



Microvision Plus User Manual

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7 July 2009

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:-

MKS Instruments, Spectra Products.
Cowley Way
Crewe
Cheshire
CW1 6AG
U.K.

Tel: +44 (0)1270 250150
Fax: +44 (0)1270 251939
Email: manual_info@mksinst.com

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Declaration of Conformity

Spectra SensorTech Ltd.
Cowley Way
Crewe
Cheshire
CW1 6AG
United Kingdom

DECLARES THAT THE FOLLOWING PRODUCTS:

LM62, LM10 VACSCAN 100
LM63, LM10, LM4 VACSCAN PLUS 100, 200
LM61, LM10, LM4, LM9 SATELLITE 100, 200, 300
LM56 MICROVISION
LM70, LM76 MICROVISION PLUS
LM77 VISION 1000P
LM78 VAC CHECK
LM79 VISION 1000I
LM80 MINILAB
LM89 VISION 1000B
LM90 VISION 1000 C / E
LM92 MICROVISION IP
LM98 e-Vision
LM99 Cirrus
LM100 300mm Resistorr
LM102 e-Vision+

ARE IN CONFORMITY WITH THE FOLLOWING EUROPEAN DIRECTIVES:

2004/108/EEC ELECTROMAGNETIC COMPATIBILITY DIRECTIVE
2006/95/EC LOW VOLTAGE DIRECTIVE

THE APPLICABLE STANDARDS ARE:

EN 61326:1998 ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL &
LABORATORY USE

EN 61010-1:1993 SAFETY REQUIREMENTS FOR ELECTRICAL
EQUIPMENT FOR MEASUREMENT,
CONTROL & LABORATRY USE.

SIGNED:



J.M.Higgins
GENERAL MANAGER
DATE: 7th July 2009

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. The short earthing braid supplied with some products, must be fitted between the terminal on the RF head and one of the CF40 vacuum flange bolts.
4. Only cables supplied with the equipment may be used for interconnections. If extension cables are required to obtain a greater separation between control unit and RF head, or if longer serial communications cables are required, they must be supplied by MKS Instruments Ltd.
5. Cables attached to all other ancillary signal and control ports must have a length of less than 3 metres. If greater length is required, MKS Instruments Ltd. must be contacted for technical guidance on possible EMC and safety issues.
6. 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, Spectra Products 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.

WARNING

The Electron Multiplier (SEM) must not be operated at temperatures above 50°C.

With dual (faraday and electron multiplier) detector instruments, serious damage will be caused to the electron multiplier if it is operated at temperatures above 50°C.

No damage is caused to the multiplier by high temperatures provided it is not switched on.

The Microvision electronics should not be exposed to temperatures above 35°C.

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1. Specification

1.1 Mechanical

Microvision Plus

Size: 127mm wide x 127mm deep x 180mm deep plus 34mm over analyser connector.

Weight: 2.2kg

PUP80 Power Supply

Size: 95mm wide x 70mm high x 180mm deep plus 20mm over strain relief.

Weight: 1.1kg

1.2 Electrical

Power Inlet: 100 to 120, 200 to 240 V rms 47-63Hz 1.3A rms

Installation category (overvoltage category) II to IEC664

Fuses Internal, not user replaceable

Insulation Class I to IEC536

1.3 Environmental

Temperature range 0 to 40°C, 80%RH non-condensing, operating and storage.

Pollution degree 2 to EN61010

Enclosure IP20 to EN60529

1.4 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 either the PUP-80 power supply unit or the LM70 or LM76 Microvision Plus units.

1.5 Connectors

The connectors for external circuits are for use only with MKS Spectra 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 PUP-80 power supply so that it is difficult to unplug the mains power cord.

Installation Category II comprises mains powered, local level appliances.

1.6 Warning labels



On the front panel refers to:

- a. Accessible hazardous voltages on analyser connector, when not mated to the analyser, which may result in a non-hazardous electric shock if touched.
- b. Tuning adjustment holes, which are not for operator use.



On the rear panel refers to:

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

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

1.7 Ventilation

Openings in the front, top and bottom panels must not be obstructed. Allow a minimum clearance of 50mm all round. Do not exceed the maximum operating ambient temperature.

2. Introduction

The Microvision Plus is a complete quadrupole residual gas analyser (RGA) comprising of a quadrupole analyser, a Microvision Plus control unit, a low voltage power supply and the necessary interconnecting cables. As opposed to traditional RGA's the Microvision Plus incorporates all of the electronics normally found in a separate control unit and RF power supply into one extremely compact unit, which fits directly onto the quadrupole analyser.

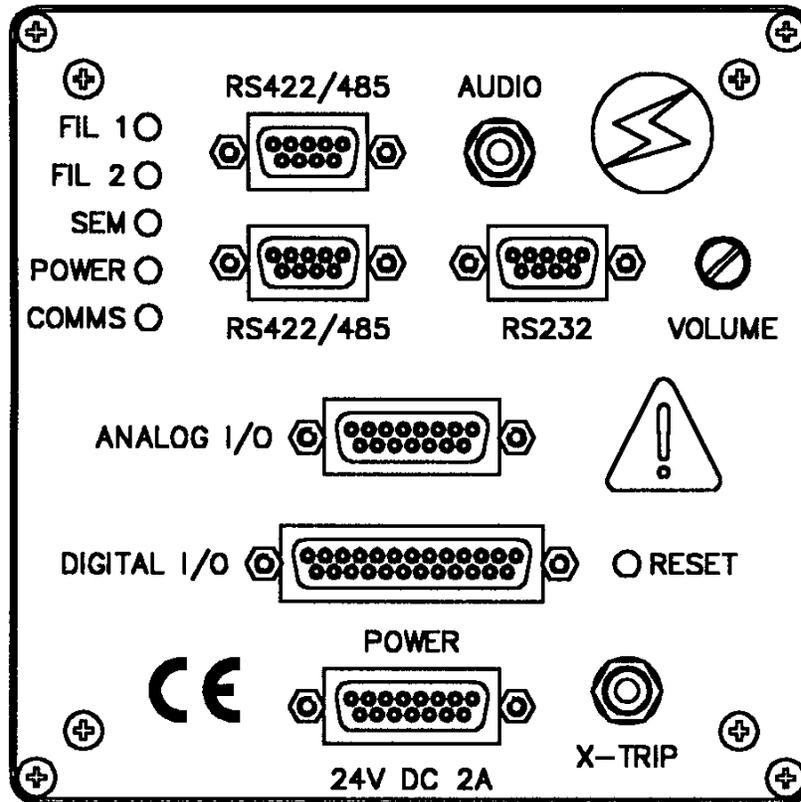
Microvision Plus is designed to be operated from a host computer which will normally be an IBM compatible PC, running the Spectra Process Eye V2.0 software package. Complete RGA systems may comprise of one Microvision Plus and a PC, referred to as a single headed system or a number of Microvision Plus units connected to a single computer known as a multi-headed system. Three types of serial communication are available to meet the needs of the various system configurations. A range of accessories is available to connect to the Microvision to further extend its operational capabilities.

This manual focuses on the Microvision Plus hardware and should be used in conjunction with the manual for the operating software.

2.1 General

The Microvision Plus is a single unit incorporating all the necessary power supply and data acquisition electronics for the residual gas analyser. Power is derived from a dedicated low voltage power supply, which is supplied as part of the standard package. Alternatively, power may be derived from a suitable Spectra Remote Vacuum Controller if the complete system incorporates one. The Microvision plugs directly onto the quadrupole analyser via the connector mounted on the front panel of the unit. All external connections including the power supply and serial communications link are made via connectors mounted on the rear panel of the unit. Microvision Plus contains no user serviceable parts and the only manual adjustment is the volume control for the audio, which is mounted on the rear panel.

2.2 User interface



Rear panel arrangement

2.2.1 Power connector

This is a 15-way D-Type socket labelled **POWER** used to connect the low voltage power supply unit.

Pin connections are:

1, 2, 3	+24 volts DC
9, 10, 11	0 volts (24 volt return)
Connector Shell	Functional Earth

The power input is 24 volts DC \pm 10%, 2 Amps max.

The primary power circuit is galvanically isolated from the system ground. The maximum common mode voltage is 60V DC or peak AC, current limited to 2mA.

2.2.2 Indicators

On the rear panel of the Microvision Plus there are five function LED indicators, their functions are described below.

1. Filament 1

This is a green LED labelled **FILAMENT 1** on the rear panel of the Microvision Plus unit. It will be illuminated when filament 1 is selected and the emission is established. If the emission is not at the selected value, it will be extinguished.

2. Filament 2

This is a green LED labelled **FILAMENT 2** on the rear panel of the Microvision Plus unit. It will be illuminated when filament 2 is selected and the emission is established. If the emission is not at the selected value, it will be extinguished.

3. SEM supply

This is an amber LED labelled **SEM** on the rear panel of the Microvision Plus unit. It will be illuminated when the multiplier detector is switched on.

4. Power on

This is a red LED labelled **POWER** on the rear panel of the Microvision Plus unit driven from the +5V supply. It will be illuminated when power is supplied to the Microvision Plus and the +5V rail is established.

5. Comms OK

This is a green LED labelled **COMMS** on the rear panel of the Microvision Plus unit. Its exact status is determined by the software.

2.2.3 RS232 connector

This is a 9-way D-Type socket labelled **RS232**. It is used to connect the Microvision to the host computer when the RS232 interface is used. This socket is also configured to provide a power feed for an Amplicon 490 fibre optic converter

Pin connections are:

Pin 1, 7, 9	Not Connected
Pin 2	TXD transmit data
Pin 3	RXD receive data
Pin 4, 6, 8	Fused +15V
Pin 5	0 volts

2.2.4 RS422/485 plug and socket

These are a 9-way D-Type socket and a 9-way D-Type plug labelled **RS422/485**.

Pin connections are:

Pin 1	0V (for termination network)
Pin 2, 3, 7	Not Connected
Pin 4	RXD (-)
Pin 5	RXD (+)
Pin 6	+5V fused (for termination network)
Pin 8	TXD (-)
Pin 9	TXD (+)

2.2.5 Audio output

This is a 3.5mm Jack socket mounted labelled **AUDIO**. It is used to connect headphones, wireless headsets or an external speaker so that audio tones generated in some of the modes can be heard. e.g. Leak checking tone and audio alarms.

The minimum load impedance should be 8 ohms and the power handling is 2 watts max.

2.2.6 Analog I/O connector

The Analog Input / Output connector is a 15-way D-Type socket labelled **ANALOG I/O**.

The Analog I/O port provides:

One Analog output 0 to +10V

Four quasi-differential Analog inputs, 0 to $\pm 10V$ with a maximum voltage on the return of $\pm 0.5V$.

$\pm 15V$ power outputs both fused at 100mA.

Pin Connections:

Pin	Function
1	-15V fused
2	Analog input 4 return
3	Analog input 3 return
4	Analog input 2 return
5	Analog input 1
6,7,14	Not Connected
8	0V analog
9	+15V fused
10	Analog input 4
11	Analog input 3
12	Analog input 2
13	Analog input 1 return
15	Analog output

Note that the total power consumption on each rail (+5V and $\pm 15V$) for both the Analog and Digital I/O ports must not exceed 100mA, otherwise internal fuses will operate. The internal fuses are not operator replaceable.

2.2.7 Digital I/O connector

The Digital I/O connector is a 25-way D-Type socket mounted labelled **DIGITAL I/O**. It is used to connect accessories such as a Remote Vacuum Controller (RVC), analogue output module, analogue input module and Valve Controller. The Digital I/O connector can also be used to provide alarm output signals and process trip signals.

The Digital I/O port provides:

- Two 8 bit bi-directional ports
- One interrupt / strobe input
- +5V fused at 100mA
- ±15V fused at 100mA

DIGITAL I/O Connector Pin Assignment		
Pin	Description	Notes
1	H1 interrupt / strobe	
2	PA1	
3	PA3	
4	PA5	
5	PA7	
6	PB1	
7	PB3	
8	PB5	
9	PB7	
10	0V Digital	
11	0V Analogue	
12	-15V fused	
13	+15V fused	
14	PA0	
15	PA2	
16	PA4	
17	PA6	
18	PB0	
19	PB2	
20	PB4	
21	PB6	
22	+5V fused	
23	Not Connected	
24	Not Connected	
25	Not Connected	

Note that the total power consumption on each rail (+5V and ±15V) for both the Analog and Digital I/O ports must not exceed 100mA.

2.2.8 Reset switch

The reset switch is accessible through a hole in the rear panel and is labelled **RESET**. Pressing the switch performs a hardware reset on the microprocessor in the Microvision Plus unit.

2.2.9 Volume control

This controls the volume of the audio tone generated by the external speaker in the Leak Check and Peak Jump Alarm modes. Note that in the Leak Check mode it is the frequency (pitch) of the audio tone, which increases with increasing signal not the volume.

The volume control should be turned clockwise to increase the volume and turned anti-clockwise to decrease the volume.

2.2.10 External trip

The external trip connector is a 3.5mm Jack socket mounted to the right of the Power connector labelled **X-TRIP**.

The external trip feature is used to protect the filaments and electron multiplier from exposure to high pressures. It allows an independent total pressure gauge or a signal from a vacuum control system to be connected to the Microvision Plus. It is the most effective of the trips available and we would always recommend its use. The external trip input can be driven in three ways.

1. Uncommitted relay contact

This is a low voltage (+5V, 1mA) contact. The contact should be closed for normal operation, open to trip the filaments or if the protective equipment is switched off.

2. Open collector TTL drive

The output transistor should be on for normal operation, open for trip or if the protective equipment is turned off.

3. Totem pole TTL drive

The signal should be low for normal operation, high for a trip condition or if the protective equipment is switched off.

The external trip circuitry is galvanically isolated from the system ground. The maximum common mode voltage is 60V DC or peak AC, current limited to 2mA.

3. Analyser Installation

This section deals with getting the equipment you have just bought out of its box and installing it on your system. If you have any questions or experience any difficulties, contact your local MKS Spectra representative who will be able to help you.

3.1 Unpacking

When you receive the Microvision Plus carefully check each item before removing the foam packaging and plastic wrapping, to ensure that no physical damage has occurred during shipment. Also, make sure all items have been received correctly by checking each item against the enclosed packing slip.

If there has been obvious damage during shipment, or if there are items listed on the packing slip as shipped which are not in the box, immediately contact your local MKS Spectra sales/service representative.

3.2 Inspecting the analyser

CAUTION

The analyser is both fragile and very easily contaminated by the slightest touch from your fingers or undesirable surfaces. Once you have inspected the analyser, return it to the protective envelope until you are ready for installation.

The analyser is supplied vacuum sealed inside a vac-formed plastic envelope for protection. Carefully unfold the envelope to allow access to the analyser.

Do not discard this packaging.

Hold the analyser **ONLY** at the vacuum flange.

Hold the analyser at the flange, with the quadrupole and ioniser structure vertically up. Carefully inspect all the observable insulators for damage.

Look at each lead from the flange to its termination point to ensure that it does not touch any other element of the analyser.

3.3 Installing the analyser

The vacuum chamber in which you intend to mount the analyser must have a 2.75 inch UHV Conflat® flange fitted with a tube of 35.0mm (1.378 ") minimum ID, inclusive of a good welded joint.

The distance from the end of the analyser to its mounting flange depends on the type of system. Refer to the table below:

Analyser Type	Length
100 amu	155mm (6.1")
200 amu single filter	155mm (6.1")
200 amu double filter	180mm (7.1")
300 amu double filter	180mm (7.1")
300 amu triple filter	230mm (9.1")

There must be at least the distance given above free of obstructions inside the vacuum chamber. If your chamber does not meet the above criteria, you should use a specially designed adapter so that the analyser may be mounted outside the chamber. Please contact your local MKS Spectra representative for assistance.

3.4 Checking the system pressure

Quadrupole analysers cannot be operated at pressures higher than 5×10^{-4} Torr and in the case of dual detector analysers (faraday and electron multiplier detectors), the multiplier should not be used at pressures above 7.6×10^{-6} Torr.

Operation above these limits will cause irreversible damage to the filaments and possibly the ion source.

Permanent damage to the multiplier will be caused if it is used outside the above ranges.

Make use of the X-Trip interlock to prevent accidental damage to the analyser.

3.5 Mounting the analyser

The standard 2 ¾ " Conflat® flange on the analyser can be sealed to the vacuum chamber with either a copper gasket, or a Viton® gasket with a square cross section. Which one you choose depends on the ultimate pressure you expect in your system and whether you intend to bake the system.

If it is not already clean then clean the gasket with suitable solvent and dry it. Remove the analyser from its shipping envelope, slip the gasket over the quadrupole structure and set it in the grooves of the flange surface.

Carefully insert the analyser into the vacuum chamber ensuring that you do not allow the leads to touch the walls of the vacuum chamber. Make sure the gasket does not slip part way out of its slot as you push the two flanges together.

Rotate the flange until the locating key on the feedthrough housing tube is as close to 11 o'clock as the bolt holes will allow. This will ensure that the Microvision is in its preferred position, although it can be mounted in any orientation.

Bolt the feedthrough flange to the vacuum chamber flange using the torque appropriate for the gasket material used.

Do not discard the plastic shipping envelope or the two-piece foam packing surrounding it.

If in the future you need to return the analyser for service, it should be returned in its original packaging to avoid damage.

4. Microvision Installation

4.1 Installation

Rotate the locking ring on the RF/analyser connector so that the slot lines up with the keyway on the connector tube. Hold the Microvision unit so that the keyway lines up with the locating key on the analyser flange.

Gently slide the Microvision unit on to the analyser. TAKE GREAT CARE the pins on the vacuum feedthrough are easily damaged. DO NOT force the Microvision unit on to the analyser.

When all of the pins are engaged, push the Microvision firmly onto the analyser to ensure electrical continuity. The last 3mm (1/8") is important. When correctly fitted the front face of the RF/analyser connector should butt up against the analyser flange.

Finally, rotate the locking ring to lock the Microvision in place. You will not be able to do this if the Microvision is not pushed fully onto the analyser.

4.2 Electrical connections

The serial communications link between the Microvision and host computer may conform to RS232, RS422 or RS485 and this will determine which of the connectors is used.

RS232 -Using the cable supplied connect the 9-way D-Type plug to the 9-way D-Type socket labelled **RS232** on the rear panel of the Microvision. The other end of the cable should be connected to an available Com port on the host computer.

RS422 -Using the cable supplied connect the 9-way D-Type plug to the 9-way D-Type socket labelled **RS422/485** on the rear panel of the microvision. The other end of the cable should be connected to an available Com port on the host computer.

RS485 -The cable from the preceding Microvision in the daisy chain should be connected to the 9-way D-Type socket labelled **RS422/485** on the rear panel of the Microvision. The cable to the next unit in the

daisy chain should be connected to the 9-way D-Type plug labelled **RS422/485** on the rear panel of the Microvision.

POWER - Insert the 15-way D-Type socket on the output lead of the power supply unit into the 15-way D-Type plug labelled **POWER** on the rear panel of the Microvision.

Attach the line cord to the power supply. The power supply will automatically set itself to operate with the local line voltage.

When the power is switched on the LED on the rear of the Microvision will illuminate.

Care should be taken in routing and securing all cables. Avoid running the serial cables next to mains power cables.

5. Baking

The Microvision should not be exposed to temperatures above 40°C, it should therefore be removed from the analyser during baking.

The analyser may be baked up to 250°C but care should be taken to avoid exposing the ceramic feedthrough to sudden changes in temperature.

The Microvision may be supplied with the factory fitted Bakeable Extender option, in which case the Microvision need not be removed and the analyser may be run during baking. Please contact your local MKS Spectra facility for further details of this option.

CAUTION

The Electron Multiplier (SEM) MUST NOT be operated at temperatures above 50°C.

6. Analyser Maintenance

6.1 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.

6.2 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 following some 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 take as a short and any reading above 5 Meg Ohm (5×10^6 ohms) as being open circuit. The following assumes that the analyser is still on the vacuum system and goes through all the possible tests.

Tools required: Ohmmeter with leads

Please refer to Page 36 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 Spectra service center for advice.
3. Move the lead from the flange and connect to pins 2 to 12 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 Spectra facility for advice.

Otherwise, you have a short to the vacuum chamber, check the dimensions of the vacuum chamber around the quadrupole analyser, or try refitting the analyser in a slightly different orientation.

Repeat the ohmmeter test 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 to 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 pin 8 and pin 8 to pin 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 Spectra service center with the results of your tests and they will advise you how to proceed.

6.3 Checking filaments

Filament status is constantly monitored by the control unit 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 a short-circuit.

Now connect the second meter lead to pin 10 (Filament 2), again your meter should indicate a 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. Ensure that the face of the analyser connector housing on the control unit butts up to the analyser flange.

Examine the RF/analyser connector on the front of the control unit and check that none of the gold sockets are pushed out of place.

6.4 Changing filaments

The analyser is fitted with dual filaments mounted on a single plate. Changing filaments is the most common maintenance event with quadrupole analysers. For this reason, the MKS Spectra 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 contained 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

Refer to the exploded views of the Filament Plate shown on Page 38.

6.4.1 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 and are retained by two M2 x 4 pan head screws (Item 3). The electrical connections are made via three barrel connectors (Item 2), one to each filament and one to filament common.
3. Hold one of the barrel connectors firmly with your pliers and slacken the outermost screws (Items 1 and 6) until the barrel connector can be removed from the filament plate and the connecting lead.
4. Repeat the above for the other two barrel connectors.
5. Remove the two M2 x 4 pan head screws that hold the filament plate in place and remove the filament plate assembly. Carry out this step carefully so as not to damage the Source Cage.
6. Remove the Filament Screen (Item 5).

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, these 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 source removal and cleaning before proceeding, see Page 30.

6.4.2 Fitting new filaments

The fitting of new 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. Place and align the new Filament Screen on the source plate mounting posts.
2. Using tweezers, carefully offer the filament plate onto the mounting posts. Be careful not to touch the source cage with either filament. There is no orientation of the filament plate required, except that the mounting holes line up with the mounting posts.
3. Re-fit the two M2 x 4 pan head screws through the filament plate and filament screen and tighten securely. Do not over tighten.
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.
5. Before re-fitting the analyser to your vacuum chamber, carry out Section 7.2 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.

6.5 Ion Source cleaning

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.

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 contained 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

Ultra-sonic bath

Measuring cylinder

Iso-propyl-alcohol

Some method of holding the analyser securely in an upright position (a small bench vice is ideal).

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 as described on Page 28.

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.

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.

Note: 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 deg. C and the analyser baked for at least two hours.

Note: 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.

6.6 Cleaning or replacing the ion source

The analyser design permits the removal of the ion source as one complete assembly, which can be replaced or dismantled for cleaning. The ion source automatically aligns on 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 contained 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
- Source alignment jig
- 4 Pieces of straight clean wire (NOT tinned or insulated) 1mm x 25mm
- Ohmmeter
- Clean container in which to put small parts
- Replacement filaments
- Replacement source parts if necessary
- Set of replacement ceramics is highly desirable if none are cracked and essential if any are broken
- Some 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

Refer to the exploded views of the Analyser shown on Page 37.

6.6.1 Removing the ion source

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 is recommended) and remove the filaments as described in Section 7.4.1.
2. Loosen the three M2 x 4 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.
3. Remove the four M2 x 4 screws (Item 2) that hold the source assembly to the filter assembly and carefully withdraw the source assembly from the filter.

6.6.2 Dismantling the source assembly

Before proceeding with this section, please ensure that you have the correct Source Alignment Jig and spare ceramics and screws available.

Refer to the exploded views of the Source Assembly shown on Page 37.

1. Carefully unscrew the four M1.6 x 8 screws (Item 1) and withdraw them from the assembly.
2. Using tweezers remove the four ceramic washers (Item 3), if undamaged keep in a safe, clean place ready for the re-assembly.
3. The Repeller Plate (Item 4) can now be removed from the mounting ring.
4. Using tweezers, remove the four ceramic washers (Item 3) and the four ceramic tubes (Item2), if undamaged keep safe as before.
5. The Source Plate (Item 5) can now be removed from the mounting ring.

This is normally as much as you will need to dismantle for cleaning or replacing source components. The Extract plate does not usually require service, as it is furthest away from potential contamination. However, if you wish to remove the Extract Plate, see the exploded diagram on Page 39.

6.6.3 Source Re-assembly

Refer to the exploded views of the Alignment Jig shown on Page 40 and the Source Assembly shown on Page 39.

1. Place the source alignment jig flat on the bench and slide in the source mounting ring, aligning the extract plate's barrel connector with the alignment mark on the jig.
2. Insert each of the four lengths of wire into the four castellations, which will hold the ceramic parts in place while the source assembly is rebuilt.
3. Slide one ceramic tube (Item 3) down each of the wires and then a ceramic washer (Item 4).
4. Orientate the source plate so that the largest circular cutout is above the extract plate's barrel connector and carefully slide it down the wires and over the ceramic tubes.
5. Place one ceramic washer over each of the exposed ceramic tubes.
6. Orientate the repeller plate so the circular cutouts align with the two visible barrel connectors and slide it down the wires over the ceramic tubes and onto the ceramic washers.
7. Place one ceramic washer over each of the exposed ceramic tubes.
8. Carefully remove one of the wires and replace with a M1.6 pan head screw (Item 2) and the M1.6 stainless steel washer (Item 1), which should be screwed down but not tightened, repeat this for the remaining three wires.
9. Check that all the plates and ceramics are seated properly before tightening the screws fully. Be careful not to over-tighten, as this will damage the ceramic spacers.
10. Push out the completed source assembly from the jig and place it on a clean, non-conducting surface. Using an Ohmmeter, check that there are no short circuits present between any of the three plates, or the source mounting ring.

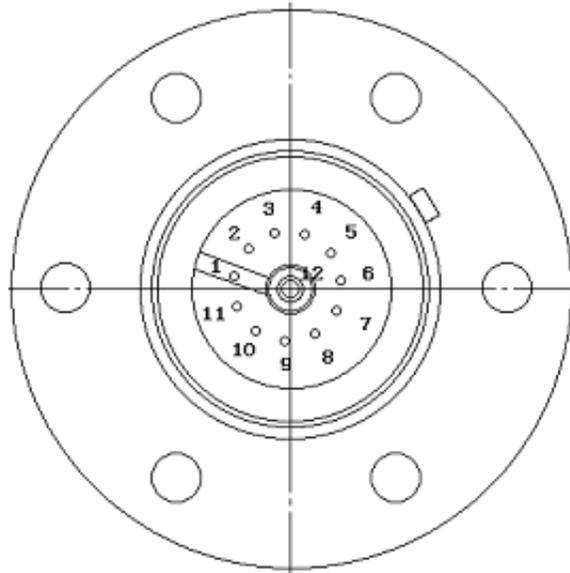
If any shorts are discovered, correct them before continuing.

11. The filament plate can now be re-fitted and the remaining connection made.

Once again, check all connections with an Ohmmeter before returning the analyser back to the vacuum chamber.

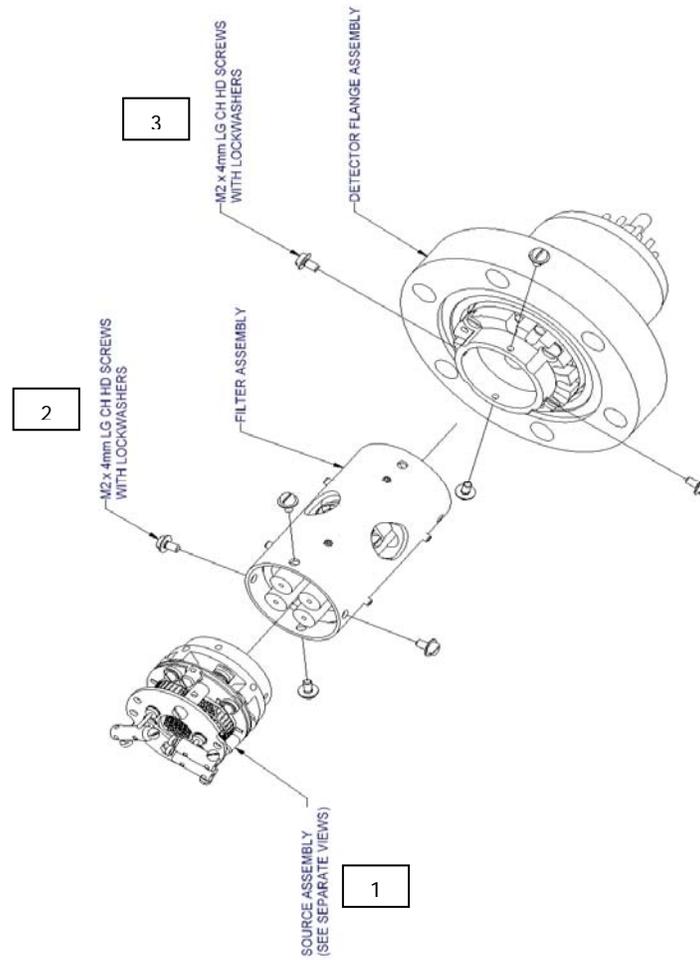
7. Exploded Views

7.1 Analyser Flange pin-outs



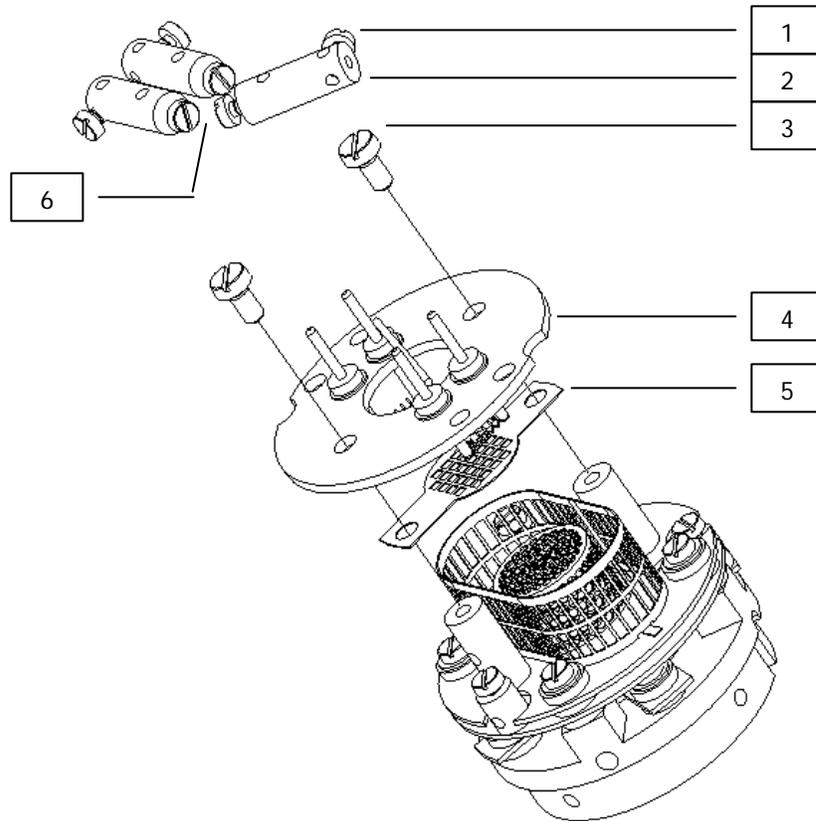
Pin Descriptions	
Pin	Connection
1	Earth
2	Source plate
3	Electron Multiplier
4	Filament 1
5	Extraction plate
6	Suppressor plate
7	RF.1
8	Repeller plate / filament common
9	No connection
10	Filament 2
11	RF.2
12	Collector

7.2 Exploded view of the Analyser



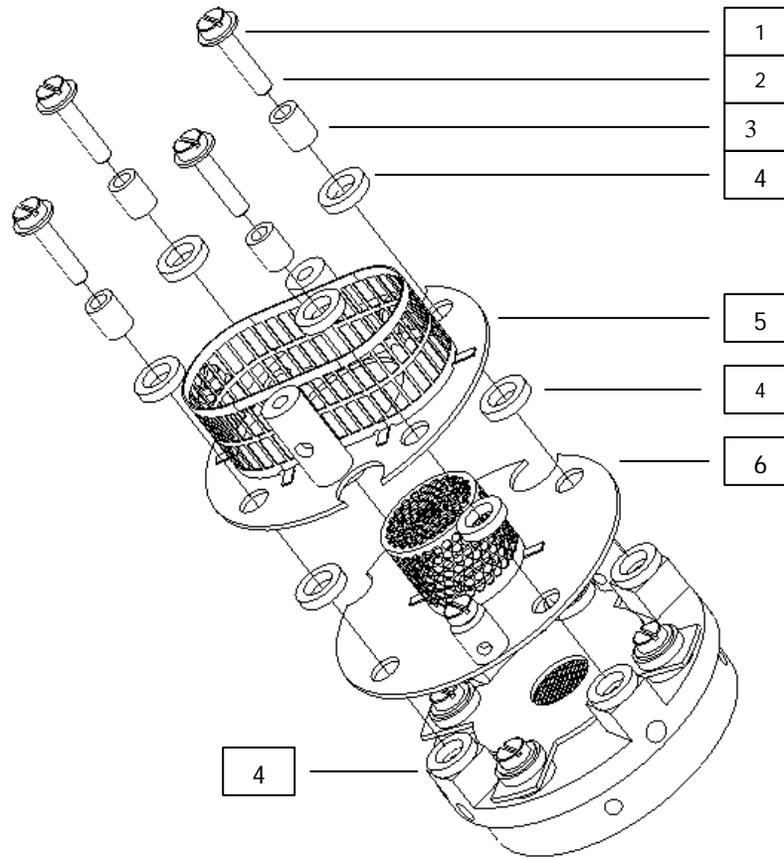
Item	Description (Dimensions in mm)	Part Number
1	Source Assembly Tungsten Fils	842-021
1	Source Assembly Thoria Fils	842-022
2+3	Screw M2 x 4	200902004

7.3 Filament Plate



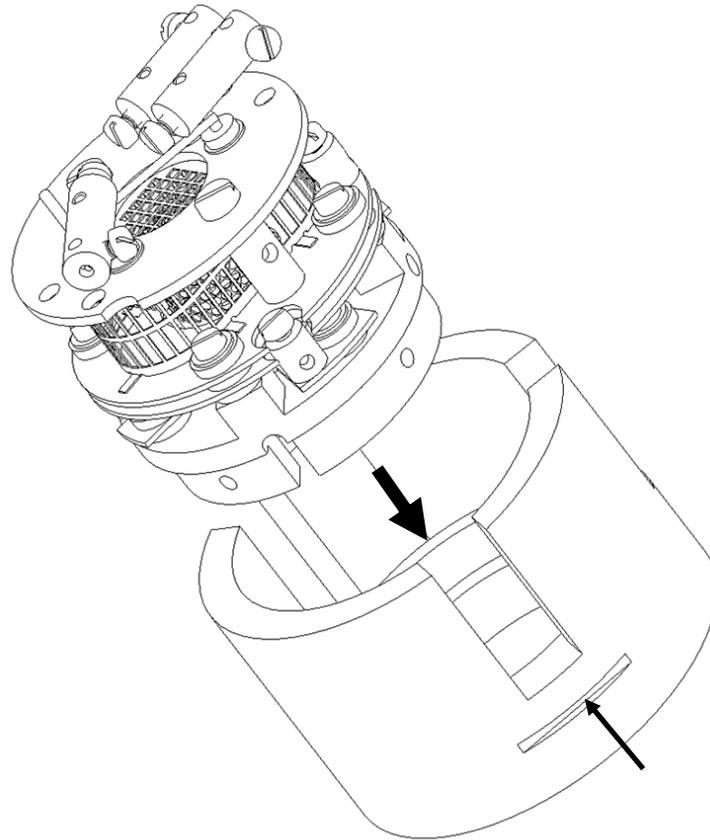
Item	Description (Dimensions in mm)	Part Number
1	Screw M1.6 x 3 (3 off)	200901603
2	Barrel Connector	305040214
3	Screw M2 x 4	200902004
4	Filament Plate Tungsten Fils	LM508-015PL
4	Filament Plate Thoria Fils	LM508-020PL
5	Filament Screen	305080594
6	Screw M1.6 x 4 (3 off)	200901604

7.4 Source Assembly



Item	Description (Dimensions in mm)	Part Number
1	Plain washer SS M1.6	27031600
2	Screw M1.6 x 8	200901608
3	Ceramic Tube 2.8D x 3.5L	400020035
4	Ceramic Washer 4.7D x 1L	400010203
5	Repeller Plate Assembly	LM508-018PL
6	Source Plate Assembly	LM508-017PL

7.5 Source Alignment Jig

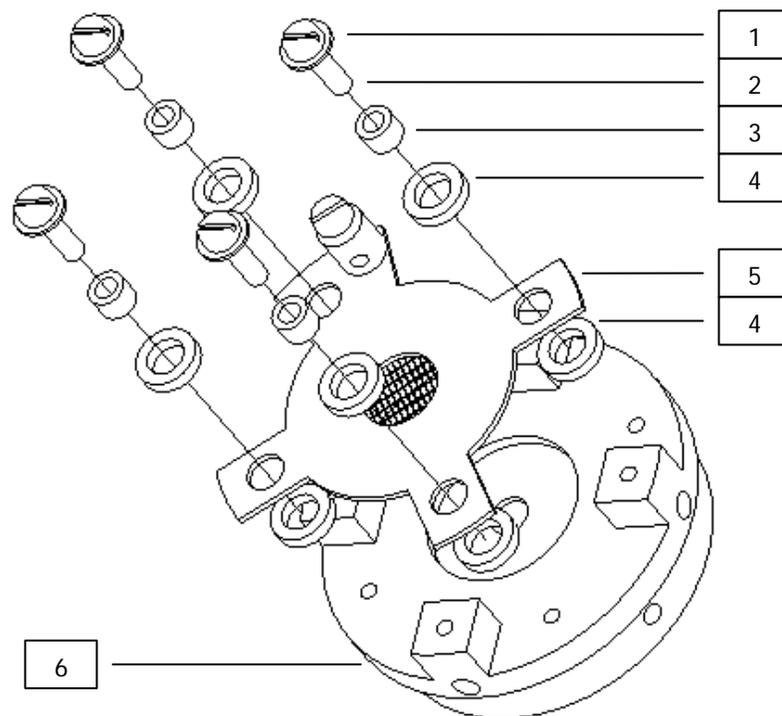


Note the orientation of the source assembly when inserted into the jig. Align the extract plate's barrel connector with the alignment indicator on the jig.

Remove the source by pushing it out from the bottom of the jig, do not pull out the source.

Item	Description (Dimensions in mm)	Part Number
1	Source Alignment Jig	842-029

7.6 Extract Plate



Item	Description (Dimensions in mm)	Part Number
1	Plain washer SS M1.6	27031600
2	Screw M1.6 x 6	200901606
3	Ceramic Tube 2.8D x 2L	400020020
4	Ceramic Washer 4.7D x 1L	400010203
5	Extract Plate Assembly	LM508-016PL
6	Source Mounting Ring	305080603

8. Returning Your Unit for Service

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

Contact your local MKS Spectra 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 detailed fault description.

Fill in the relevant sections of the Health and Safety Returns Form on pages 41 and 42 of this manual, 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

RETURNS FORM

Please complete the form and fax or send by first class post to the appropriate MKS Spectra facility. Fax numbers and addresses can be found on the inside front page of this manual. 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
--

Please Complete The Following

Our RMA number:

Customer P.O. No.

Customer Bill to Address:

Company
Department
Address

City
Zip/Postal Code

Customer Return To Address (if different from above):

Company
Department
Address

City
Zip/Postal Code

User's Name:

Phone No.:

Equipment Shipped

Item 1:

Serial No.:

Item 2:

Serial No.:

Item 3:

Serial No.:

Please describe the system fault in detail:

Details of all 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.

Signed:

Title:

Date:

Phone No.