

# e-Vision<sup>®</sup> & e-Vision<sup>+</sup><sup>®</sup>

## User Manual

SP101010.104  
27 September 2006

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.

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## EC DECLARATION OF CONFORMITY

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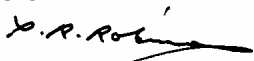
DECLARES THAT THE FOLLOWING PRODUCTS:

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  
LM79 VISION 1000I  
LM89 VISION 1000B  
LM90 VISION 1000 C / E  
LM78 VAC CHECK  
LM80 MINILAB  
LM98 e-Vision  
LM102 e-Vision+

ARE IN CONFORMITY WITH THE FOLLOWING EUROPEAN DIRECTIVES:  
89/336/EEC ELECTROMAGNETIC COMPATIBILITY DIRECTIVE  
73/23/EEC LOW VOLTAGE DIRECTIVE AS AMMENDED 93/68 EEC

THE APPLICABLE STANDARDS ARE:  
EN 61326:1998 ELECTRICAL EQUIPMENT FOR MEASUREMENT,  
CONTROL & LABORATORY USE  
EN 61010-1:2001 SAFETY REQUIREMENTS FOR ELECTRICAL  
EQUIPMENT FOR MEASUREMENT,  
CONTROL & LABORATRY USE.

SIGNED:



T.R.ROBINSON  
GENERAL MANAGER  
DATE: 23<sup>rd</sup> February 2004

# **Warning**

**The control unit must not be powered up when not connected to the analyser**

## **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 meters. 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.

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# **1. Specification**

## **1.1 Mechanical**

### **e-Vision<sup>&</sup> e-Vision<sup>+</sup>**

Size: 127mm wide x 127mm deep x 159mm deep, plus 34mm over analyser connector.

Weight: 2.0 kg

### **24VDC Power Supply**

Size: 75mm wide x 45mm high x 170mm deep plus 30mm over strain relief.

Weight: 0.6 kg

### **Analyser**

e-Vision - 2 inch single mass filter, 1 – 100amu, Faraday detector.

Max. Operating pressure  $5 \times 10^{-4}$  Torr ( $6.5 \times 10^{-4}$  mbar)

e-Vision<sup>+</sup> - 4 inch single mass filter, 1 -100amu & 1 – 200amu, Faraday and SEM detector.

Max. Operating pressure  $7.6 \times 10^{-5}$  ( $1 \times 10^{-4}$  mbar)

## **1.2 Electrical**

Power Inlet: 100 to 120, 200 to 240 VAC rms 47- 63Hz 2.1A 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 the 24VDC power supply unit or the e-Vision / e-Vision+ unit.

## 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 24VDC power supply so that it is difficult to unplug the supply 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 supplied 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 e-Vision<sup>®</sup> is a complete quadrupole residual gas analyser (RGA), comprising of a quadrupole analyser, an e-Vision control unit, a low voltage power supply and the necessary interconnecting cables, incorporating all of the electronics normally found in a separate control unit and RF power supply, into one compact unit, which fits directly onto the quadrupole analyser.

The e-Vision is designed to be operated in several ways:  
From a host computer, which will normally be an IBM compatible PC running the MKS Spectra EasyView Windows software package.

By browsing to the e-Vision using a Java enabled web browser.

By integrating the e-Vision control into current systems through the use of the ASCII protocol command set.

A complete RGA system comprises of an e-Vision connected to a single computer, or network, using the Ethernet (RJ-45) connector.

This manual focuses on the e-Vision and e-Vision<sup>+</sup> hardware and should be used in conjunction with the relevant user interface manual during installation.

## 3. Connections

### 3.1 The rear panel

Please refer to Figure 1 for the arrangement of the connectors on the rear panel. Pin numbers are marked on the various connectors.

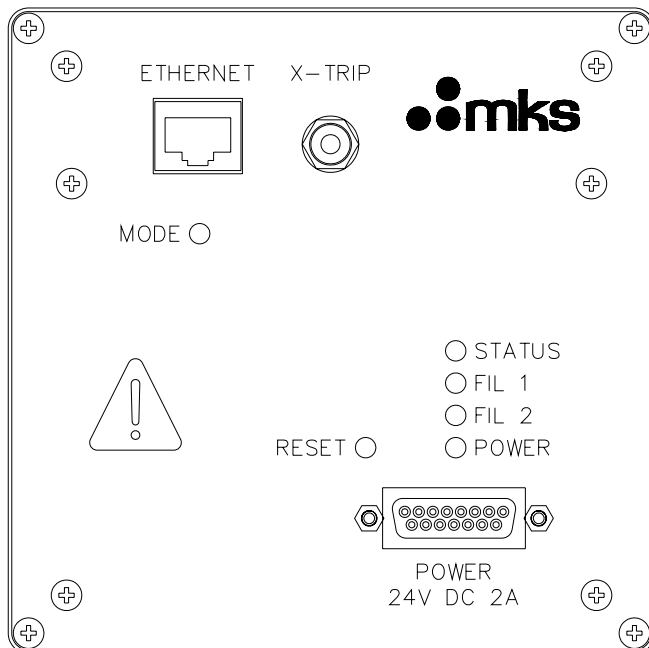


Figure 1. Rear panel arrangement

### 3.2 Power connector

This 15-way D-Type socket labeled **"POWER"** on the rear panel of the unit is used to connect the low voltage power supply unit.

The pin connections are as follows:

1, 2, 3	(joined together)	+24 volts DC
9,10,11	(joined together)	0 volts (24 volt return)
Connector Shell		functional earth

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

The current drawn depends on the mass range and whether a filament is on or off. 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.

### 3.3 Power indicator

The power indicator is a 3mm Green LED labeled **"POWER"** on the rear panel of the unit. This is illuminated when power is applied to the unit.

### 3.4 Ethernet connector

This is an RJ45 style connector labeled **"ETHERNET"** on the rear panel of the unit. It is used to connect the e-Vision to the host computer, this accepts standard Cat5 patch cables, as follows:

If connecting directly to a PC, use a crossover or cross-wired Cat5 Patch cable.

If connecting to a network, use a standard Cat5 Patch cable.

### 3.5 External trip

The external trip connector is a 3.5mm Jack socket mounted to the right of the Power connector on the rear panel and labeled **"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 signal from a vacuum control system to be connected to the e-Vision.

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, off 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.

### **3.6 Reset switch**

If a problem occurs, or during specific operations such as a software download, it may be necessary to reset the e-Vision electronics.

### **3.7 Mode switch**

See Section 10 for function details.



## ***4. 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.

### **4.1 Unpacking**

When you receive the e-Vision 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.

### **4.2 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.

### 4.3 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:

System Type	Length
e-Vision	81mm (3 ¼")
e-Vision +	146mm (5 ¾")

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.

### 4.4 Checking the system pressure

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

## 4.5 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 e-Vision 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 expensive damage.**

## 5. e-Vision Installation

Unless prevented by other considerations, it is desirable to position the e-Vision Control Electronics package horizontally, with the lettering on the side panels “right side up”. This facilitates cooling of the electronics, as well as being cosmetically optimized, and affords the best thermal stability during operation. However, it is permissible to operate the unit in any orientation, and the user should consider easy access to the vacuum chamber as more important in the mounting of the e-Vision.

### 5.1 Installation

Rotate the locking ring on the stainless steel analyser connector so that the slot lines up with the keyway on the connector tube. Hold the e-Vision unit so that the keyway lines up with the locating key on the analyser flange.

Gently slide the e-Vision unit on to the analyser.

**Take great care, the pins on the vacuum feedthrough are easily damaged. DO NOT force the e-Vision unit on to the analyser.**

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

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

### 5.2 Electrical connections

Insert the 15-way D-Type socket on the output lead of the power supply unit into the 15-way D-Type plug labeled “**POWER**” on the rear panel of the e-Vision.

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

When power is applied, the LED on the rear of the e-Vision will illuminate.

Connect a cat5 patch lead to the socket marked “**ETHERNET**”. If a direct connection to the host PC is required, use a crossover cable. If connecting via a network hub, a standard patch lead may be used.

If required, connect your X-Trip signal cable to the socket marked “**X-TRIP**”. For signal options, see Section 3.5.

Care should be taken in routing and securing all cables. Avoid running any of the signal cables next to mains power cables or sources of electrical noise.

### **5.3 IP Address**

The default IP address of the e-Vision is 192.168.0.250.

Details on how to change this IP address can be found in the manual supplied with your RGA operating software.

### **5.4 Re-setting the IP address**

To re-set the unit back to its default IP address, carry out the following procedure:

1. Push the "reset" button
2. Immediately push and hold the "mode" button until the "status" indicator lights and flashes rapidly four times and is then extinguished.
3. Press the "reset" button to reboot the unit using the default IP address.

#### **Important:**

If the instrument has been configured for DHCP, keep the MODE button pressed for 90 seconds, or a reset will not occur.

## ***6. Baking***

The control electronics (e-Vision) must not be exposed to temperatures above 40°C and should 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.

### **CAUTION**

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

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

In this case only the Faraday detector should be used, NOT the multiplier.

The multiplier will not be damaged by high temperatures, providing it is not switched on.

## ***7. Java Web Applet***

---

It is possible to view and manipulate certain aspects of the EasyView package remotely via your Internet browser. This provides the facility of network users without the EasyView software installed, access to the sensor data.

The applet is highly intuitive and includes all the data display routines required for troubleshooting, including leak detection mode.

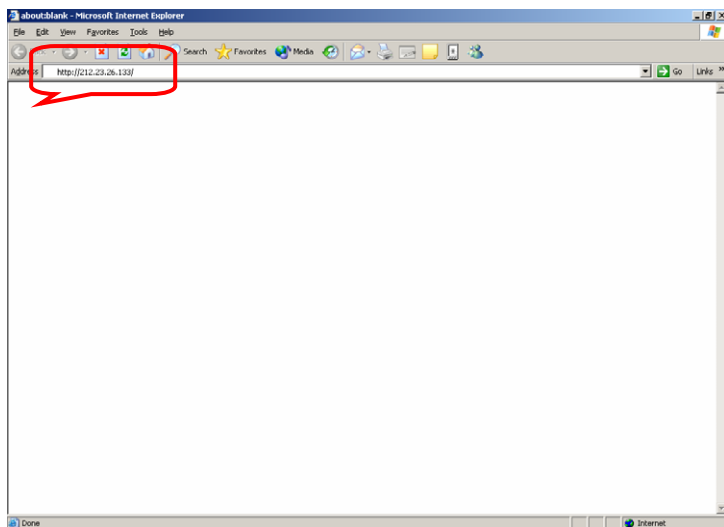
All that is required is a Java enabled Web browser and the IP address of the unit you wish to view.

Simply enter the IP address of the sensor you wish to view into the "Address" field of your browser and you are taken to the sensor's home page. A Java applet can be downloaded from this page to enable access.

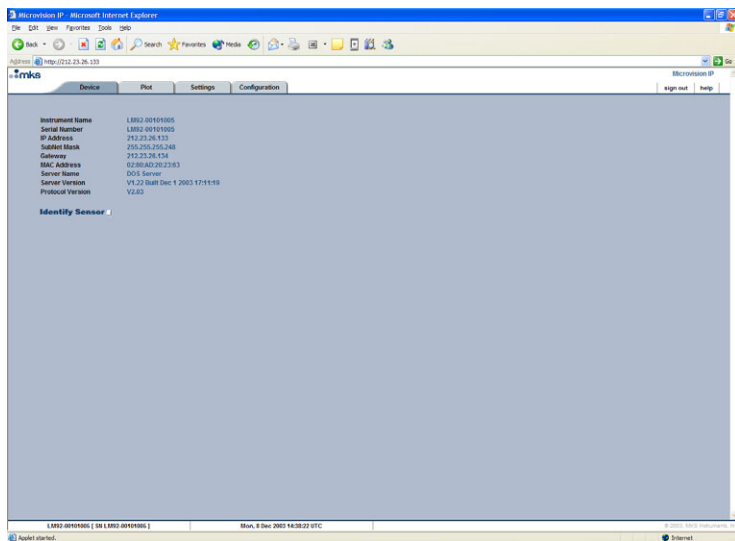
The default IP address of your unit is factory set at 192.168.0.250. this can be changed via the browser interface via the "Settings" tab.

## 7.1. Accessing the instrument

Start your web browser and type in the IP address of the instrument you wish to view.



You are directed to the instruments home page.

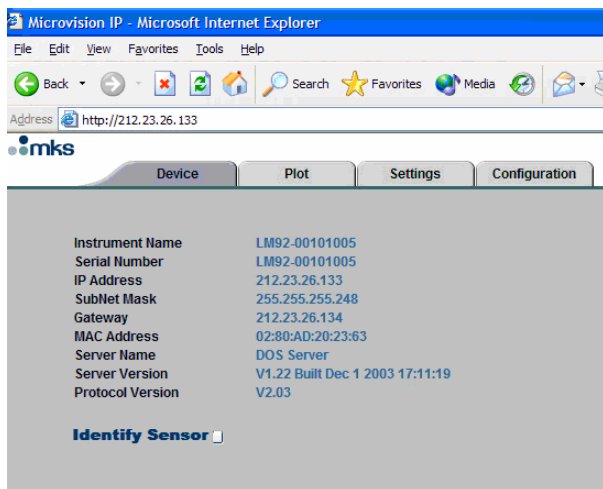




If you chose not to install the Java runtime when you installed the main EasyView program, you will need to do this now before you can proceed.

If a connection to the internet is available, you can download the applet by clicking on the "Plot" tab.

If your PC does not have access to the internet, you will have to install the Java runtime from the EasyView installation disk.



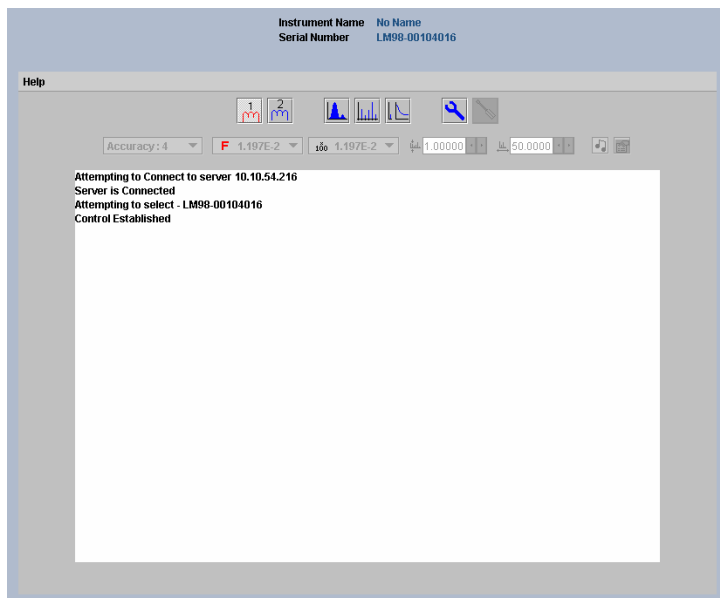
Clicking the "Plot" tab begins the Java download.



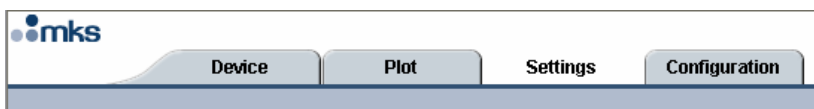
Accept the security warning to begin.

Once the Java runtime has been downloaded and installed, you may need to click the "Refresh" button on your browser.

You now have access to the instrument, to start, click the "Plot" tab once again. The view changes as shown below and access to the toolbar is now available.



## 7.2 Page Tabs

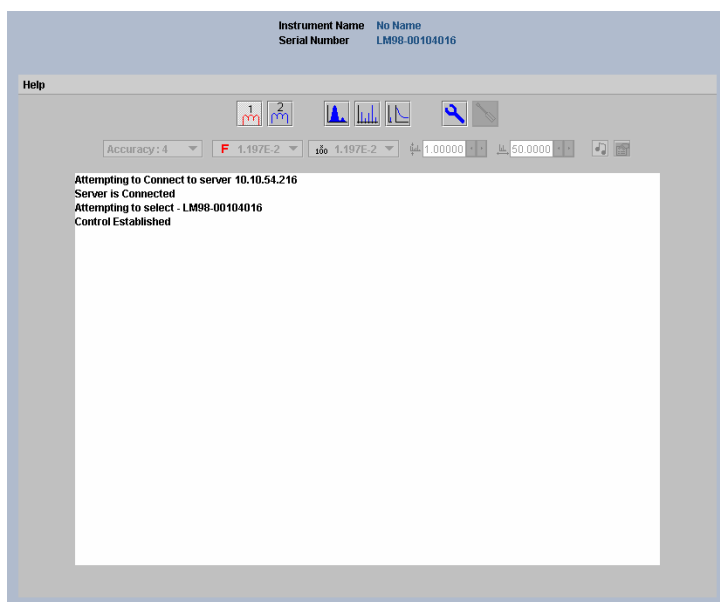


### 7.2.1 Device

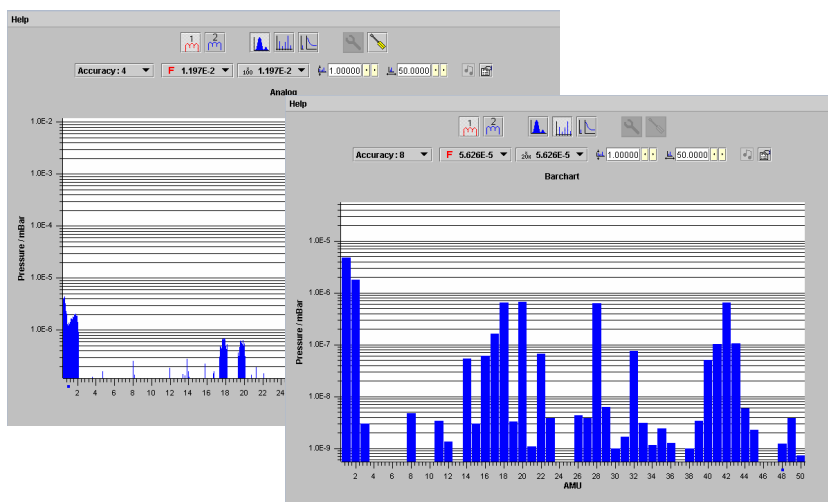
Instrument Name	No Name
Serial Number	LM98-00104016
IP Address	10.10.54.216
SubNet Mask	255.255.255.0
Gateway	0.0.0.0
MAC Address	02:80:AD:20:2F:DE
Server Name	Var Not Recognised
Server Version	D1.0 Built Apr 8 2004 13:28:47
Protocol Version	D1.00

Instrument information such as friendly name, IP address and internal software versions are displayed.

## 7.2.2 Plot



This is the measurement page where most of your time will be spent. From here you can access any of the measurement modes, filament control and diagnostics.



### 7.2.3 Settings

The Settings page is password protected with a default password of “MKS”. It is recommended that this password be changed to prevent unauthorised changes to the sensor configuration files. See “Security” for details.

The image shows two screenshots of a web interface. The top screenshot is a password protection dialog with the text: "This section is Password Protected. Please Enter password to continue." Below this is a text input field labeled "Enter Password" and a "Submit" button. The bottom screenshot shows the "Settings" page with three tabs: "Sensor", "Network", and "Security". The "Sensor" tab is active, displaying the following configuration options: "Friendly Name" (text input with "No Name"), "Filament Type" (dropdown menu with "Tungsten"), "RF Trip" (checkbox), "Emission Trip" (checkbox), "External Trip" (checkbox), "Filament Trip" (radio button), "Filament Control" (radio button), and a "Configure Sensor" button. A "Done" button is located at the bottom right of the "Sensor" tab area.

Under the “Sensor” tab, the following options are available:

#### **Friendly Name**

Giving the unit a friendly name is especially useful if you have more than one sensor package installed.

#### **Filament Type**

Tungsten or Thoria filament types are available depending on your sensor package option. The filament current drawn by the types of filaments is different, so you should ensure that the correct setting is chosen to match your sensor.

#### **RF Trip – recommended Enabled**

If the RF stage of the electronics package runs out of tune, an on-screen alarm is generated.

## **Emission Trip – recommended Enabled**

If a problem is detected with filament emission, the filament is turned off.

## **External Trip**

The filaments can be controlled by an external signal applied via the “X-trip” socket. See the e-Vision hardware manual for signal requirements.

If External Trip is selected, the “Filament Trip” and “Filament Control” options become available.

### **Filament Trip**

Turns the filament off when the X-trip condition is met. The filament must be manually switched on once the trip condition is cleared.

### **Filament Control**

The filament will be turned off for the duration of the X-trip condition, once the condition is cleared, the filament will switch back on automatically.

## **Configure Sensor**

Once the options have been configured, click on this button to write the configuration settings to the sensor.

When finished with this dialog, click the <Done> button to exit the dialog.

## 7.2.4 Network

The screenshot shows a configuration window with three tabs: 'Sensor', 'Network', and 'Security'. The 'Network' tab is active. It contains two main sections. The first section, 'Specify IP Address', has three input fields: 'IP Address' with the value '10.10.54.216', 'Sub Netmask' with '255.255.255.0', and 'Gateway' with '0.0.0.0'. The second section, 'Obtain Address Automatically', has three radio buttons: 'DHCP' (which is selected), 'BOOTP', and an unlabeled radio button. At the bottom left of the main area is a button labeled 'Set IP Address'. At the bottom right of the window is a button labeled 'Done'.

Under the "Network" tab, the following options are available:

### **Specify IP Address**

You may change the sensors IP address, Subnet mask and Gateway if required. For help on understanding and assigning IP addresses, please see the on-line help included on the EasyView installation disk.

### **Obtain Address Automatically**

DHCP - Obtain an IP address from your DHCP server.

BOOTP -

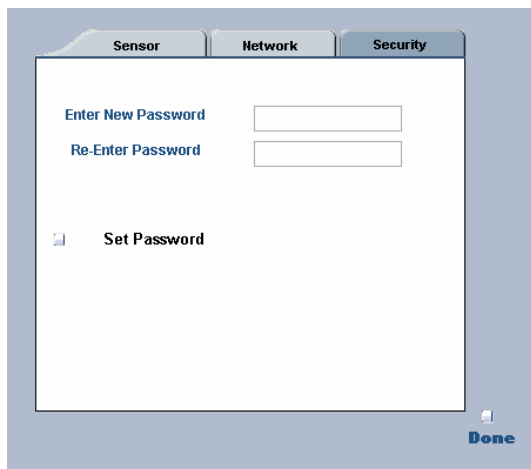
### **Set IP Address**

Once the options have been configured, click on this button to write the configuration settings to the sensor.

When finished with this dialog, click the <Done> button to exit the dialog.

## 7.2.5 Security

The default "Settings" password can be changed here. Enter and confirm your new password.



The screenshot shows a software interface with three tabs at the top: "Sensor", "Network", and "Security". The "Security" tab is selected. Inside the dialog, there are two text input fields. The first is labeled "Enter New Password" and the second is labeled "Re-Enter Password". Below these fields is a button with a small icon and the text "Set Password". In the bottom right corner of the dialog, there is a "Done" button.

### Set Password

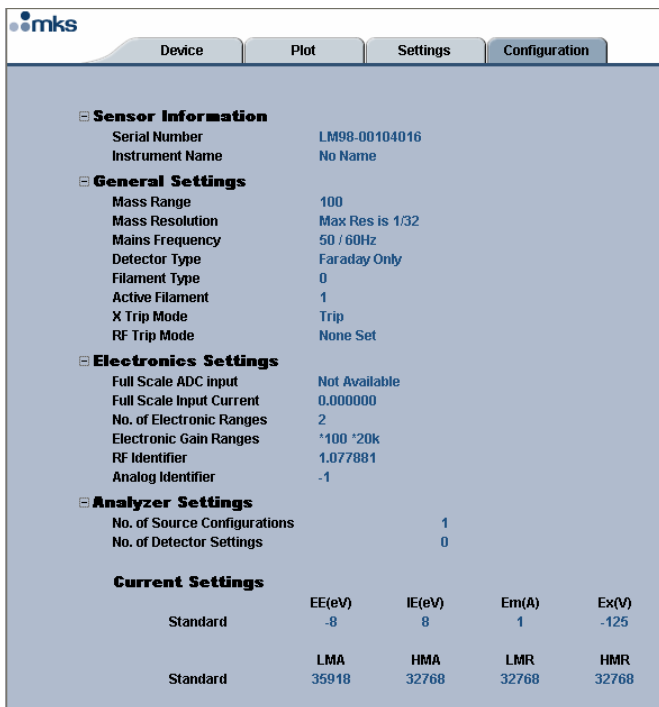
Once the password has been changed, click on this button to write the new password to the sensor.

When finished with this dialog, click the <Done> button to exit the dialog.



## 7.2.6 Configuration

The “Configuration” tab provides a detailed report on the sensor’s configuration settings.

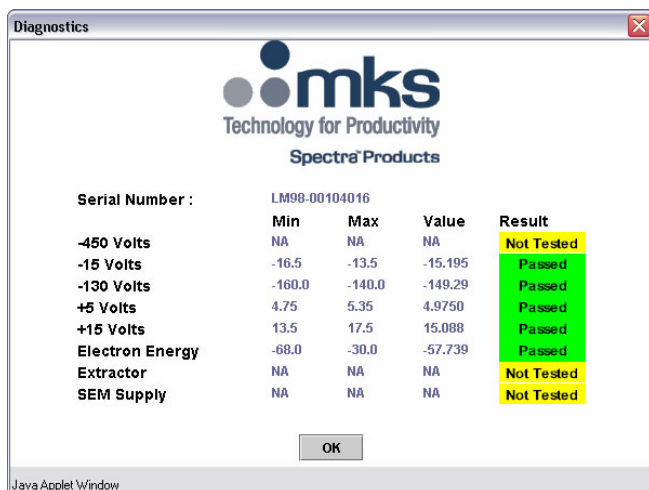


The screenshot shows the MKS Configuration tab with the following settings:

- Sensor Information**
  - Serial Number: LM98-00104016
  - Instrument Name: No Name
- General Settings**
  - Mass Range: 100
  - Mass Resolution: Max Res is 1/32
  - Mains Frequency: 50 / 60Hz
  - Detector Type: Faraday Only
  - Filament Type: 0
  - Active Filament: 1
  - X Trip Mode: Trip
  - RF Trip Mode: None Set
- Electronics Settings**
  - Full Scale ADC input: Not Available
  - Full Scale Input Current: 0.000000
  - No. of Electronic Ranges: 2
  - Electronic Gain Ranges: \*100 \*20k
  - RF Identifier: 1.077881
  - Analog Identifier: -1
- Analyzer Settings**
  - No. of Source Configurations: 1
  - No. of Detector Settings: 0
- Current Settings**

	EE(eV)	IE(eV)	Em(A)	Ex(V)
Standard	-8	8	1	-125
	LMA	HMA	LMR	HMR
Standard	35918	32768	32768	32768

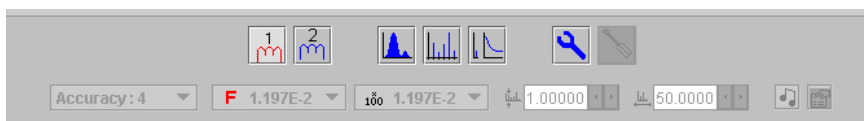
## 7.2.7 Diagnostics



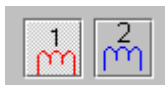
Diagnostics can only be performed whilst in the Plot mode without a measurement running.

The diagnostics checks each power supply within the electronics package and displays the result. Some power supplies are not tested, as shown here, depending on the sensor configuration.

## 7.3 Page Views and Controls



The measurement modes, scan parameters and instrument diagnostics can be accessed from the toolbar. Each function is described in turn through the following section.



### Filament Control

Click the buttons to turn on, or switch between the filaments. The currently active filament is displayed in red.



### Scan Modes

Analog, Bar Chart and Leak Detect modes.



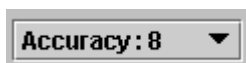
### Diagnostics

Displays a diagnostic report on the instrument.



### Tuning

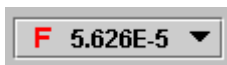
Enter the tuning mode. You must be in Analog Scan mode, this setting is password protected.



### Accuracy

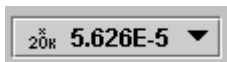
Scan accuracy determines the sampling amount carried out on each reading.

A high accuracy number provides a clean scan but increases scan time. The accuracy ranges available are from 0 to 8.



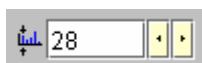
### Detector Select

Depending on the instrument configuration, Faraday only, or Faraday and Multiplier detectors are available.



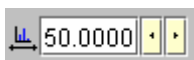
### Gain Select

X100 or x20k electronic gain ranges are available.



### Start Mass

The start mass of the measurement, or when in Leak Detect mode, the probe mass.



### **Mass Span**

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



### **Pressure Unit Select**

Select from the list of available pressure units.



### **Tone On/Off**

Generates an audio tone in Leak Detect mode. Not available with some sensor packages.

## **8. Analyser Maintenance**

### **8.1 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.**

## 8.2 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 ( $5 \times 10^6$  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 47 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.

### **8.3 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.

## **8.4 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 49.

### **8.4.1 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 Section 7.5.

### **8.4.2 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.

## 8.5 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 in Section 8.4.1 .

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.

## **8.6 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 48.

### 8.6.1 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.

### 8.6.2 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 50.

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 (Item 2), 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 in Section 8.5.

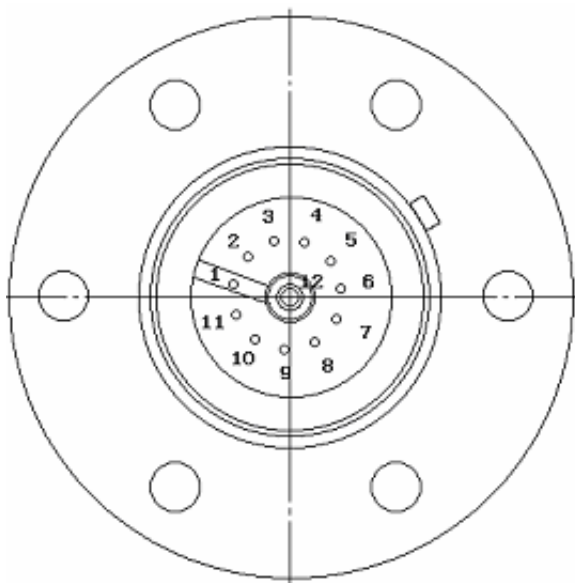
### 8.6.3 Source Re-assembly

Refer to the exploded views of the Alignment Jig shown on Page 51 and the Source Assembly shown on Page 50.

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.

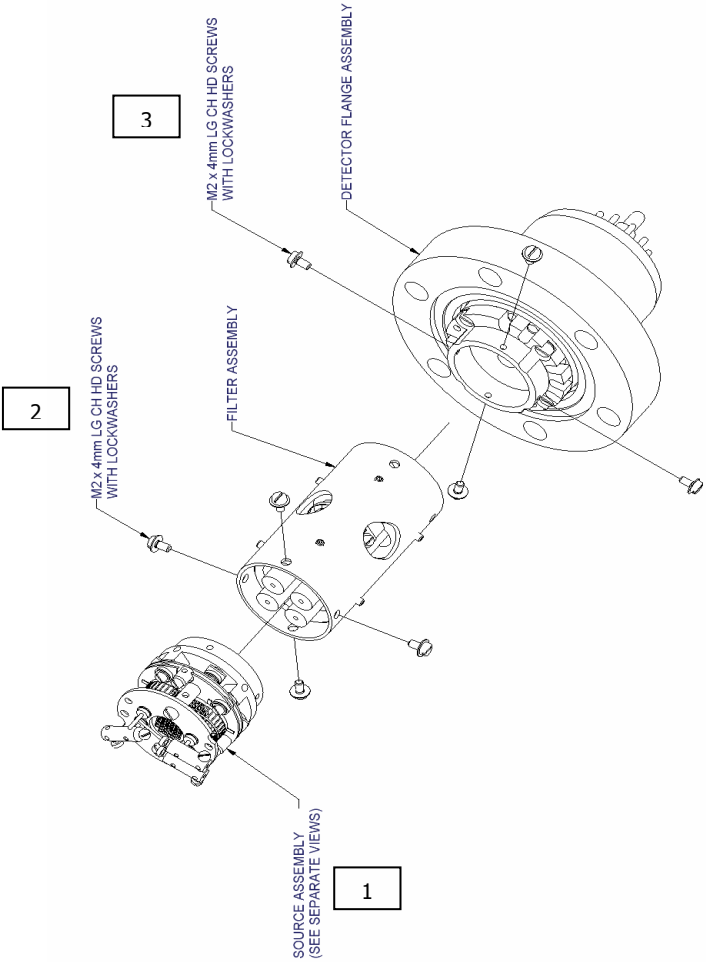
## 9. Exploded Views

### 9.1 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

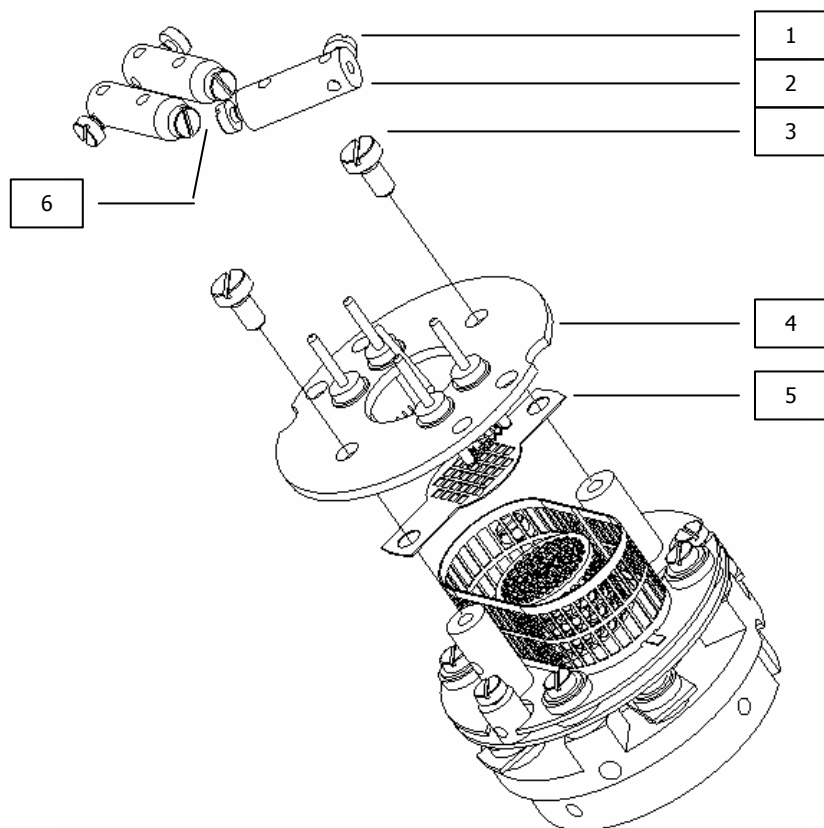
## 9.2 Exploded view of the Analyser



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

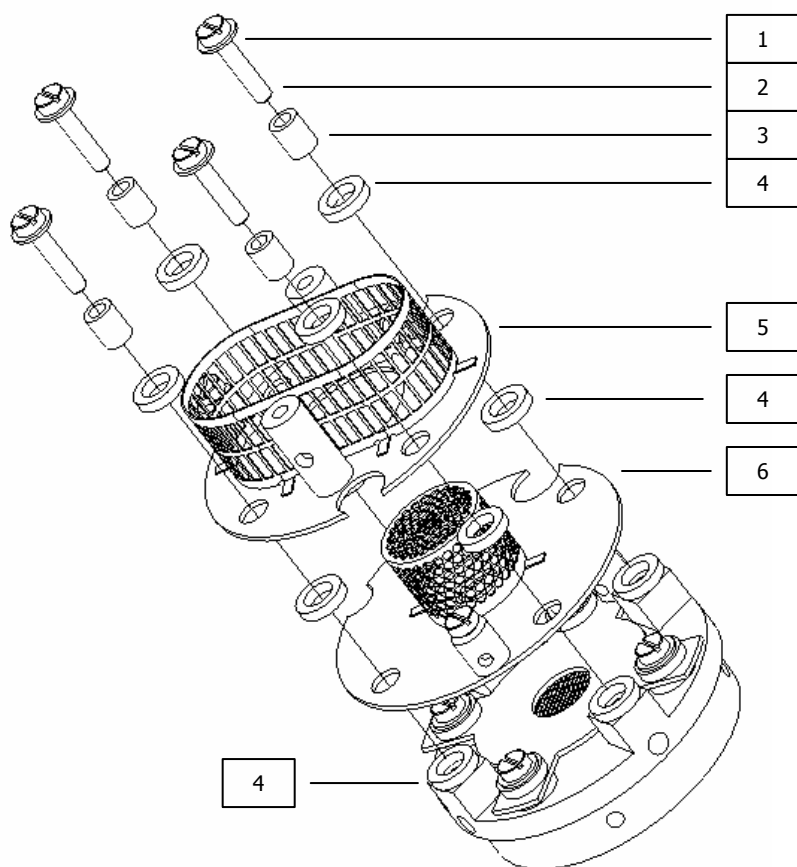


## 9.3 Filament Plate



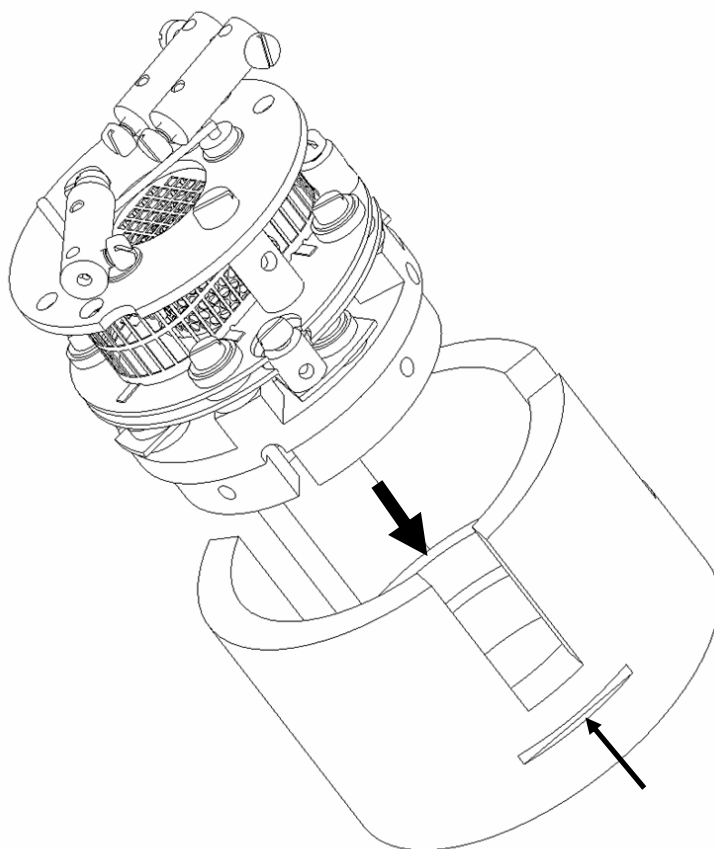
Item	Description (Dimensions in mm)	Part Number
1	Screw M1.6 x 3 (3 off)	200901603
2	Barrel Connector	305040214
3	Screw M2 x 4	200902004
4	Filament Plate Tungsten Fils	LM508-015PL
4	Filament Plate Thoria Fils	LM508-020PL
5	Filament Screen	305080594
6	Screw M1.6 x 4 (3 off)	200901604

## 9.4 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

## 9.5 Source Alignment Jig

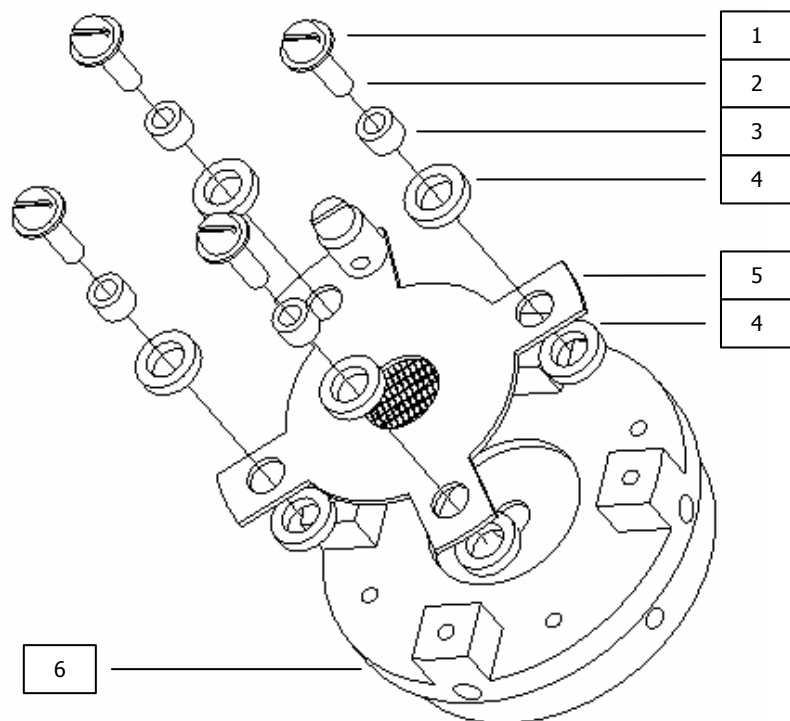


Note the orientation of the source assembly when inserted into the jig. Align the extract plate's barrel connector with the alignment indicator on the jig.

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

## 9.6 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

## ***10. 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 32 and 33 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:

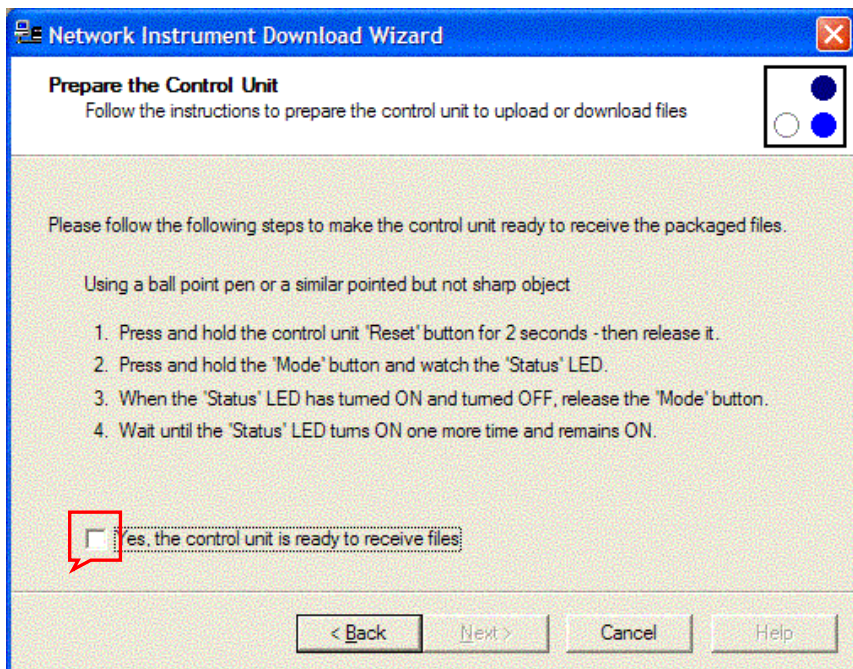
Title:

Date:

Phone No.

## 11. FTP Mode

Software updates for the e-Vision units are supplied as self-executing files. When these files are launched, the following dialog is displayed providing instructions on how to configure the e-Vision unit for file transfer.



It is important you follow these instructions exactly. When each stage has been completed successfully, check the box and then the <Next> button to begin the update.

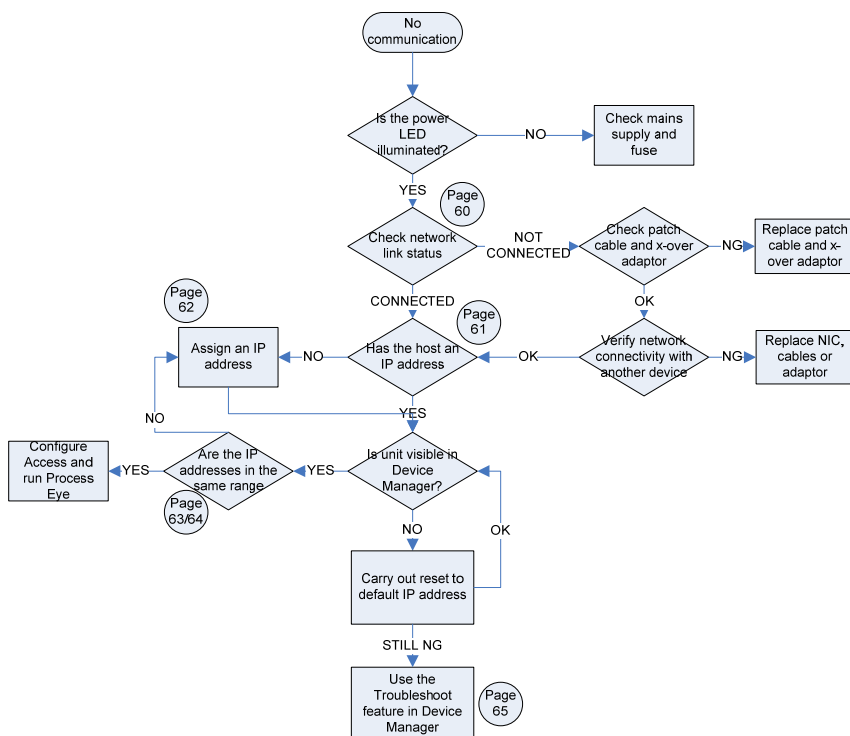
**Do not power down the unit during this process, unless told to do so.**



## 12. Communications Troubleshooting

The following flowchart should help you through any connection problems you may encounter.

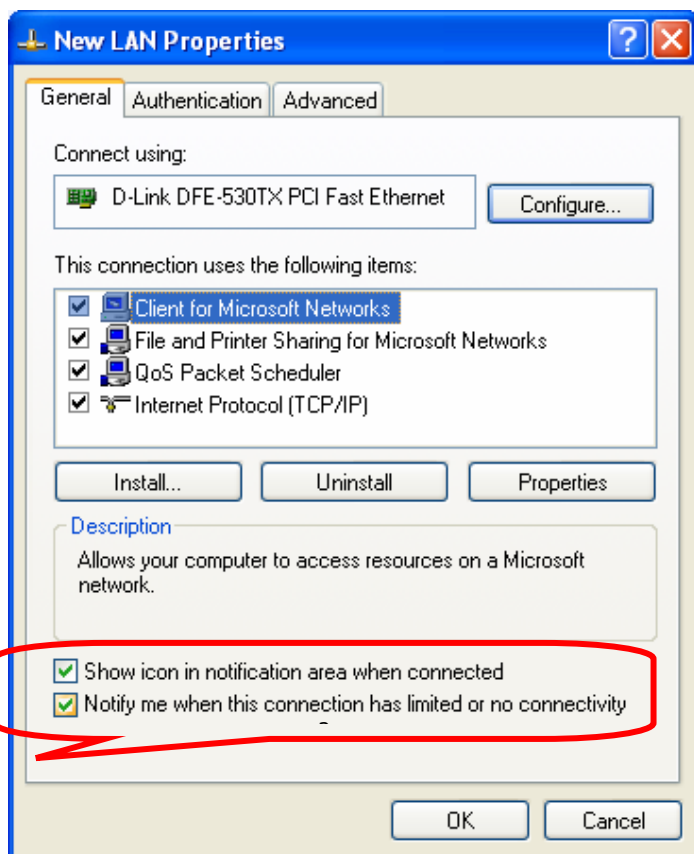
Note that this assumes you are connecting directly from the host PC to the instrument. If the instrument is to become part of a network, then assistance should also be sought from your IT staff.



## Enabling the Network Connection Notification

To aid in troubleshooting, the network status notification should be enabled. The following paragraph explains the procedure.

Open Windows Control Panel and select the NETWORK CONNECTIONS icon. Choose the network connection you are using for the link with the instrument, right-click and choose PROPERTIES.



Check the options shown above. Your network connection status is now displayed in the task-bar, near the clock. Mouse-over the icon to check the status of the connection.

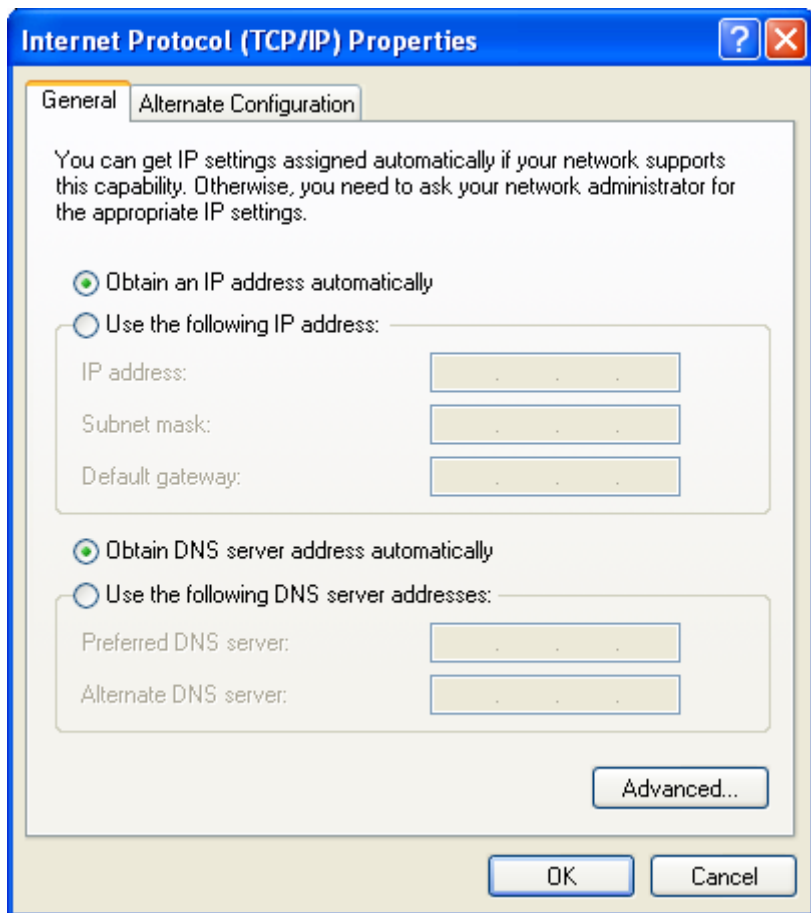


## Check the IP Address of the Host Computer

Open Windows Control Panel and select the NETWORK CONNECTIONS icon. Choose the network connection you are using for the link with the instrument, right-click and choose PROPERTIES.

Highlight the INTERNET PROTOCOL (TCP/IP) entry from the list and click on the PROPERTIES button.

The following displays a computer configured for automatic IP addressing (DHCP). If you are not part of a DNP network or intend to directly connect to the instrument, you will need to assign a static IP address.

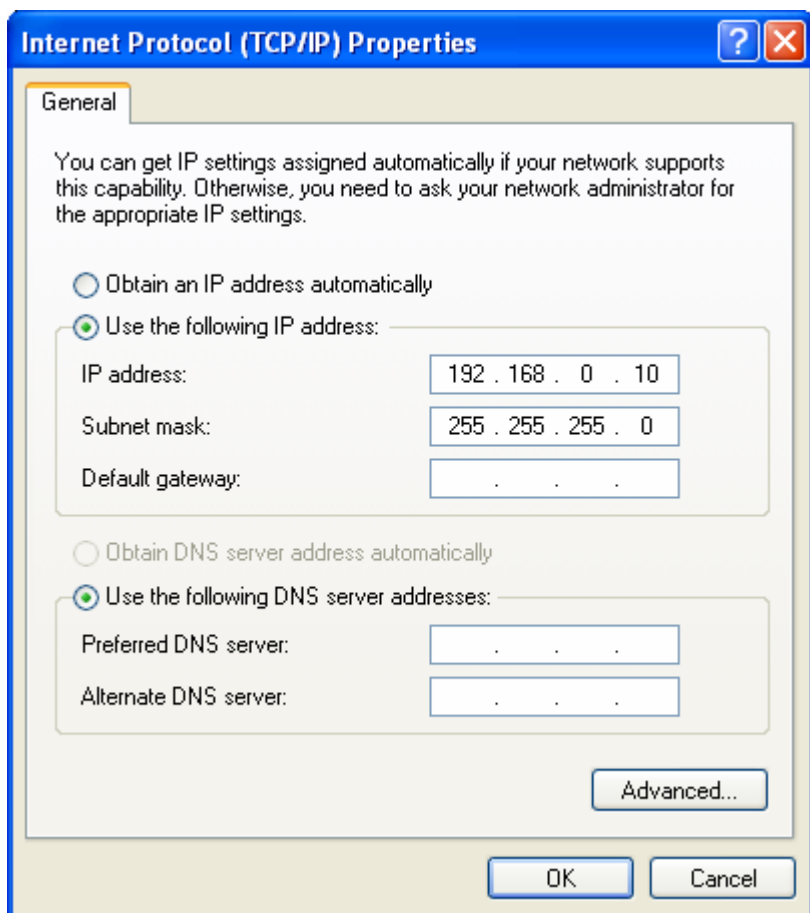


## Assign a Static IP Address

Open Windows Control Panel and select the NETWORK CONNECTIONS icon. Choose the network connection you are using for the link with the instrument, right-click and choose PROPERTIES.

Highlight the INTERNET PROTOCOL (TCP/IP) entry from the list and click on the PROPERTIES button.

The default IP address of the instrument is 192.168.0.250, the host PC address needs to be in the same range, but not the same number. As you can see below, this host's IP address ends in 10, but could have been any number up to 255 excluding 250. Use the Subnet shown.

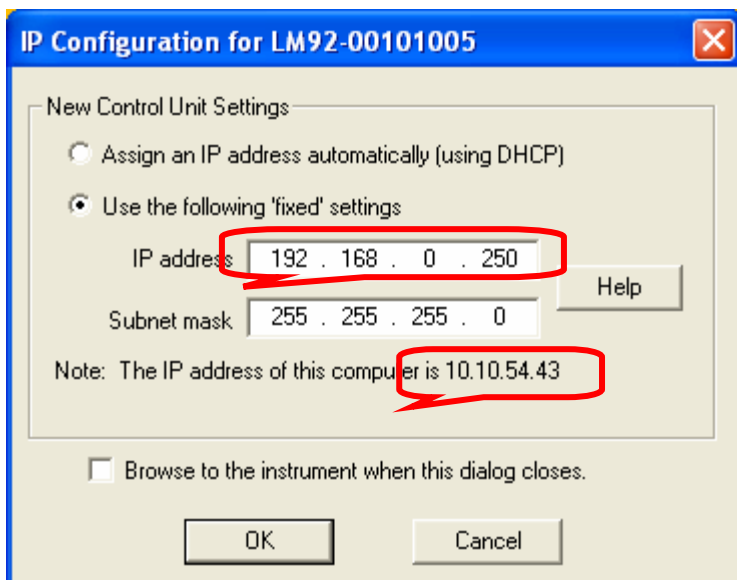


## PC and Instrument on different IP ranges

You can use Process Eye's Device Manager to check on the current IP address status of both the host PC and the instrument.

Start DEVICE MANGER, highlight the instrument, click the CONFIGURE button and choose CHANGE THE IP ADDRESS from the list.

You can see in the dialog below, that the IP address of the instrument differs from the IP address of the host computer.



In this example, the host PC will not be able to communicate with the instrument while the two IP addresses are in different ranges.

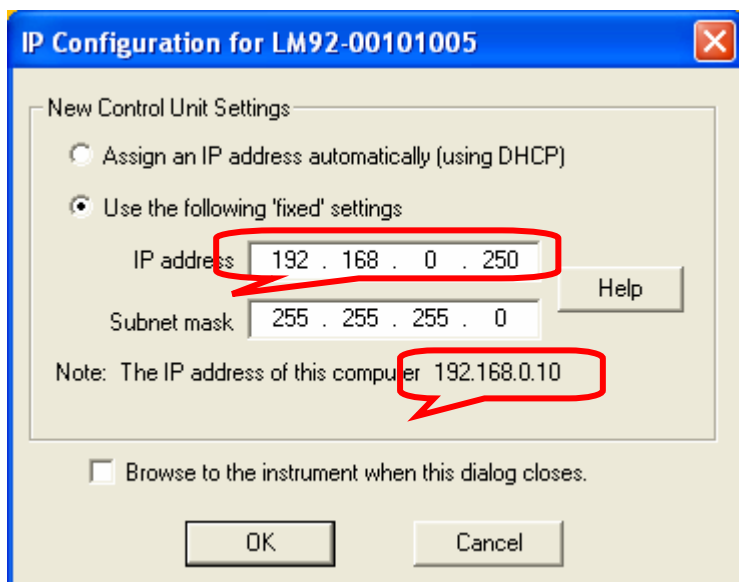
There are two options. Change the IP address of the host PC, or change the IP address of the instrument.

To change the IP address of the instrument, overwrite the current address with the new one.

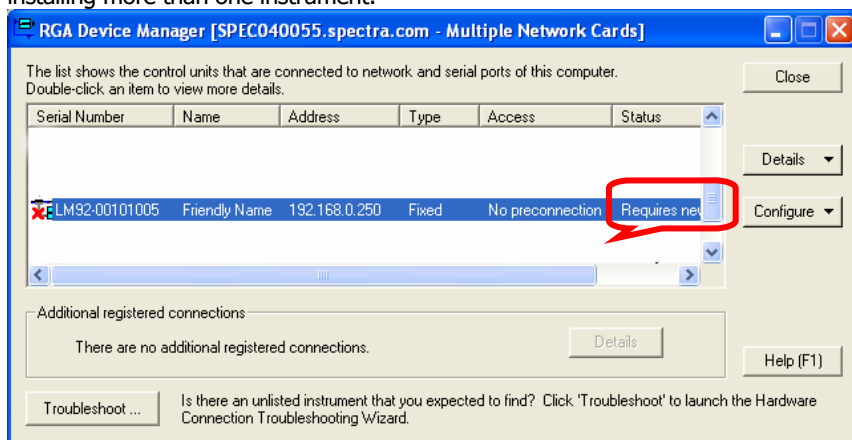
Note: If the host PC is part of your network, then changing its IP address is not recommended without seeking advice from your IT staff. Likewise, assigning a new IP address to the instrument must be done under advice or network conflicts could occur.

## PC and Instrument on the same IP ranges

You can see in the dialog below, that the IP address of the instrument and the IP address of the host computer are in the same IP range.



In the above case communication between the host PC and the instrument is possible, though Device Manager will recommend you change the instruments IP address to another, not ending in .250. This is to avoid potential problems when installing more than one instrument.



## **Resetting the Default IP Address**

To reset the instrument to its default IP address of 192.168.0.250, carry out the following procedure:

Power on the unit

Press the RESET button and immediately press and hold the MODE button for 20 seconds.

### **Important:**

If the instrument has been configured for DHCP, keep the MODE button pressed for 90 seconds, or a reset will not occur.