing such as screws and washers are accounted for, any lost fixings could cause serve damage when the power is turned on by shorting across electrical components

1. Slacken the locking ring using a 4 mm Allen key.



2. By holding the front panel of the Electronics Package, carefully slide it free of the analyser. No electrical connector need to be removed from the unit, it can be positioned as shown in the picture below.



3. Make a note of the orientation of the analyser with respect to the vacuum chamber. Use the locking pip on the analyser flange as a reference (it will usually be in the 12 o'clock position).

4. Remove the six M6 bolts and washers which fasten the CF35 flange of the analyser to the vacuum chamber.

5. Carefully withdraw the analyser from the vacuum chamber. Leave the old copper gasket in place until you are ready to fit the new one, it will help protect the knife edge from accidental damage.

Analyser maintenance is fully described in the next section.

Analyser Maintenance

You should not attempt repair other than replacing the filaments or cleaning / replacing the ion-source.
Further servicing may be carried out on-site, or on an RTB basis.
Please contact your local MKS representative for further information.

Ohmmeter analyser checks

There are a number of circumstances when carrying out some simple checks with an ohmmeter can be worthwhile. If you suspect a failed filament, or want to check for shorts-circuits following maintenance, performing some simple checks can save a great deal of time.

In carrying out these checks, we can legitimately accept two ranges of meter readings as possibly acceptable and anything outside these ranges as being a definite fail. Any readings less than 1 ohm we can assume as a short-circuit and any reading above 5 Meg Ohm ($5x10^6$ ohms) as being open circuit. The following assumes that the analyser is still on the vacuum system and details all the possible tests.

Tools required: Ohmmeter with leads
Please refer to Page 50 for analyser pin numbers.

1. Attach a meter lead to pin 1 of the analyser feedthrough.

2. Connect the other lead to the analyser flange, you should read a short circuit. If not, you have either a serious problem, or more likely a faulty meter/meter leads. If after checking your meter, an open circuit still exists, contact your nearest MKS service center for advice.

3. Move the lead from the flange and connect to pins 2 through12 on the analyser feedthrough in turn. Each one should give an open circuit. If not, you have a short to earth.

There are two types of short to earth, an internal short between one part of the analyser and an earthed part of the analyser, or more commonly, a short between part of the analyser and the vacuum chamber.
In either case, remove the analyser from the vacuum chamber and repeat the test. If the result is the same, then you have an internal short and should contact your local MKS facility for advice.
Otherwise, you have a short to the vacuum chamber, check the dimensions of the vacuum chamber around the quadrupole analyser against the dimensions provided on Page 6 of this manual, or try refitting the analyser in a slightly different orientation.
Repeat the ohmmeter tests before pumping down the vacuum chamber. Remember that the ion source gets very hot during operation and the stainless steel components will expand slightly. Sometimes a short will only develop when the analyser has been run for a while and is up to temperature.

4. Move the meter lead from pin 1 and attach it to pin 2 of the analyser feedthrough. Connect the other lead to pins 3 through 12 on the analyser feedthrough in turn. Each one should give an open circuit.
Now move the meter lead from pin 2 to pin 3 and check to pins 4 to 12. Proceed around the feedthrough until all possible connections have been checked.
All the pins should show an open circuit to all other pins, EXCEPT pin 4 to 8 and pin 8 to 10, which should show short-circuit as these are the filament connections.
If any of the pins read short-circuit to another pin, contact your local MKS service center with the results of your tests and they will advise you how to proceed.

Checking filaments

The status of the filaments is constantly monitored by the Cirrus2 and the operating software. This is achieved by measuring the flow of electrons emitted by the hot filament, referred to as the emission current, flowing to the ion source cage.

This is normally maintained at a fixed value of 1mA. The current flow through the filament is increased until the value of emission current is reached. If, however, the control electronics reaches the limit of its filament current supply capability and the emission current has still not reached 1mA, a filament fail condition will exist.

In the vast majority of cases this will be due to a blown filament, more correctly described as an open circuit filament. There are other conditions, such as a heavily contaminated ion source, which will result in a filament fail condition when the filament is not open circuit.
If you suspect a blown filament, carry out the following test before removing the analyser from the vacuum system.

Connect meter lead one to analyser feedthrough pin 8, which is the common connection to both the filaments.
Connect the second meter lead to pin 4 (Filament 1). You should read short-circuit.
Next connect the second meter lead to pin 10 (Filament 2), again your meter should indicate short-circuit.
If either or both filaments are blown, the meter will indicate an open-circuit and the filaments will need to be replaced.
If the meter reading suggests that the filament is good but the control unit shows a filament fail, the most likely cause would be a break down in electrical continuity or contamination of the ion source.

Changing filaments

Changing filaments is the most common maintenance event with quadrupole analysers. For this reason the MKS analyser has been designed to make this task as quick and easy as possible.
Below is a list of the tools and equipment you will require. We recommend that you assemble the following items before you start. Remember that the instrument is supplied with a tool kit that contains some of the things you will need;

small jewelers screwdriver (2mm)
pair of tweezers
small pair of smooth jawed needle nosed pliers
pair of clean cotton gloves
clean bench on which to work
Ohmmeter
clean container in which to put small parts
replacement filament
a method of holding the analyser securely in an upright position, (a small bench vice is ideal).
pen and paper on which to make notes and sketches

You are now ready to pump down and continue the operation of your quadrupole.

Removing the filaments

1. Remove the analyser from the vacuum system making sure that you do not touch the exposed internal surfaces and place it on the bench in an upright position.

2. The filaments are located on the very top of the analyser, retained by four M2 x4 pan head screws. The electrical connections are made via two barrel connectors, one to each filament, see Fig.1.

3. Hold the barrel connectors highlighted in orange firmly with your pliers and slacken the screws highlighted in red until the barrel connector can be removed from the filament plate and the connecting lead, see Fig.2.

4. Remove the four M2 x4 pan head screws highlighted in red holding the filament plate in place, see Fig.3.

5. Remove the two filament plates. Carry out this step carefully so as not to damage the filaments, see Fig.4.

Refer to the views on the following page

PVD ion source views

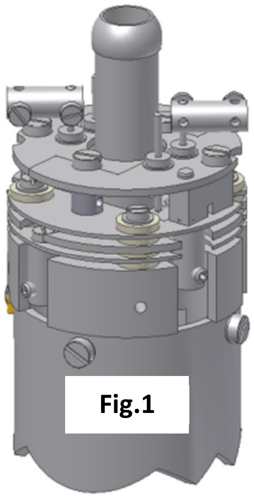


Fig.1

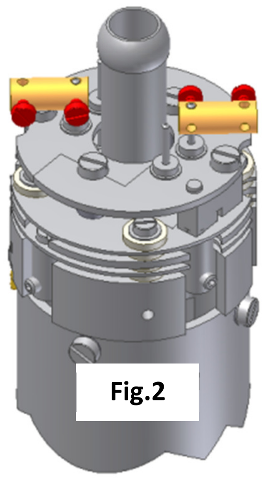


Fig.2

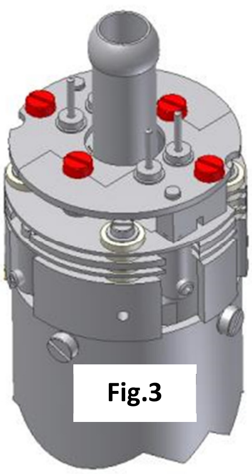


Fig.3

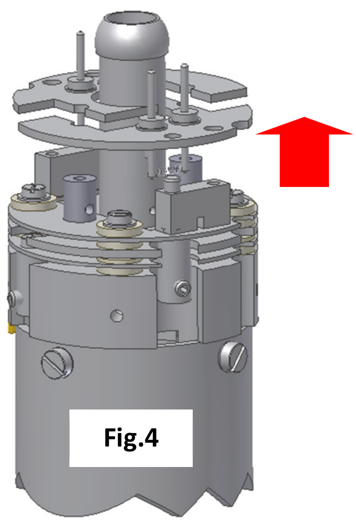


Fig.4

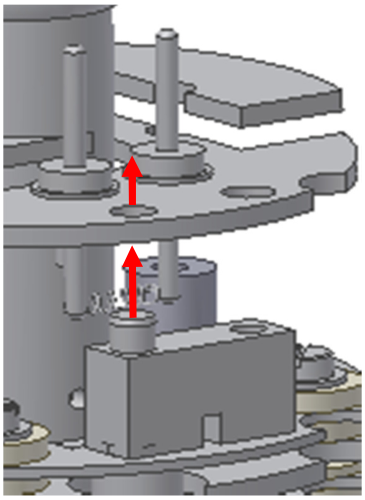
It is worthwhile at this stage to see if the source requires any attention, especially if the filament(s) have broken because of an over pressure situation in your vacuum system.

With the filaments removed, you have a clear view of the source cage. The signs to look for are powdery deposits, which will vary in colour but may be brown, blue, canary yellow or white depending upon the precise circumstances which led to their formation.
If these oxides are present, it is recommended that you refer to the section on ion source cleaning on page 47 before proceeding.

Fitting filaments

The fitting of filaments is simply the reversal of the procedure for removing them. Care should be taken at all stages to ensure that no shorts are introduced and that the analyser is kept clean.

1. Using tweezers carefully place each filament plate onto the mounting posts. Each filament plate has a locating hole which fits over a locating stud.



2. Loosely re-fit the four M2 x4 pan head screws through the filament plates.

3. Once all four screws have been loosely fitted, check the alignment of both filament plates before tightening securely.

4. Re-fit each barrel connector in the same orientation as removed, sliding each barrel connector over the connecting lead and filament post and while holding the barrel connector firmly with pliers, tighten all screws.

Do not slide the barrel connector all the way down the filament post as you may short-circuit the insulating feedthrough. Leave 1- 2mm of clearance

5. Before re-fitting the analyser to your vacuum chamber, refer to page 41 for details on how to check for any short circuits.

6. Replace the analyser into your vacuum housing and again check for shorts or grounding to the outer vacuum housing.

You are now ready to pump down and continue the operation of your quadrupole.

Ion Source cleaning

Cleaning while fitted to the analyser

Sometimes it is possible to clean the ion source without removing it from the analyser. For the user who has the necessary equipment available including a means to suitably dry the analyser, it is usually worth trying this method before removing or replacing the ion source. However, it is likely only to be successful where the source is contaminated with loose or alcohol soluble deposits.

Remove the analyser from the vacuum chamber and place it on the bench in an upright position (the use of a small bench vice is recommended), remove the filaments by following the appropriate guide for your type of analyser starting on Page 43.

Insert the analyser into the measuring cylinder so that the knife edge side of the flange rests on the lip of the cylinder. Note the level which the ion source comes to on the measuring cylinder before removing the analyser and filling the measuring cylinder with sufficient iso-propyl-alcohol to cover the ion source only.

Note: the measuring cylinder should be of a diameter and length to accommodate the analyser.
Put the measuring cylinder into the ultra-sonic bath for 10 to 15 minutes.
Remove the analyser and allow any excess alcohol to drain off. Keep the analyser inverted (feedthrough upper most) until it is dry.
Do not let any alcohol run down the analyser into the flange assembly as this will seriously damage the multiplier.
Check the condition of the ion source. A second or third wash may be required.

The ultra sonic bath may loosen some of the screws in the ion source. Take care not to throw these away when discarding the alcohol

The analyser must be dried of cleaning solution before it can be used. We recommend the use of a clean oven for this purpose. The oven should be set at 80^{0}C and the analyser baked for at least two hours.

Check the documentation on your cleaning solution for guidelines on handling the substance and any fire or explosion risks involved

After the bake period, check all the screws in the ion source are tight and re-fit the analyser to the vacuum chamber.
A further bake under vacuum will be required to drive off any remaining residue.

Remove for cleaning

The analyser design permits the removal of the ion source as one complete assembly for cleaning or replacement. The ion source is easily aligned to the main analyser assembly, allowing easy replacement without the need for special jigs.

Below is a list of the tools and equipment you will require. We recommend that you assemble the following items before you start. Remember that the instrument is supplied with a tool kit that contains some of the things you will need.

Small jeweler's screwdriver (2mm)
Pair of tweezers
Small pair of smooth jawed needle nosed pliers
Pair of clean cotton gloves
Clean bench on which to work
Ohmmeter
Clean container in which to put small parts
Pen and paper on which to make notes and sketches

1. Remove the analyser from the vacuum system, place it on the bench in an upright position (holding the analyser in a small bench vice or analyser support stand is recommended).

2. If you are cleaning the ion-source, then you should follow the steps on removing the filaments before continuing.

3. Loosen the two M2x4 screws highlighted in red that secure the filament connecting wires, see Fig.1.

4. Loosen the three M2 x3 set screws highlighted in red that secure the three insulated wires that run from the analyser flange assembly to the source, repeller and extractor plates and slightly bend the wires out of the way, see Fig.2.
Loosen the three M1.6 x2 screws highlighted in red that secure the three insulated wires that run from the analyser flange assembly to the source, repeller and extractor plates and slightly bend the wires out of the way, see Fig.2a.

5. Remove the three M2 x4 screws and shakeproof washers highlighted in red that hold the source assembly to the filter assembly, see Fig.3.

6. Carefully withdraw the source assembly from the filter, Fig.4.

Refer to the views on the following pages.

PVD Ion source views

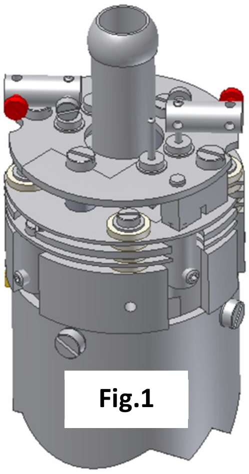


Fig.1

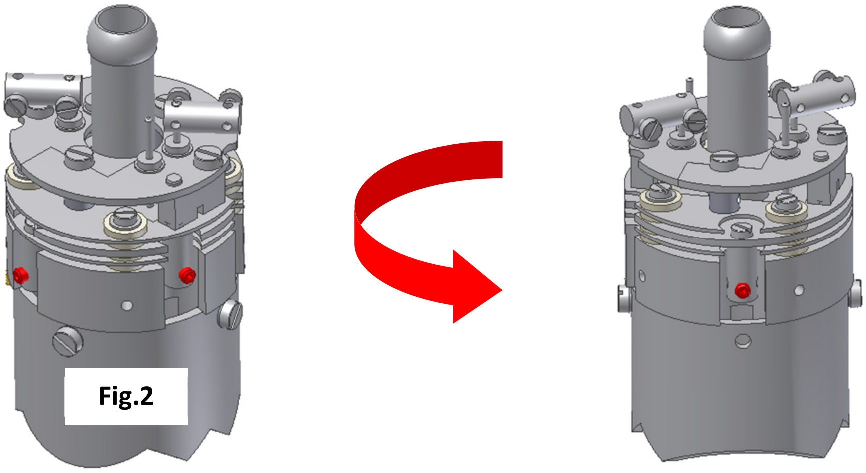


Fig.2

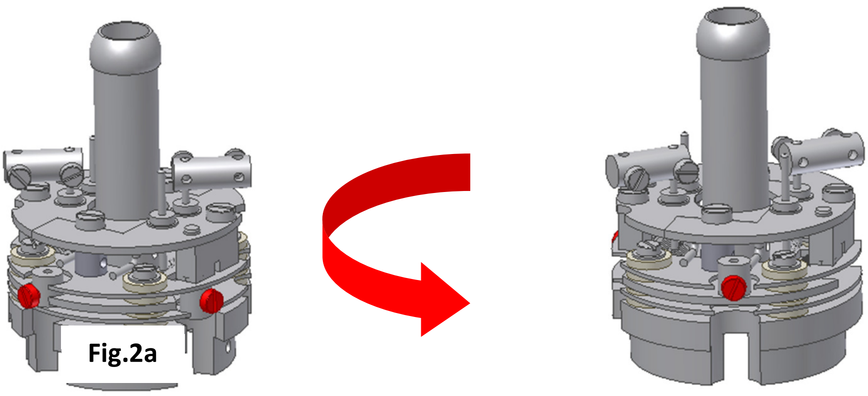


Fig.2a

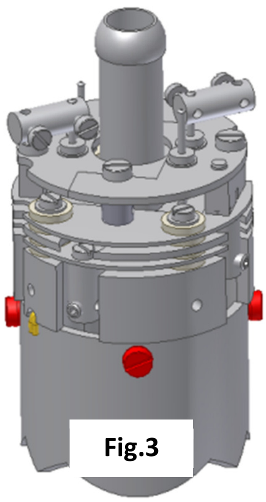


Fig.3

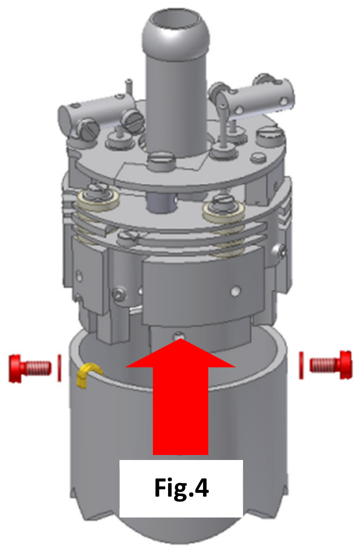
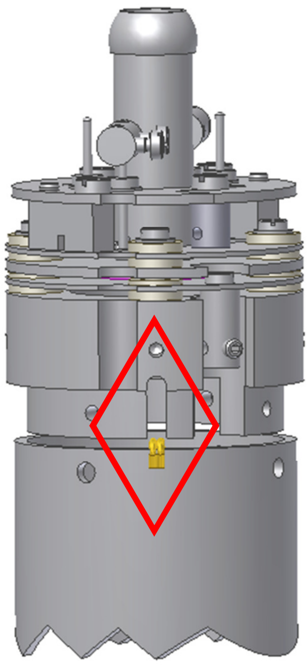


Fig.4

Refitting the ion source

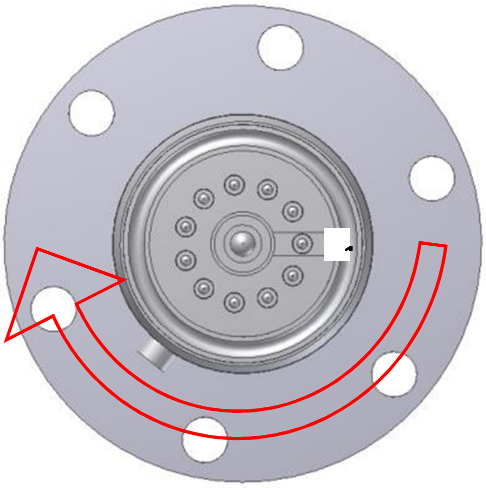
Refitting the ion-source is simply the reversal of the procedure for removing it. Care should be taken at all stages to ensure that no shorts are introduced and that the analyser is kept clean.

The orientation of the ion-source is by the small notch on the mounting base. This notch is positioned so that it sits over the gold leads visible on the filter assembly as indicated below.
Once positioned, slide home the ion-source assembly so that it sits flush on top of the filter, refit the three M2x4 screws and shakeproof washers and tighten securely.



Analyser pin-outs

Pin 1 is easily identified as it is the only pin with a metalized contact running through it. The pins are numbered clockwise from this pin.



Pin Descriptions	
Pin	Connection
1	Earth
2	Source plate
3	Electron Multiplier
4	Filament 1
5	Extraction plate
6	Suppressor plate
7	RF.1
8	Filament common
9	Repeller plate
10	Filament 2
11	RF.2

7. Spare Parts

Spare parts for your quadrupole analyser are available from your local MKS Instruments sales office under the part numbers detailed below.
Filaments are supplied in pairs, either on a single plate or on two plates depending on the analyser.
Replacement ion sources are supplied complete with filaments.

Filaments

Ion source	Tungsten	Thoriated Iridium
PVD	842-060	842-002

Ion source

Filter type	Ion source type	Tungsten	Thoriated Iridium
Any filter type	PVD	842-045	842-047

If you require a spare part not mentioned above, please contact your local MKS Instruments office for help on obtaining a part number.

8. Returning Your Unit for Service

If you wish to return your instrument for service, please follow these simple guidelines.

Contact your local MKS service facility to obtain a Returns Material Authorisation (RMA) number. We will require some instrument details, such as the serial numbers, date of purchase and a fault description.

Fill in the relevant sections of the Health and Safety Returns Form below, or we can provide you with a copy.

This form MUST accompany the instrument when returned, delays in providing this completed form will lead to delays in the servicing of the instrument.

Securely package all items to be returned, using the original packaging where possible and send to the address provided by the relevant service department.

Support Contact Numbers

Europe (UK) +44 (0) 1270 250150
USA +01 408-750-0347

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RETURNS FORM

Please complete the form and send to the appropriate MKS facility. Please ensure that we have this information before we receive the equipment. A copy should also be given to the carrier.

FAILURE TO COMPLETE THIS FORM OR COMPLY WITH THE PROCEDURE WILL LEAD TO DELAYS IN SERVICING THE EQUIPMENT

Our RMA number:	Customer P.O. No.

Customer bill to address:

Customer return address (if different from above):

Name:	Contact number:

Equipment returned:

Item 1:	Serial No.:
Item 2:	Serial No.:
Item 3:	Serial No.:

Please describe the system fault in detail:

Details of substances pumped, or coming into contact with the returned equipment.
Chemical names:

Precautions to be taken in handling these substances:

Action to be taken in the event of human contact or spillage:

I hereby confirm that the only toxic or hazardous substances that the equipment specified above has been in contact with are named above, that the information given is correct and that the following actions have been taken:

1. The equipment has been securely packaged and labelled.
2. The carrier has been informed of the hazardous nature of the consignment if applicable.

Signed:	Title:
Date:	Phone No.: