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Spectra™ Products

HPQ2-IP Manual

SP101009.103
10 October 2012

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

You can send your comments to:-

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Declaration of Conformity

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

DECLARES THAT THE FOLLOWING PRODUCT:

LM101 HPQ2-IP Control unit

IS 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 & LABORATORY USE.

WARNING
This apparatus shall not be used in the residential, commercial, and light industrial environment unless further mitigation measures are taken.
For advice please contact Spectra SensorTech Ltd.

SIGNED:

J.M.Higgins
GENERAL MANAGER
DATE: 19th February 2007

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 HPQ2 unit.

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.

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 stock 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.

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.

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.

1. Specification

General

Mass Range Capability	2 to 80 amu
Detector System	Faraday Cup
Maximum Recommended Operating Pressure	1×10^{-2} mBar (8×10^{-3} Torr)
Maximum Permissible Operating Pressure	2×10^{-2} mBar (1.6×10^{-2} Torr)
Minimum Detectable Partial Pressure	1×10^{-10} mBar (8×10^{-11} Torr)
Mass Stability	Better than $\pm$0.1 amu over 8 hours at constant ambient temperature
Resolution	<1.2 amu at 10% peak height
Total shipping weight	6.0kg

Analyser

Maximum Bakeout Temperature	250^0C
Mounting Flange	2 ¾ inch Conflat (CF35)
Insertion Length	1.0 inch (25.4mm)
Ion Source Sensitivity	5 x 10-5 A/Torr
Electron Energy	40 and 70 eV nominal (adjustable from PC)
Emission Current	0.1 and 0.7mA nominal (adjustable from PC)
Filaments	2, independent, tungsten

Control unit

Control Unit Weight	2.3kg
Dimensions	127mm x 127mm x 210mm
Overall length	2245mm
Maximum Ambient Operating Pressure	35^0C non-condensing
PC Software	Process Eye Professional or Easyview
Power	24V DC 3A External supply included
Communication	Ethernet
Distance	100Metres

2. Introducing HPQ2-IP

The HPQ2-IP is a complete quadrupole residual gas analyser (RGA) designed to operate at higher pressures than traditional quadrupole instruments. The HPQ2-IP system is based around an extremely compact quadrupole analyser which has an insertion length into the vacuum of 1 inch (25.4mm) and mounts on a CF35 (2 ¾ inch) Conflat flange.

The HPQ2-IP 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. A separate low voltage power supply connects to the HPQ2-IP control unit.

The HPQ2-IP is designed to be operated from an IBM compatible PC running either Process Eye Professional or Easyview software. Communication between the PC and the HPQ2-IP is via an Ethernet link.

The complete HPQ2-IP system will comprise; HPQ2-IP analyser, HPQ2-IP control unit, low voltage power supply, interconnecting cables, manual, tool kit and either Process Eye Professional or Easyview software.

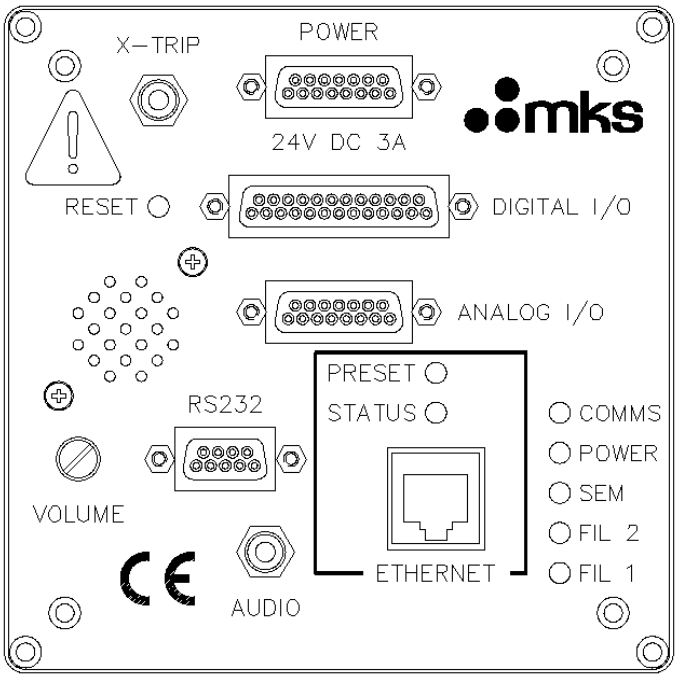
This manual focuses on the HPQ2-IP hardware and should be used in conjunction with the manual for the operating software, Process Eye Professional or Easyview.

3. Control Unit Overview

The HPQ2-IP control unit 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 HPQ2-IP control unit plugs directly onto the HPQ2-IP quadrupole analyser via the connector mounted on the front panel of the unit. All external connections including the power supply and communications are made via connectors mounted on the rear panel of the control unit.

The HPQ2-IP control unit contains no user serviceable parts and the only manual adjustment is the volume control for the audio, which is mounted on the rear panel.

3.1 The Rear Panel



3.2 Power Connector

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

Pin connections are:-

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

The power input is 24 volts DC ± 10%, 3 Amps max.
The current drawn depends on the mass range and whether a filament is on or off.

3.3 Indicators

On the rear panel of the HPQ2-IP control unit there are six LED indicators, their functions are described below.

Filament Indicators

An indicator, Fil1 or Fil2 is lit to show the currently active filament.

SEM Indicator

The indicator is lit when the SEM detector is active. This is not implemented on the HPQ2-IP as there is no SEM detector fitted.

Power

The indicator is lit when power is supplied to the HPQ2 unit.

Comms

This indicator will flash to show a comms event to the HPQ2-IP unit. If there are no active communications with the HPQ2-IP, this indicator will pulse at approximately 2Hz, depending on the RGA software version used.

Status

Indicates the current state of the instrument. The indicator is lit while the unit is booting, or when in FTP mode, otherwise it is off.

3.4 Ethernet Connector

This is an RJ45 style connector used to connect the HPQ2-IP to the host computer. Use 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 Audio Output

This is a 3.5mm Jack socket mounted on the rear panel and 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.

3.6 Analog I/O Connector

The Analog Input / Output connector is a 15 way D-Type socket mounted on the rear panel of the HPQ2-IP unit and labelled **ANALOG I/O**. It consists of;
one analog output 0 to +10V and four quasi-differential analog inputs 0 to ±10V with a maximum voltage on the return of ±0.5V.
±15V power outputs both fused at 100mA, fuses are self resetting.

Analog Connector 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 ±15V) for both the Analog and Digital I/O ports must not exceed 100mA.

3.7 Digital I/O Connector

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

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.

3.8 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 HPQ2-IP control unit.

3.9 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 labelled **X-TRIP.**

The external trip feature is used to protect the filaments 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 HPQ2-IP. 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 fully isolated from the system ground.

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 HPQ2-IP 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 inner diameter inclusive of a good welded joint.

The distance from the end of the analyser to its mounting flange is 1.0 inches (25.4mm).

There must be at least the distance given above free of obstructions inside the vacuum chamber. We recommend you to allow an extra 3mm (0.125 inch) just to be sure. If your chamber does not have that much room or only a small flange you should use a specially designed adapter so that the analyser can be mounted outside the chamber. Please contact your local Spectra facility for assistance.

4.4 Checking the System Pressure

The HPQ2-IP analysers must not be operated at pressures higher than 2×10^{-2} mBar (1.6×10^{-2} Torr).

If you intend to monitor a process where the pressure exceeds the above you must make sure you switch off the filaments. We would recommend using a cold cathode gauge or capacitance manometer with a set point and relay contacts connected to the external trip socket on the HPQ2-IP control unit. It is permissible to expose the analyser to high pressure, even above atmosphere, but the filament must be switched off.

CAUTION - A worse problem exists in sputter processes where sputtering is meant to 'throw' materials around corners. If the quadrupole analyser extends into the 'throw area' of the sputtering deposition, it will rapidly become coated and cease to function properly. Turning off the power to the Quad during sputtering or etching will not prevent this contamination. It is most important to ensure that the analyser is shielded from his type of contamination.

Remember the warranty does not cover cleaning of the analyser.

4.5 Mounting the Analyser

The standard 2 ¾ inch 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.

If it is not already clean then clean the gasket with suitable solvent and dry it. 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 9 o'clock as the bolt holes will allow. This will ensure that the HPQ2-IP control unit is in its preferred position, although, it can be mounted in any orientation. The HPQ2-IP will be more susceptible to drift in the location and height of peaks if it is mounted in a different orientation to that described above and it may not meet its published specification.

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

Please do not throw shipping cover or the two piece foam packing surrounding it away. If at a future date you need to return the analyser for service it is vital it is shipped in its original packaging to avoid potentially very expensive damage.

5. Control Unit Installation

5.1 Connecting the Control Unit to the Analyser

Before installing the HPQ2-IP control unit find the 4mm AF Allen key shipped with the instrument. It will either be in the toolbox or attached to the control unit.

CAUTION

The following instructions must be observed to ensure the instrument complies with the Electromagnetic Compatibility Directive (EMC Regulations). Also, the performance of the instrument may be de-graded in terms of noise immunity if the following instructions are not observed.

Using the 4mm Allen key slacken the bolt on the clamping ring on the RF/analyser connector so that the clamping ring is loose and free to move easily.

Rotate the clamping ring on the RF/analyser connector so that the slot (which will be directly below the threads of the M5 socket set screw) lines up with the keyway on the connector tube. Hold the HPQ2-IP control unit so that the keyway lines up with the locating key on the analyser flange.

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

When all of the pins are engaged, push the control unit 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.

Using the 4mm Allen key tighten the socket set screw on the clamping ring. The socket set screw should be tightened sufficiently so that the whole unit is rigidly secured to the analyser.

If any problems arise due to electromagnetic emissions from this unit, first check the tightness of this clamp.

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 connector labeled **"POWER"** on the rear panel of the HPQ2-IP.

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 HPQ2-IP will illuminate.

In the case of an Ethernet connection, 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"**.

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 HPQ2-IP 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 "preset" button until the unit emits a bleep. The IP address has now been re-set.

Further details on using and assigning an IP address can be accessed from the built-in help files contained in the Process Eye/EasyView software, or in the Troubleshooting section of this manual.

6. Baking

The HPQ2-IP control unit should not be exposed to temperatures above 40°C so it 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.

7. Analyser Maintenance

7.1 General Overview

The HPQ2-IP quadrupole analyser is the front end of your mass-spectrometer, it produces electrical signals which when presented to your electronics enable them to display in a meaningful fashion the content of either your vacuum system or of some other "interesting" gasses introduced via an inlet.

Before embarking on any analyser maintenance you should have all the necessary parts and tools ready. If you are in any doubt about the work that you wish to undertake please contact your local Spectra facility, ask for the service department and have the serial number of the analyser ready. The serial number is engraved on the analyser flange and will begin with the letters "LM".

The HPQ2-IP 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 collector
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.

7.2 Maintenance of Your Analyser

Most, if not all, quadrupole analysers have areas of inherent weakness requiring periodic maintenance. This should be viewed as similar to automobiles which from time to time require oil changes etc. to protect the performance of the engine. Just like the automobile the frequency with which this work has to be carried out depends upon many factors such as the number of miles driven, the climate, the average length of journey and the speed at which the vehicle is usually driven.

Similarly with quadrupole analysers the type and cleanliness of the vacuum system, the hours of operation and the type and pressure of sample being analysed play a large part in determining the maintenance frequency. Apart from these considerations there are times when the analyser will require maintenance and these are when "accidents" happen i.e. when someone vents the vacuum system to air with the filament still switched on or when someone forgets to turn on the water cooling for the oil diffusion pump etc. These occurrences only vary in the magnitude of the disaster that ensues.

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 a layer of metal oxides is deposited. These, being insulators, have a far more noticeable effect upon the performance of the source and therefore a more frequent cleaning program should be undertaken.

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.

In the remainder of this section we describe how to replace filaments, replace the ion source and clean the ion source as an assembly. The HPQ2-IP analyser has been designed to allow these jobs to be carried out with minimal training and specialised equipment. Further analyser maintenance, is not described in this manual as we feel this is only possible after training by Spectra personnel. If you have any doubts about analyser maintenance please call you local Spectra facility.

7.3 Failed Filaments

The filament status is constantly monitored by the power supply electronics and the operating software. This is done by measuring the flow of electrons emitted by the hot filament, referred to as the emission current, and flowing to the ion source cage. This is normally maintained at a fixed value between 0.1mA and 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 the required level 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 conditions such as a heavily contaminated ion source which will result in a filament fail when the filament is not open circuit. So, checking that the filament is open circuit is worth doing before going to the trouble of removing the analyser from your vacuum system.

7.4 Ohmmeter Analyser Checks

There are a number of circumstances when carrying out some simple checks with an ohmmeter can be well worthwhile. If you suspect a failed filament or want to check for shorts following some maintenance, a lot of time can be saved by performing some simple checks.

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 ($5x10^6$ 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 35 for the analyser pin numbers.

7.5 Checking for shorts

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

Connect the second meter lead to the analyser flange, you should have a short circuit. If not you have a serious problem or more likely a faulty meter.

3. Connect the second meter lead to each of 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 basically 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 than you have an internal short and should contact your local Spectra facility. 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.

4. Attach the first meter lead to pin 2 of the analyser feedthrough. Connect the second meter lead to each of pins 3 to 12 on the analyser feedthrough in turn. Each one should give an open circuit. Now attach the first meter lead to pin 3 and check to pins 4 to 12. Proceed around the feedthrough until all possible connections have been checked.

All pins should show open circuit to all other pins EXCEPT pin 4 to pin 8, pin 4 to pin 10 and pin 8 to pin 10 which should show short as these are the filament connections (see the next section). If any of the pins do show short to an other pin contact your local service centre with the results of your testing and they will advise you as to how to proceed.

7.6 Checking Filaments

If you suspect a blown filament, for instance the control unit shows filament fail, carry out the following test before removing the analyser from the vacuum system.

1. Connect meter lead one to analyser feedthrough pin 8 which is the common connection to both the filaments.

2. Connect the second meter lead to pin 4 (Filament 1). You should have a short circuit, the resistance of the filament is about 0.5 ohms when it is cold.

3. 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 should 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. Examine the RF/analyser connector on the front of the HPQ2-IP control unit, check that none of the gold sockets are pushed out of place.

7.7 Changing Filaments

The HPQ2-IP quadrupole analyser is fitted with a dual, self-aligning filament assembly. This assembly consists of a circular plate fitted with three small feedthroughs. Between these feedthroughs on the under side of the filament plate are attached the filament wires. When we talk about filaments and replacement filaments it is this assembly to which we are referring. Changing filaments is probably the most common maintenance procedure that has to be undertaken with quadrupole analysers but the analyser has been designed to make the task as quick and easy as possible.

Tools required
Here 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 was supplied with a tool kit, which contained some of the things you will need.

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

As the HPQ2-IP is very small it is not really necessary to hold it in a vice as long as you are reasonable careful.

***** Always wear cotton gloves when working on the analyser *****

7.8 Removing the Filaments

1. Remove the analyser from the vacuum chamber making sure you do not touch any of the exposed surfaces. Place the analyser on the bench so that the ion source is uppermost, secure it in a vice if you prefer take care not to over tighten the jaws.

2. The filament assembly is located at the very top of the analyser and the electrical connections are made by two barrel connectors. Make a note of the orientation of the barrel connectors.

3. Hold one of the barrel connectors firmly with your pliers and slacken both screws undoing them 1 to 1½ turns. Lift away the barrel connector and put it in your container.

4. Repeat step 3 to remove the other barrel connector.

5. Remove the two M1.6 x 3 slotted pan head screws which hold the filament assembly in place on the ion source and put them in your container. This is easily done if you carefully undo the screw fully, then, lift it away using your tweezers.

6. Make a note of which way round the filament assembly is fitted onto the ion source then lift away the filament assembly.

It is worthwhile at this stage checking 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 where the signs to look for are powdery deposits of tungsten oxides. 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 any further.

7.9 Fitting New Filaments

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

1. Place the filament assembly in the correct orientation onto the top of the source ensuring that the filament wire does not touch any part of the source and thus potentially cause damage. Be careful to fit the filament plate into the top of the cylindrical foil repeller without bending the foil.

2. Refit the two M1.6 x 3 pan head screws that fasten the filaments to the ion source.

3. Place a barrel connector over one of the filament connection wires and gently pull the wire towards the ion source and fit the barrel connector to the appropriate feedthrough. Tighten the two screws on the barrel connector. Be sure the wire up to the barrel connector stays close to the analyser body.

4. Repeat step 3 for the other filament connection.

5. Check with your Ohmmeter for shorts.

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

7.10 Ion source, replacing and cleaning

The HPQ2-IP analyser design permits the removal of the ion source as one complete assembly which can be replaced or cleaned as an assembly. The ion source automatically aligns on the main analyser assembly allowing it to be easily replaced without the need for any special jigs.

7.11 Removing the Ion Source

Once again you are advised to get the necessary tools together before you start this job. It really does make life simpler.

Tools required:

A small jewellers screwdriver (2mm)
A pair of tweezers
A small pair of smooth jawed needle nosed pliers
A 0.89mm (0.035") Allen key
A pair of clean cotton gloves
A clean bench on which to work
An Ohmmeter
A clean container in which to put small parts
Replacement filament(s)
Replacement source parts if necessary
A pen and paper on which to make notes and sketches
Some method of holding the analyser in an upright position, a small vice is ideal.

1. Remove the analyser from the vacuum system, place it on the bench in an upright position, secure it in a vice if you prefer.

2. Remove the filament assembly as described on Page 31.

3. Locate the three barrel connectors attached to three of the plates which form part of the ion source. Undo the screws on these barrel connectors 1 to 1½ turns.

4. Undo the two very small socket set (Allen) screws that are positioned in the side of the source mounting collar at the base of the source assembly. These may be partially obscured by connecting wires.

5. The source is now free from the rest of the assembly and can be removed and placed onto the bench.

7.12 Cleaning the Source

The ion source may be cleaned as a complete assembly as described below.

Equipment required:

Isopropyl alcohol
Ultra-sonic bath
Clean glass beaker
Drying oven or heat gun

Using an ultra-sonic bath can loosen some of the screws in the ion source carefully examine any used isopropyl alcohol before throwing it away in case there are some screws in the beaker.

1. Remove the ion source from the analyser as described on Page 33.

2. Place the ion source in the beaker and fill with sufficient isopropyl alcohol (ipa) to fully immerse the ion source. Place in the ultra-sonic bath for 10 to 15 minutes.

3. Replace the ipa and place in the ultra-sonic bath for a further 10-15 minutes.

4. Remove the ion source and rise with clean ipa and place in a drying cupboard for at least an hour to dry off all ipa residue. If a drying cupboard is not available use a heat gun to dry the ion source.

5. Check that all the screws in the ion source assembly are tight.

6. Re-fit the ion source by following the instructions on Page 35.

If after two washes there are still deposits on the ion source it should be returned to an MKS service facility to be cleaned.

7.13 Re-fitting the Ion Source

Re-fitting the ion source is simply the reversal of removing it.

1. Position the ion source in the correct orientation above the analyser and then fit the three wires into the three barrel connectors on the various plates which make up the ion source. This is quite difficult and requires patience, so, take your time.

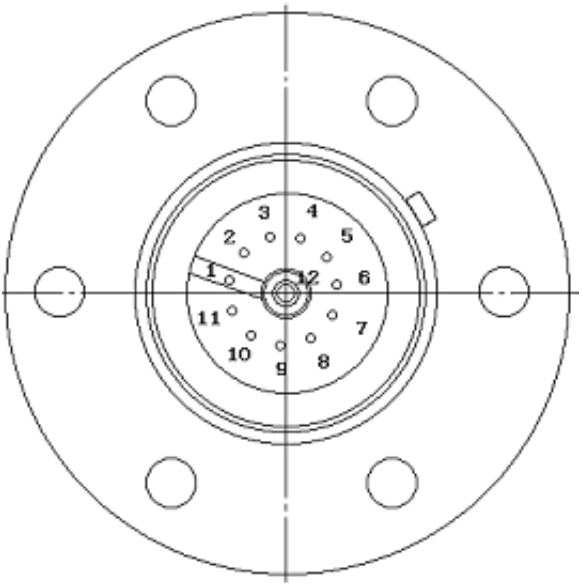
2. When the ion source is in place tighten the two socket set (Allen) screws in the source-mounting collar.

3. Tighten the screws in the three barrel connectors.

4. Re-fit the filament assembly by following the instructions on Page 32.

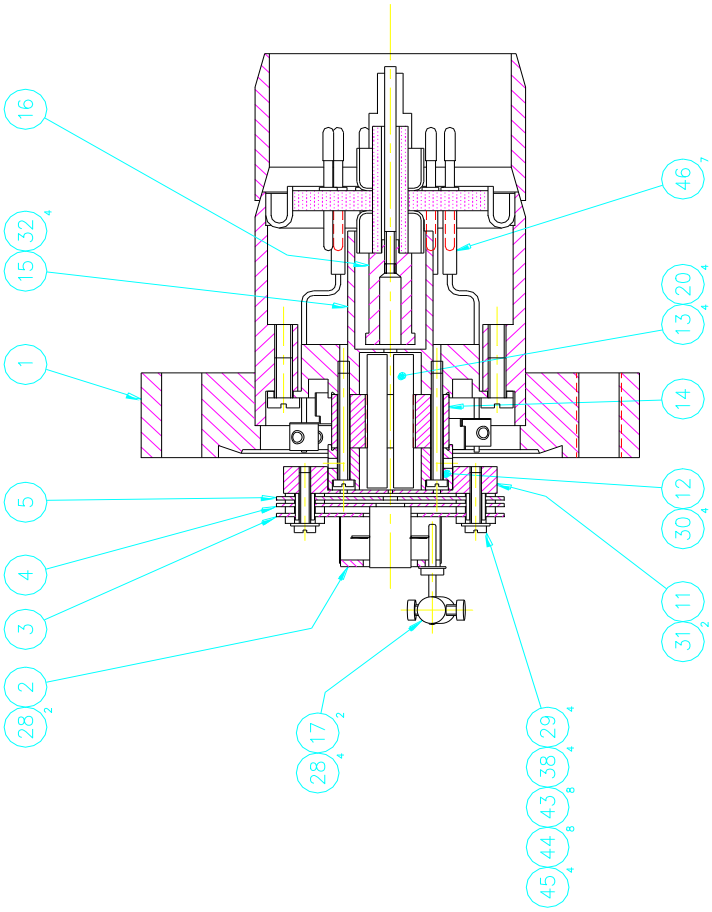
8. Exploded Views

8.1 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

8.2 Exploded View of the Analyser



HPQ2-IP Analyser	
Reference	**Part Description**
1	Flange Sub Assembly
2	Filament Sub Assembly
3	Repeller Plate Sub Assembly
4	Source Plate Sub Assembly
5	Extraction Plate Sub Assembly
11	HPQ2-IP Source Mounting Ring
12	HPQ2-IP Filter Clamp Ring
13	HPQ2-IP F/Electrode
14	Ceramic Filter Saddle
15	HPQ2-IP Filter Mount
16	HPQ2-IP Faraday Cup
17	HPQ2-IP Filament Barrel Connector
18	HPQ2-IP Connector
19	RF Loop for HPQ2-IP
20	Screw M1.6 x 5.6 modified
28	Screw M1.6 x 3 ch hd stainless steel
29	Screw M1.6 x 8 ch hd stainless steel
30	Screw M1.6 x 16 ch hd stainless steel
31	Screw M2 x 3 socket hd stainless steel
32	Screw M2.5 x 6 ch hd stainless steel
38	Washer Plain M1.6 stainless steel
43	Washer Ceramic 5.5 x 2.9 x 0.5mm
44	Ceramic Spacer 1mm White XDA080
45	Ceramic Tube 2.7 x 1.7 x 4.0mm long
46	Tube 0.076”dia x 0.056” id x .375” long Aly53
47	Alsint Tube 2mm x 1.2mm x 300mm long
48	Nickel Wire 1mm dia.
49	Stainless Steel Wire 22swg.

9. Ion Source Parameters

The following table gives the default ion source settings for HPQ2-IP in its three operating modes.

Instrument & Mode	ION SOURCE PARAMETER			
	Emission	**Electron Energy**	**Ion Energy**	**Extractor**
HPQ2-IP RGA Mode	0.7mA or 0.39mA	70eV	7.0eV	-110V
HPQ2-IP HP Mode	0.1mA	35eV	5.0eV	-58V
HPQ2-IP Leak Mode	1.0mA	88eV	10.0eV	-130V

Emission Current in RGA Mode

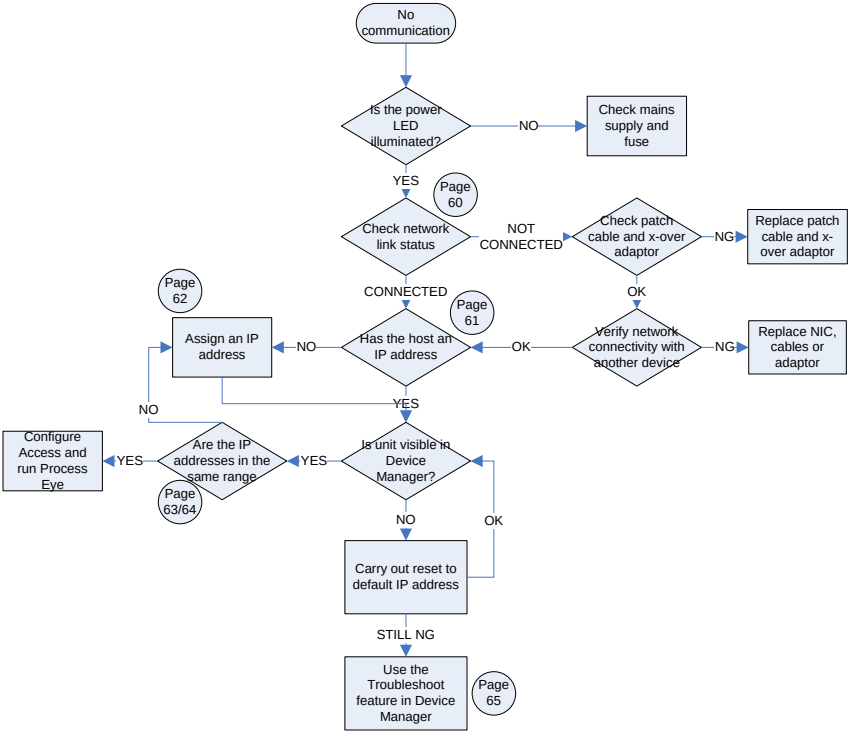
On older instruments (those with serial numbers LM75-00298025 and below) the emission current should be set to 0.70mA.

On newer instruments (those with serial numbers LM75-00298026 and greater) the emission current should be set to 0.39mA.

This change results from changes to parts used in the ion source. An incorrect emission current setting will result in a loss of sensitivity.

10. Communications Troubleshooting

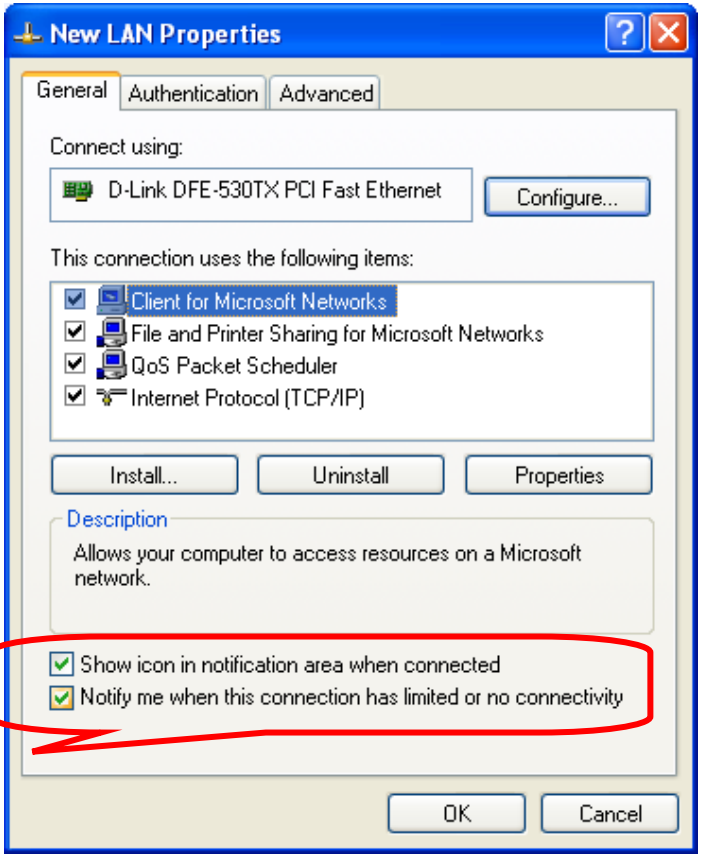
The following flowchart should help you through any connection problems you may encounter.
Note that this assumes you are connecting directly from the host PC to the instrument. If the instrument is to become part of a network, then assistance should also be sought from your IT staff.



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.



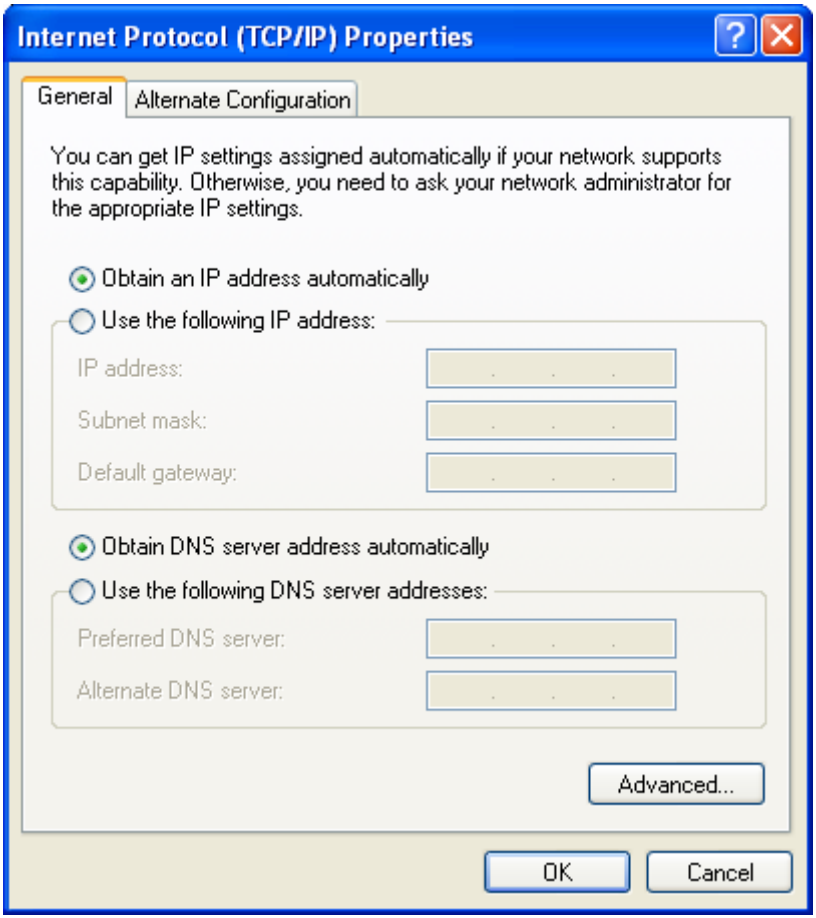
Check the options shown above. Your network connection status is now displayed in the task-bar, near the clock. Mouse-over the icon to check the status of the connection.

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 DNCP network or intend to directly connect to the instrument, you will need to assign a static IP address.

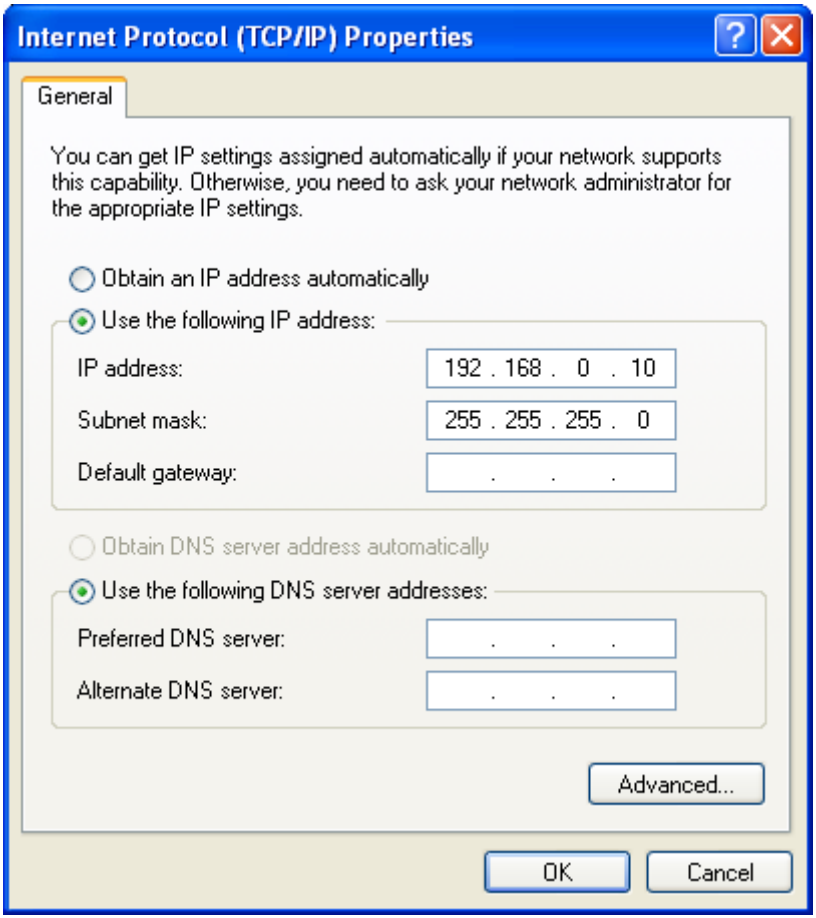


Assign a Static IP Address

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.

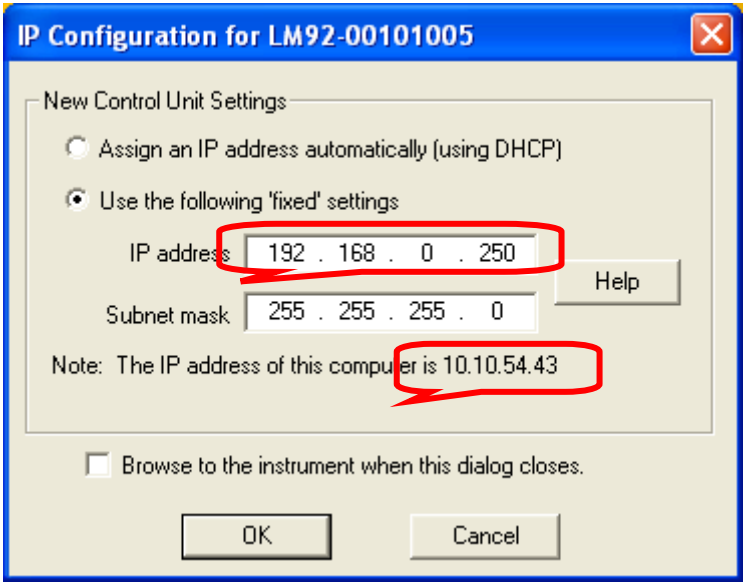


PC and Instrument on different IP ranges

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.



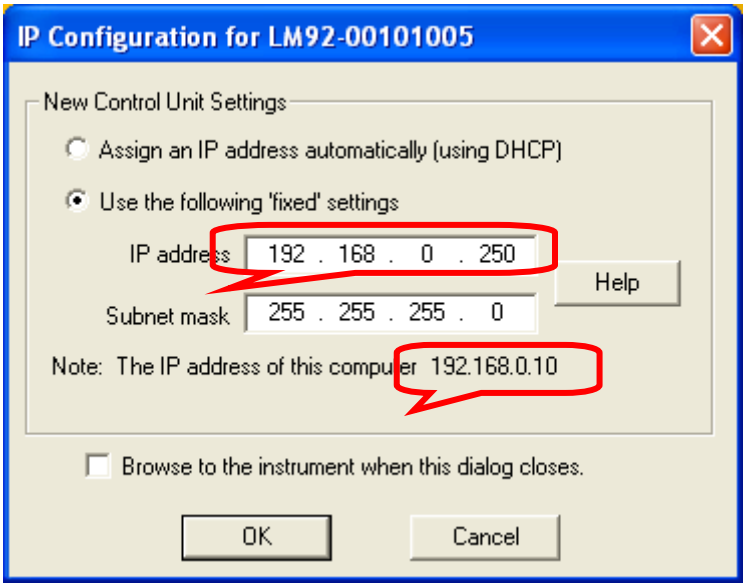
In this example, the host PC will not be able to communicate with the instrument while the two IP addresses are in different ranges.

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, overtype the current address with the new one.

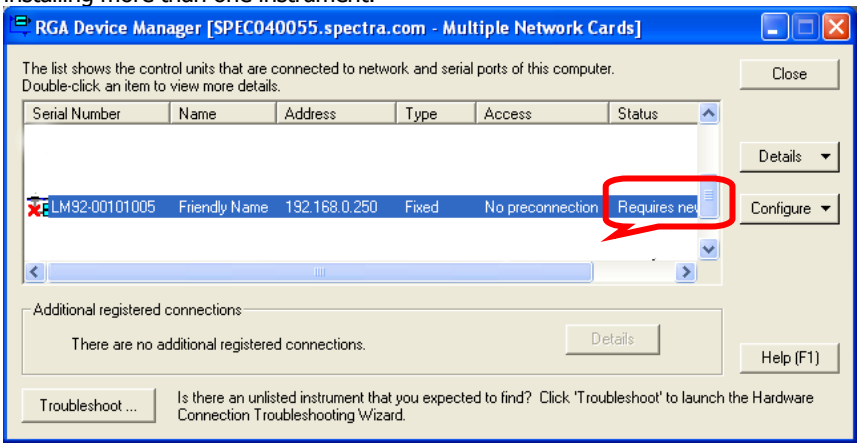
Note: If the host PC is part of your network, then changing its IP address is not recommended without seeking advice from your IT staff. Likewise, assigning a new IP address to the instrument must be done under advice or network conflicts could occur.

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 PRESET button for 20 seconds.

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

11. 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 51 and 52 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.