



# SEM / SAM User's Guide

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## Preface

This document has been compiled with great care and is believed to be correct at the date of print. The information in this document is subject to change without notice and does not represent a commitment on the part of OMICRON Vakuumphysik GmbH.



**Please note.** Some components described in this manual may be optional. The delivery volume depends on the ordered configuration.



**Please note.** This documentation is available in English only.



**Attention.** Please read the safety information on pages 9 to 10 before using the instrument.

<b>Related Manuals</b>
<b>SEM 20:</b> Electron Focusing Column, User's Guide, FEI
<b>SEM 500:</b> Instruction Manual: Microfocus Electron Gun, Staib
Pulse Counting Unit for SEM
Scan Control Unit SCU / SCU S
Instruction Manual for Model 97 SED Preamplifier, PHI
EA 125 Electron Analyser Technical Reference Manual
EAC 2000 Control Unit
CPC Electronics
DAT 125 Hints and Tips
Spectra 6.xx Interface and Software Manual

Table 1: Related manuals.

## Copyright

No part of this manual may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, for any purpose without the express written permission of OMICRON Vakuumphysik GmbH.

## Warranty

OMICRON acknowledges a warranty period of 12 month from the date of delivery (if not otherwise stated) on parts and labour, excluding consumables such as filaments, sensors, etc.

No liability or warranty claims shall be accepted for any damages resulting from non-observance of operational and safety instructions, natural wear of the components or unauthorised repair attempts.

## Normal Use

The SEM 20 / SEM 500 scanning electron microscopy packages may only be used

- with the electron column and the secondary electron detector (Channeltron) properly installed to a vacuum system with base pressure below  $1 \times 10^{-9}$  mbar,
- SEM 20 only: with the electron gun chamber differentially pumped by its respective ion pump
- with the SED preamplifier box tightly fixed to the Channeltron at the vacuum system,
- with all electronics units properly installed in a closed rack cabinet and all access doors of the rack cabinet closed and locked,
- with all cabling connected and all electronics equipment switched on; SEM 20 only: with the safety interlock function enabled
- in an indoor research laboratory environment by personnel qualified for operating delicate scientific equipment.
- Proper grounding/earth connections of the vacuum system and the electronics units are vital.
- The required connections for electrical supplies may only be carried out by authorised personnel qualified to handle lethal voltages.
- The **customer is responsible for CE compliance** and labelling of the experimental setup as a whole.



### **Warning: Lethal Voltages!!**

Adjustments and fault finding measurements as well as installation procedures and repair work may only be carried out by authorised personnel qualified to handle lethal voltages.



**Attention:** Please read the safety information in the relevant manuals before using the instrument.

## Conditions of CE Compliance

OMICRON instruments are designed for use in an indoor laboratory environment. For further specification of environmental requirements and proper use please refer to your quotation and the product related documentation (i.e. **all** manuals, see individual packing list).

The OMICRON SEM / SAM packages comply with CE directives as stated in your individual delivery documentation if used unaltered and according to the guidelines in the relevant manuals.

### Limits of CE Compliance

This compliance stays valid if repair work is performed according to the guidelines in the relevant manual and using original OMICRON spare parts and replacements.

This compliance also stays valid if original OMICRON upgrades or extensions are installed to original OMICRON systems following the attached installation guidelines.

### Exceptions

OMICRON **cannot** guarantee compliance with CE directives for **components** in case of

- changes to the instrument **not authorised by OMICRON**, e.g. modifications, add-on's, or the addition of circuit boards or interfaces to computers supplied by OMICRON.

The customer is responsible for CE compliance of entire **experimental setups** according to the relevant CE directives in case of

- installation of OMICRON components to an on-site system or device (e.g. vacuum vessel),
- installation of OMICRON supplied circuit boards to an on-site computer,
- alterations and additions to the experimental setup not explicitly approved by OMICRON

**even if** performed by an OMICRON service representative.

### Spare Parts

OMICRON spare parts, accessories and replacements are not individually CE labelled since they can only be used in conjunction with other pieces of equipment.



**Please note:** CE compliance for a combination of certified products can only be guaranteed with respect to the lowest level of certification. Example: when combining a CE-compliant instrument with a CE 96-compliant set of electronics, the combination can only be guaranteed CE 96 compliance.

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## 1. Introduction

There are two SEM packages available to combine with the EA 125 analyser package for SEM/SAM application. SEM 20 comprises an electron gun with thermal field emitter for 20 nm resolution capability. SEM 500 achieves a resolution <500 nm employing an electron gun with a tungsten filament.

### SEM 20

The Scanning Electron Microscopy Package SEM 20 consists of:

- Double Lens Electron Column with Thermal Field Emitter
- Deflection Controller with Amplifier Box
- Digital High Voltage Power Supply with Manual User Interface
- Ion Getter Pump for differential pumping of Gun Chamber
- Secondary Electron Detector (SED): Channel Electron Multiplier with Preamplifier Box
- SED Power Supply with High Voltage and Bias Modules
- Video Scanner
- TV-Monitor
- DAT IM scan generation and imaging software with PC plug-in board SP 410

optional

- PC with DAT IM installed

### SEM 500

The Scanning Electron Microscopy Package SEM 500 consists of:

- Electron Gun with tungsten filament
- High voltage power supply
- Deflection Controller

- Secondary Electron Detector (SED): Channel Electron Multiplier with Preamplifier Box
- SED Power Supply with High Voltage and Bias Modules
- Scan Control Unit
- TV-Monitor
- DAT IM scan generation and imaging software with PC plug-in board SP 410

optional

- PC with DAT IM installed

## **SAM SYS EA**

The SEM packages SEM 20 or SEM 500 are used in combination with the energy analyser EA 125 for Auger-Electron-Spectroscopy and Scanning Auger Microscopy.

The SAM SYS EA package consists of:

- SEM 20 or SEM 500 SEM package
- EA 125 energy analyser setup
- PC with DAT 125 IM Spectra/Imaging soft- and hardware for AES/SEM/SAM

For details on energy analyser, control unit, and control software see related manuals.



## 2. Safety Information



### Important:

- Please read this manual and the safety information in all related manuals before installing or using the instrument.
- The safety notes and regulations given in this and related documentation have to be observed at all times.
- Check for correct mains voltage before connecting any equipment.
- Do not cover any ventilation slits/holes so as to avoid overheating.
- The SEM / SAM package may only be handled by authorised personnel.



### Warning: Lethal Voltages!!

- Adjustments and fault finding measurements may only be carried out by authorised personnel qualified to handle lethal voltages.
- Lethal voltages are present inside all control and supply units during operation.



### Always

- All connectors which were originally supplied with fixing screws must always be used with their fixing screws attached and tightly secured.
- Always disconnect the mains supplies of all electrically connected units before
  - opening the vacuum chamber or a control unit case,
  - before touching any cable cores or open connectors,
  - before touching any part of the in-vacuum components.
- Leave for a few minutes after switching off for any stored energy to discharge.



## Never

- Never exceed a pressure of 1.2 bar inside the vacuum chamber.
- Never have in-vacuum components connected to their electronics in the corona pressure region, i.e. between 10 mbar and 10<sup>-3</sup> mbar, so as to avoid damage due to corona discharge.



## This product is only to be used:

- within a dedicated UHV system
- under ultra-high-vacuum conditions
- indoors, in laboratories meeting the following requirements:
  - altitude up to 2000 m,
  - temperatures between 5°C / 41°F and 40°C / 104°F (specifications guaranteed between 20°C / 68°F and 25°C / 77°F)
  - relative humidity less than 80% for temperatures up to 31°C / 88°F (decreasing linearly to 50% relative humidity at 40°C / 104°F)
  - pollution degree 1 or better (according to IEC 664),
  - overvoltage category II or better (according to IEC 664)
  - mains supply voltage fluctuations not to exceed ±10% of the nominal voltage

### 3. SEM 20 Wiring Configuration

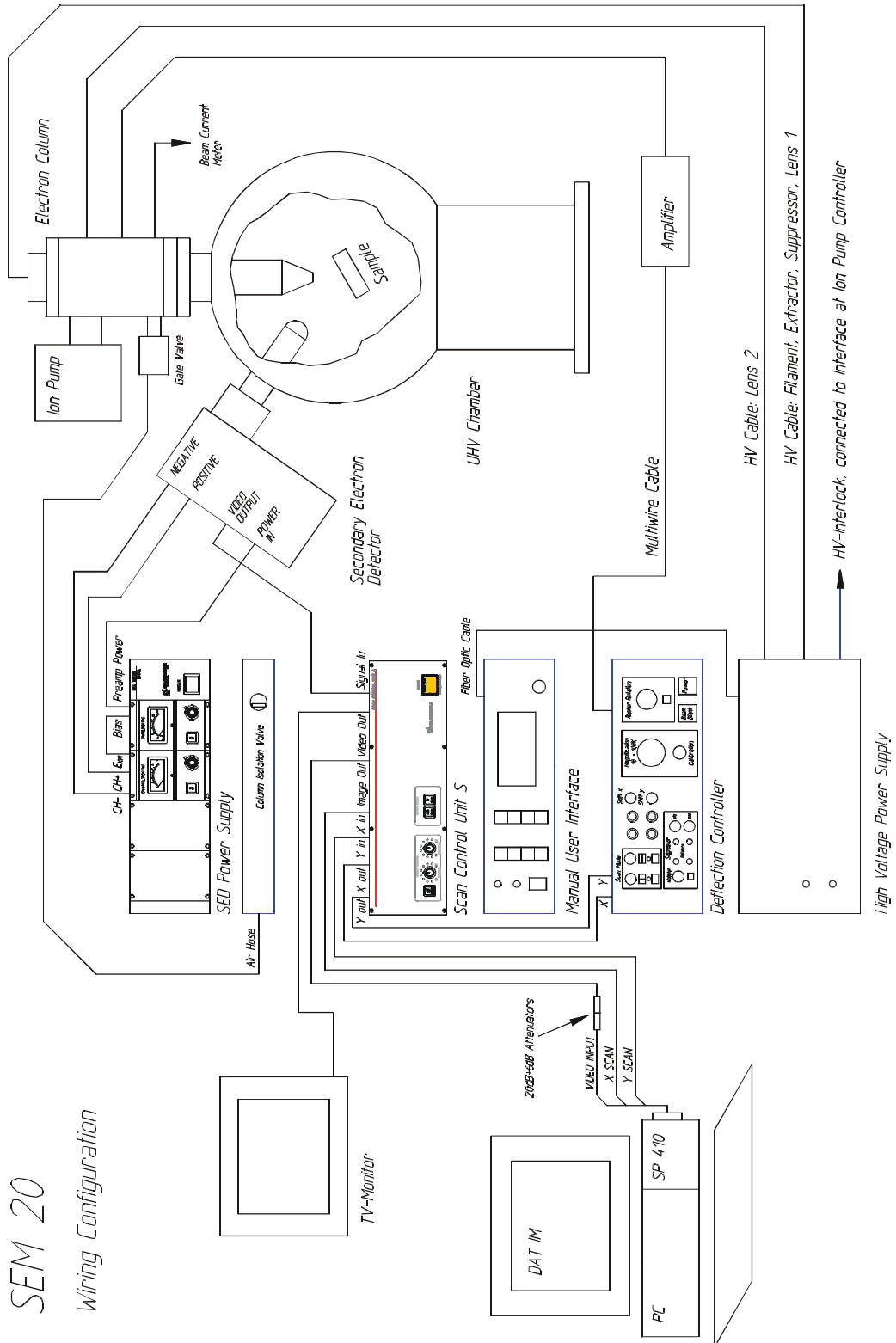
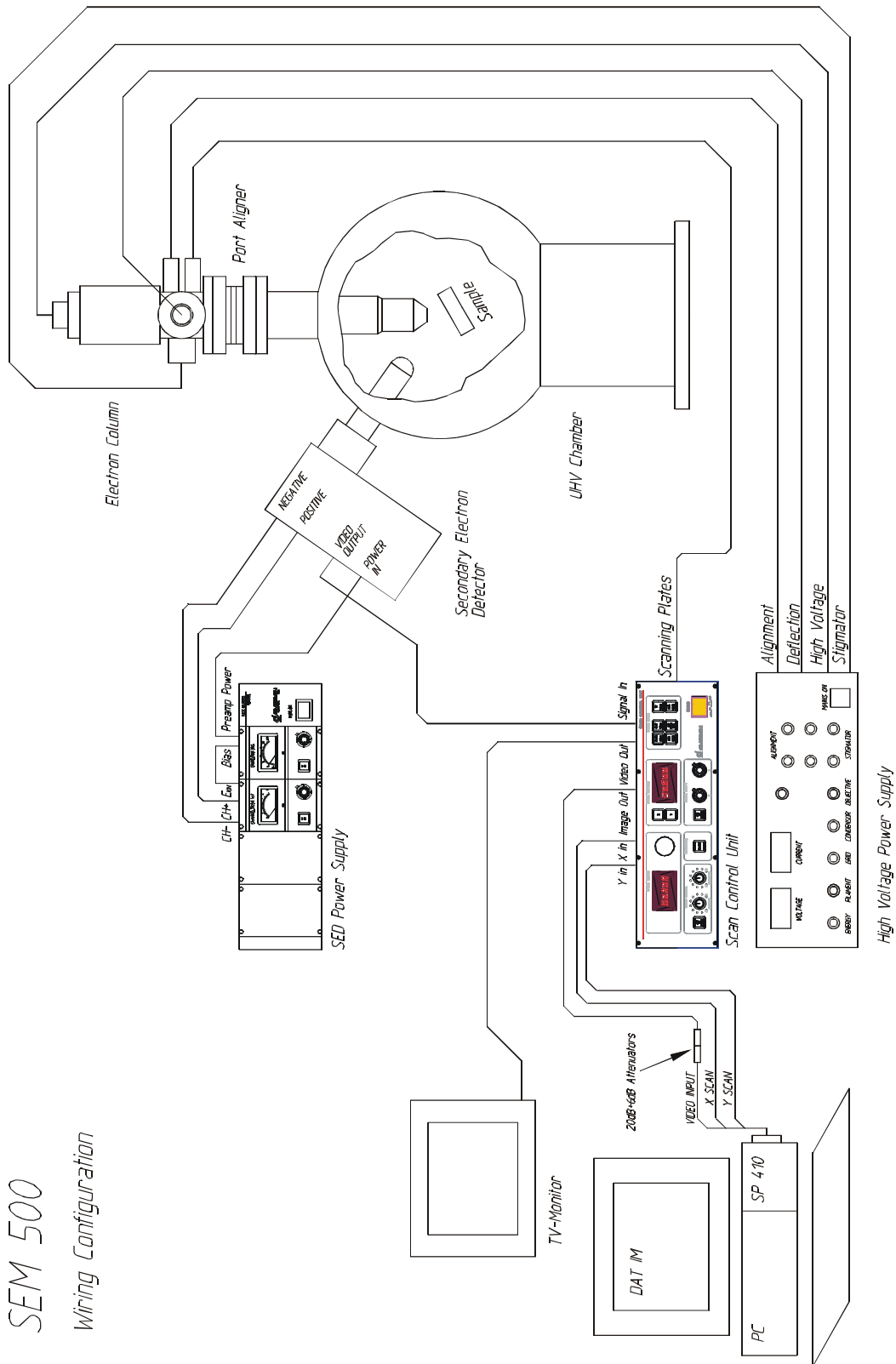


Figure 1. SEM 20 wiring configuration.

# 4. SEM 500 Wiring Configuration



SEM 500  
Wiring Configuration

Figure 2. SEM 500 wiring configuration.

## 5. Scanning Electron Microscopy

In a scanning electron microscope a focused electron beam is scanned across the sample in a raster. The incident electrons generate a number of effects.

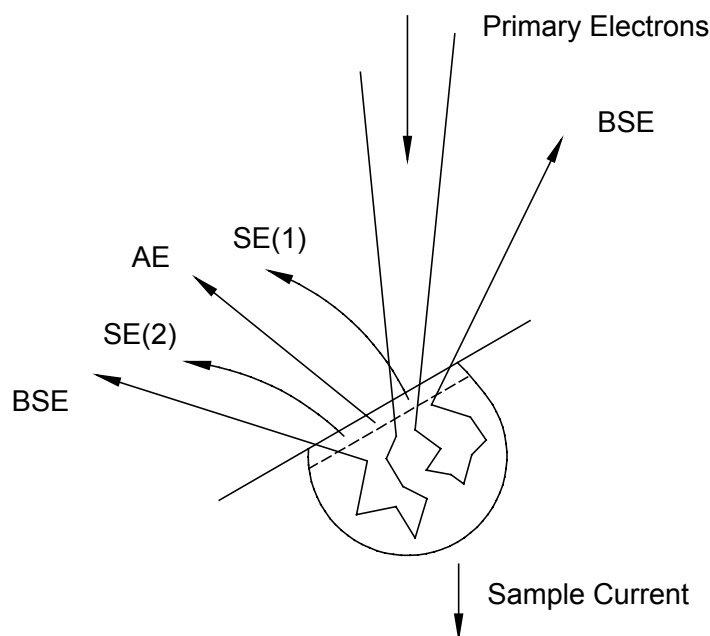


Figure 3. Interaction volume, schematic diagram. The range of the interaction volume decreases with higher atomic numbers of the sample material and increases with the beam voltage of the incident electrons.

- Backscattered electrons (BSE) are primary electrons after elastic scattering, with energies ranging up to the beam accelerating voltage.
- Secondary electrons (SE) are (inner) shell electrons generated by ionisation of the sample atoms. They are rather slow ( $E_{SE} < 50$  eV).
- Auger electrons (AE) indirectly also originate from the ionisation process (outer shell electrons filling inner shell holes) but their energy distinctively reflects inner-atomic transition energies and can be used for identifying the emitting material.
- Electro-magnetic radiation in the visible and near-visible regime originates from electrons which had been excited to the valence band and are now falling back into their original state. This effect is not of interest in our case.
- Characteristic X-rays originate from outer shell electrons filling inner shell holes just like in the Auger electron production. This effect is not of interest in our case.

- Bremsstrahlung originates from primary electrons being slowed down by the Coulomb field of the sample atom nuclei. This effect is not of interest in our case.
- A proportion of electrons is flowing to ground as sample current. Therefore the sample must be connected to a defined earth/ground potential. The sample current may also be used for imaging in special measurement setups. Otherwise this effect is not of interest in our case.

## Secondary Electrons

The various radiation/particle products from the electron-surface interaction originate from different locations at or below the surface. Secondary electrons (SE), for example, are frequently used to produce surface images with high topography contrast. This is due to the fact, that secondary electrons may only escape from the sample if they are produced sufficiently close to the surface (exit depth 1-10 nm). As a result the yield of the secondary electrons depends on the local surface structure.

Looking more closely, there are two types of secondary electrons

- The "normal" secondary electrons SE(1) are generated by primary electrons when they interact with near-surface sample atoms.
- The secondary electrons SE(2) are generated by the back-scattered electrons when leaving the sample. They are contributing to the background signal.

The number of secondary electrons generated depends on the atomic number only for lightweight elements. However, the number of back-scattered electrons strongly depends on the atomic number and hence does the number of SE(2). As a result a material contrast can also be found in secondary electron images.

Microstructures, surface roughness and edges generally lead to a higher SE(2) yield because more BSE reach the surface, leading to a high topography contrast. This effect increases with higher sample tilt angles towards the primary beam.

Since secondary electrons are rather slow ( $E_{SE} < 50$  eV) they need to be accelerated towards the detector and are then detected and amplified by a positively biased electron multiplier. An image of the sample topography is achieved by using the secondary electron detector output as the video signal source for a computer or TV imaging system.

Secondary electrons from sample locations not in line-of-sight of the detector are also collected because of the driving potential. These add to the 3-dimensional appearance of the images.

The spatial image resolution on the sample is determined by the signal variation of the SE(1) during scanning. The SEM magnification can be changed by reducing or enlarging the raster size of the electron beam while keeping the frame size on the monitor constant. When working in ultra high vacuum there is no beam induced carbon contamination on the sample surface, unlike in conventional SEM in high vacuum, provided the sample itself is clean.

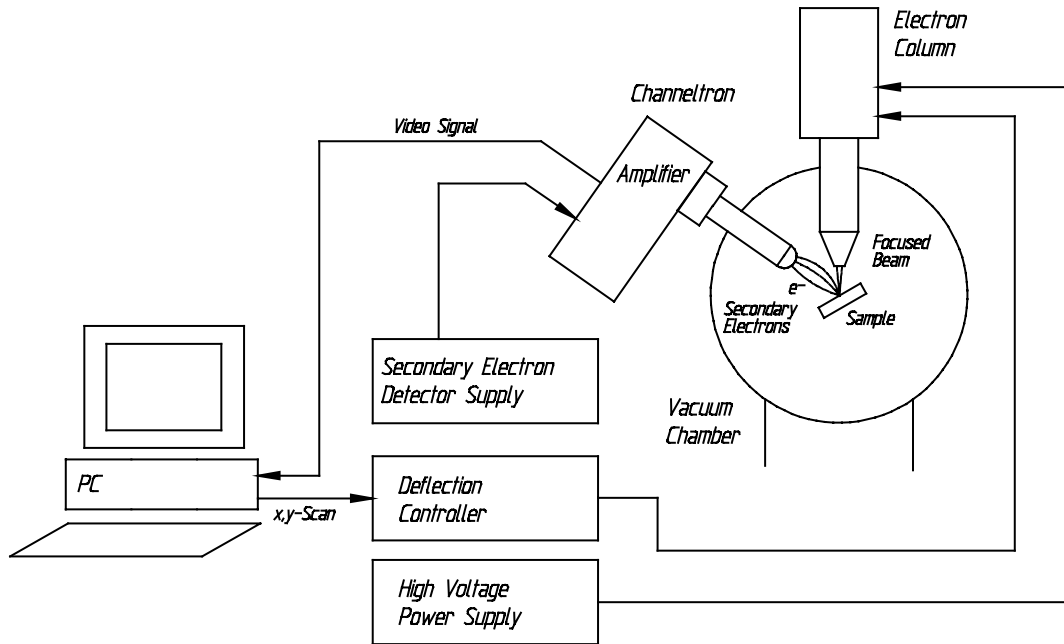


Figure 4. SEM block diagram.

For further information on scanning electron microscopy see [1], [2] on page 28.

## Auger Electrons

Auger electrons are produced when, after ionisation by the incident electron beam, a vacancy in the inner electron shell of the atom is filled by electrons from a higher energy state. The surplus energy is emitted in form of an Auger electron, or an X-ray photon.

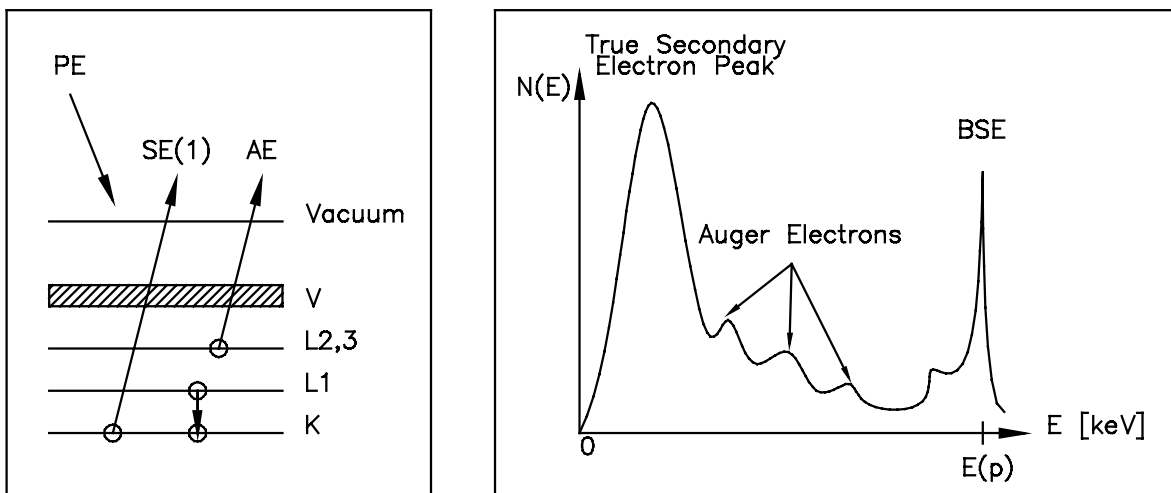


Figure 5. Secondary electrons and Auger electrons, schematic diagram (not to scale).

In Auger Electron Spectroscopy (AES) the characteristic Auger electrons are detected by an energy analyser to identify the chemical surface composition of a sample under investigation.

In Scanning Auger Microscopy (SAM) the energy analyser counter output is used as the signal source for the imaging system, showing the spatial distribution of a selected element. For material contrast images background measurements have to be performed in order to eliminate the topography contrast. Note that the software does this automatically when the respective option is selected.

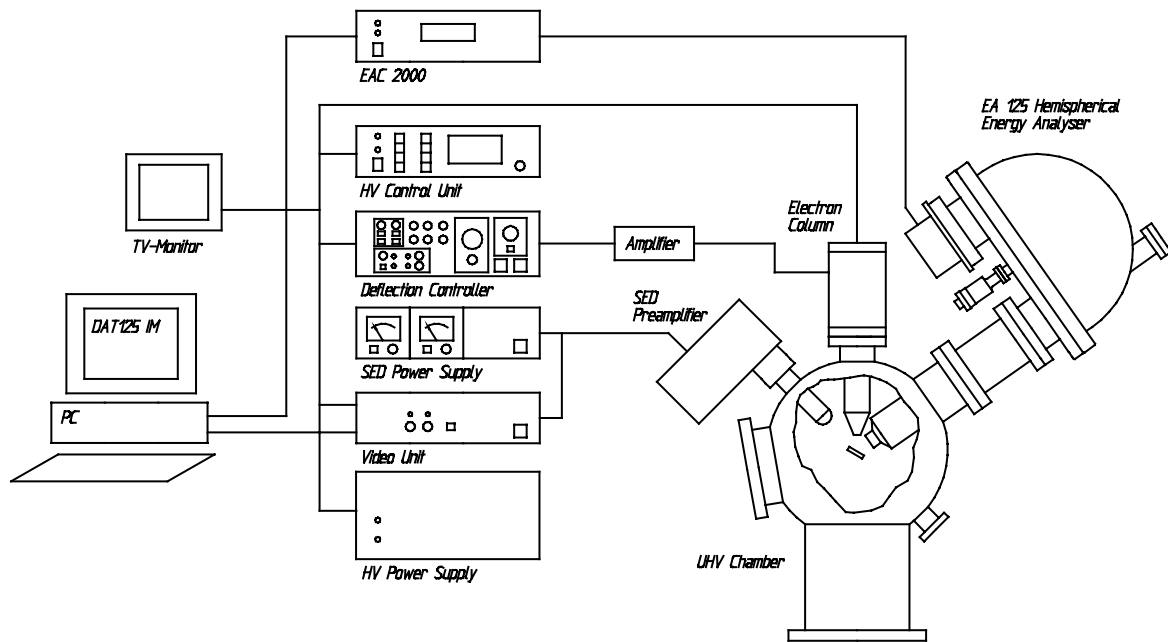


Figure 6. SEM/SAM system, schematic diagram.



## 6. SEM Imaging

Prepare the experiment:

- Mount units in rack with screws tightly fixed to ensure proper grounding.
- Ensure cabling is correct according to figure 1 or 2.
- Ensure vacuum is below  $10^{-9}$  mbar.
- Ensure sample is grounded.
- Switch on all SEM control electronics. - Do not switch on any EAC electronics that may also be present on your system.

Start the Spectra/Imaging program:

- at the DOS prompt `c:\> goimage`

This starts a batch program calling PISPECTR, a version of the Spectra software combining spectroscopy and SEM/SAM imaging parts. A DLL file (eac.dll) for communicating with the analyser is also loaded.

- From the Display Page enter the Image Page by pressing <Ctrl><Home>
- Set gain slider one step to the right from the centre position, set black level slider to the middle
- Select BISC input and set scan rate = 1.
- Click on READY to start scanning
- Start up the electron column according to the relevant manual.

At the SED Power Supply

- On the Channeltron Bias Module press HV ON and set to +250 V.
- On the Channeltron HV Module press HV ON and set to a value between 800 V and 1 kV.

When there is an image on the screen:

- Set contrast/brightness by adjusting the Channeltron High Voltage at the SED power supply. (Note: the Channeltron High Voltage is the **primary control** for signal amplification.)

The secondary electron yield depends on the actual beam current and the sample tilt angle towards the primary beam. Operating the Channeltron® at high gain with high secondary electron yield will shorten its lifetime. The Channeltron is working in analogue mode.

- Use gain and offset potentiometers at the Scan Control unit for further adjustment of contrast or brightness, respectively.
- The gain slider in the Image Page is normally set slightly off-centre (1 step to the right hand side from the centre position).
- The black level slider is normally set to the centre position.



**Please note:** Do not change the gain slider and black level slider positions in the software without need.

- Align the electron column for optimum performance, see electron gun test sheet.
- For slow scan image acquisition increase the scan rate in order to improve the signal-to-noise ratio.
- For imaging at TV rates switch to "Video" on the Scan Control unit and observe the image on the TV monitor.
- In order to save images a file name must be defined. Enter the Display page of the Spectra imaging software and press F7.

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See SPECTRA-Manual for

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Introduction to Image	chapter 14
Use of Image Program	chapter 15
Output to Printer	chapter 16

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## 7. SAM Imaging

### Aligning the Electron Column with the Energy Analyser

The SEM raster field has to be within the analyser's field of view (analysis area), i.e. the electron-optical axes of both the electron column and the analyser have to meet close enough on the sample.

The energy analyser output can be used as the video signal source (by selecting S-IN as signal input) during an SAM measurement with the energy slider (Image page) reduced to below 50 eV, i.e. imaging with secondary electrons. The raster field has to be enlarged in order to enclose the analysis area of the EA 125 (Ø1 mm to Ø5 mm). This can be done for example by reducing the accelerating voltage.

In order not to damage the analyser Channeltron<sup>®</sup> in pulse counting mode, make sure that the beam current is sufficiently low or reduce the Channeltron<sup>®</sup> gain. Imaging at higher Auger electron energies (up to 2 keV) requires longer dwell times due to the reduced signal intensity. Otherwise increase the beam current and/or software gain setting.

The spot should now be visible within the raster field. If the spot is still not within the raster field you may further reduce the beam accelerating voltage in order to enlarge the electron column's field of view.



**Please note:** Since the EA 125 spot position also depends on the Z-position of the sample, make sure that the sample holder is at the correct working distance before adjusting the electron column.

Having detected the EA 125 analysis area (usually a bright spot on a dark background) now adjust the electron column mechanically at the port aligner in order to bring the centre of the electron raster field into coincidence with the centre of the EA 125 spot. Also check that the sample is positioned in the correct working distance with respect to the analyser.

### Optimising Count Rates

This is an alternative way of aligning the electron column and energy analyser.

- At the analyser control unit choose High Magnification.
- Set a pass energy of 50 eV or 100 eV at the region record page.
- Press ALT Z for an acoustic signal (pitch increases with count rate) or observe the count rate display in the upper right corner of the display page.
- Start a spectrum (F6) and pause it (F9). Using the port aligner move the electron gun in such a way as to achieve the maximum count rate in the analyser. Use the TV output for SEM to see if the

electron gun is still positioned at the area of interest on your sample. If not, **move the sample** accordingly.

- Make sure that the sample is positioned at the correct working distance using estimation by the sight and/or finding the maximum count rate.
- After maximising the count rate reduce the slit width. In order to compensate for the reduced count rate choose a higher pass energy or raise the sample current. Now fine-adjust the beam position of the electron gun.
- Abort spectrum acquisition (F9 followed by F10) and return to the Image Page (Ctrl+Home).
- Click on S-IN input to select the energy analyser as signal source
- Set the appropriate dwell time.
- Set the analyser energy using the energy slider when no background subtraction should be performed. Start with an energy of about 500 eV.



**Attention:** When the Image Page is opened the energy analyser controller **automatically turns on the high voltage** for the counter Channeltron<sup>®</sup> at the energy analyser.

Reduce the gain or switch off the Channeltron<sup>®</sup> when performing SEM imaging prior to SAM at high beam currents to avoid damage.

## Measuring Auger Spectra

- Ensure the cabling of the energy analyser, control unit, and the PC-based board SP 625 is correct.

Presuming the electron gun is operating:

- Start the Spectra/Imaging program (c:\>goimage).
- Switch on energy analyser control unit.

For an integral Auger spectrum of a selected sample area defocus, or better: leave the electron beam scanning in TV mode. You thus know exactly from which area the spectrum is taken.

For local analysis select spots X1, X2, ... , X10 (by pressing F1, F2, ..., F10) and set the relevant energy ranges in the Region Record Page (region 1 corresponds to spot X1 etc.).

Optimisation of sample position for maximum count rates:

- Acquire a spectrum; choose an energy with high count rate for optimisation.
- Restart the spectrum at the selected energy and press F9 - energy scan stops.
- Press ALT Z for an acoustic signal (pitch increases with count rate) or observe the count rate display in the upper right corner of the display page.
- Optimise energy analyser setting according to the relevant manual.

See SPECTRA-Manual for	
The Display Page	chapter 3
The Region Record Page	chapter 4
Experiment Configuration and Control	chapter 6
Parameter ranges	chapter 11
File storage and file formats	chapter 12

## Image Modes

Imaging can be done in three modes using a different number of Channeltron<sup>®</sup>s.

1. One Channeltron<sup>®</sup> only: select Channel 1 in the Region Record page.
2. All Channeltron<sup>®</sup>s simultaneously: select SUM MC1 ... MCmax in the Region Record page, MCmax depending on the number of Channeltron<sup>®</sup>s available. In this case the energy spread is again defined by the pass energy and the distance of the Channeltron<sup>®</sup>s. **Note:** this mode gives the highest count rates.
3. The outer Channeltron<sup>®</sup>s only: select MCD in the Region Record page. In MCD mode the difference between the two Channeltron<sup>®</sup> signals is recorded. The Channeltron<sup>®</sup> signal separation is similar to the energy separation between signal and background for a typical pass energy.

In the Channel 1 mode and SUM mode a background reduction mode has to be selected when prompted.

- In the Display Page draw a box reaching from the peak (P) to the background (B) of the spectrum curve using the mouse, see also figures 8 and 9.
- Change to the Image Page.
- Select one of the supplied modes: P-B, (P-B)/B or (P-B)/P+B).

(For a line scan use the cursor to draw a line on the image, exit from the Image page and activate the line scan mode (Mode 3) in the Region Record page.)

## Performing SAM

- Activate the Display Page.
- After spectrum acquisition select peak and background energy for SAM by dragging (left mouse button) the rectangle from the right hand side (background) to the left (peak).
- Enter the Image Page (<Ctrl><Home>).
- Select P-B, (P-B)/B, or (P-B)/(P+B) background subtraction to eliminate any topographic contrast superimposing material contrast.
- Set Dwell Time  $\leq 1$  ms for fast overview image. Higher dwell times generally increase the signal-to-noise ratio, depending on the beam current (count rate).
- Before starting SAM we recommend SEM scanning the area under investigation for final settings of magnification and focus. Simply click BISC for SEM or S-IN for SAM imaging.
- Select S-IN input.
- Click Ready to start SAM.
- For dwell times of  $\geq 1$  ms use function N for grey scale normalisation of SAM image.

For terminating the SAM scan at high dwell times click BISC input (repeatedly). The frame will then be continued with the (faster) scan rate set for SEM.

## Switching Between SEM and SAM in the Image Page

### SEM:

- Click on `BISC input` to select the SED as signal source.
- Set the appropriate frame rate.

### SAM:

- set the pass energy at the region record page and start a spectrum (F6). After all values have been taken over abort spectrum acquisition (F9 and the F10) and return to the Image Page (Ctrl+Home). **Note: this procedure only needs to be done once.**
- Click on `S-IN input` to select the energy analyser as signal source
- Set the appropriate dwell time.
- Set analyser energy at energy slider when no background subtraction should be performed.



**Attention:** When the Image Page is opened the energy analyser controller **automatically turns on the high voltage** for the counter Channeltron<sup>®</sup> at the energy analyser.

Reduce the gain or switch off the Channeltron<sup>®</sup> when performing SEM imaging prior to SAM at high beam currents to avoid damage.

## 8. Example: AES and SAM on a Cu/Fe/Cu(100) Sample

Images courtesy of A. Wießner, M. Agne, D. Reuter, and J. Kirschner, MPI Halle, and G. Schäfer, OMICRON Vakuumphysik GmbH.

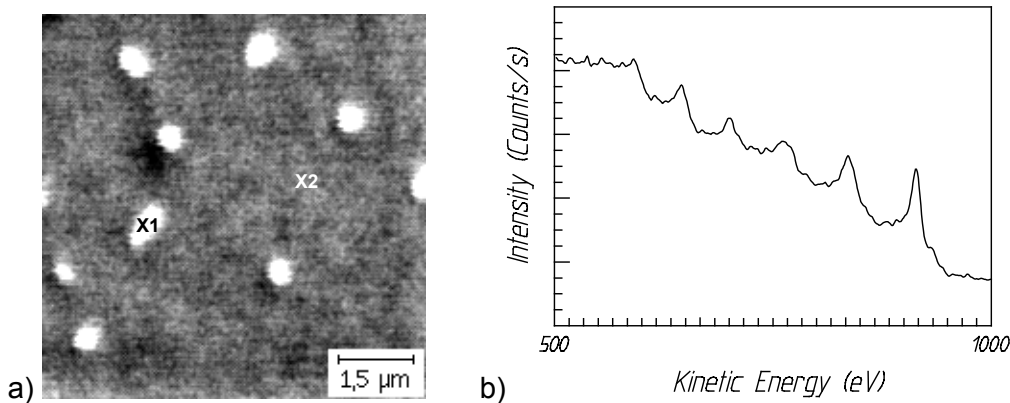


Figure 7. a) SEM image. b) Integral spectrum of sample area.

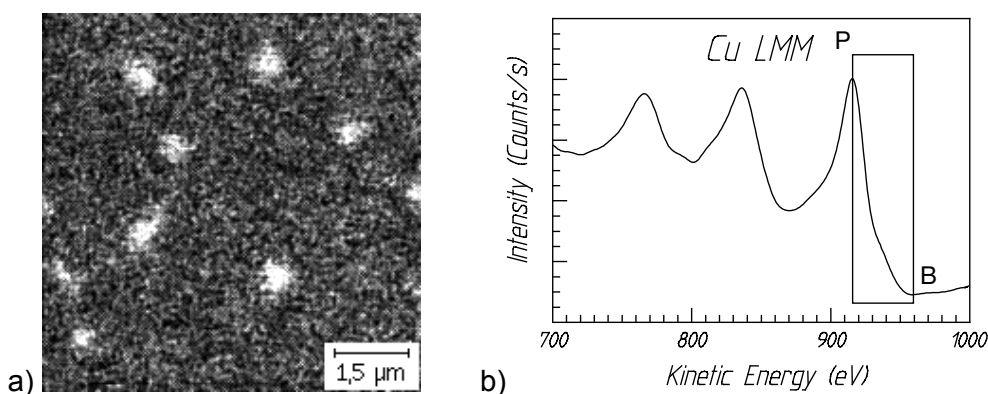


Figure 8. a) SAM-Cu (P-B)/B. b) Spectrum at position X1.

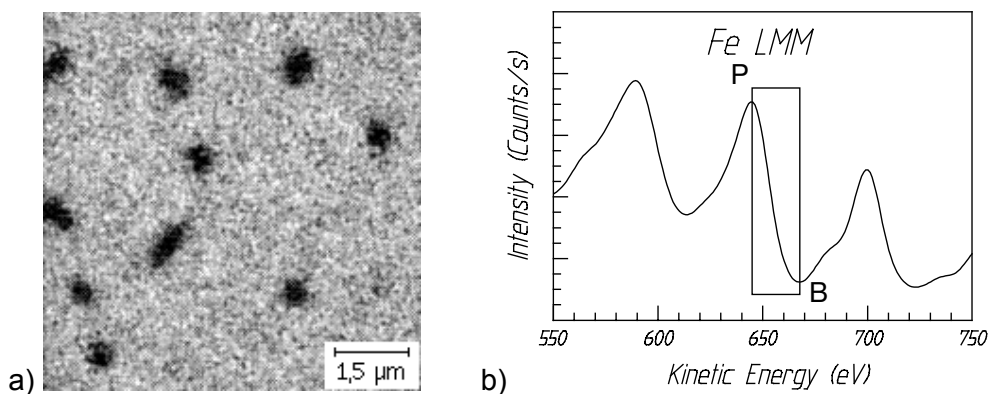


Figure 9. a) SAM-Fe (P-B)/B. b) Spectrum at position X2.



## 9. Trouble Shooting

### General

Problem	Comment
No XY scan	check the output of the imaging board at the SEM AD3B socket, see next page, using an oscilloscope
Image is all black or all white	<ol style="list-style-type: none"> <li>1. Check the beam current</li> <li>2. Check the Channeltron<sup>®</sup> voltage is around 1000 V</li> <li>3. Check the output of the preamplifier</li> <li>4. Check contrast and brightness settings on the SCU.</li> <li>5. Check the attenuators and the signal level input to the imaging board.</li> <li>6. Check the gain slider setting (should be one step off centre to the right ).</li> <li>7. Check the black level slider (should be in the centre position).</li> </ol>
No video signal	The imaging board accepts a signal level between zero and 35 mV within a 300 mV range. The offset can be adjusted with a trimmer on the (front-) panel of the imaging board. Attenuators are employed to make sure that the 0.7 V video output meets this signal level.
Vibration level too high	Please refer to page 26.

### SEM 500

Problem	Comment
Picture is very stigmatic.	<p>Adjust the electron gun and stigmators, see gun manual.</p> <p>Check the magnetic field in the vicinity of the chamber, see page 26.</p> <p>One coil of the deflection stage may not be working. Check that pins 1+2 as well as pins 4+5 are connected in the deflection stage feedthrough.</p>

## 10. Appendix

### Resolution

The resolution of a scanning electron microscope is defined by the spot diameter achievable with the scanning electron gun. The resolution can be limited by mechanical vibration of the whole system, by AC magnetic fields and by earth loops.

The OMICRON system rests on air damping legs in order to limit the mechanical vibration transferred from the floor. For ultimate resolution the vibration level of the floor should be as small as possible.

To reduce the influence of any magnetic fields the vacuum chamber is a  $\mu$ -metal chamber. Particularly the AC magnetic field in the vicinity of the chamber should be as low as possible. The static magnetic field should be less than 100  $\mu$ T, the AC magnetic field should be less than 0.15  $\mu$ T (< 0.1  $\mu$ T for SEM 20).

Earth loops can introduce 50 Hz or 60 Hz noise. All electronics components used including the PC should be connected to the same mains line. There must be a good earth connection between the system and ground, which should be a common ground for all the electronics as well.

### Mechanical Instabilities

Any wiring from the rack to any instruments mounted inside the vacuum chamber can introduce vibration to the whole system. It is good practise to attach wires firmly to the bench of the vacuum system or support heavy cables in a U-like bend, see figure 10.

- Check if the sample plate is sitting correctly on its support.
- Check if the pneumatic vibration isolation of the bench is adjusted correctly: no mechanical contact allowed between bench and floor, support heavy cables in a U-like bend, see figure 10.

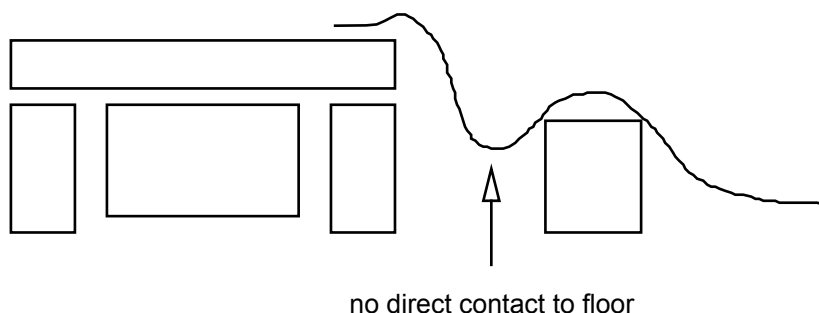


Figure 10. Supporting heavy cables to prevent mechanical noise pick-up.

During sensitive measurements rotary pumps have to be switched off.

## System Air Damping Legs

The air damping legs "Integrated Dynamics PD" come together with a control cabinet integrated into the system rack. After installation the air damping legs are activated by pulling the red button (slightly turn and then pull it).

For the installation and precise adjustment of the legs please refer to the manufacturers manual "Integrated Dynamics Engineering installation and service manual for pneumatic isolation systems".

After any changes to the vacuum chamber it might be necessary to readjust the legs.

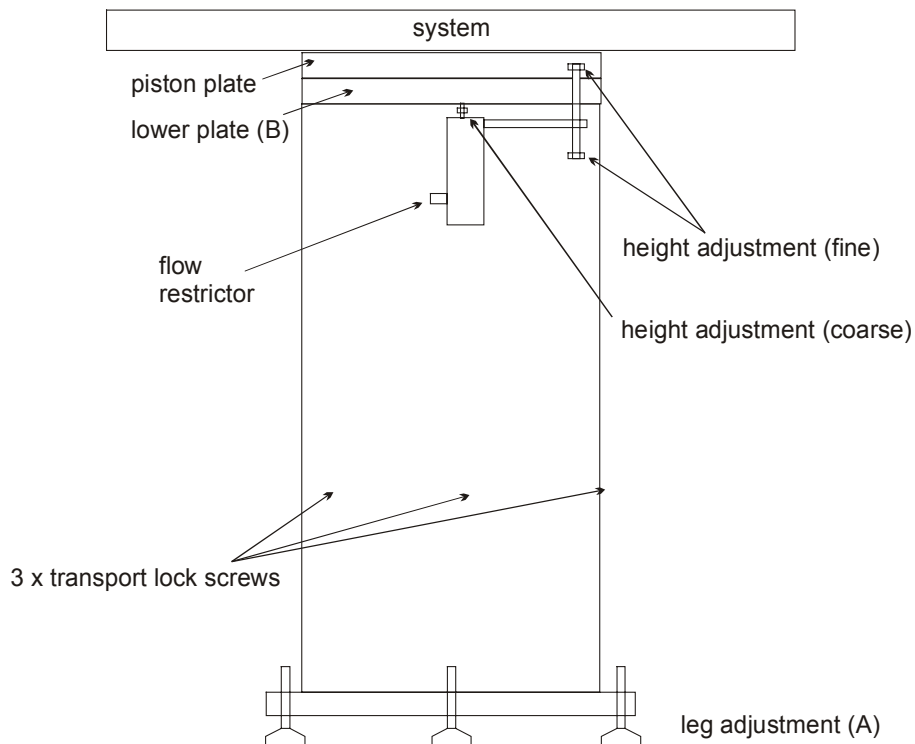


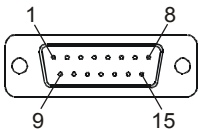
Figure 11. System air damping legs, schematic diagram. Deactivated position shown.

When the legs are deactivated there should be a small gap of about 0.5 mm between the piston plate and the system. This gap should be as parallel as possible. It can be adjusted by turning the screws at the bottom of the damping leg, see figure 11(A).

When the legs are activated the gap between the piston plate and the lower plate, see figure 11(B) should be about 5 mm (typical working gap). The gap can be adjusted using the height adjustment screws, a clockwise motion of the screw raising the mount, anti-clockwise motion lowering. The height adjustment coarse screw should **not** be altered!

If a high vibration level is detected at the system, all air damping legs should be checked. The leg housing must not touch the system. Check by slightly moving every piston plate in any direction, check that it is resting free on the air and the inner cylinder is not touching the leg housing at the inside.

## Connector Pinouts

SEM AD3B	15-pin sub-D socket
	pin 2: earth/ground pin 3: SIGNAL IN pin 6: earth/ground Y SCAN pin 8: Y SCAN pin 13: earth/ground X SCAN pin 15: X SCAN

## Literature

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- [9] Prutton M (1995). Microanalytical Imaging with Auger Electrons, Microscopy, Microanalysis, Microstructures 6, 289-320

## Service Procedure

### Should your equipment **require service**

- Please **contact OMICRON** headquarters or your local OMICRON representative to discuss the problem. Preferably use the provided FAX form below to make sure all necessary information is supplied and because the required service engineer may not be available immediately.

The service department may also be contacted via e-mail.

"service@omicron.de"

- Always **note the serial number(s)** of your instrument and related equipment (e.g. head, electronics, preamp...) of your instrument or have it at hand when calling.

### If you have to **send any equipment back to OMICRON**

- Please contact **OMICRON headquarters** before shipping any equipment.
- Place the instrument in a polythene bag.
- **Use the original packaging and transport locks.**
- Take out a **transport insurance policy.**

### For UHV equipment only:

- Make sure the **plastic transport cylinder is clean** and no dust or packaging materials can contaminate the instrument.
- Wear suitable cotton or polythene gloves.
- **Re-insert all transport locks** (if applicable).
- Cover the instrument with aluminium foil and/or place it in a polythene bag.
- **Fix the instrument into its plastic cylinder** (if applicable).
- Include a filled-in and signed copy of the "Declaration of Decontamination" at the back of the related manual.

**No repair of UHV equipment will be carried out without a legally binding signed decontamination declaration !**

# Service FAX Reply

**To**  
**OMICRON Vakuumphysik GmbH**

Test and Service Department  
Idsteiner Straße 78  
D - 65232 Taunusstein  
Germany

Tel: +49 - 61 28 - 987-230  
**FAX: +49 - 61 28 - 987 33 230**

**From**

.....

.....

.....

.....

.....

Tel: .....

FAX: .....

**Type of Instrument** .....

**Serial Number** .....

**Purchasing Date** .....

**(Last Service Date** .....

**Problem:**

**Date:**

**Signature:**

## Decontamination Declaration

If performing repair or maintenance work on instruments which have come into contact with substances detrimental to health, please observe the relevant regulations.

If returning instruments to us for repair or maintenance work, please follow the instructions below:

- **Contaminated units** (radioactively, chemically etc.) must be decontaminated in accordance with the radiation protection regulations before they are returned.
- **Units returned** for repair or maintenance must bear a clearly visible note "free from harmful substances". This note must also be provided on the delivery note and accompanying letter.
- Please use the attached attestation declaration at the end of this manual.
- **"Harmful substances"** are defined in European Community Countries as **"materials and preparations in accordance with the EEC Specification dated 18 September 1979, Article 2"** and in the USA as **"materials in accordance with the Code of Federal Regulations (CFR) 40 Part 173.240 Definition and Preparation"**.

**No repair will be carried out without a legally binding signed declaration !**

## Declaration of Decontamination of Vacuum Equipment and Components

The repair and/or service of vacuum equipment/components can only be carried out if a correctly completed declaration has been submitted. **Non-completion will result in delay.** The manufacturer reserves the right to refuse acceptance of consignments submitted for repair or maintenance work where the declaration has been omitted.

**This declaration may only be completed and signed by authorised and qualified staff.**

### 1. Description of components

Type: \_\_\_\_\_ Serial No: \_\_\_\_\_

2. Reason for return \_\_\_\_\_

### 3. Equipment condition

**Has the equipment ever come into contact with the following** (e.g. gases, liquids, evaporation products, sputtering products...)

- |  |                              |                             |
|--|------------------------------|-----------------------------|
| • toxic substances?  | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| • corrosive substances ?   | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| • microbiological substances (incl. sample material)?                      | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| • radioactive substances (incl. sample material)?                          | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| • ionising particles/radiation ( $\alpha, \beta, \gamma$ , neutrons, ...)? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |

**For all harmful substances, gases and dangerous by-products which have come into contact with the vacuum equipment/components please list the following information on (a) separate sheet(s):** trade name, product name, manufacturer, chemical name and symbol, danger class, precautions associated with substance, first aid measures in the event of an accident.

Is the equipment free from potentially harmful substances?      Yes       No

**The manufacturer reserves the right to refuse any contaminated equipment / component without written evidence that such equipment/component has been decontaminated in the prescribed manner.**

### 4. Decontamination Procedure

Please list **all harmful substances, gases and by-products** which have come into contact with the vacuum equipment/components together with the decontamination method used.

SUBSTANCE	DECONTAMINATION METHOD

(continue on a separate sheet if necessary)

### 5. Legally Binding Declaration

Organisation: \_\_\_\_\_

Address: \_\_\_\_\_

Tel.: \_\_\_\_\_ Fax: \_\_\_\_\_

Name: \_\_\_\_\_ Job title: \_\_\_\_\_

**I hereby declare that the information supplied on this form is complete and accurate.**

Date: \_\_\_\_\_ Signature: \_\_\_\_\_ Company stamp: \_\_\_\_\_



## Useful OMICRON Contacts

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