Vision 1000-C/E Manual

LP102012 Rev 1.01

September 2002

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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http://www.MKSInst.com. Follow links to Spectra products.

EC DECLARATION OF CONFORMITY

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

DECLARES THAT THE FOLLOWING PRODUCTS:

LM62, LM10 VACSCAN 100
LM63, LM10, LM4 VACSCAN PLUS 100, 200
LM61, LM10, LM4, LM9 SATELLITE 100, 200, 300
LM56 MICROVISION
LM70, LM76 MICROVISION PLUS
LM77 VISION 1000P
LM78 VAC CHECK
LM80 MINILAB

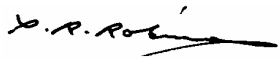
ARE IN CONFORMITY WITH THE FOLLOWING EUROPEAN DIRECTIVES:

89/336/EEC ELECTROMAGNETIC COMPATIBILITY DIRECTIVE
73/23/EEC LOW VOLTAGE DIRECTIVE AS AMMENDED 93/68 EEC

THE APPLICABLE STANDARDS ARE:

EN 61326:1998 ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL & LABORATORY USE
EN 61010-1:1993 SAFETY REQUIREMENTS FOR ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL & LABORATRY USE.

SIGNED:



T.R.ROBINSON
EUROPEAN OPERATIONS MANAGER
DATE: 1ST JULY 2001

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 Spectra SensorTech 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, Spectra SensorTech 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 Spectra SensorTech 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 Spectra SensorTech 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 Spectra SensorTech Ltd., unless special arrangements are made.
3) 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 Spectra SensorTech Ltd.
4) Equipment enclosures embody certain special fastening and bonding devices that affect EMC and safety performance. These must be correctly re-fitted after servicing.

Contents

Section 1.
Safety

WARNING

This section of the manual contains important safety information.

Please read it carefully.

1.1. Manual conventions

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.

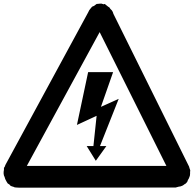
Instructions in CAUTION and WARNING boxes MUST be observed. MKS Spectra accepts no liability for any injury or damage resulting from a failure to observe instructions in CAUTION or WARNING boxes.

1.2. 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.



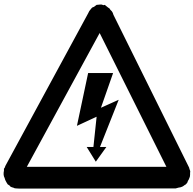
The Electric Shock (ISO 3864, No.B.3.6) symbol.

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

The following warning labels used on the Vision 1000-C/E systems are explained below.

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

On the rear panel of the Microvision Plus refers to:
Read all instructions carefully before use.
The control and signal ports are designed for connection to MKS Spectra accessories via MKS Spectra 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 Microvision Plus, 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.

1.3. Fuses

The Vision 1000-C/E systems must be powered down and disconnected from the mains supply before changing fuses.

Although the fuses on the RVC1A and turbo pump controller 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, except those on the Payne Engineering heater power controllers inside the control rack, which are 0.25" X 1.25".

Details of fuse types and ratings can be found in the Turbo Pump Controller manual, the RVC1A manual, and the Payne Engineering Power Controller specification sheet. NOTE! The fuses in the Payne Engineering power controllers are a special 2msec type designed to protect semiconductors. They are available only from Payne Engineering as #49C25-5, or from MKS Spectra Products as #103-070-113.

1.4. Electrical connections

The Vision 1000-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 Microvision Plus 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 Spectra must be consulted before any non-MKS Spectra 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 Spectra facility before proceeding.

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Section 2.
Installation

The Vision 1000-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 and trunking.
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. A bracket fitted to the turbo pump supports a cooling fan. Electro-pneumatic valves are attached to the turbopump body to actuate the pneumatic inlet sampling valves.

The standard V1000C/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, the turbo pump controller, and the RGA chamber and inlet heater controllers. The cables running between the sub

rack and the RGA vacuum chamber can be fitted into trunking (conduit) to give additional protection.

CAUTION

There are subtle differences among the various available configurations of the Vision 1000-C/E systems.

There are small differences among Vision 1000-C/E systems. Variations are usually due to the type of process tool to which the Vision 1000-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 1000-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 below.

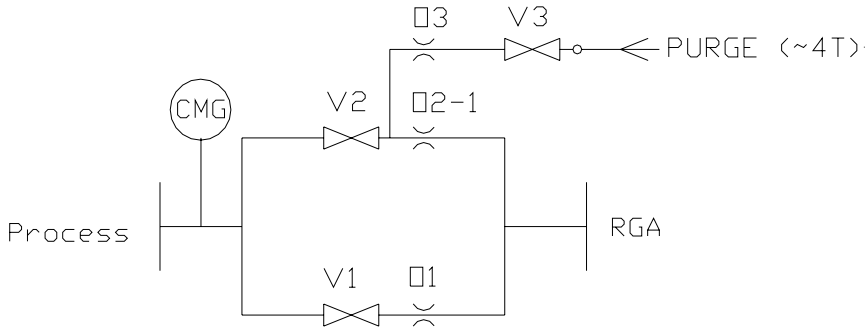


Figure 1. 3-Valve "Etch" Configuration

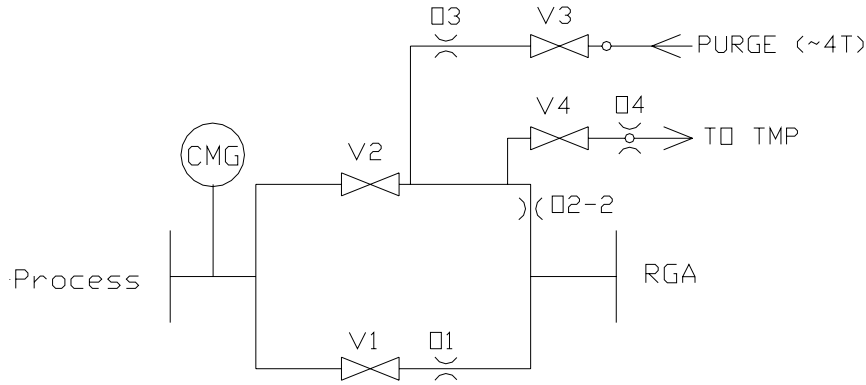


Figure 2. 4-Valve, Fast-Response "LPCVD" Configuration

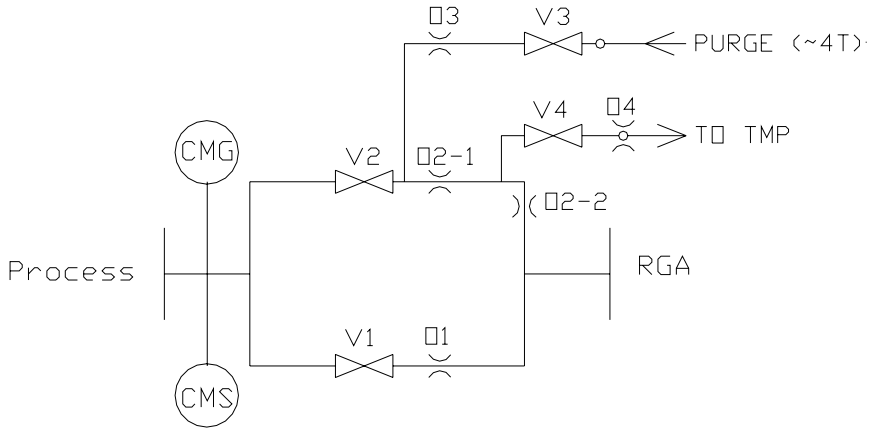


Figure 3. 4-Valve, High-Pressure "CVD" Configuration

2.1. Safety

WARNING

There are no operator serviceable parts within this unit.

2.2. Initial checks

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 Spectra facility or sales/service representative.

Carefully unpack the various parts of your Vision 1000-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 1000-C/E system.

2.3. Vacuum system installation

As much of the system as is practically possible has been shipped pre-assembled. The whole of your Vision 1000-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.

2.3.1. RGA vacuum chamber overview

The Vision 1000-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 (RVC1A).

Integral to the UniBloc™ body are all necessary pressure-sampling orifices. These are located in the valve seats to provide minimal trapped gas volumes when switching among the various inlet ranges. The three basic UniBloc configurations have been summarized in Figures 1-3, above. Please refer to the shipment report for details of the inlet configuration. The inlet configuration of your Vision 1000C/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. 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 Spectra 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 1000C/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.

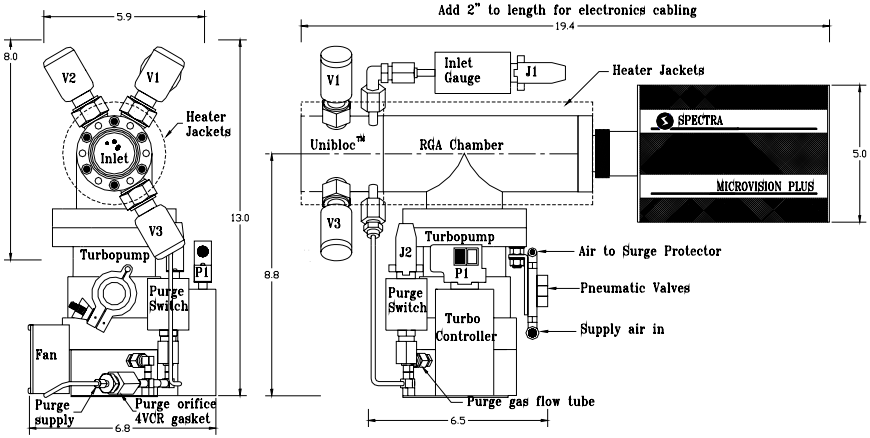


Figure 4: 3-Valve V1000E Dimensions (inches)

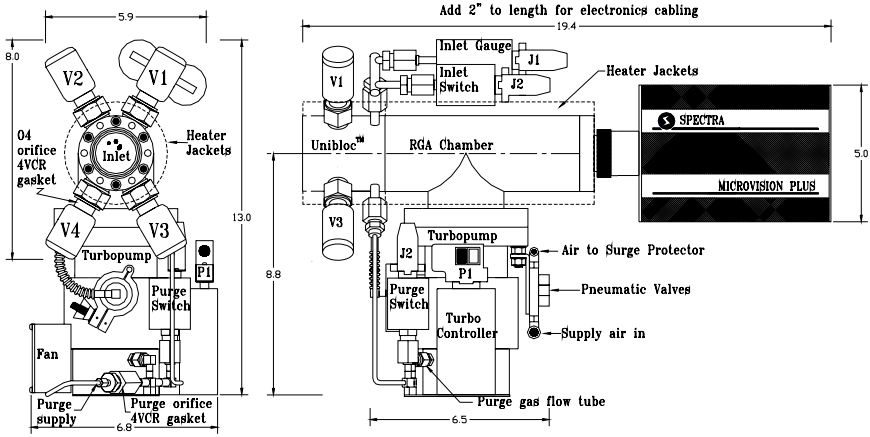


Figure 5: 4-Valve V1000C Dimensions (inches)

2.3.2. Main chamber installation

This is a job that requires two people - one to support the Vision 1000C/E system while the other fits the bolts to the flange. The Vision 1000C/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 V1000C/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 V1000C/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.

2.3.3. 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 the turbopump body. The size of this fitting is

customer dependent. This gas opens the inlet valves. There is another manifolded pneumatic fitting here for extending the gas supply to the SurgeProtector valve assembly.

Purge gas at 0.11- 0.12 MPa (1-3 psig) must be supplied to the 1/8" Swagelok™ fitting on the Purge Assembly. The absence of adequate purge gas pressure is sensed by a Baratron™ pressure switch at the turbopump. The RVC1A 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 RVC1A will shutdown the RGA, to protect the turbopump.

Either N2 or Ar, of suitable purity (at least five 9's, suggested), may be used. Purge gas consumption rate is about 6 sccm. Do NOT disassemble the VCR-4 joint into the turbopump! This connection contains a VCR gasket/orifice that sets the flow of purge gas into the turbopump! If this fitting is opened, a new gasket/orifice (25 micron) must be installed to ensure a leak-free connection.

While the purge orifice sets the desired purge flow, a "purge flow tube" establishes the desired backpressure to trip the purge pressure switch. This flow tube is inserted into the Swagelok™ connection at the purge port of the turbopump. It is a section of 1/16" OD capillary tubing, 2.2" long, with 0.046" ID.

2.3.4. 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 (described and shown in Section 2.3.11, below).

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.

2.3.5. Heater jackets

The Vision 1000C/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.

2.3.6. MicroVision Plus installation

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

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

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

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

2.3.7. Electrical installation

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.

2.3.8. Electrical specification

Power Consumption: 100 - 120Vac or 220 - 240Vac 50/60Hz, 1KVA typical.

There are two fuses on the rear panel of the Remote Vacuum Controller, please refer to the RVC manual for further details.

There are two fuses on the rear panel of the turbo pump controller, please refer to the turbo pump controller manual for further details.

Only use IEC or UL approved Mains fuses are used to protect this equipment:

Safety Class I
Installation Category II
Pollution Category II

WARNING

The Yellow/Green Earth Core of the Power Cord must be connected to the Power Source Protective Earth Terminal.

2.3.9. Equipment rack

The Remote Vacuum Controller (RVC1A), the turbo pump controller and the two heater-power controllers are 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.

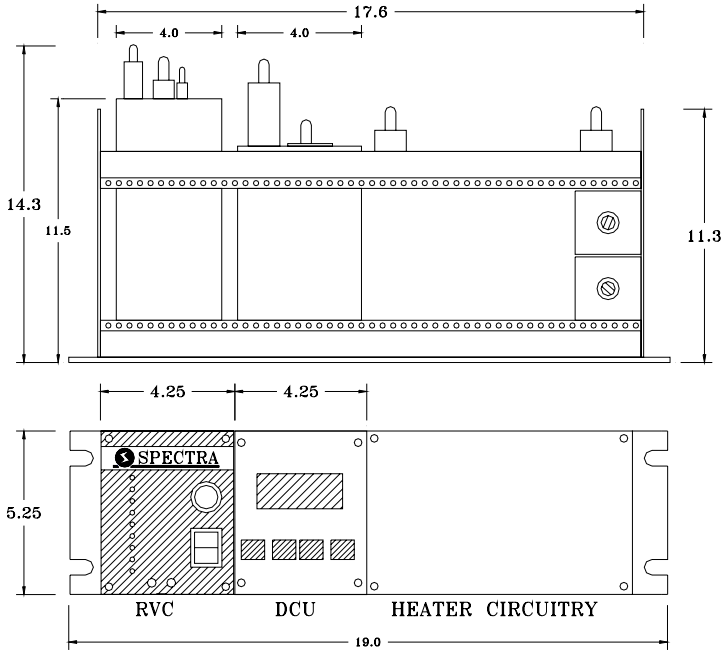


Figure 6: Controller Rack Dimensions (inches)

2.3.10. 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 an identification letter for reference in the tables and descriptions of this section.

ID	Cable Function
	Cables between the RVC rack and the RGA head.
A	RVC Interlock Interface
B	Inlet Valve Solenoid Power
C	MicroVision Plus Digital I/O
D	MicroVision Plus 24VDC
E	Heater Power
F	Turbopump 24VDC
G	Turbopump Controller RS-485
	Cables at the RVC rack
H	Backing Pump Power (unused in standard configuration)
I	Turbopump Display/PS Power

J	Turbopump Display/PS Power Out
K	Bake Power
	Cables at the RGA
L	Turbopump Cooling Fan
	Cables between the RGA and the Computer
M	MicroVision RS-232
	Cables between the RGA and the SurgeProtector
N	SurgeProtector 24VDC

ID	Start point	Finish point
	RVC Rack	**RGA head**
A[1]	RVC, "Interface" Socket	J2 to Purge Pressure Switch
A[2]		J4 to P4 from P1 of cable F[2]
A[3]		J1 to Inlet Gauge
A[4]		J3 to Inlet Pressure Switch(option)
B	RVC, "Valve" Socket 1	SMC Valve Manifold
C	RVC, Free Plug 4	MicroVision Plus Digital I/O
D	RVC, MicroVision Plus 24VDC Free Socket	MicroVision Plus 24VDC
E	Heater Controller, Free Socket	Heater Jackets
F[1]	Turbopump Display/PS, 24VDC Socket	P1 to Turbopump Controller
F[2]		P4 to J4 from Cable A[2]
F[3]		RS-485 Socket to Cable G
F[4]		J5 to Cable N
G	Turbopump Display/PS, RS-485 Socket	RS-485 Socket of Cable F[3]
	RVC Rack	**RVC Rack**
H	RVC, Free Socket C	Backing Pump (unused)
I	RVC, Turbopump Power Free Socket	Heater Panel, TP Power In
J	Heater Panel, TP Power Out Free Socket	Turbo Display/PS, Line VAC In
K	RVC, Bake Power Free Socket	Heater Panel, Bake Power In
	RGA head	RGA head
L	Turbopump Fan	Fan socket of P1 of Cable F[1]
	RGA head	**Computer**
M	MicroVision Plus, RS-232 Socket	Comm Port 2 (as required)
	RGA head	**SurgeProtector Valve**
N	TurbopumpController, Socket J5 of Cable F[4]	SurgeProtector Valve

2.3.11. Connecting the cables

The first task is to identify which end of the cable bundle goes to the RVC equipment rack and which to the RGA head. The easiest way to do this is to locate cable F, the turbopump 24VDC cable. At the RGA vacuum chamber end, it has a right-angle DB15 connector with a pair of RJ-11 sockets in the side of the head-shell and breaks-out to three more connectors. Figures 7 and 8 depict the cables involved.

If so supplied, run the plastic trunking between the equipment rack and the main vacuum chamber, and secure the trunking to the special support bracket fitted to the turbopump. The trunking connector includes a lock nut, slacken this and slide the connector into the large cut out in the bracket then tighten the lock nut.

Make the various connections from the RVC rack to the RGA head, involving cables A through G. Note that there are often multiple connections for one cable, such as the 4 connections for cable A.

Connect cable L, for the turbopump fan, to the socket in the connector of the Turbopump 24VDC cable (F) at the RGA head.

Connect cable N, for the SurgeProtector foreline valve, to the connector on the Turbopump 24VDC cable.

Make the various connections from the RVC rack to the RGA head, involving cables A through G.

Make the various connections among components at the equipment rack, involving cables I through J.

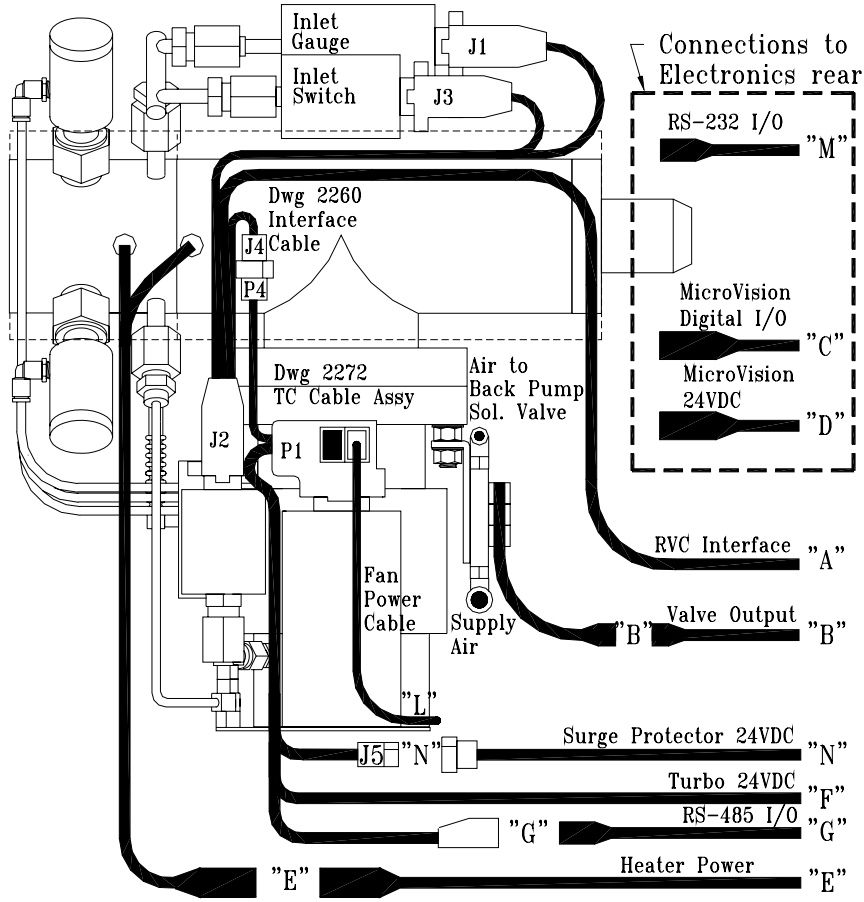


Figure 7: RGA Cables

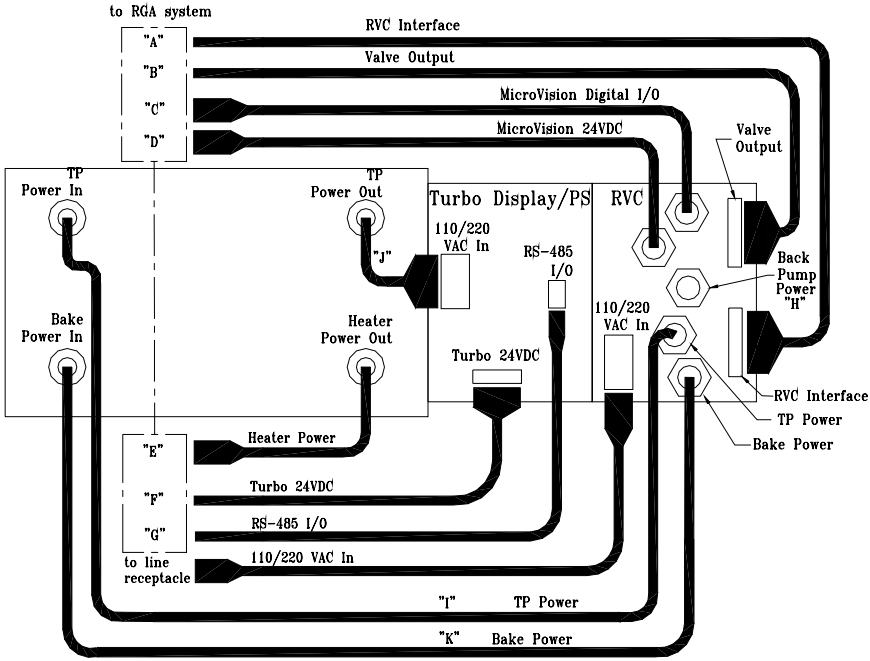


Figure 8: Controller Rack Cables

2.3.12. Connecting to the process tool

The V1000C/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 settings on two tiny circuit boards in the head-shells of the system cabling to convert the pressure signal(s) into high/low signals for the vacuum "Status" inputs of the RVC1A. 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.

2.3.13. Mains power

There is a single mains power connection to the Vision 1000C/E which is made to the RVC1A. 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

2.3.14. Computer connection

Vision 1000C/E systems are used in conjunction with MKS Spectra ProcessEye 2000 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 1000C/E system.

There is one RS-232 serial communications cable to connect the computer to the MicroVision Plus of the Vision 1000C/E. Connect cable M to the appropriate comms port on the PC. You may need to use a comms cable to act as an extension cable, depending on the location of the PC. This will normally connect to comms port 2 on the PC. Port 1 is usually reserved for possible process tool connections (e.g., SECS). The Spectra ProcessEye 2000 operating manual will give further details of comms port connections. The documentation that came with the PC will identify the comms ports.

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 1000C/E system.

If you are supplying your own PC install ProcessEye 2000, 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 before you do.

Section 3.
Operation

3.1. Overview

This section gives an overview of the Vision 1000C/E system operation.

The MicroVision Plus control unit receives power from the RVC1A. The power switch on the RVC1A must be ON to operate the system. When it is started, the MicroVision Plus senses the presence of the vacuum system controller (RVC1A) and interlocks its operation to it.

ProcessEye 2000 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 RVC1A 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 RVC1A 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 RVC1A indicates Pump Up to Speed. Note that turbopump purge-gas must be supplied as specified in the Installation section of this manual (2.3.3).

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 ProcessEye 2000 software interface to the RVC1A.

CAUTION

Check the complete installation thoroughly before proceeding.

3.2. Start up

Be sure the turbo pump controller On/Off switch (on the back of the controller) is in the On position. It should always be left in this position because control of turbopump power is achieved by the RVC1A controlling the mains power to the turbo controller.

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

On your PC, start MKS Spectra ProcessEye 2000. The software will detect that the RVC1A is fitted and the Remote Vacuum Controller status and control panel will be available at the bottom of the ProcessEye window. To start the Vision 1000C/E vacuum system, click on the turbopump button. The colour of the button indicates the status: Red = off; Yellow = starting; and green = running at full speed. More information about the RVC operating software can be found in the manuals for the RVC1A and ProcessEye 2000.

The Vision 1000C/E may also be started from the RVC1A, directly. This is useful if the PC is disconnected or the Spectra software is not running. To start the system from the RVC1A, 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 1000C/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 ProcessEye Bar-Chart recipe (refer to the ProcessEye 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 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.

3.3. 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 1000C/E.

The vacuum system used in the Vision 1000C/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 1000C/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 1000C/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 1000C/E uses a Microvision Plus there can be an audio tone at the head if the volume control knob on the MicroVision Plus box is turned up and it is enabled in the recipe. Alternatively, position the monitor so that you can see the screen while you are leak-checking. You can also connect an external speaker or headphones to the PC. Please consult the Microvision Plus manual for details of the audio output.

Starting at the top of the Vision 1000C/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.

If you do find a leak shut the system down (see section **3.6. System shut down**), fix the leak and start again.

Once the RGA vacuum chamber is leak-tight, check the part of the Vision 1000C/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 the system down (see section **3.6. System shut down**), fix the leak and start again. Remember you may need to break the seal between the Vision 1000C/E and the process chamber in which case you will also have to shut down the process chamber.

3.4. Heating and Baking

The RGA chamber normally runs at 70°C and the inlet valve UniBloc assembly runs at 70°. 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 to a temperature of $200^{O}C$ (the heater jacket supplied is self-regulating) 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, 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 $70^{o}C$. 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 70^0C!

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.

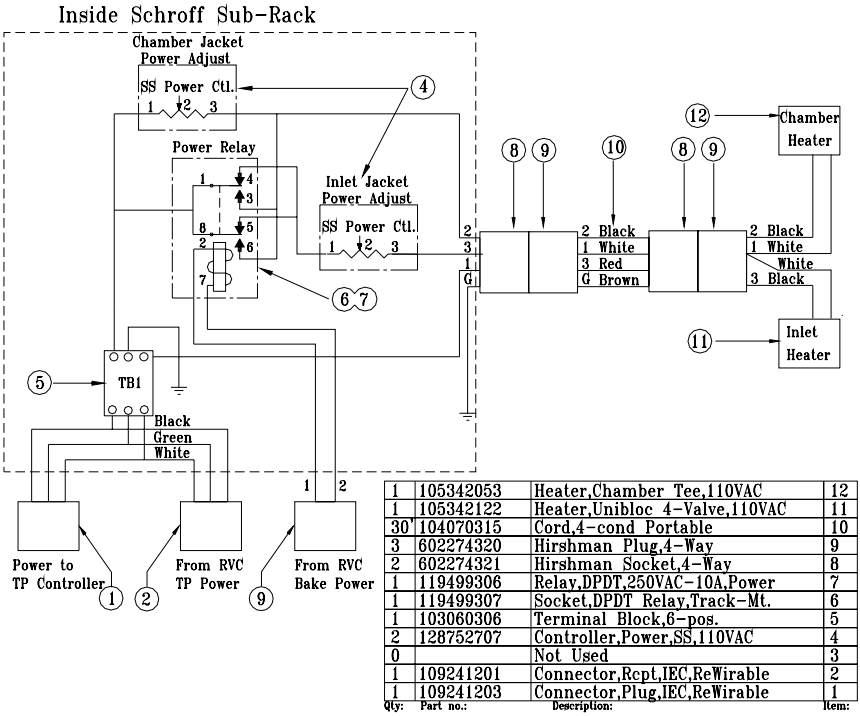
THIS IS AN EXPENSIVE REPAIR.

Baking can be started (and stopped) directly at the RVC1A with the BAKE button. It can also be controlled through the RVC status and control panel of ProcessEye 2000.

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.

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.



Qty:	Part no.:	Description:	Item:
1	105342053	Heater,Chamber Tee,110VAC	12
1	105342122	Heater,Unibloc 4-Valve,110VAC	11
30'	104070315	Cord,4-cond Portable	10
3	602274320	Hirshman Plug,4-Way	9
2	602274321	Hirshman Socket,4-Way	8
1	119499306	Relay,DPDT,250VAC-10A,Power	7
1	119499307	Socket,DPDT Relay,Track-Mt.	6
1	103060306	Terminal Block,6-pos.	5
2	128752707	Controller,Power,SS,110VAC	4
0		Not Used	3
1	109241201	Connector,Rcpt,IEC,ReWirable	2
1	109241203	Connector,Plug,IEC,ReWirable	1

Figure 9: Heater Power Schematic

3.5. Inlet operation

The Vision 1000C/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 (Figures 1 and 2). That is, there is a flow-restricting orifice (O2-1 or O2-2) under the valve seat of V2 that effects a pressure drop from the process chamber to the RGA ion source. 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 (Figure 2). 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 (Figure 3). 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 is can take. The RVC1A 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.

Inlet Pressure:	*> Set Points 1 & 2*	*> Set Point 1*	*< Set Point 1*
State*:	Idle/Purging	Process Sampling	Base Sampling
RVC Status 2:	Off	On	Off
RVC Status 1:	Off	Off	Off
V1:	Closed	Closed	Open
V2 (and V4):	Closed	Open	Open
V3:	Open	Closed	Closed

*All states require the turbopump at full speed. Sampling states require the filament ON.

3.6. System shut down

It is important to follow the procedure outlined below to shut down and switch off the Vision 1000C/E system.

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

2. Switch off the turbopump from the Remote Vacuum Controller window or by pressing the PUMPS switch on the RVC1A.

3. Switch off the RVC1A.

4. Disconnect the Vision 1000C/E from the mains power.

Section 4.
Maintenance

Vision 1000-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 6 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 1000-C/E, including preventative measures, such as renewing filaments, to coincide with planned maintenance of the process system.

4.1. Inlet gauge zero

With the process chamber at a pressure of less than 1 mtorr, connect a volt meter to the red and black coded sockets at the back of the connector on the inlet gauge. Remove the plug from the ZERO hole on the back end of the gauge. DO NOT REMOVE THE SPAN PLUG! Adjust the trimmer in the ZERO hole to read 0.000 volts. Replace the plug.

4.2. Operating pressure

As described in Section 3.5 on Inlet Operation, the Vision 1000C/E system has a special closed ion source with optimum operating pressure of this source is $1x10^{-3}$ to $3x10^{-3}$ mbar (to $2x10^{-3}$ torr). 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.

4.3. 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 1000C/E system by following the instructions in section **3.6. System shut down**, remove the heater jackets and the Microvision Plus.

2. Remove any connection to the process chamber side of the UniBloc™.

3. *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.

4. Pull the inlet straight away from the RGA chamber, taking care not to put pressure on the ion source coupling components.

5. 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).

4.3.1. 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 1000C/E system is re-assembled it must be leak checked before re-fitting the heater jacket.

4.3.2. Replacing internal orifices

Exchanging an inlet valve assembly is a reasonable operation to perform in the field. 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 Spectra facility regarding appropriate servicing options.

4.4. Vision 1000C/E electronics

The RGA control unit (Microvision Plus) supplied as part of your Vision 1000C/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 particularly relevance to customers who operate more than one Spectra RGA.

4.5. Turbopump 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. In general, the oil wick of the Pfeiffer 071-03 turbopump should be replaced every 6 to 12 months. Consult the turbopump manual supplied with your system for further details.

4.6. 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 Microvision Plus 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 Microvision Plus 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.

4.6.1. 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

1. Shut down the Vision 1000C/E system as described in section "**3.6. System shut down"** of this manual.
2. 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 3 o'clock.
3. Remove the six ¼" x 28 bolts.
4. 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.

4.6.2. Re-fitting the analyser

1. 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.
2. Clean, using a suitable solvent, and dry the new copper gasket then slip it over the analyser in place of the old one.
3. 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.
4. Rotate the analyser flange so that it is in the correct orientation, as noted in step 4.4.1.2, above.
5. Bolt the flanges together remembering to tighten opposite bolts equally.
6. Re-fit the Microvision Plus.

Appendix 1
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.

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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.:

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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.:

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