MiniLab (LM80) Manual

SP101012 Rev 2.01
October 2012

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

You can send your comments to:-

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CW1 6AG
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Certificate of Conformance

EC DECLARATION OF CONFORMITY

Spectra SensorTech Ltd.
COWLEY WAY
CREWE
CHESHIRE
CW1 6AG
UNITED KINGDOM

DECLARES THAT THE FOLLOWING PRODUCTS:

LM80 MINILAB
LM77 VISION 1000-P

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 50081-1:1992 GENERIC EMISSION STANDARD
EN 50082-1:1992 GENERIC IMMUNITY STANDARD
EN 61010-1:1993 SAFETY REQUIREMENTS FOR ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL & LABORATRY USE.

SIGNED:

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

Additional Installation Maintenance and Operating Instructions

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 Leda-Mass 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, Leda-Mass 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 Leda-Mass 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 Leda-Mass 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 Leda-Mass 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 Leda-Mass 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

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Errata and addenda

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Section 1.
MiniLab

This paper manual has been generated from the MiniLab Help Manual reference LP105007 Rev 2.50 which is a paperless manual run on the Windows Help Viewer. Some of the formatting has been changed but the text has not been altered, for this reason the section below makes little sense.

1.1. Welcome

Document Title:	MiniLab Help Manual
Document Reference:	LP105007
Current Issue:	Rev 2.50
Issue Date:	27 Nov. 2000

Welcome to the MiniLab Help Manual.
This Help Manual is only applicable version 3 MiniLabs. These have serial numbers beginning LM80-.

This manual covers aspects of the MiniLab benchtop gas analysis system. You will have been supplied with other manuals that deal with the operating software, Microvision Plus quadrupole and the pumps.

Please read the next two help topics before proceeding any further.
Getting Help
Using this Help Manual

1.2. Getting Help

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 would welcome your feedback particularly relating to any omissions or inaccuracies you may discover in this help document.

This MiniLab Help document is continuously being updated. Please contact your local MKS Spectra facility to see if there is a newer version available. Please have the information in Welcome ready.

If you need help in relation to any aspect of this or any other Spectra product please contact your local MKS Spectra facility.

If you require technical support in the UK, Ireland or Europe or would like

details of local support in mainland Europe please contact:

MKS Instruments Spectra Products
Cowley Way
Crewe
Cheshire
CW1 6AG
U.K.
+44 1270 250150 Tel. International
+44 1270 251939 Fax. International

01270 250150 Tel. U.K.
01270 251939 Fax. U.K.

e-mail: service@spectra-intl.co.uk

If you require technical support in North America or would like details of local support in America or the Far East please contact:

MKS Instruments Spectra Products
380 Woodview Ave.
Morgan Hill
CA 95037
USA

(408) 778-6060 Office
(408) 776-8575 Fax
Toll Free 1-800-VAC CHECK

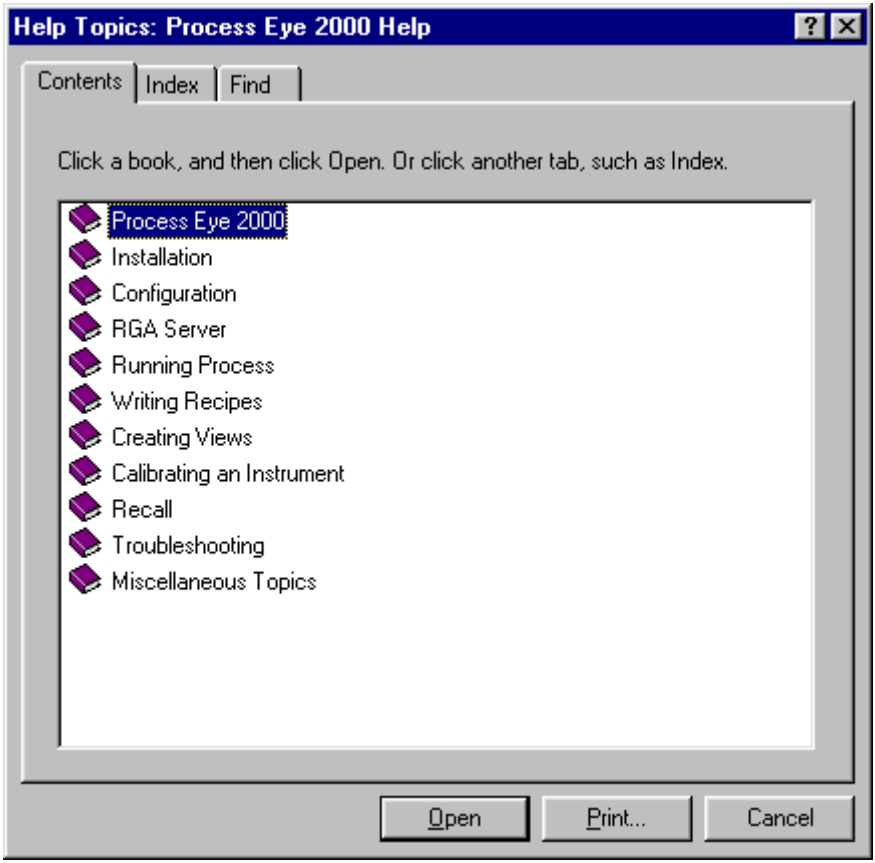
If you require technical support in Japan please contact:

Spectra International Japan Co. Ltd.
1323-231 Kizu,
Akoh City
Hyogo Prefecture 678-0165
Japan

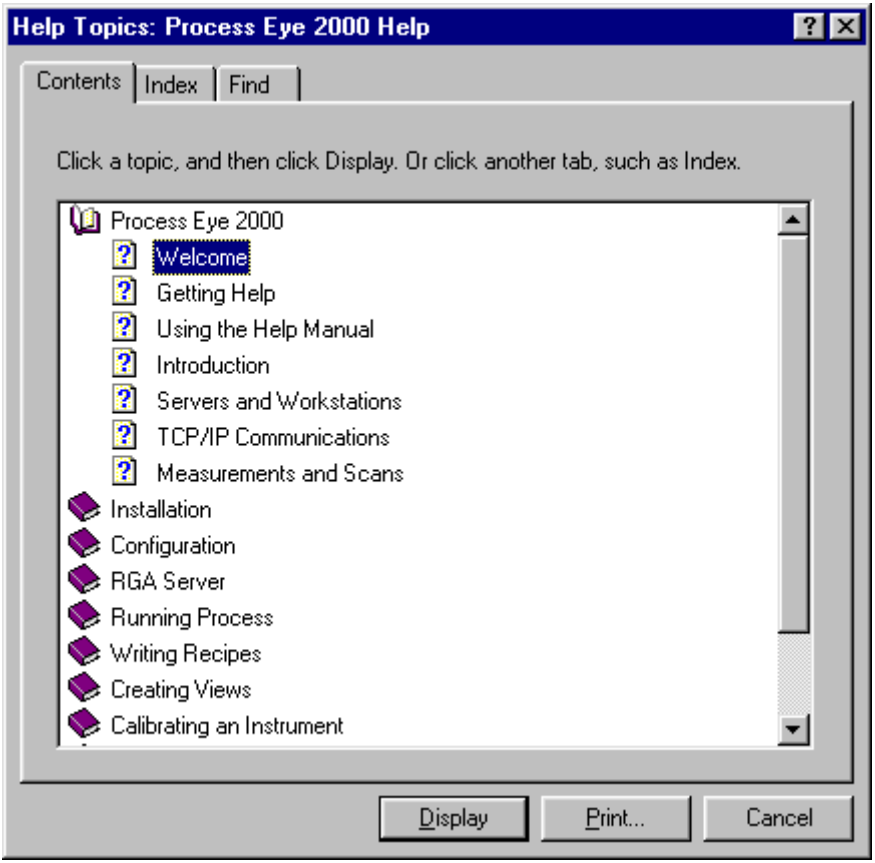
Tel: (07914)-6-8061
Fax: (07914)-6-8062

Visit our website at: http://supersite.net/spectra-rga

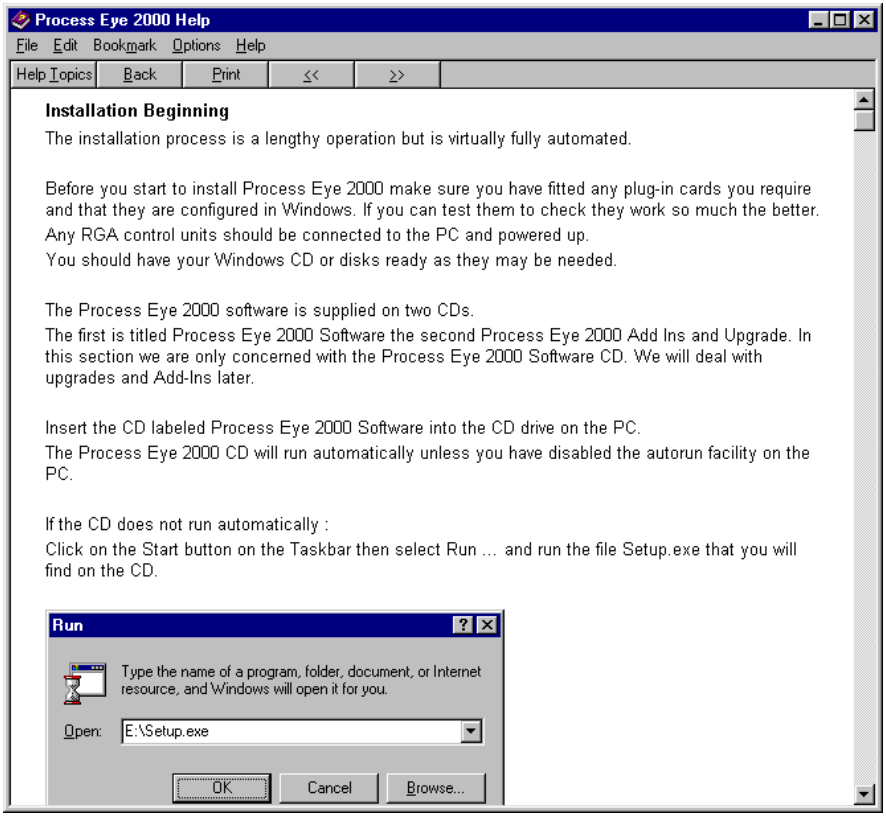
1.3. Using this Help Manual



The Help Manual uses the Windows Help viewer. When you open the Help Manual the content page will be displayed.
Click on one of the books then click on the Open button or just double click on the book of your choice.
To start at the beginning of the Help Manual double click on the Process Eye 2000 book.



The list of help topics or other books will be displayed.
Click on the topic of interest then click on the Display button or just double click on the topic of your choice.
If you want to start at the beginning of the manual select the Welcome help topic.
The chosen help topic will be displayed as shown below.



If it will not fit into the window a scroll bar will be added to the help window.

Use the Forward Browse button to move through the Help Manual one topic at a time. Think of this as turning the pages of a traditional manual. This will be greyed out if you are viewing the last help topic.

Use the Backwards Browse button to move backwards through the Help Manual one page at a time. Again, the Help Manual has been designed so that this button simulates turning the pages of a book. This will be greyed out if you are viewing the first page of the Help Manual.

Click on the Help Topics button to display the content page.

Click on the Back button to view the previous help topic that was being displayed.

Click on the Print button to print the currently displayed help topic.

Section 2.
Safety

2.1. Manual Conventions

Important safety information is highlighted by the use of WARNING and CAUTION.

WARNING

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

CAUTION

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

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

2.2. 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 MiniLab instrument are explained

below.

The Exclamation Mark (ISO 3864, No.B.3.1) label on the side panel refers to the need to refer to the manual before:
replacing fuses
making any electrical connections

The Electric Shock (ISO 3864, No.B.3.6) symbol on the side panel refers to the presence of hazardous voltages on the mains connector and the fuse holders.

2.3. Fuses

The MiniLab system must be powered down and disconnected from the mains supply before changing fuses.

Although the fuses on the side panel are accessible, they should only be changed by competent persons.

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 the fuse ratings can be found in Technical Specification .

2.4. Electrical Connections

The MiniLab must be powered down and isolated from the mains power supply before any electrical connections are made.

2.5. Removing Panels

In order to carry out some maintenance procedures and to complete the

installation procedure some of the MiniLab's panels must be removed.
Before removing any panels the MiniLab must be powered down and isolated from the mains power supply.

Caution should also be taken as some of the internal panels may become hot during normal operation.

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 3.
Introduction

3.1. Overview

MiniLab is a compact, benchtop, on-line gas analysis system built around a quadrupole mass spectrometer.

Within the MiniLab case a Microvision Plus quadrupole mass spectrometer is fitted into a small stainless steel vacuum chamber. This chamber is evacuated by a turbomolecular pump backed by a dry diaphragm pump. Most of the chamber is within an oven to allow operation at an elevated temperature.

Most MiniLab systems sample gas using a capillary inlet which can be seen emerging from the side of the MiniLab cabinet. The diaphragm pump serves as a by-pass pump for the capillary inlet.

The MiniLab is a self contained system which operates in conjunction with an IBM compatible PC running one or more of Spectra's software packages. The PC connects to the MiniLab via two serial cables; the first is used to connect to the Microvision Plus the second connects to the turbo pump controller.

This manual is written to accompany the version 3 MiniLab. If you have any doubts as to whether this is the correct manual for your system examine the serial number label. The serial number label can be found on the side panel housing the switches and connectors. Serial numbers for all version 3 MiniLabs begin LM80-. If this manual does not match your MiniLab please contact your local Spectra facility.

You should also refer to the Microvision Plus manual and the manual which accompanies the software package, RGA for Windows or Process Eye.

Manuals supplied with some of the major components such as vacuum pumps will have been supplied to you. You should refer to these as required.

3.2. Technical Specification

3.2.1. Mechanical specification

Size
Height 445mm

Depth 410mm
Width 710mm

Weight 55kg

3.2.2. Electrical specification

Power inlet
230V rms 47-63Hz 13A rms

Installation category (overvoltage category) II to EN61010

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

Panel Label	**Rating**
Gauge & RGA	3.15A
Heaters	1A
Fan	1A
Vent Valve	1A
Diaphragm Pump	6.3A
Turbo Pump	3.15A

3.2.3. Environmental

Temperature range 0 to 40 deg C, 80% relative humidity non-condensing, operating and storage.

Pollution degree 2 to EN61010

3.2.4. Safety

Class 1 to EN61010
IP20 to EN60529

For details of warning labels refer to the previous section of this manual.

Section 4.
Installation

4.1. Un-packing

This section of the manual describes the installation of the MiniLab. Please follow each section carefully and in sequence. Only omit those sections which do not specifically apply to your particular installation.

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 boxes have been received by checking against the packing slip.

The MiniLab will be shipped in one box or crate but if you have also ordered a PC this will be shipped in separate boxes.

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 sales/service representative.

Carefully unpack the various parts of your MiniLab 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 assemble the MiniLab system.

4.2. Installation overview

Before we go into the installation procedure in detail the following is a very brief overview of what MiniLab installation involves.

The MiniLab is supplied with the vacuum system fully assembled. You will need to fit the Microvision Plus control unit to the analyser and make the necessary electrical connections. To do this you will need to remove the MiniLab cover.

The MiniLab is supplied with the capillary inlet fully assembled and fitted so, nothing to do there.

The MiniLab operates in conjunction with an IBM compatible PC which will have to be connected. With the PC there are two possible scenarios:

1. we have supplied a PC with the MiniLab, in which case all the software will have been installed and tested as part of the complete system

2. you are supplying your own PC in which case you will have to install the software before you can run the MiniLab.

You may want to connect the MiniLab to a nitrogen purge system or vent the exhaust gas to an extractor system, in which case there will be some pipe work to do. You may have been advised whether we feel for your particular application nitrogen purging is necessary, desirable or absolutely vital. Please heed our advise.

Lastly, you will need to connect the capillary inlet to the gas sample point.

4.3. MiniLab Assembly

4.3.1. Removing the cover

WARNING
Disconnect from the mains power before removing the cover.

At this stage you should not have connected the MiniLab to the mains but check to make sure it is disconnected before removing the cover.

1. The cover is secured by six M4 x 8 posi pan head screws. We will assume the MiniLab is positioned so that the side panel with the switches and connectors is on the left. The six screws are positioned as follows:

two are on the front panel
two are on the rear panel
one is on the right-hand end panel
one is on the left of the top panel

Remove all six M4 x 8 screws.

2. The cover may be removed by lifting it upwards or sliding it to the right.

4.3.2. Fitting the Microvision Plus

For use in MiniLab the Microvision Plus has been re-housed so it does not look like the instruments in the brochure. It is exactly the same control unit but with a different case which is more suitable for the MiniLab cabinet.

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.

You are now ready to make the electrical connections.

4.3.3. Microvision Plus electrical connections

There are five cables to connect to the front panel of the Microvision Plus control unit. Unfortunately, the connectors on the Microvision Plus control unit are not labelled. (On the very latest units the connections are labeled with engraved legend as per the diagram below). Fortunately, due to the type of connectors it is difficult to get it wrong. The difficult one are the Jack Plug for the External trip as you could connect it to the Audio socket and the RS232 cable which could be connected to the RS422 / 485 connector.

Please refer to the drawing of the connector layout below.

1. Connect the cable with the 6mm Jack Plug to the Jack Socket just to the right of the 15 way D-Type Plug on the front panel of the Microvision Plus. This connector is labelled X-TRIP on the drawing below.

2. Connect the cable with the 15 way D-Type socket to the 15 way D-Type plug on the front panel of the Microvision Plus. This is the power supply for the Microvision Plus. The connector is marked POWER on the drawing below.

3. Connect the cable with the 25 way D-Type plug to the 25 way D-Type socket on the front panel of the Microvision Plus. The connector is marked DIGITAL I/O on the drawing below.

4. Connect the cable with the 15 way D-Type plug to the 15 way D-Type socket on the front panel of the Microvision Plus. The connector is marked ANALOG I /O on the drawing below.

5. Connect the cable with the 9 way D-Type plug to the 9 way D-type socket on the front panel of the Microvision Plus. This socket is labeled RS232 in the drawing below.

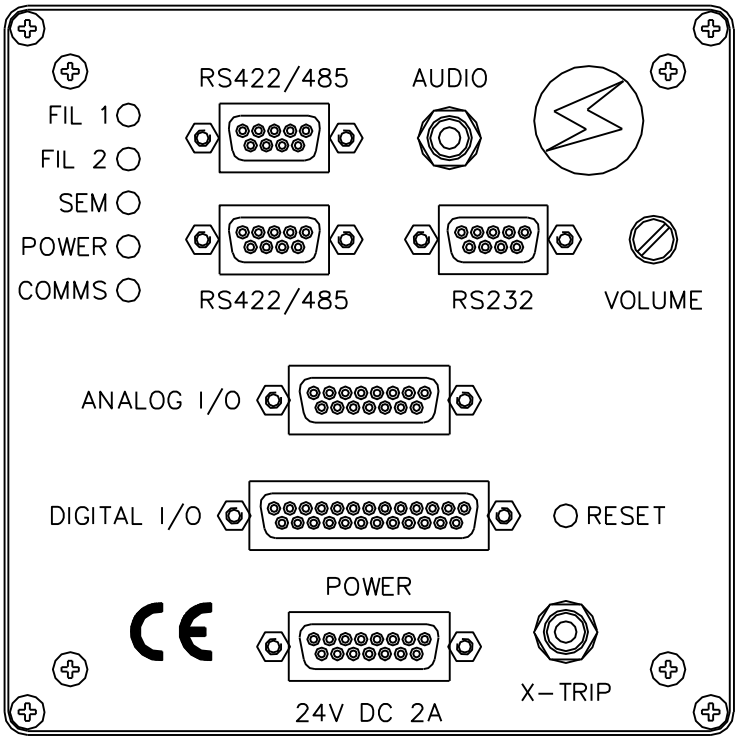

Figure 2 Microvision Plus connector layout

Further information about the Microvision Plus control unit may be found in the Microvision Plus manual, reference LP101009.

4.3.4. Replacing the cover

The MiniLab cover can only be fitted one way round. Re-fit the cover either by dropping into place from above or sliding it into place from the right.

Re-fit the six M4 x 8 posi pan head screws.

4.4. Connecting the PC

We assume that:
your PC has two available comms. ports, Com1 and Com2, to connect to the

MiniLab
the connectors are both 9 way D-Type plugs.
If your PC does not conform to this please refer to Alternative PC Connection .

CAUTION

Only use RS232 cables supplied with the equipment. We cannot guarantee that other manufacturers cables will operate reliably in Spectra systems.

There are two RS232 serial communication cables to connect the PC to the MiniLab.

1. Make sure that both the MiniLab and the PC are switched off and isolated from the mains power supply.

2. Connect the first RS232 cable to the 9 way D-Type labeled RGA COMMS on the side of the MiniLab.

3. Connect the first RS232 cable to Com1 on the PC. Please consult the documentation that came with your PC if you need help identifying Com1.

4. Connect the second RS232 cable to the 9 way D-Type labeled TURBO COMMS on the side of the MiniLab.

5. Connect the second RS232 cable to Com2 on the PC. Please consult the documentation that came with your PC if you need help identifying Com2.

Longer RS232 comms. cables are available, please contact your local Spectra facility if you require them.

4.5. Software Installation

The software will have been supplied on 3.5 inch floppy disks which can be found at the front of the white ring binder which contains this and the other Spectra manuals.

If we have supplied the PC as part of a complete system the software will have already been installed and tested. You can keep the disk safe as backups.

The following instructions are intended for users supplying their own PC.

4.5.1. RGA for Windows software

Please follow the instructions in the Installation section of the RGA for Windows manual, reference LP101005 Rev 2.45 (or greater).

4.5.2. Recall software

The Recall software will be installed at the same time as the RGA for Windows software, you will see it as one of the five options.

Turbo controller software

The turbo controller software will have been supplied on a separate 3.5 inch floppy disk. This disk will contain two files:
V-Turbo.exe
V-Turbo.ini

Using Windows Explorer copy these two files to the Spectra folder.

You will now have to edit the V-Turbo.ini file. Using Notepad or some other text editor if you prefer open V-turbo.ini. There will be the following lines:

[CONFIGURATION]
Comm Port = 3

Edit the second line to change the comm. port setting to the one you have used to connect the turbo controller serial cable to. If you have followed the instructions above you will change this to 2.

Save the edited V-Turbo.ini file.

The last thing to do is to create a shortcut to the V-Turbo.exe file so that you can easily start the turbo pump.

With the cursor position on the desktop in Windows95, *right click* and select **New | Shortcut**. The Create Shortcut menu will appear. *Click* on the **Browse . . .** and then find the file V-Turbo.exe in the Spectra folder. *Click* on the **Open** button then *click* on the **Next>** button.

Select a name for the Turbo program the default will be shown, V-Turbo.exe change this if you prefer.

Click on the **Finish** button and the new icon will appear on the desktop.

You can create shortcuts elsewhere and in other ways, please consult the Windows95 manual or on-line help if you want more details.

4.5.3. Process Eye software

You may be using Process Eye software instead of RGA for Windows. Follow the instructions in the Process Eye 1.6 manual, reference LP101012 Rev 1.10 (or greater) to install this software.

It may be possible to run either RGA for Windows or Process Eye software with your MiniLab. If you purchased both software packages you should also have received some special instructions. You will probably need some training as well .

In this manual we assume you are only running RGA for Windows software.

Please contact your local Spectra facility if you require help.

4.6. Total Pressure

MiniLab includes an independent total pressure gauge the output of which is connected to Analogue Input 1 on the Microvision Plus control unit. We recommend configuring RGA for Windows to use the external total pressure signal rather than the RGA total pressure signal.

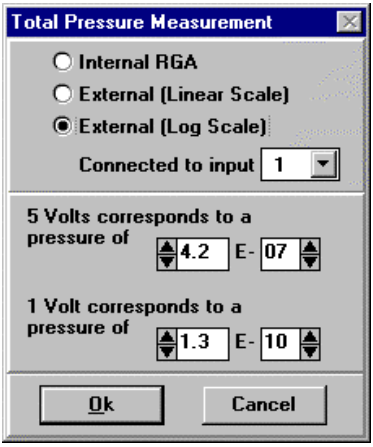

Figure 3 Total pressure dialog box

Please refer to section **4.14.1.2. Total pressure Microvision Plus** in the RGA for Windows manual (ref. LP101005 Rev 2.45).

In the Total Pressure Measurement *dialog box* select **External (Log scale)** and

set:

Connect to input	to 1
5Volts corresponds to a pressure of	to 4.2 E-7
1Volt corresponds to a pressure of	to 1.3 E-10

4.7. Hooking Up The MiniLab

4.7.1. Capillary connection

Connect the capillary assembly to the gas same point. The capillary terminates with a 1/4 inch (6.35mm) stainless steel pipe ready to couple to a 1/4 inch Swagelok fitting. You may wish to use a shut off valve to prevent the loss of gas when the capillary needs to be removed for maintenance.

Other types of termination can be provided, please contact your local Spectra facility for further information.

4.7.2. Nitrogen purge

All MiniLab units include the facility to purge the turbo pump bearings and vent the vacuum chamber with nitrogen. This feature is usually used where units are likely to be exposed to corrosive and/or toxic gases. There are two 1/4 inch Swagelok ports on the side panel of the MiniLab labelled INLET and EXHAUST.

Connect a dry nitrogen supply at a pressure of 1 to 2 p.s.i. above atmospheric pressure to the INLET port.

Connect a second pipe to the port labelled EXHAUST to exhaust the dry nitrogen safely. The exhaust nitrogen may now contain corrosive/toxic gases.

4.7.3. Exhaust

Even if you are not using nitrogen purge you may wish to connect the MiniLab to an exhaust system or simply vent through a window.

In this case connect 1/4 inch o.d. nylon or PTFE tube to the two ports marked INLET and EXHAUST.

Note that the MiniLab does not use rotary pumps so there will be no hydrocarbon vapours emitted by the vacuum pumping.

Section 5.
Operation

5.1. Start Up

The MiniLab system is interlocked to prevent any accidental damage.

5.1.1. Power up

Connect the MiniLab to the mains supply and switch the mains supply on.
At this stage none of the pumps should be running, there should be no power to; the RGA control unit, the bake-out switch or the capillary heater (if fitted). This is due to the interlocking preventing powering components until the turbo pump is switched on and is up to speed.

Power up your PC and locate the icon to start the turbo pump controller program, V-Turbo.exe. We will assume you have the icon on the Desktop.

The operation of the cooling fans is as follows.
Inside the MiniLab there are four cooling fans.
The Turbo Cooling Fan is mounted vertically next to the turbo pump.
Baseplate Fan 1 is mounted horizontally under the diaphragm pump.
Baseplate Fan 2 is mounted horizontally just behind the diaphragm pump.
The fourth cooling fan is inside the turbo pump controller.
When you power up the MiniLab the cooling fan inside the turbo controller starts. The other three cooling fans do not start.
When you start the turbo pump the Turbo Cooling Fan starts, but the two Baseplate Fans do not start.
When the turbo reaches full speed (or 90 - 100% full speed) Baseplate Fans 1 and 2 start.

5.1.2. Switch on

Double click on the turbo controller icon on your Desktop.
The Turbomolecular Pump window will be displayed.

To start the system *click* on the **Start Pump** button.

The automatic vent valve will close and the diaphragm pump will start. In the Turbomolecular Pump window the status box will change from Waiting To Start to Accelerating and the button will change to the **Stop Pump** button.

The display in the Turbomolecular Pump window will give an indication of the

turbo pump's rotational speed, which should smoothly accelerate. At this time there should still be no power to either the RGA control unit, the SYSTEM HEATER switch or the CAPILLARY HEATER switch.

When the turbo's rotational speed reaches approximately 95% of full speed (58KRPM in the case of a Varian V150HT pump) the interlock relay should be energised and you will find that there is now power to the RGA POWER switch on the side panel of the MiniLab.

The SYSTEM HEATER switch and the CAPILLARY HEATER switch should now have power connected and when switched on the switches should be illuminated. In normal operation these switches should be off, leave them switched off at this stage.

The pump should continue to accelerate to full speed (62 KRPM in the case of a Varian V150HT pump) and after a period of up to 8 minutes from first switch on the status box in the Turbomolecular Pump window should change from:
Accelerating
to
Normal Operation

5.2. Starting the Quad

Ideally you want the pressure to reach $1x10^{-5}$ Torr before switching on a filament on the quadrupole. The trip contact on the cold cathode gauge is connected to the external trip on the RGA control unit. The trip is set to $1x10^{-5}$ Torr so you cannot actually switch the filaments on until the pressure falls below this level. We recommend allowing the MiniLab to run for 30 minutes after the turbo pump is up to speed before switching the RGA on. Now might be a good time to go for a cup of coffee.

To start the quad move the switch labelled RGA POWER to the on position. The switch will be illuminated when there is power to the quad. Now, refer to the RGA for Windows manual to run up the software and switch the filaments on.

If you have not used RGA for Windows before or are unfamiliar with modern quadrupole mass spectrometers we strongly recommend you to read section 3 of the RGA for Windows manual and work through the Guide Tour. After reading through this section you will have switched the filaments on and established that the quad is working correctly.

5.3. Running Hot

Before you can start to use the system properly, you will need to run it for sufficient time to allow the back-ground peaks to drop. This amount of time can be significantly reduced by baking the system. This should be done after the system has run for at least an hour to allow the pressure in the system to drop below $1x10^{-5}$ Torr. The $180^{o}C/80^{o}C$ switch should be set to 180 ^{o}C and the SYSTEM HEATER switched on (it will illuminate when on). A dry, inert gas should be flushed continuously through the capillary inlet during bake out. The quadrupole should be running with the filament on but must be using the faraday detector. Do not use the multiplier detector during baking.

CAUTION
The Electron Multiplier (SEM) MUST NOT be operated at temperatures above $50^{o}C$.

With dual (faraday and electron multiplier) detector instruments serious damage will be caused to the electron multiplier if it is operated at temperatures above $50^{0}C$.

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.

The total pressure should gradually start to rise and you should bake the system at least until that pressure starts to drop. In normal operation an initial bake of at least 24 hours is required although in general the longer the system is baked the better.

To improve the back-ground 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.

5.3.1. Temperature switch

The $180^{o}C/80^{o}C$ should be set to $180^{o}C$ for the initial bakeout that will reduce the water background. After this period running at a lower temperature with the switch set to $80^{o}C$ is adequate in preventing the condensation of vapours in the

vacuum chamber which could lead to memory effects. Often it is not necessary to have the system heater switch on at all. This will depend on the application.

MiniLab has been designed to allow continuous operation, using the Faraday detector, with the system heater on at a setting of 180°C or 80°C.

5.3.2. Capillary heater

Set the switch labelled CAPILLARY HEATER to the on position to switch the capillary heater on. There is less chance of vapours condensing in the capillary leading to memory effects or even blockage when the capillary is heated. Whether you need to heat the capillary or not depends on the application and the nature of the gases being sampled.

MiniLab has been designed to allow the capillary heater to be run continuously.

5.4. Shutting Down

The MiniLab should be run continuously unless it is not to be used for an extended period of time or it needs to be shut down for maintenance.
To shut down the MiniLab.

1. Switch the capillary heater and the system heater off.
2. Switch the quadrupole filaments off.
3. Wait for 5 minutes to allow the filaments to cool.
4. In the Turbomolecular Pump window *click* the **Stop Pump** button. You should be able to hear the pumps stop and the vent valve open.
5. Wait for 5 minutes so that the cooling fans are still running before disconnecting the MiniLab from the mains supply.

Section 6.
Maintenance

6.1. Maintenance Introduction

In this section of the manual we cover all the maintenance tasks you are likely to have to deal with.

Generally the MiniLab will require very little maintenance. Changing filaments and replacing the fused silica tube liner are the only two tasks you are likely to have to do.

WARNING
Before undertaking ANY maintenance shut down the MiniLab and isolate from the mains supply.

Only competent persons should carry out maintenance.

6.2. Removing the MiniLab Cover

1. Shut down the MiniLab by following the instructions in Shutting Down . Disconnect the mains power supply.

WARNING
Disconnect from the mains power before removing the cover.

2. The cover is secured by six M4 x 8 posi pan head screws. We will assume the MiniLab is positioned so that the side panel with the switches and connectors is on the left. The six screws are positioned as follows:
   two are on the front panel
   two are on the rear panel
   one is on the right-hand end panel
   one is on the left of the top panel

   Remove all six M4 x 8 screws.

The cover may be removed by lifting it upwards or sliding it to the right.

6.2.1. Refitting the MiniLab cover

1. The MiniLab cover can only be fitted one way round. Re-fit the cover either by dropping into place from above or sliding it into place from the right.

2. Re-fit the six M4 x 8 posi pan head screws.

6.3. Removing the Oven Lid

1. Remove the MiniLab cover by following the instructions in Removing the MiniLab Cover .

2. Remove the five M3 posi-pan head screws which secure the lid.

3. Lift the lid upwards then slide towards the Microvision Plus control unit.

Note that the underside of the lid is lined with 12mm thick insulation which can easily be damaged.

6.3.1. Refitting the oven lid

1. Position the lid in the correct orientation (use the screw holes as a guide) and then slide under the top return of the side panel and into place on the top of the oven.

2. Re-fit the five M3 posi-pan head screws.

6.4. Leak Checking

The vacuum system housed in the MiniLab enclosure was fully leak checked as part of the assembly and test procedure before it left the factory. Will not have to leak check before you get the system up and running.

To leak check you will need a cylinder of helium fitted with a regulator and a length of flexible hose to spray helium inside the cabinet. You can use another gas, Argon is often used on vacuum systems, and any grade of helium will do (balloon gas is quite adequate).

WARNING
To leak check you will need to run the MiniLab with the cover removed.

To leak check the system you will need to have the MiniLab powered up and

running with the cover removed. For this reason only suitably trained personnel should undertake leak checking.

1. Remove the MiniLab cover by following the instructions in Removing the MiniLab Cover.

2. Turn RGA for Windows to the Leak Check mode, check that the probe gas is set to mass 4 (Helium) or the appropriate mass if you are using another gas, set the range to E-10 and disable autoranging (refer to the RGA for Windows manual if you need help).

MiniLab uses a Microvision Plus so position the monitor so that you can see the screen while you are leak checking.

3. To leak check the capillary inlet you will need to seal the atmospheric end by fitting a shut off valve and closing it. Spray helium over the whole capillary inlet assembly paying particular attention to spraying helium into the capillary assembly from the low pressure end in the MiniLab inlet compartment. If there is a break or leak in the fused silica tube this is the only way it will show up.

4. Once you have finished open the shut off valve at the atmospheric end of the capillary inlet and spray helium over the end of the capillary, you should see a large signal. If not, you have a problem, the quad is not measuring helium and you will need to correct this before going through the leak checking process again.

5. Allow the helium which has just entered the system time to pump away. Follow the instructions in Removing the Oven Lid to remove the oven lid.

6. Starting at the top of the vacuum chamber spray helium over the entire MiniLab vacuum system. Pay particular attention to any newly created vacuum seals.

If you do find any leaks you will need to shut down the MiniLab, fix the leak, start up the MiniLab and leak check again.

7. When you have finished replace the oven lid then re-fit the MiniLab cover.

6.5. Pumping

6.5.1. Turbo pump

The turbo pump used in your MiniLab is maintenance free. If you do suspect a problem with the turbo pump first consult the turbo pump manual which will have been supplied with your MiniLab. If you are still experiencing difficulties contact your local MKS Spectra facility.

6.5.2. Diaphragm pump

The only routine maintenance that the diaphragm may require is the replacement of the diaphragms and inlet valves. Please consult the diaphragm pump manual supplied with the MiniLab for further information.

To gain access to the diaphragm pump remove the MiniLab cover by following the instructions in Removing the MiniLab Cover

If you do not know what to do next please do not attempt any diaphragm pump maintenance. Instead contact your local MKS Spectra facility.

6.6. Microvision Plus

There are no user serviceable parts within the Microvision Plus control unit.

6.6.1. Fitting the control unit

1. Check that the MiniLab is disconnected from the mains supply.

2. If the MiniLab cover is in place remove it by following the instructions in Removing the MiniLab Cover .

3. 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.

4. 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.

5. 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.

6. 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.
7.

6.6.2. Removing the control unit

1. If the MiniLab cover is in place remove it by following the instructions in Removing the MiniLab Cover .

2. Disconnect the five cables from the front of the Microvision. There are four D-Type connectors and one Jack Plug.

3. Rotate the locking ring on the RF/analyser connector so that the slot lines up with; the keyway on the connector tube and the locating key on the analyser flange. Slide the locking ring along the RF/analyser connector away from the analyser.

4. Gently pull the Microvision Plus control unit away from the vacuum chamber sliding it off the analyser. TAKE CARE the pins on the vacuum feedthrough are easily damaged.

5. Lift away the Microvision Plus control unit.

6.7. Quadrupole Analyser

6.7.1. Removing the analyser

1. Remove the Microvision Plus control unit by following the instructions above.

CAUTION
The quadrupole analyser is a delicate instrument which 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.

To remove and replace the analyser you will need:
One 10mm spanner
One CF35 copper gasket

2. Make a note of the orientation of the analyser with respect to the vacuum

chamber. Use the locking pip on the analyser flange as a reference (it will usually be in the 12 o'clock position).

3. Remove the six M6 bolts and washers which fasten the CF35 flange of the analyser to the CF63 zero length adapter.

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.

Analyser maintenance is fully described in the Microvision Plus manual.

6.7.2. Refitting the analyser

1. Note the gas inlet tube on the top of the analyser (if it is fitted with a PVD) source. Look into the vacuum chamber and note the ceramic socket which 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.

4. Rotate the analyser flange so that it is in the correct orientation.

5. Bolt the flanges together remembering to tighten opposite bolts equally.

6. Re-fit the Microvision Plus by following the instructions above.

You will need to leak check the system as you have just made a new vacuum seal. Follow the instructions in Leak Checking before re-fitting the MiniLab cover as described in Removing the MiniLab Cover .

6.8. Changing Filaments

1. Remove the analyser by following the instructions in Quadrupole Analyser

2. Replacing the filaments is described in the maintenance section of the Microvision Plus manual, reference LP101009 Rev 1.00 (or greater).

3. Re-fit the analyser by following the instructions Quadrupole Analyser .

6.9. Inlet

Virtually all MiniLab systems use a capillary inlet to admit sample gas into the MiniLab for analysis. MKS Spectra produce a variety of capillary inlets but the Flexil capillary is the one usually used in MiniLabs. It is the Flexil capillary that we deal with in this manual.

The Flexil capillary inlet assembly consists of a white PTFE tube containing a fine bore stainless steel tube down the centre of which is threaded a 0.32mm I.D. fused silica tube. A low voltage power supply is connected across the stainless steel tube to provide heating of the fused silica tube. The capillary is supported by a bracket in the inlet compartment of the MiniLab and is terminated with a 1/4 inch stainless steel pipe at the atmospheric end. The whole capillary is electrically insulated due to the heating method.

Capillary Inlet - Removal
Capillary Inlet - Fitting
Fused Silica Tube

6.10. Replacing The Orifice Disk

You may need to replace the orifice if it becomes blocked or, more likely, you wish to fit a different size orifice in order to monitor an environment operating at a different pressure. The orifice is a small disc with a hole in it fitted into a holder machined into the CF flange. The inlet flange is mounted on the end of the quadrupole vacuum chamber opposite to the analyser flange. The flange is held in place by eight M8 stainless steel bolts.
The analyser in your MiniLab will almost certainly be fitted with a PVD source so there will be a ceramic socket which mates with the gas inlet tube on the top of the analyser. You may wish to remove this to get easier access to the orifice holder, although it is not essential.

1. Shut down the MiniLab by following the instructions in Shutting Down then disconnect from the mains supply. Remove the MiniLab cover by following the instructions in Removing the MiniLab Cover .

2. Disconnect the high pressure end of the capillary from the gas source. If there is a shut off valve remember to close it.

3. At the high pressure end of the capillary assembly using a 5/16 inch spanner remove the nut with the 1/4 inch pipe welded to it. Remove the graphite vespel ferrule.

4. Remove the oven lid by following the instructions in Removing the Oven Lid .

5. In the oven compartment use a 5/16 inch spanner to undo the nut on the 1/4 to 1/16 inch Swagelok Reducer and slide it and the ferrule along the fused silica tube towards the support bracket.

6. Slide the fused silica tube down the capillary assembly from the low pressure end towards the high pressure end. Leave about 20mm of fused silica tube exposed in the oven compartment. Remove the nut and the ferrule.

7. Remove the Swagelok Tee. Use a 9/16 inch spanner to un-do the two stainless steel nuts. You can hold the body of the Tee using a 1/2 inch spanner.

8. Use a 13mm spanner to remove the eight bolts which secure the CF inlet flange to the vacuum chamber. You will not be able to complete remove the lower most bolt as it will foul on the stainless steel by-pass pipe.

9. Pull the inlet flange away from the vacuum chamber and lift it away. Remember that there is likely to be a ceramic socket on the vacuum side of this flange.

If your analyser is fitted with a PVD source you may wish to remove the ceramic socket from the flange at this point. Before doing this note how the socket is free to slide around against the flange within the limits of the securing ring. When you come to re-fit the ceramic socket you will have to tighten the screws sufficiently to allow the same movement with a similar force. Carefully unscrew and remove the three M2 slotted screws and their springs and lift away the ceramic socket and metal securing ring.

10. Remove the screw which is in the centre of the double thickness flange (this holds the orifice in place). Now remove the orifice disc.

11. Fit the new orifice disc and replace the screw. Just tighten the screw

sufficiently to hold the disc in place do not over tighten it as this may distort the disc. It does need to be tight enough to make a seal if gas can leak around the orifice disc this will effectively give you a larger sized orifice than you want.

12. Fit a new copper gasket and re-fit the inlet flange. Make sure that the ceramic coupling mates with the gas inlet tube on the analyser.

13. Re-fit the Swagelok Tee. The two stainless steel nuts should be tightened finger tight plus 3/4 turns using a 9/16 inch spanner.

14. Thread the Swagelok Reducer nut and then the ferrule (bevel of ferrule towards the vacuum chamber) over the fused silica tube.

15. Thread the fused silica tube into the Swagelok Reducer and continue to thread it in until you feel it butt up against the vacuum chamber inlet. Now, withdraw the fused silica tube by 5mm. Slide the ferrule into place then tighten the nut of the Reducer FINGER TIGHT. With a 5/16 inch spanner tighten the nut a further 1/4 TURN only.

Note: the vacuum chamber inlet is where the first two CF63 flanges to the right of the Swagelok Union Tee meet. If you are unsure about inserting the correct length of fused silica tube into the Reducer and through the Swagelok Tee measure the distance (it's about 85 to 90mm) and mark it on the fused silica tube at the atmospheric end first.

16. At the high pressure end of the capillary assembly fit the ferrule and nut with the pipe welded to it, tighten finger tight plus 1/4 turn. Trim the end of the fused silica tube flush with the end of the 1/4 inch stainless steel tube.

17. You will now need to leak check the inlet, see Leak Checking before fitting the oven lid, see Removing the Oven Lid and replacing the cover, see Removing the MiniLab Cover .

6.11. Capillary Inlet - Removal

1. Shut down the MiniLab by following the instructions in Shutting Down .

2. Make sure the MiniLab is disconnected from the mains supply. Then remove the cover by following the instructions in Removing the MiniLab

Cover

3. Disconnect the atmospheric end of the capillary from the gas source. If there is a shut off valve remember to close it.

4. Remove the oven lid by following the instructions in Removing the Oven Lid .

5. Locate the white ceramic terminal block on the capillary support bracket within the oven compartment. Remove the capillary heater supply wires from the upper connections on this terminal block.

6. Locate the 1/4 inch Swagelok Union Tee in the inlet compartment of the MiniLab. On the side of the Tee towards the capillary support bracket is a 1/4 inch to 1/16 inch Swagelok Reducer. Using a 5/16 inch spanner remove the nut from the end of the reducer then, slide it and the graphite vespel ferrule along the fused silica tube towards the capillary support bracket.

7. At the high pressure end of the capillary using a 5/16 inch spanner remove the nut with the 1/4 inch pipe welded to it and the graphite vespel ferule from the fused silica tube.

8. Slide the fused silica tube from the low pressure end down the capillary. You can gently pull the fused silica tube from the high pressure end. Leave about 20mm exposed beyond the capillary support bracket.

9. Using a 3mm Allen key remove the two screws from the front face (the one facing the Swagelok Tee) of the capillary support bracket.

10. On the outside of the MiniLab remove the two posi-pan head screws which hold the white PTFE capillary sleeve to the cabinet.

11. You can now pull the capillary together with the capillary sleeve through the side of the cabinet. Be careful not to damage the insulation especially with the capillary heater wires.

6.12. Capillary Inlet - Fitting

1. If for some reason the MiniLab is running shut it down by following the instructions in Shutting Down .

2. Make sure the MiniLab is disconnected from the mains supply. If it is fitted remove the cover by following the instructions in Removing the MiniLab Cover **.**

3. If it is fitted remove the oven lid by following the instructions in Removing the Oven Lid **.**

4. Thread the low pressure end of the capillary through the hole in the side panel of the MiniLab. Be careful not to damage the insulation in the oven compartment.

5. Secure the white PTFE capillary sleeve to the MiniLab side panel using the two posi-pan head screws.

6. Fit the two socket set screws which fasten the capillary to the capillary support bracket. Tighten them using a 3mm Allen key.

7. Locate within the oven compartment. Fit the capillary heater supply wires to the white ceramic terminal block on the capillary support bracket.

8. At this point you may want to fit a new fused silica tube in which case refer to the instructions in Fused Silica Tube .

If you are retaining the existing fused silica tube slide it down the capillary assembly from the high pressure. You can gently pull the fused silica tube from the low pressure end once it is clear of the capillary support bracket.

9. Thread the Swagelok Reducer nut and then a graphite vespel ferrule (bevel of ferrule towards the vacuum chamber) over the fused silica tube.

10. Thread the fused silica tube into the Swagelok Reducer and continue to thread it in until you feel it butt up against the vacuum chamber inlet. Now, withdraw the fused silica tube by 5mm.

Note: the vacuum chamber inlet is where the first two CF63 flanges to the left of the Swagelok Union Tee meet. If you are unsure about inserting the correct length of fused silica tube into the Reducer and through the Swagelok Tee measure the distance (it's about 85 to 90mm) and mark it on the fused silica tube at the atmospheric end first.

Slide the ferrule into place then tighten the nut of the Reducer FINGER TIGHT.

With a 5/16 inch spanner tighten the nut a further **1/4 TURN** only.

11. At the high pressure end of the capillary assembly fit the ferrule and nut, tighten finger tight plus 1/4 turn using a 5/16 inch spanner.

12. You will now need to leak check the inlet, see Leak Checking before fitting the oven lid, refer to Removing the Oven Lid and replacing the cover, see Removing the MiniLab Cover .

6.13. Fused Silica Tube

You may need to replace the fused silica capillary tube which forms part of the capillary inlet assembly if it has been damaged or becomes blocked.

1. Shut down the MiniLab by following the instructions in Shutting Down then disconnect from the mains supply. Remove the MiniLab cover by following the instructions in Removing the MiniLab Cover**.**

2. Disconnect the high pressure end of the capillary from the gas source. If there is a shut off valve remember to close it.

3. At the high pressure end of the capillary assembly using a 5/16 inch spanner remove the nut with the 1/4 inch pipe welded to it. Remove the graphite vespel ferrule.

4. Remove the oven lid by following the instructions in Removing the Oven Lid.

5. In the oven compartment use a 5/16 inch spanner to undo the nut on the 1/4 to 1/16 inch Swagelok Reducer and slide it and the ferrule along the fused silica tube towards the support bracket.

6. Slide the fused silica tube down the capillary assembly from the low pressure end towards the high pressure end. Once the fused silica capillary appears at the high pressure end you can pull it out of the assembly. Be careful to remove the nut and ferrule once the fused silica tube has cleared the reducer in the oven compartment.

7. Take the cassette of fused silica tubing and carefully feed one end down the capillary assembly from the high pressure end. The fused silica tubing is quite fragile but should slide freely down the inner bore of the capillary

assembly. Continue to feed the tube down the capillary until it emerges beyond the capillary support bracket at the low pressure end.

8. Thread the Swagelok Reducer nut and then the ferrule (bevel of ferrule towards the vacuum chamber) over the fused silica tube at the support bracket end.

9. Thread the fused silica tube into the Swagelok Reducer and continue to thread it in until you feel it butt up against the vacuum chamber inlet. Now, withdraw the fused silica tube by 5mm. Slide the ferrule into place then tighten the nut of the Reducer FINGER TIGHT. With a 5/16 inch spanner tighten the nut a further **1/4 TURN** only.

Note: the vacuum chamber inlet is where the first two CF63 flanges to the right of the Swagelok Union Tee meet. If you are unsure about inserting the correct length of fused silica tube into the Reducer and through the Swagelok Tee measure the distance (it's about 85 to 90mm) and mark it on the fused silica tube at the atmospheric end first.

10. At the high pressure end of the capillary cut the fused silica tube, leaving about 50mm surplus, by scoring with a scalpel and snapping.

11. Refit the ferrule and nut with the pipe welded to it, tighten finger tight plus 1/4 turn then, trim the end of the fused silica tube flush with the end of the 1/4 inch stainless steel tube.

12. You will now need to leak check the inlet, see Leak Checking before fitting the oven lid, refer to Removing the Oven Lid and replacing the cover, see Removing the MiniLab Cover .

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Section 7.
Other Topics

7.1. Spares List

The following is a list of commonly needed spare parts you may require for your mass spectrometer system. This list covers the MKS Spectra range of mass spectrometer systems so some of the items will not be applicable to your system.

If you require prices or further information please contact your local MKS Spectra facility. Turn to the front of this manual for address details.

Item	**Part Number**
Tungsten filaments, pack of 2	842-060
Thoriated iridium filaments, pack of 2	842-002
CF35 copper gaskets, pack of 10	300-010
Rotary Pump Oil, Hydrocarbon	488-010
Rotary Pump Oil, Fomblin	488-014
Graphite Vespel Ferrules	488-020
Fused silica tube Capillary, 1 cartridge	488-040
Orifice Disk 20 micron	372-170
Orifice Disk 30 micron	372-171
Orifice Disk 40 micron	372-172
GLT Capillary Assembly	450-161

7.2. Alternative PC Connection

In the MiniLab manual we assumed that two comms port were available to connect the MiniLab to the PC. In some circumstances there may only be one available port. For instance, the PC has two comms ports and the first one is used for the mouse. This need not prevent you from running the MiniLab. Modify the instructions given in the manual in accordance with the following.

The Turbo pump controller software only needs to run when you want to start or stop the pump. Once the pump is running the serial cable can be disconnected and the pump will remain in its present state.

1. The help topic Connecting The PC describes connecting the PC to the MiniLab. If you only have one comms port connect it to the TURBO

COMMS connector on the MiniLab.

2. Install the software as described in Software Installation . Make the change to the [CONFIGURATION] section of the V-Turbo.ini file. We will assume you are using comm port 2.

3. When you install the RGA for Windows software select the same comm port (comm port 2).

4. Follow Start Up that describes starting the pumps. Once the Turbo pump is up to speed and the Turbomolecular Pump window shows Normal Operation close the Window by *clicking* on the Close button (this is the button in the top right-hand corner with a X icon).

5. Disconnect the serial cable from the TURBO COMMS connector on the MiniLab and connect it to the RGA COMMS connector.

6. Run up RGA for Windows as normal.

Shutting Down describes shutting down the MiniLab. Modify the instructions as follows.

1. With only one comms port first close RGA for Windows by Exiting from the program. If the filaments were on wait 5 minutes for them to cool.

2. Disconnect the serial cable from the RGA COMMS connector on the MiniLab and connect it to the TURBO COMMS connector.

3. Start the Turbo Pump controller software by *double clicking* on the icon on your Desktop. The software will re-establish communications with the turbo controller, determine that it is operating normally and display the **Stop Pump** button.

4. To stop the pump and shut down the MiniLab *click* on the **Stop Pump** button.

If your PC does not use 9 way D-Type plugs for the comms connectors please contact your local MKS Spectra facility as alternative serial cables are available.

7.3. Gas Consumption

The MiniLab fitted with the standard Flexil Capillary Inlet will consume 20ml/min from the gas source.
The above figure was simply determined by filling a 5 litre Gas Sample Bag with Nitrogen, connecting the MiniLab inlet to the bag and timing how long it took to empty (4 hours).
4 hours is 240 minutes therefore 5000/240 = 20.8 ml / minute.

7.4. Troubleshooting

7.4.1. Turbo Not Reaching Full Speed

The turbo pump used in the version 3 MiniLab at full speed spins at 62,000 r.p.m., sometimes the pump may not reach this speed and trip out. There are a number of possible reasons for this and you may need to carryout some simple experiments to determine exactly where the problem lies.
The most likely causes of the turbo pump failing to reach full speed are:
Faulty turbo pump controller
Faulty turbo pump
Large leak
High pressure in the backing line

Please read the whole of this topic before doing anything.

Faulty turbo pump controller
Generally, if the turbo pump controller is faulty the pump will not spin at all. So, if the pump reaches some speed the turbo controller is probably all right. If you can easily swap the controller do so to make sure it is alright.

Faulty Turbo Pump
The most likely thing to fail on the pump is the bearings. If you remove the turbo pump from the chamber and gently try to spin the rotor. It should spin easily and smoothly, if it does not the bearings need replacing. A whining noise and overheating are other signs that the bearings in the pump need to be replaced. If the bearings need to be replaced contact your local MKS Spectra facility and arrange to return the pump.

A Large Leak
A large leak on the system can prevent the turbo pump from reaching full speed. Without the pump up to full speed you cannot leak check the vacuum system using the quadrupole. You need to try to isolate the problem area. Try some or all of the following.
If your MiniLab is fitted with an automatic vent valve remove it from the turbo

pump and replace it with a suitable screw fitted with an O ring (or use tread tape if you do not have an O ring). See if this makes a difference. Automatic vent valves rely on a solenoid valve that can fail.
Remove the inlet system from the quadrupole vacuum chamber and plug the Swagelok fitting on the inlet flange. See if the turbo now comes up to speed.
Take the turbo pump off the vacuum chamber and fit a blanking flange to the turbo pump and see if it now comes up to speed. If it does there is a gross leak on the vacuum chamber.
If the backing pump is a rotary pump and there is a large leak you with see oil mist coming from the exhaust.

High Pressure in the Backing Line
Normally the pressure in the backing line will be no greater than 5mBar. If the pressure goes significantly above this it can prevent the turbo pump from reaching full speed. You can fit a total pressure gauge in the backing line and see what the pressure is. You can try changing the backing pump and checking all the connections in the backing line. With a diaphragm backing pump the most likely reason is a failure in the diaphragm pump.

If your system uses a separate backing pump either a rotary pump or a diaphragm pump the pressure should in the 10-3 mBar range.

Report your findings from the above to your local MKS Spectra facility, they will advise you how to proceed.

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Index