mks
Technology for Productivity
Spectra™ Products

Vision 2000-C/E Manual

SP102005.102
March 2013

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

You can send your comments to:

MKS Instruments, Spectra Products
Cowley Way
Weston Road
Crewe, Cheshire
CW1 6AG
United Kingdom

+44 (0) 1270 250150 Tel.
+44 (0) 1270 251939 Fax.

www.mksinst.com

MKS Instruments UK Ltd.
2-4 Cowley Way
Crewe, Cheshire
CW1 6AG United Kingdom

mks
Technology for Productivity
Spectra™ Products

Declaration of Conformity
Vision 2000C (LM90)

Declaration:

MKS Instruments UK Ltd. hereby declares that the Vision 2000C (LM90) product complies with the EMC and LVD directives and the following standards:

2004/108/EEC ELECTROMAGNETIC COMPATIBILITY DIRECTIVE

The item detailed above has been tested in accordance with:

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

2006/95/EC LOW VOLTAGE DIRECTIVE

The item detailed above has been tested in accordance with:

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

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

I hereby declare that the Vision 2000C (LM90) product meets with the requirements of the above referenced European Standards and complies with the referenced European Directives.

Signed:

Stephen Drysdale
General Manager
22 March 2013

CE 13

MKS Instruments UK Ltd.
2-4 Cowley Way
Crewe, Cheshire
CW1 6AG United Kingdom

mks
Technology for Productivity
Spectra™ Products

Declaration of Conformity
Vision 2000C/E (LM115)

Declaration:

MKS Instruments UK Ltd. hereby declares that the Vision 2000C/E (LM115) product complies with the EMC and LVD directives and the following standards:

2004/108/EEC ELECTROMAGNETIC COMPATIBILITY DIRECTIVE

The item detailed above has been tested in accordance with:

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

2006/95/EC LOW VOLTAGE DIRECTIVE

The item detailed above has been tested in accordance with:

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

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

I hereby declare that the Vision 2000C/E (LM115) product meets with the requirements of the above referenced European Standards and complies with the referenced European Directives.

Signed:

CE 13

Stephen Drysdale
General Manager
22 March 2013

Additional Installation Maintenance and Operating Instructions

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

Installation

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

- 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.

- 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 UK Ltd.

- 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 UK Ltd must be contacted for technical guidance on possible EMC and safety issues.

- 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.

Operation

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 UK Ltd.

All instructions given in the operating manual must be followed.

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

Maintenance

WARNING-DANGEROUS VOLTAGES EXIST INSIDE THE EQUIPMENT

Maintenance functions must only be carried out by competent persons.

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

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

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

Table of Contents

WARNING

This section of the manual contains important safety information.
Please read it carefully.

Important safety information is highlighted by the use of WARNING and CAUTION boxes. The use of these boxes is described below:

WARNING

WARNING boxes are used where failure to observe the instructions could result in personal injury or death.

CAUTION

CAUTION boxes are used where failure to observe the instructions could result in damage to the equipment or associated equipment.

Instructions in CAUTION and WARNING boxes MUST be observed.

MKS Instruments accepts no liability for any injury or damage resulting from a failure to observe instructions in CAUTION or WARNING boxes.

Warning Symbols

Various warning labels and symbols may be attached to the instrument their general use is explained below.

The Exclamation Mark (ISO 3864, No.B.3.1) label.

General caution.
Refer to the manual for detailed instructions.

The Electric Shock (ISO 3864, No.B.3.6) symbol.

This is generally used on the instruments to warn of the presence of hazardous voltages.

The following warning labels used on the Vision 2000-C/E systems are explained below.

The Exclamation Mark (ISO 3864, No.B.3.1) label.

On the rear panel of the Microvision2 refers to:
Read all instructions carefully before use.
The control and signal ports are designed for connection to MKS Instructions accessories via MKS Instruments cables.

The Electric Shock (ISO 3864, No.B.3.6) symbol on the:

Turbo controller, refers to possible risk of Electric shock, if the covers are removed.
Only competent Service personnel should gain access.

Remote Vacuum Controller, refers to possible risk of Electric shock, if the covers are removed.
Only competent Service personnel should gain access.

Front panel of the Microvision2, refers to accessible hazardous voltages on the analyser connector, when not mated to the analyser, which may result in a non-hazardous electric shock if touched.
Tuning adjustment holes, which are not for operator use.

Fuses

The Vision 2000-C/E systems must be powered down and disconnected from the mains supply before changing any fuses.

Although the fuses on the RVC2 are accessible, only competent persons should change them.

Although fuses sometimes wear out, this is rare. In most cases, fuses blow due to a fault condition. When a fuse blows, every effort should be made to clear the fault before the fuse is replaced. For continued protection against risk of fire, replace only with fuses of specified rating and type.

All fuses are 20mm X 5mm H.R.C. ceramic, 250V AC, characteristic (T) and compliant with IEC 127.

Details of fuse types and ratings can be found in the RVC2 manual and printed on the rear panel.

Electrical Connections

The Vision 2000-C/E must be powered down and isolated from the mains power supply before any electrical connections are made.

On the rear panel of the Microvision2 there are no hazardous voltages on any of the ports (electrical connectors). Connections must not be made that may place hazardous voltages or currents on these ports. MKS Instruments must be consulted before any non-MKS Instruments cables or accessories are connected to these ports.

If you are unclear about any of the safety information contained in this section of the manual please contact your local MKS Instruments facility before proceeding.

Installation

System Overview

The Vision 2000-C/E is a self contained RGA system for sampling directly from a CVD or Etch process chamber. It consists of five main parts:

- The RGA vacuum chamber that bolts directly on to the process chamber.
- The turbopump foreline isolation valve and gauge assembly (Surge Protector)
- The equipment sub-rack.
- The interconnecting cables.
- The operating PC.

The RGA vacuum chamber contains the quadrupole residual gas analyser with a differentially pumped CVD ion-source, a special MKS UniBloc™ inlet sampling valve with integral pressure reduction orifices, process chamber pressure gauge and a purged turbomolecular pump. This assembly is surrounded by a dual-zone electrically heated jacket. The entire system is controlled via the rack-mounted RVC2 and the System Interface Module.

The standard V2000C/E turbopump foreline provision is connection to the foreline of the process tool itself. This ensures that the small amounts of process gas that are sampled from the process chamber are returned to an appropriate exhaust gas scrubber system. The Surge Protector assembly isolates the RGA turbopump foreline from the tool foreline when the RGA system pump is off and when the tool foreline pressure is above 3 torr.

WARNING

The RGA system must never be operated without exhausting to a hazardous gas scrubbing system that is appropriate for the process gases it might sample!
In normal operation, sampled gas flow can be up to 0.06 sccm for 3-valve inlets and up to 10 sccm for 4-valve inlets. In either case, the exhaust gas will consist of any sampled process gas mixed with 6 sccm of turbopump purge gas (N2 or Ar).

A 19-inch sub-rack houses the Remote Vacuum Controller (RVC), the cables running between the sub rack and the RGA vacuum chamber may be fitted into trunking (conduit) to give additional protection.

CAUTION

There are subtle differences among the various available configurations of the Vision 2000-C/E systems.

There are small differences among Vision 2000-C/E systems. Variations are usually due to the type of process tool to which the Vision 2000-C/E is to be fitted, the type of process to be monitored and the pressure regime from which the system will be sampling.

The design variations are purely to give the user the best possible system to meet the needs of the application. This manual covers all variations of Vision 2000-C/E. The shipment report will detail your particular system and you should refer to this when the manual gives details of options. The most common variants are shown on the next page.

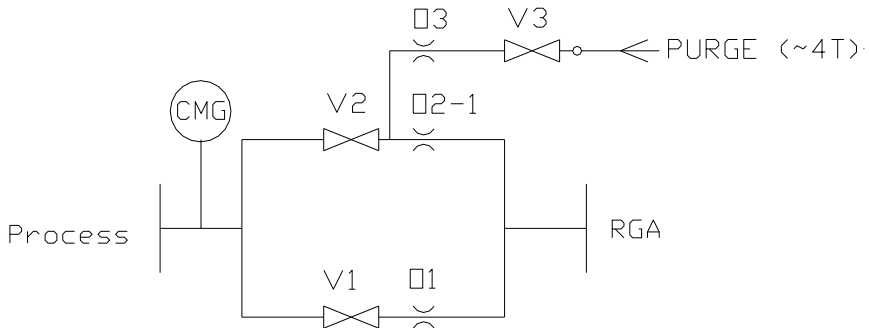


Fig.1: 3-Valve “Etch” Configuration

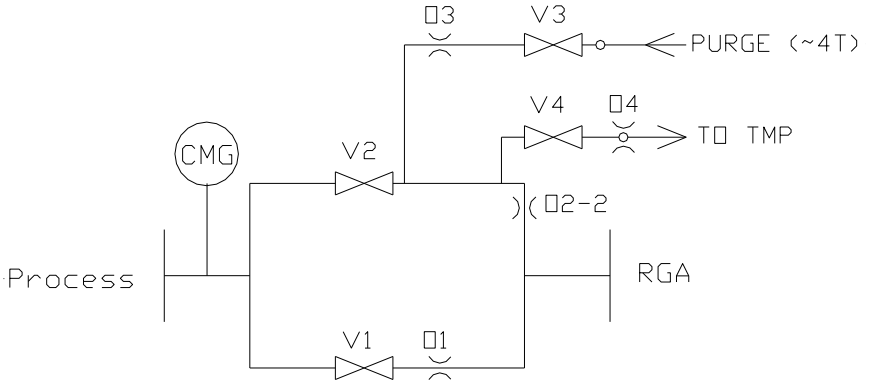


Fig.2: 4-Valve, Fast-Response “LPCVD” Configuration

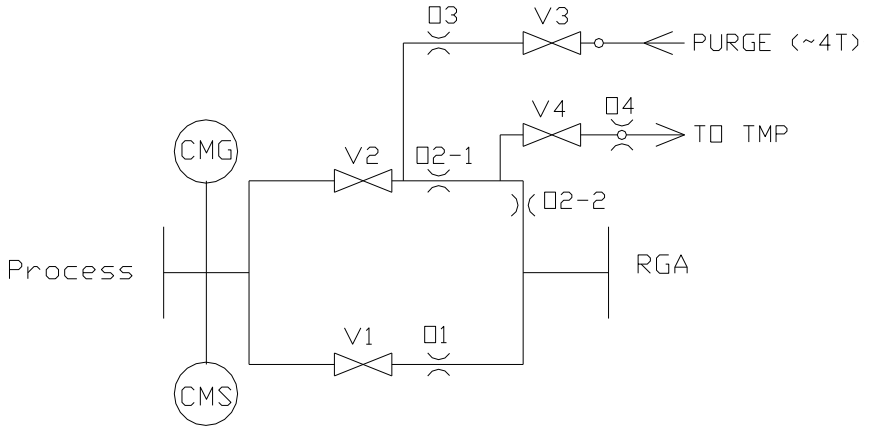


Fig.3: 4-Valve, High-Pressure “CVD” Configuration

Unpacking

When you receive the equipment carefully check each item before removing the packaging to ensure that no physical damage has occurred during shipment. Also check that all the boxes have been received by checking against the packing slip.

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

Carefully unpack the various parts of your Vision 2000-C/E system. Again, check for any signs of damage.

Find the shipment report and check for any missing items. Keep the shipment report safe, this is an important document and you may need to refer to it later.

We suggest you keep the packaging material until the system is up and running as this seems to dramatically reduce the chances of something needing to be returned!

Most insurance claims for shipment damage must be placed within 7 days from the date of delivery - in WRITING. So, don't delay - Check It Out !

You are now ready to assembly the Vision 2000-C/E system.

Vacuum System installation

As much of the system as possible has been shipped pre-assembled. The whole of your Vision 2000-C/E system has been assembled and tested before being partially dissembled prior to shipping.

CAUTION

The vacuum system interface components are of high precision and should only be fitted by competent personnel.

RGA vacuum chamber overview

The Vision 2000-C/E is supplied with the RGA vacuum chamber already assembled; the quadrupole analyser is fitted into the chamber, the turbomolecular pump is also fitted as is the 3- or 4-valve UniBloc™ inlet assembly. The inlet valves are controlled from the Remote Vacuum Controller (RVC2).

Integral to the UniBloc™ body are all necessary pressure-sampling orifices. The three basic UniBloc configurations have been summarized on Page 10.

Please refer to the shipment report for details of the inlet configuration. The inlet configuration of your Vision 2000C/E has makes little difference to its installation. On the face of the UniBloc™ inlet valve that connects to the RGA chamber is a ceramic CIS (closed ion source) coupling.

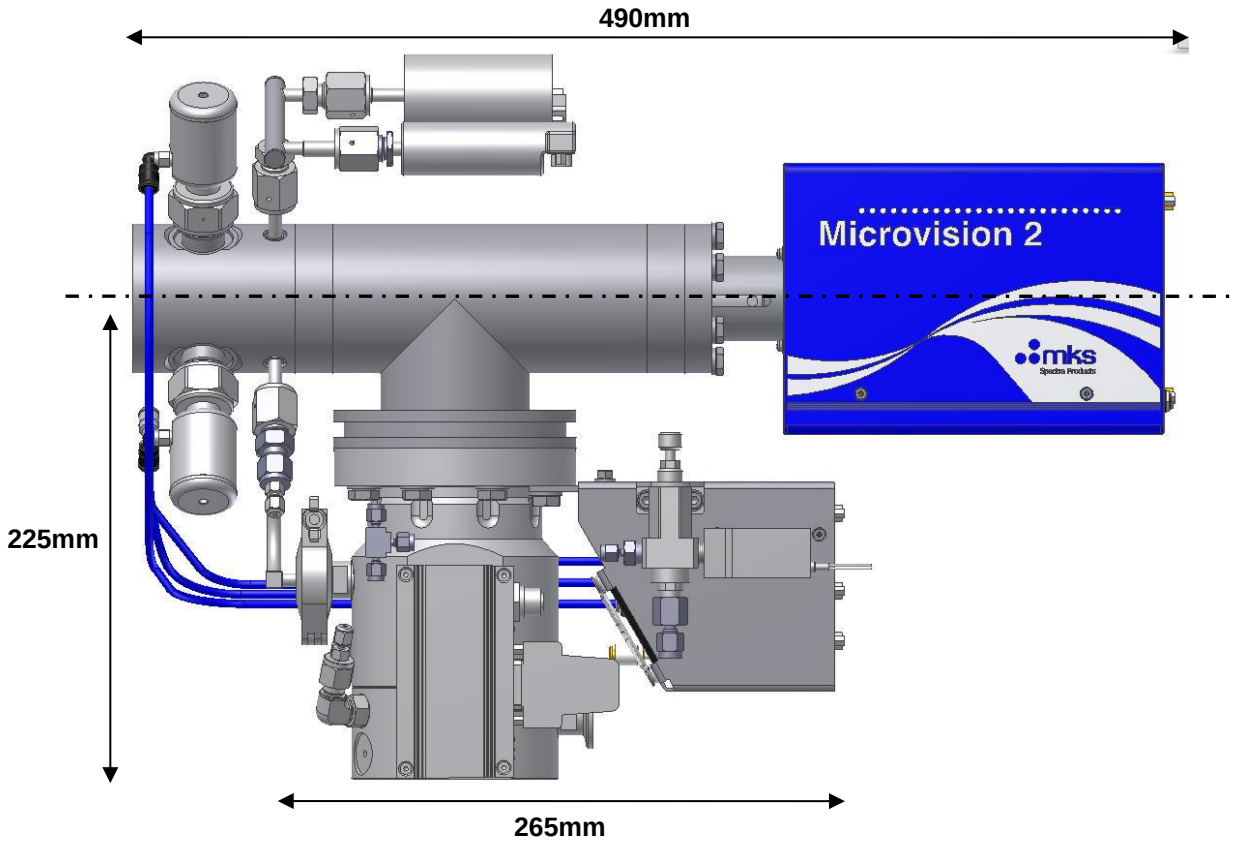
Exchanging an inlet valve assembly is a reasonable operation to perform in the field, though advice must be sought on the correct seating and conditioning of the valve's sealing face.

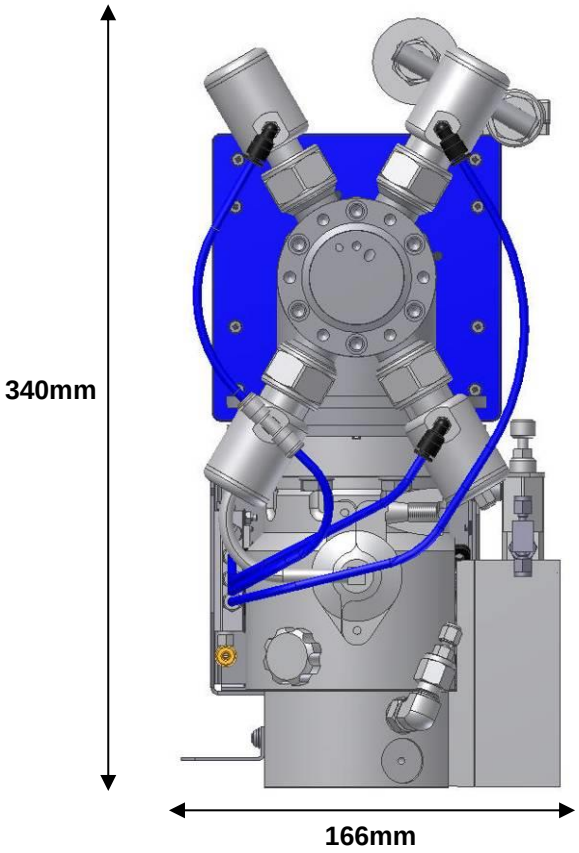
It is also possible to change the internal orifices if they become plugged, or if it becomes necessary to change the operating pressure range(s). However, changing internal components of a UniBloc™ in the field is not currently recommended.
If you suspect that you need to have your UniBloc™ serviced, please consult the local MKS Instruments facility regarding appropriate servicing options.

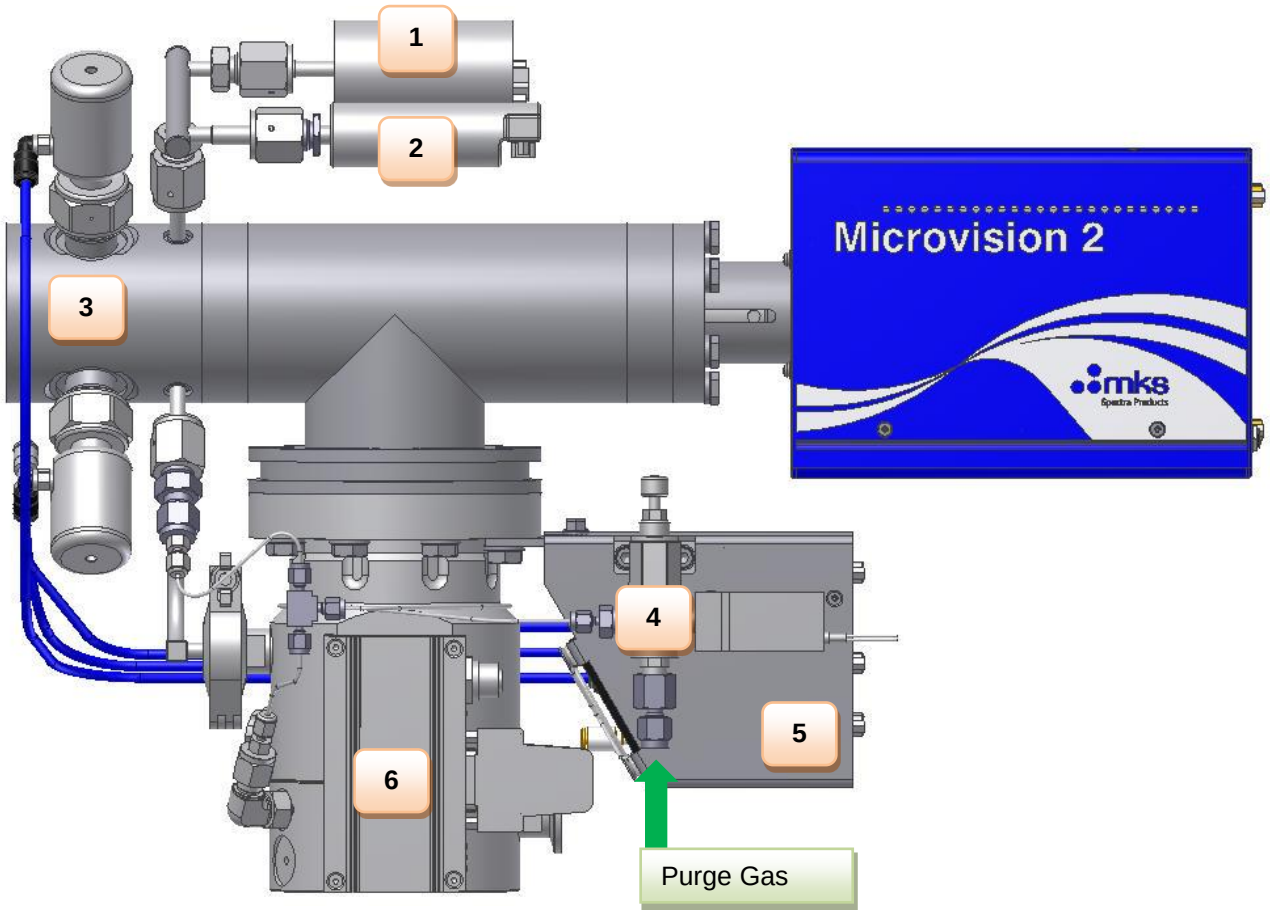
Fitted to the other side of the process valve there might be various adapting components, such as an elbow, an elbow and nipple or two elbows. The exact configuration will depend on the type of process tool to which the Vision 2000C/E is to be fitted.

CAUTION

The inlet flange of the UniBloc™ is tapped for bolts that are ¼" x 28 thread/inch by 7/8" long. Silver-plated bolts, or equivalent lubrication, must be used to avoid damaging the UniBloc™ body.

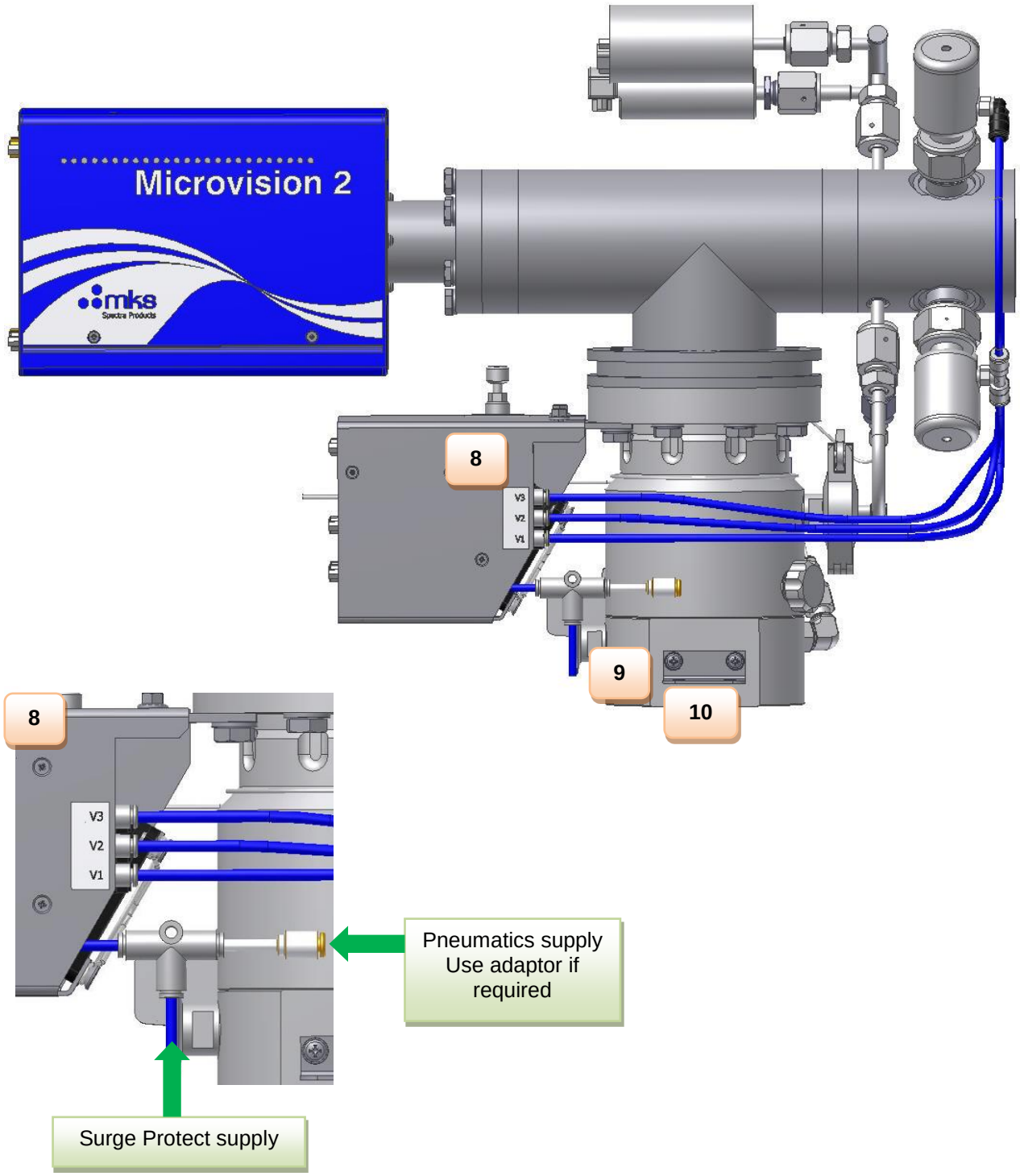

490mm
Microvision 2
mks
225mm
265mm


340mm
166mm

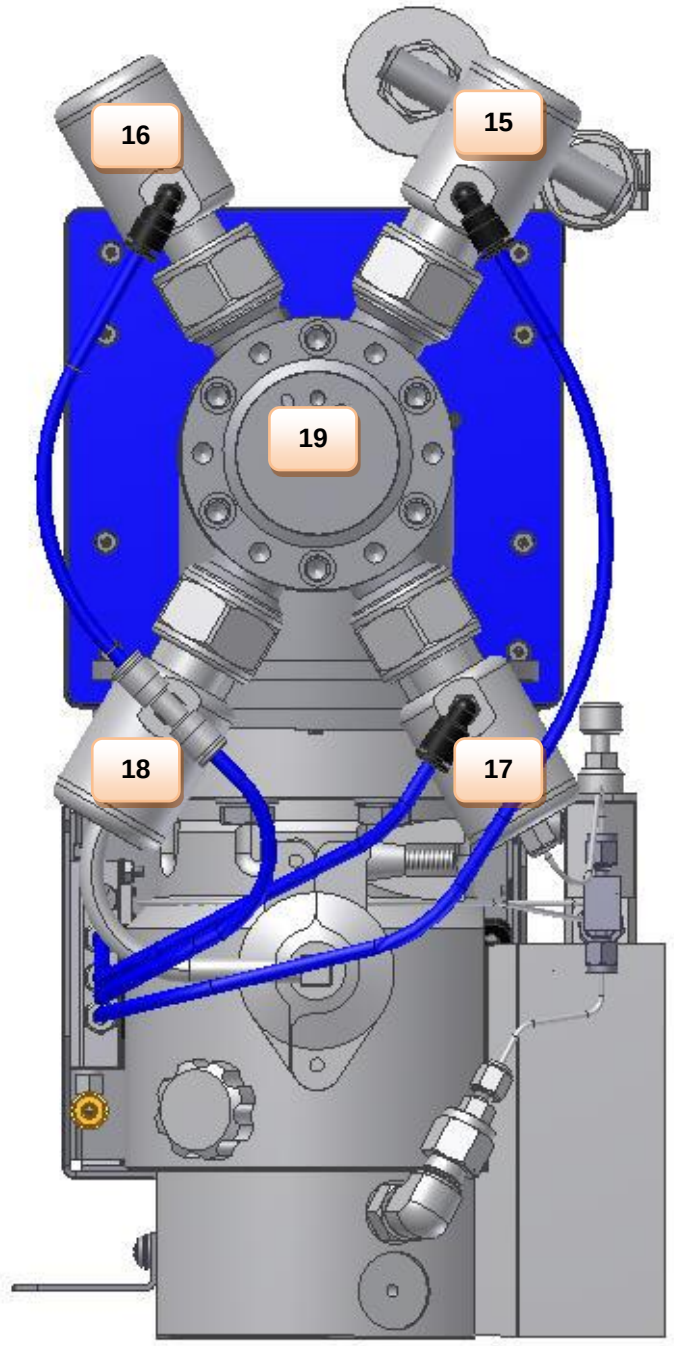


Item Ref	Description
1	HiVac OK – (1T or 10T depending on working pressure) 722 Baratron Gauge
2	LoVacOK – 890B Gauge
3	UniBloc™ inlet assembly
4	Purge regulator assembly – 3.5 to 8Bar Argon or dry Nitrogen supply required **
5	System Interface Module
6	Turbo molecular pump and controller
7	

** The Purge supply regulator is factory set and requires no adjustment.



Item Ref	Description
8	Pneumatic Manifold assembly – 60 – 80 psig dry air
9	Fore line connecting flange
10	Cable loom supporting bracket



Item Ref	Description
15	V1
16	V2
17	V3
18	V4
19	UniBloc™ mounting face
20	

Main Chamber installation

This is a job that requires two people - one to support the Vision 2000C/E system, while the other fits the bolts to the flange. The Vision 2000C/E will operate in any orientation, but it is preferable to mount it with the quadrupole analyser horizontal, and the turbo pump hanging down, vertically.

The turbopump must not be inverted, to any degree – that is, it must not be oriented with the exhaust end of its shaft higher than its inlet end.

CAUTION

The V2000C/E vacuum system is heavy (~18kg, 40lb) and must be adequately supported to avoid serious damage to the process chamber! Independent support for the RGA vacuum system is strongly recommended.
Installation should be performed by competent personnel using appropriate installation components.

Note that care must be taken to support the weight of the V2000C/E assembly (approx. 18kg, =40lb) at the tool. Most process tools have aluminium chamber walls with fittings that will not support this weight and torque, directly.

MKS Spectra Products offers an adjustable stand to support the weight of the RGA at the tool without stressing the point of vacuum connection (e.g., model 02184-4175). Please contact your MKS Spectra representative for details on available sizes and configurations. Other support means that bear the weight of the system from the turbopump flange or from under the turbopump are also permissible, provided that they do not generate a stress between the mounting point and the inlet connection. Make the vacuum connection to the process chamber using a clean CF35 copper gasket or O-ring, as required.

NOTE: With 4-valve UniBloc™ inlets, if the path from the inlet flange face to the point of gas flow being sampled is long, response time can be improved by using a length of 1/8" OD PTFE tubing from the point to be sampled to the face of the UniBloc™.

Be sure that the tubing material is compatible with the process gases to which it will be exposed – PTFE is just a suggestion. In this case, insert the end of the tubing approximately ½" into the V2 port on the face of the UniBloc (angled hole pointing to V2 actuator). It must fit, snugly, so that it will not fall out. If this is done, ensure that the other end will not interfere with the operation of the process tool. If this tube is later removed and replaced, ensure that no debris is pushed up into the V2 actuator when inserting the new tube.

Pneumatic actuation and Purge Gases

Compressed air at 0.52 - 0.65 MPa (60-80 psig) must be supplied to "push-in" inlet fitting of the valve manifold mounted on in the Interface Module. The size of this fitting is customer dependent. This gas opens the inlet valves.
There is T- pneumatic fitting here for extending the gas supply to the SurgeProtector valve assembly.

Purge gas at 3.5 to 8Bar must be supplied to the 1/8" Swagelok™ fitting on the Purge Assembly. The absence of adequate purge gas pressure is sensed by a pressure switch at the regulator. The RVC2 will interpret this condition as "turbo-not-ready" and react to it the same as if the turbopump was not running at full speed. If this condition persists more than a few minutes, the RVC2 will shutdown the RGA to protect the turbopump.

Either N2 or Ar of suitable purity (at least five 9's is suggested) may be used. Purge gas consumption rate is about 6 sccm.

Connecting the foreline and SurgeProtector valve

A length of metal bellows with KF-16 terminations is supplied for connecting the turbopump exhaust fitting to the SurgeProtector valve assembly.
Connect the stainless steel foreline directly to the turbopump using a KF16 centering O-ring and clamp. The valve assembly must be installed at the remote end of the foreline bellows, away from the RGA turbopump.

Carefully note the valve labels regarding orientation and install it so that the port on the axis of the valve is connected to the RGA turbo foreline and the “side” port is installed towards the tool foreline.

The integral gauge must sense the pressure in the process tool vacuum line. Finally, when it is permissible to interrupt the process tool, connect the SurgeProtector to the tool vacuum. Connect the supplied length of 4mm tubing from the spare fitting on the valve-solenoid manifold block to the SurgeProtector actuator and plug-in its electrical cable to the matching connector at the harness near the RGA turbopump.

When operating the RGA, it is essential that the tool vacuum be kept <2 torr at all times. Depending upon the dynamics of tool foreline pressure rises and the length of foreline bellows from the turbopump to the SurgeProtector, the RGA system can tolerate up to 1 minute of isolation before shutting-down the RGA vacuum system due to foreline over-pressure condition.

If the tool vacuum line cannot meet these requirements, and independent backing pump will be required for the RGA. This pump must be appropriate to handle up to 20 sccm of gas flow at <2 torr, and be compatible with the process gases being sampled. Furthermore, all appropriate safety and environmental regulations regarding exhaust scrubbing and personnel exposure must be strictly followed.

Heater jackets

The Vision 2000C/E is supplied with two heater jackets fitted: one on the main RGA chamber; and another around the inlet valve assembly.

There is no need to remove the heater jacket during the installation and testing procedure. The heater jacket enables the quadrupole chamber to be kept warm during normal operation, and to be baked, which should be done before attempting to acquire critical data. Note that the heater jacket is designed to be a tight fit.

When properly installed, the main chamber jacket covers from the face of the RGA analyser flange to the radial tubulation for inlet purge gas fitting. The shorter inlet jacket installs similarly, with the snaps finishing on the same side as those of the main jacket.

The temperature of the two heater jackets is monitored and controlled via the Interface Module mounted to the turbo pump. No user adjustments are required.

MicroVision2 installation

Slacken the hex bolt on the clamping ring so the ring can be freely rotated. Line up the slot on the analyser connector with the pip on the flange of the analyser.

Gently slide the Microvision2 unit on to the analyser. TAKE GREAT CARE the pins on the vacuum feedthrough are easily damaged. DO NOT force the Microvision2 unit on to the analyser.

When all of the pins are engaged, push the Microvision2 firmly onto the analyser to ensure electrical continuity. The last 3mm (1/8”) is important. When correctly fitted the front face of the RF/analyser connector should butt up against the analyser flange.

Finally, tighten the clamping ring enough to securely hold the Microvision2 to the analyser.

WARNING

The electrical installation must be carried out by qualified personnel in accordance with local standards and regulations.

The electrical installation should be carried out after the vacuum system installation. Please follow the next sections, in sequence.

Electrical specification

See the RVC2 and Microvision2 User Manuals for specifications

Only use IEC or UL approved Mains fuses are used to protect this equipment:
Safety Class I
Installation Category II
Pollution Category II

WARNING

This appliance must be earthed

Equipment rack
The Remote Vacuum Controller (RVC2) is fitted into a 19-inch sub-rack. The sub-rack should be fitted into a 19-inch equipment rack using four M6 screws, plastic cup washers and cage nuts.

Interconnecting cables
All the cables that run between the equipment rack and the RGA vacuum chamber may be routed in protective conduit (e.g., plastic trunking) that provides a good degree of protection, according to the location of installation. All cables are labelled at both ends. All the connectors have been chosen to minimise the risk of making a wrong connection. The table below gives cable functions and cable destination.

Rack	RGA System	Location / Notes
System 1	System Box	Interface Module - System 1
System 2	System Box	Interface Module - System 2
System 3	System Box	Interface Module - System 2
Turbo Pump	Turbo Pump	Turbo pump control module
ECU Power	Power	Microvision2
Digital IO	Digital IO	Microvision2

Connecting to the Process Tool

The V2000C/E system uses an integral Baratron™ manometer at its inlet to sense the tool chamber pressure to permit safe and automatic operation of the inlet sampling valves.

Two pressure set-points are established by software settings within the Interface Module to convert the pressure signal(s) into high/low signals for the vacuum “Status” inputs of the RVC2. No electrical connections to the tool are required to determine its vacuum state. The set-points are adjusted at the factory to match the inlet configuration and its internal orifice sizes and require no field adjustment.

Only periodic inlet gauge re-zeroing is recommended.

Mains power

There is a single mains power connection to the Vision 2000C/E which is made to the RVC2. Connect the mains power cable to a suitable single-phase supply:

100/120 Volts AC 50/60 Hz 15 Amps
220/240 Volts AC 50/60 Hz 13 Amps

LINE	BROWN
NEUTRAL	BLUE
EARTH	GREEN/YELLOW

Computer connection

Vision 2000C/E systems are used in conjunction with MKS Instruments Process Eye Professional software running on a PC. If a PC has been supplied as part of the system, the software will have been installed onto the hard drive and will have been fully tested as part of the complete Vision 2000C/E system.

There is one Ethernet connector at the rack-end of the loom into which you should connect, via an STP patch lead to the Ethernet Port of the host PC.

The PC, its monitor and any accessories (e.g., printer) will need their own mains power supply connection. These are not provided directly from the Vision 2000C/E system.

If you are supplying your own PC, install Process Eye Professional by following the instructions in the relevant manual(s).

You are now ready to power up the system. Please read the next section of this manual carefully before you do.

Warning, exposed metal surfaces reach high temperatures during bake-out. Allow an adequate cooling down period before handling

Operation

Overview
This section gives an overview of the Vision 2000C/E system operation.

The Microvision2 control unit receives power from the RVC2. The power switch on the RVC2 must be ON to operate the system. When it is started, the Microvision2 senses the presence of the vacuum system controller (RVC2) and interlocks its operation to it.

Process Eye Professional is started from the PC by an icon on the desktop. The vacuum system must be started-up using this application program before the RGA filament can be turned on. However, to facilitate bringing-up an installation quickly, the turbopump may be started and Bakeout initiated, directly from the RVC2 panel, without use of the computer software.
The operation of the vacuum system controller is fully described in the Remote Vacuum Controller manual.

The pumps are switched on from the Remote Vacuum Controller window or from the RVC2 and the sequence of events is as follows:

- The turbopump will start, the SurgeProtector valve will open (given tool vacuum <3 torr) and the turbo will accelerate.
- When the turbo reaches 95% of full speed, the RVC2 indicates Pump Up to Speed. Note that turbopump purge-gas must be supplied as specified in the Installation section of this manual.
- At this point the RGA filament may be switched on and the background spectra in the RGA chamber may be observed.

Before a process sampling valve can be opened, the corresponding “Pressure OK” signal(s) from the inlet gauge must be met. These set-points are factory preset for the inlet supplied.

A process valve can be opened either manually or automatically from the Process Eye Professional software interface to the RVC2.

CAUTION

Check the complete installation thoroughly before proceeding.

Start up

Set the Remote Vacuum Controller (RVC) “Interlocks” key switch to ON and the power switch to On (I)

On your PC, start Process Eye Professional. The software will detect that the RVC2 is fitted and the Remote Vacuum Controller status and control panel will be available at the bottom of the Process Eye Professional window.

To start the Vision 2000C/E vacuum system, click on the turbopump button.
The colour of the button indicates the status:

Red = off
Yellow = starting
Green = running at full speed

More information about the RVC operating software can be found in the manuals for the RVC2 and Process Eye Professional.

The Vision 2000C/E may also be started from the RVC2 directly. This is useful if the PC is disconnected or the Process Eye software is not running. To start the system from the RVC2, briefly press the PUMPS switch on the front panel. Note that this control can also be used to turn the turbopump OFF.

As soon as the Vision 2000C/E is started the SurgeProtector foreline valve should open (if tool vacuum is <3torr) and the turbopump will start.

The turbo pump controller will indicate when the pump is up to speed and the Turbopump indicator in the RVC window will change from yellow to green. Note that the turbopump controller will be programmed to a set-point of 95% of rated speed.

After the turbopump has reached full speed, you may switch the RGA filament on, but we recommend waiting at least 10 minutes after the adsorbed gas load in the RGA vacuum chamber to reduce before switching a filament on.

Switch the RGA filament on and look at the RGA chamber background spectrum using a Process Eye Professional Bar-Chart recipe (refer to the Process Eye Professional documentation for further details).

The pressure is likely to be quite high but should be falling. If the pressure is very high switch the filament off and wait a little while for the pressure to fall.

Now, check that the process valves work. Ensure that there is a good vacuum in the process chamber. The pressure in the process chamber must be below the corresponding sample-valve pressure set-point to permit you to open a sampling valve.

With the Remote Vacuum Controller in the manual mode and a filament on, open the process valve. The process valve will open and you will be able to see a spectrum of the process chamber.

Once you have established that the process valve is working correctly, close the valve. Minimizing exposure to corrosive process gases when not actively monitoring them will protect RGA system operating life.

Leak checking
At this point you will have assembled the system, checked that it is working and you that you can see a background spectrum. The next thing to do is to leak check the Vision 2000C/E.

The vacuum system used in the Vision 2000C/E was fully leak checked as part of the assembly and test procedure before it left the factory. You need to leak check in case any leaks have occurred due to shipping damage and to check the one seal you have made between the Vision 2000C/E and the process chamber.

Ensure that the process valve is closed.

To leak check you will need a cylinder of helium fitted with a regulator and a length of flexible hose to spray helium around the Vision 2000C/E. You can use a different tracer gas (other than oxygen and nitrogen) as long as it is safe and you modify the mass being monitored in the leak-hunting recipe accordingly. Helium is preferred, and any grade will do.

Run a Leak Hunt recipe in Process Eye and check that the probe gas is set to mass 4 for helium (or the appropriate mass, if you are using another gas).

As the Vision 2000C/E uses a Microvision2 there can be an audio tone available via headphones or powered speaker if enabled in the recipe. Alternatively, position the monitor so that you can see the screen while you are leak-checking. Please consult the Microvision2 manual for details of the audio output.

Starting at the top of the Vision 2000C/E vacuum system slowly and carefully spray helium over the entire system paying particular attention to the vacuum seals. Watch the monitor or listen to the audio tone for a signal indicating a leak.

Once the RGA vacuum chamber is leak-tight, check the part of the Vision 2000C/E between the process valve and the process chamber.

Open the process valve and spray helium over the valve, the seal to the process chamber and the connecting pipe work.

If you do find a leak shut down the system (see System Shut Down on Page 27), fix the leak and start again. Remember you may need to break the seal between the Vision 2000C/E and the process chamber in which case you will also have to shut down the process chamber.

Heating and Baking
The RGA chamber runs at a temperature of 70°C and the inlet valve UniBloc assembly at 90°C. Preset, limited power is applied to these heater jackets any time the turbopump is on. This improves gas response time by reducing the residence time of gases on the walls, especially polar species. From the time of starting the turbopump, allow at least 2 hours for temperature equilibration. During this time, background gas levels will vary, significantly.

Before you can start to use the system to its full potential, you will need to run it for sufficient time to allow the background in the RGA vacuum chamber to drop.
Baking the system will significantly reduce this time. This should be done after the system has run for at least an hour to allow the pressure in the system to drop below $1x10^{-5}$ mBar. We recommend baking the RGA vacuum chamber for at least 20 hours.

Optimum bake-out is achieved by having the inlet valve open with the process chamber at the normal operating pressure of very clean and dry inert gas, or by having all inlet valves closed (the V3 purge valve will be open). The quadrupole should be running with the filament on, but MUST be using the faraday detector.

DO NOT use the multiplier detector during baking!
DO NOT use the electron multiplier detector within the first two hours after terminating baking!

CAUTION

The Electron Multiplier (SEM) MUST NOT be operated at temperatures above 90^0C. Do NOT bake with the SEM selected. After baking ends, wait at least 2 hours before using the SEM!

The electron multiplier will be seriously damaged if it is operated at temperatures above 90^0C!

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

The only remedy when a multiplier has been damaged due to being operated at higher temperatures is to replace it.

Baking can be started (and stopped) directly at the RVC2 with the BAKE button. It can also be controlled through the RVC status and control panel of Process Eye Professional.

The total pressure should gradually start to rise and you should bake the system at least until that pressure starts to drop.

It is useful to create timed bakeout recipes to run with the Faraday detector and turn the bake Off after a preset time so the system can cool down unattended. The default Bake period is 8 hours.

To improve the background further it is recommended that you run and degas both filaments. The amount of time spent in reducing the background peaks depends entirely on the application and is left to the discretion of the customer. If you switch the system off it will vent to atmosphere introducing water vapour and you will have to bake again. Venting to clean dry nitrogen or argon is strongly recommended. Note that the RGA chamber will vent, partially, to the supplied purge gas whenever the turbopump is off.

Warning, exposed metal surfaces reach high temperatures during bake-out. Allow an adequate cooling down period before handling

Inlet operation
The Vision 2000C/E system has a special, closed ion-source.
The optimum operating pressure of this source is $1x10^{-3}$ to $3x10^{-3}$ mbar (to $2x10^{-3}$ torr). As the ion source pressure increases above the optimum, the peak heights become significantly non-linear - that is, they do not rise as much as the pressure.

Monitoring processes at pressures higher than $5x10^{-3}$ mbar requires inlet pressure reduction. The 3-valve inlet and high-flow 4-valve inlets accomplish this with a single stage of pressure reduction through the V2 path. This method is suitable for inlet pressures up to about 10 torr.

In select "fast-response" configurations, additional pumping is provided through V4 to O4. Orifice O4 is a VCR gasket orifice at the UniBloc™ fitting that connects to the side-port of the turbopump. Its size depends upon the factory configuration (typically between 0.007" and 0.031").

Do NOT disassemble this connection unless you have the proper replacement in-hand!

For higher inlet pressures, a two-stage approach must be used, with additional pumping between the two sequential orifice stages, O2-1 and O2-2.
The inlet pressures that can be sampled properly are determined by this configuration and the size of the orifices. Again, differential pumping is obtained through V4 and O4. Again, orifice O4 is a VCR gasket orifice at the UniBloc™ fitting that connects to the side-port of the turbopump. Its size depends upon the factory configuration.

Do NOT disassemble this connection unless you have the proper replacement in-hand!

The state of the inlet manifold is process chamber pressure dependent. This table summarizes the various conditions that it can take. The RVC2 interlocks prevent opening a sampling valve (V1 or V2) when the inlet pressure exceeds the factory set-point (except when overridden by turning Off the "Interlocks" with the key at the RVC). The set-points are typically about 10-50% above the maximum intended inlet pressure for a given sample valve.

System shut down procedure
It is important to follow the procedure outlined below to shut down and switch off the Vision 2000C/E system.

1. Switch off the RGA filament and wait for 15 minutes for the filament to cool down.

2. Switch off the turbo pump from the RVC2 Window within Process Eye Professional, or by pressing the PUMPS switch on the RVC2.

3. Switch off the RVC2.

4. Allow the turbopump to come to a complete stop

Maintenance

Vision 2000-C/E systems require periodic maintenance largely due to the effects of exposure to corrosive process gases. The frequency of minimum maintenance is, therefore, dependant on the application. Most commonly (approximately 12 months), the turbopump will require bearing lubricant exchange and the filaments will need to be replaced. The ion source might also need to be rebuilt at this point. Less frequently, the electron multiplier will be replacement (when gain can no longer be adjusted to be sufficient). The inlet gauge zero offset should also be checked

Systems configured for a very low V1 inlet pressure (< 20 mtorr) will require periodic inlet gauge zero offset correction, especially If the process chamber is vented frequently, or ambient temperature changes.
In general, it is a good idea to schedule maintenance of the Vision 2000-C/E, including preventative measures, such as renewing filaments, to coincide with planned maintenance of the process system.

Inlet gauge zero
Zeroing should be carried out only with the process chamber at a pressure of less than 1 mtorr,

One gauge system (722 Baratron only)
Connect a DVM set to read DC mV to the two flying leads coming from the gauge connector and measure the voltage.

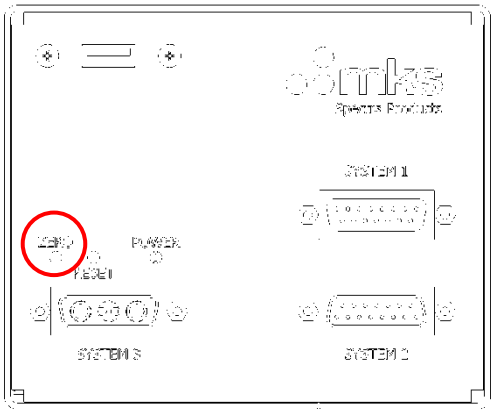
Ensure that the process chamber pressure is below 1milli-torr then check the meter reading. If the indicated voltage is greater than zero, then you should re-zero the gauge:

> Remove the grommet covering the zero adjustment potentiometer and using a small, flat-blade screwdriver, fine-tune until the indicated voltage reads 0.00mV DC (+/- 0.5mv DC).

DO NOT ADJUST THE "SPAN" CONTROL!

Two gauge system (722 and 890 Baratron)
Once the 722 is zeroed, move the meter to the tails of the 890 gauge. Locate and press the recessed zero switch and check the meter reading is around 0.00mV DC (+/- 0.5mV DC)

Once the gauge(s) has been zeroed, you should immediately zero the Interface Module by pressing the recessed "Zero" button, a tactile click will be felt once pressed.



Operating pressure
As described in Inlet Operation on Page 27, the Vision 2000C/E system has a special closed ion source with an optimum operating pressure.

Monitoring processes at pressures higher than $5x10^{-3}$ mbar requires inlet pressure reduction. The UniBloc™ inlet is factory-configured to the application requirements specified at time of order. By changing its configuration and/or internal flow-restricting orifices, it is possible to change its pressure sampling range.
If application requirements change, please contact an MKS representative for information regarding return of the UniBloc for reconfiguration.

Removing the inlet valve assembly
The UniBloc™ inlet-valve assembly bolts directly onto the RGA chamber inlet flange with a standard CF40 (2.75" CFF) gasket. It is held in place by special ¼" x 28, socket head, silver-plated bolts that run through its length from the process chamber end of the inlet valve. To access these bolts, the process chamber end of the UniBloc™ must be exposed.

On the RGA face of the UniBloc™ is the ceramic coupling socket that mates with the gas inlet tube on the closed ion source. When the UniBloc™ inlet is removed, care must be taken pull it straight away from the RGA chamber, not allowing it to move radially, or damage will be done to this critical component or its mounting hardware.

To remove the UniBloc™ inlet:

1. Shut down the Vision 2000C/E system by following the instructions on Page 27.
2. Remove the heater jackets and the Microvision2.
3. Remove any connection to the process chamber side of the UniBloc™.
4. Remove the six ¼" x 28 bolts that are recessed into the flange of the UniBloc, taking care to support the inlet when the last two bolts are freed.
5. Pull the inlet straight away from the RGA chamber, taking care not to put pressure on the ion source coupling components.
6. If the ceramic coupling is removed, take care to note the details of its assembly (ceramic on flange, retainer ring on ceramic, screws through springs and then through retainer ring into flange).

Refitting the inlet valve assembly
All components must be scrupulously clean for UHV service prior to reassembly.

If you removed the ceramic coupling-socket, refit by it reversing the procedure followed during its removal. For system with compression springs, note the following tightening procedure: tighten these screws until the top of the screw head is flush with the top surface of the ceramic coupling (springs will be very loose). Then tighten all screws 2 full turns more (0.8mm). The springs should now provide pressure that holds the ceramic securely, but allows it to slide freely with slight pressure.

To re-fit the UniBloc™ inlet, reverse the removal procedure. Take care to ensure the ceramic coupling socket mates correctly with the gas inlet tube on the closed ion source. Tighten the special bolts carefully, gradually tightening them in stages so that the tension is developed evenly all the way around the flange. An over-tightened, stripped bolt is a very costly and inconvenient mistake to repair.

Once the Vision 2000C/E system is re-assembled it must be leak checked before re-fitting the heater jacket.

Vision 2000C/E electronics
The RGA control unit (Microvision2) supplied as part of your Vision 2000C/E system is designed specifically to operate with a closed ion source. No damage will be caused to the analyser or the electronics if a replacement standard RGA control unit is fitted, but the performance will be dramatically reduced. This is of particular relevance to customers who operate more than one MKS RGA.

Turbo pump maintenance
The bearings in the turbo pump need to be re-lubricated, periodically. The period will depend upon the corrosiveness of the process gases being sampled, the flow rate (significantly higher for 4-valve systems) and the number of hours per day spent sampling process gas. Consult the turbopump manual supplied with your system for further details.

Mass spec maintenance
The only routine maintenance required by the quadrupole is to change the filaments. The filaments will wear out in time and changing filaments is fully described in the Microvision2 manual.

Also, the ion source may need to be cleaned which would be done as part of the filament replacement procedure, again this is fully described in the Microvision2 manual. A filament needs to be replaced when it will no longer turn on, as indicated by the software status when running the system.

Finally, after a significant number of hours of process gas exposure, the electron multiplier (SEM) detector will also require replacement. In extreme cases, this can be as soon as 3 months, but 1-2 years is more typical. For non-corrosive gas sampling, SEM performance is often acceptable for several years. The SEM will need to be replaced when the bias voltage required to achieve the required sensitivity is near the limit of the electronics (1500V for the channel-plate type of detector).

CAUTION

The quadrupole analyser is a delicate instrument that is easily damaged and can be expensive to repair. The safest place for the analyser is in its vacuum chamber, so leave the analyser where it is until you have everything ready.

Removing the analyser
Before you can change the filaments or clean the ion source the quadrupole analyser must be removed from the vacuum chamber. Before removing the analyser check that you have all the parts and tools ready for the maintenance work. Also, have ready something to stand the analyser on. A small vice is useful for this.

The UniBloc™ inlet valve fitted between the RGA chamber and the process chamber will allow the RGA chamber to be vented to atmosphere without affecting the process chamber. We would recommend venting the RGA chamber when the process chamber is not being run, just in case there is an unexpected accident or the inlet valves have been contaminated and developed a small leak.

To remove and replace the analyser you will need:

¼" 12-point box-end wrench
One CF40 copper gasket

Shut down the Vision 2000C/E system as described on Page 27.

- Make a note of the orientation of the analyser with respect to the vacuum chamber. This is most easily done by making a mark on the vacuum chamber in line with the locking pip on the analyser's feedthrough housing. Relative to a turbopump orientation of 6 o'clock, the standard analyser alignment pip orientation is at 9 o'clock.
- Remove the six ¼" x 28 bolts.
- Carefully withdraw the analyser from the vacuum chamber. Leave the old copper gasket in place until you are ready to fit the new one, it will help protect the knife edge from accidental damage.
- Replacing the filaments or ion-source along with cleaning methods are described in the Microvision2 User Manual.

Re-fitting the analyser
- Note the gas inlet tube on the top of the analyser source. Look into the vacuum chamber and note the ceramic socket that the gas inlet tube must mate with when you re-fit the analyser.
- Clean, using a suitable solvent, and dry the new copper gasket then slip it over the analyser in place of the old one.
- Carefully, insert the analyser into the vacuum chamber trying not to let the leads touch the wall of the vacuum chamber. Make sure the gasket does not slip out of its slot as you push the flanges together. Make sure that the gas inlet tube on the top of the analyser mates with the ceramic socket. When properly mated the analyser flange should be flush with that of the vacuum chamber. If the two flanges are not parallel, the gas inlet tube is not in the ceramic socket.
- Rotate the analyser flange so that it is in the correct orientation, as noted in the above steps.
- Bolt the flanges together remembering to tighten opposite bolts equally.
- Re-fit the Microvision2.

Returning Your Equipment

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

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

Fill in the relevant sections of the Health and Safety Returns Form below, or we can provide you with a copy. This form MUST accompany the instrument when returned, delays in providing this completed form will lead to delays in the servicing of the instrument.

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

Support Contact Numbers

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

Health and safety clearance form

1. This form must be used when returning analysers and other equipment for service.

2. A completed copy of this form should be faxed or sent by post to ensure that we have this information before we receive the equipment.

   A further copy should be handed to the carrier with the equipment.

3. Failure to complete the form or comply with the procedure will lead to delays in servicing the equipment.

RETURNS FORM

1. This form must be completed when returning equipment for service or repair.

2. Please complete the form and fax or send by first class post to the appropriate 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.: