VT Sub-System User's Guide

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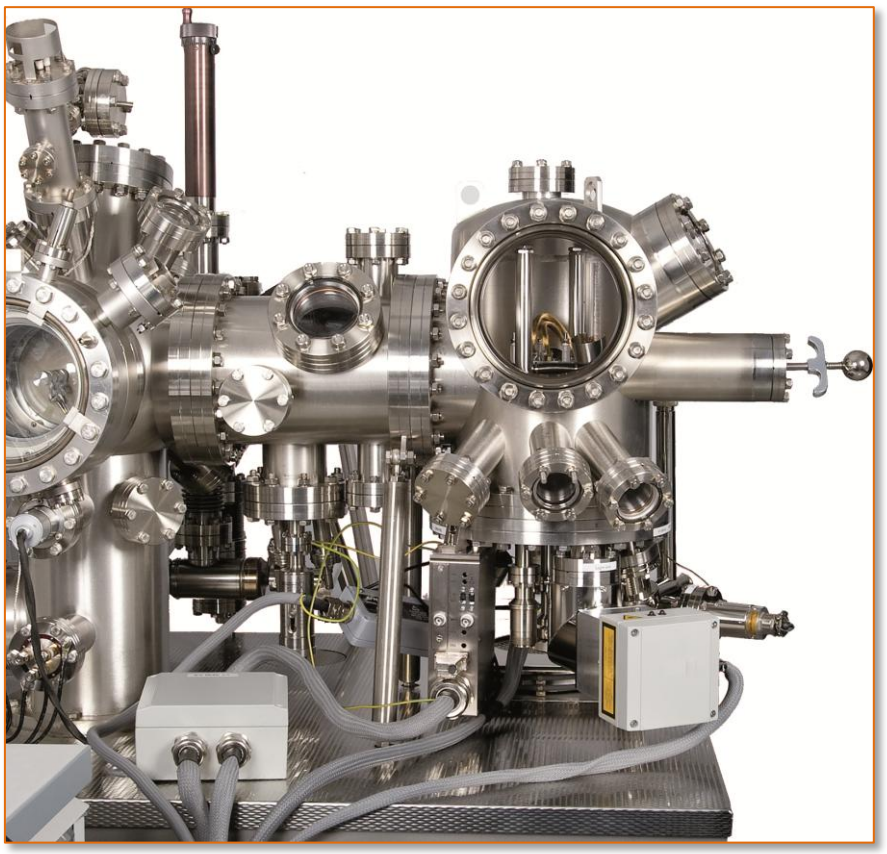

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Preface

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 Scienta Omicron GmbH.

Notice

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

Notice

This documentation is available in English only.

Notice

Please read the safety information on pages 11 to 16 before using the instrument.

Trademarks

Trademarks:

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Copyright

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Warranty

Scienta Omicron acknowledges a warranty period of 12 months 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.

Waste Electric and Electronic Equipment

In compliance with the WEEE directive (2002/96/EC) Scienta Omicron ensures that all products supplied by Scienta Omicron which are de-commissioned and which are labelled with a WEEE Registration Number will be taken back by Scienta Omicron free of charge.

All costs of packing, transport, duty, etc. to the destination of the nearest Scienta Omicron Returned-WEEE-Centre shall be borne by the customer. The customer is required to:

- Declare the returned material is free from contamination or hazardous materials from usage (include Decontamination Declaration sheet),
- Request a valid Return Material Authorisation (RMA) available from the Scienta Omicron service department,
- Ship all returned goods to the advised destination "Scienta Omicron Returned-WEEE-Centre, DDP (INCOTERMS)".

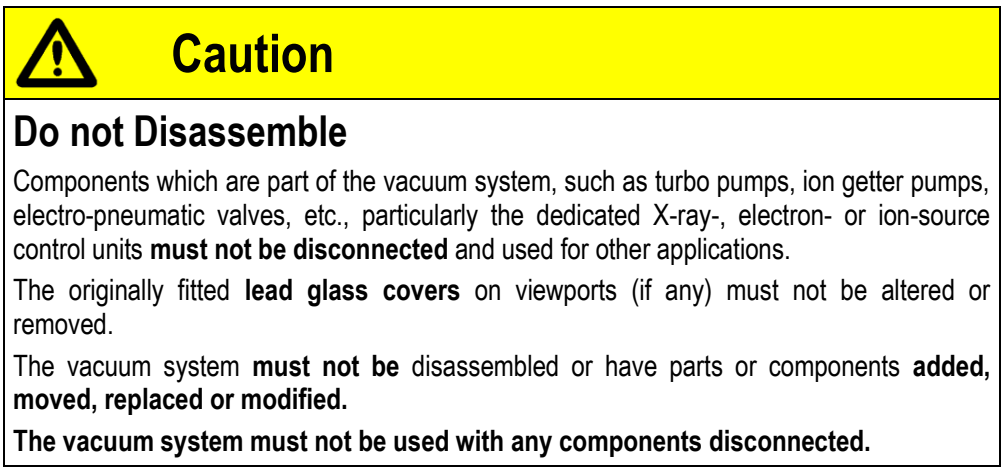
Otherwise Scienta Omicron will not accept any shipment.

Normal Use

The **Scienta Omicron UHV System for surface science** is a vacuum system for surface preparation and analysis. Typical surface preparation methods include sputtering, annealing and evaporation coating. The so-prepared samples can subsequently be analysed using various techniques, e.g. scanning probe microscopy and spectroscopic techniques, such as photo electron spectroscopy and various electron spectroscopy methods including electron diffraction.

Spectroscopy techniques mean excitation and analysis of secondary particles or secondary radiation using primary beams of electrons, ions or electromagnetic radiation such as X-rays or UV-light.

The **Scienta Omicron UHV System for surface science** consists of bench, vacuum vessel(s), vacuum pumps manipulator(s), fast entry lock chamber, sample transfer system, bake-out system and 19" rack(s) for controllers. Additionally, scanning probe microscopes, primary beam source(s) such as X-ray, UV-, electron- or ion-source(s) and the respective means for detection of reflected primary beam, secondary particles or secondary radiation, such as electron energy analyser, mass spectrometer or luminescence screen, have been installed depending on the ordered configuration.



Caution

Radiation Protection

All Scienta Omicron UHV systems which are originally equipped with primary sources **are fitted with all necessary protection equipment** against radiation exposure (lead glass covers, sufficient wall thickness of vessels, etc) according to the **Deutsche Röntgenverordnung and the European Council Directive 96/29/Euratom 1996.**

- Said protection equipment must not be altered or weakened and shall be checked for proper condition on a regular basis.
- Any changes to the population of ports such as removing components, fitting additional components, adding viewports, etc. can affect the radiation exposure and are therefore strictly forbidden. In addition, said changes render the CE compliance void and Scienta Omicron refuses any liability for damages occurring after such changes.

Attention

Local Authorities

According to requirements by local legislation it could be inevitable for customers with systems including spectroscopy techniques to

- **register** the entire system with local authorities
- obtain **permits** for operating personnel
- **limit operation** to authorised personnel

Local authorities shall be contacted before putting the instrument into commission.

The **Scienta Omicron UHV System for surface science** shall always be used as a **complete system** with all supplied components mounted and all control units and power supplies attached to their dedicated components.

The **Scienta Omicron UHV System for surface science** shall always be used

- With all viewports of the analysis chamber and all viewport in line of sight of excitation sources and sample holders (e.g. viewports on bolt-on chambers, LEED optics, etc.) fitted with protective lead glass covers
- With CE labelled Scienta Omicron components which are explicitly specified for this purpose
- With original cable sets which are explicitly specified for this purpose
- With **all** cabling connected according to the relevant manual(s) and secured, if applicable
- With **all** interlocks installed
- With all electronics equipment switched on
- In an indoor research laboratory environment

- By personnel qualified for operation of vacuum equipment and delicate scientific instruments
- In accordance with all related manuals
- **In accordance with requirements by local legislation** regarding the commissioning and/or operation of X-ray producing equipment.
- The vacuum system must not be used with any components disconnected.
- Pressure vessels, such as gas cylinders or dewars, must be connected via a pressure reducer and a suitable over-pressure safety relief valve ensuring that the system pressure stays below 1.2 bar at all times.

Warning

The control unit supplies 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.

Please read the safety information in the relevant manual(s) before using the instrument.

Notice

This instrument generates direct and/or indirect X-rays. If the system is used according to the manual radiation emission is well below the thresholds given in the council directive 96/29/Euratom of May 13th 1996.

A classification for the various Scienta Omicron products according to the European council directive is included in the system manual.

Responsibilities for Safety Precautions

The Scienta Omicron supplied system is an experimental platform for material research. It has been designed for maximum flexibility in use, providing a broad variety of preparation techniques. In particular systems comprising thin film deposition equipment such as evaporators, MBE cells, e-beam evaporators, sputter/chemical deposition means, gas or liquid inlets, etc. enable processes for creating new materials of "designed" composition. Such systems can be charged with a huge variety of initial substances and the yield will be an even greater variety of resulting substances.

- Initial substances from case to case may be hazardous, i.e. toxic, flammable, explosive, etc. Careful handling and application of all safety precautions is a MUST for reasonable usage. Users shall refer to the safety data sheets of every single substance they load into the system.

- Resulting substances may even be more critical. Beyond the desired processes yielding the specific targeted materials, there may be a variety of unexpected and unknown substances occurring from gas or surface reactions. Those substances may be hazardous and contaminate the interior of the system, i.e. the vessels, the pipe work, sample manipulation equipment, etc.

- Hazardous substances may come in touch with the environment and may endanger the users and the working environment.

- Uncontrolled gas reactions may happen when venting a system.

Special care must be taken on pump exhaust lines, potentially needing filtering or scrubbing.

Users shall take responsibility for all safety precautions necessary with respect to the initial substances as well as for the desired and the undesired resulting substances. Users are responsible for:

- Personal protection

- Protection of the working environment

- General environmental protection

- Waste abatement

- System exhaust scrubbing

- Decontamination of decommissioned equipment

- Compliance with national, local, and facility safety regulations

- The necessary lab safety installations

- Careful handling as per safety data sheet specification

- Thinking ahead of potential hazards of desired and undesired resulting substances

- Careful use of the system within the boundaries of the "intended" use and observation of component specifications - i.e. explosive or flammable substances shall only be used with the appropriate safety installations (corrosive or explosive gas pumps, concentration limit warning equipment etc.)

Conditions of CE Compliance

Scienta 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 **Scienta Omicron UHV System** complies 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 Scienta Omicron spare parts and replacements.

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

Exceptions

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

- Changes to the instrument **not explicitly agreed by Scienta Omicron**, e.g. modifications, add-on's, or the addition of circuit boards or interfaces to computers supplied by Scienta Omicron.

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

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

even if performed by an Scienta Omicron service representative.

Spare Parts

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

Notice

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.

Contents

Preface **2**
Copyright 2
Warranty 2
Waste Electric and Electronic Equipment 3
Normal Use 3
Responsibilities for Safety Precautions 6
Conditions of CE Compliance 7

Contents **8**
List of Figures 9
List of Tables 9

1. Introduction **10**

2. Safety Information **11**

3. Installation **17**
Site Preparations Scienta Omicron UHV Systems 18
Electrical Box (Special) 22
Startup 23

4. System Start-Up **24**
Pumping 24
Pumping Down the System 25
System Bakeout 26
Bakeout procedure 27
Bakeout Temperatures 29

5. System Operation: Electronics **30**
IGP and TSP Controller 30
Ion Getter Pump Controller 30
Titanium Sublimation Pump Controller 31
PVCx Ion Gauge Controller 32
PVCx Bakeout Controller 33

6. System Operation: Sample Entry, Handling and Transfer **35**
Sample Entry via RTTA 35

7. System Shut-Down **36**
Venting the System 36
Releasing Residual Pressure 37
Electrical Shut-Down 37

8. Service and Maintenance **38**
Maintenance Requirements 38
Scienta Omicron Flange Definitions 40
Vacuum Pictograms 41

Service at Scienta Omicron 42

Index 43

Decontamination Declaration 44

List of Figures

Figure 1. Isometric drawing of the system. 17
Figure 2. Customer system drawing, top view. 19
Figure 3. Three-phase power socket type to be supplied by the customer. 20
Figure 4. Electrical box, schematic diagram. 22
Figure 5. Pumping system diagram 24
Figure 6. Positions of the valves in table 3. 25
Figure 7. Bakeout parameters, schematic diagram. 33
Figure 8. Sample transfer system diagram. 35
Figure 9. Venting assembly to be provided by the customer. 36

List of Tables

Table 1. Customised system configuration 10
Table 2. Fuses of the switch box. 22
Table 3. Valve setting for start-up, bakeout, venting and normal operation 24
Table 4. Bakeout temperatures for customised system configuration. 29
Table 5. Recommended periods at specified pressures for titanium sublimation pumps. 31
Table 6. Typical emission currents for the ion gauge. 32
Table 7. Parameter settings recommended for the ion gauge. 33
Table 8. Pressure trip value settings recommended by Omicron. 33
Table 9. Typical settings for the PVCi bakeout controller 34
Table 10. Scienta Omicron flange definitions. 40
Table 11: Vacuum pictograms used in this manual. 41

1. Introduction

Your Scienta Omicron ultra high vacuum system is an analytic instrument for various science techniques designed to meet the special requirements of the attached components.

System Type

MULTIPROBE® *S*	One-chamber system without fast entry lock

Attached Components

VT STM XA	Scanning probe microscope for STM applications
TPT	Tip preparation tool

Table 1. Customised system configuration.

All vacuum chambers have their own associated pumping stage. They are separated by manual or electro-pneumatic gate valves which allow independent pumping.

Oven panels with fan assisted heaters and programmable bakeout cycle are supplied for system bakeout.

2. Safety Information

Caution

Important:

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

Warning

Warning. Lethal Voltages!!

- Adjustments and fault finding measurements may only be carried out by authorised personnel qualified to handle lethal voltages.
- Lethal voltages may be present inside the distribution box and electronics rack during operation.

Caution

Never

- Never exceed a total 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^{-3} mbar, so as to avoid damage due to corona discharge.

Caution

Thermocouple Connector

- If a voltage is applied to the sample on the manipulator this voltage is also present at the connector of the thermocouple which measures the sample temperature.

Caution

Always

- All connectors which were originally supplied with fixing screws must always be used with their fixing screws attached and tightly secured.
- All connectors which were originally supplied with a short circuit plug must either be connected to the electronics or fitted with their short circuit plug.
- **disconnect** the mains supplies of all electrically connected units **before**
  - ⇨ venting, pumping down or opening the vacuum chamber
  - ⇨ connecting any supplementary equipment,
  - ⇨ before opening the distribution box or electronics rack,
  - ⇨ 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.

Caution

Attention. Radiation

- UHV systems not equipped with an X-ray source upon delivery **must not** be fitted or operated with X-ray producing sources! Experimental methods such as XPS or ESCA require a specific system configuration.
- If the UHV system is supplied with an X-ray source or an electron source above 5 keV fitted, all viewports of the actual chamber and all other viewports which are not shielded from the X-ray source by metal parts (e.g. viewports on bolt-on SPM chambers, LEED optics, etc.) must be fitted with protective lead glass windows.

Caution

Do not Disassemble

- Components which are part of the vacuum system, such as turbo pumps, ion getter pumps, electro-pneumatic valves, etc., must not be disconnected and used for other applications.
- The vacuum system must not be used with any components disconnected.

Caution

Installation Warnings

- The installation of the UHV system to the mains power supply must be established by authorised specialist staff. This is not part of the installation procedure performed by an Scienta Omicron service representative.
- The local mains power supply system must comply with the voltage and current values stated in the Surface Science Systems User's Guide.
- The vacuum system must not be put to operation without a proper electrical earth/ground connection.
- For systems with X-ray source requirements by local legislation, e.g. registration, limited access, etc., must be observed.

Caution

Attention. Heavy Items

- Oven panels as well as bolt-on chambers, assemblies and components can be very heavy.
- Please wear suitable protective clothing, e.g. a safety helmet, working gloves and safety shoes, when handling heavy components.
- At least two people are needed for the installation of the oven panels. Panels may fall over or clamp fingers during installation.

Caution

Attention. High Temperatures

- The UHV system may only be baked with the oven panels properly installed.
- The oven panels may become hot locally (> 70°C).
- The oven panels must remain in place until the bake-out controller temperature display has returned to room temperature.

Caution

Chemical Hazard

- For all supplied or recommended chemicals such as silver paint glueing agents or solvents please read the manufacturer's safety information.

Caution

Pyroelectric Effect

- Temperature changes of the piezo materials used in scanner and coarse position drives can generate **charge build up** on the connectors. The discharge current is not dangerous (while painful) but **may seriously damage the electronics** or the piezos themselves. The charge build up must be avoided by terminating the electrical connectors:
  - ⇨ During **bakeout** (including the heating up and cooling down times) fit the respective sockets with their short circuit plugs.
  - ⇨ During cooling down and warming up of a **cryostat** leave the instrument connected to the live electronics or fit the respective sockets with their short circuit plugs.

Caution

Viewports

- Always handle viewports carefully. Improper installation and handling may cause implosion.
- Do not use viewports where the glass shows scratches or any other visible marks, abrasions or imperfections.
- Viewports must not be subjected to total pressures above 1.2 bar on the vacuum side and 1.0 bar on the atmospheric side.
- One accidental smack with a tool or the application of a strong laser beam may already damage the viewport sufficiently to cause cracking during pump-down or under UHV conditions later on.
- Protect viewports with a safety cover or vent the UHV system whenever handling tools or workpieces in the vicinity of a viewport.
- Protect viewports with aluminium foil on the outside during bakeout and do not exceed a temperature rise or fall of 5°C/min. Although the viewports withstand a bakeout temperature of 450°C, **the maximum bakeout temperature of the equipped system will be much lower due to other components connected.**
- Eye protection should be worn when near to a viewport, even if using protective covers.
- If viewports are used on instruments with X-ray generative sources, lead glass covers with sufficient X-ray absorption must be used.

Caution

Liquid Nitrogen and Liquid Helium:

- LHe and LN_2 are colourless, odourless and tasteless non-toxic substances.

1 litre of liquid will turn into 700 litres of gas which can cause a large pressure build up followed by a possible explosion. Always fit a burst disk to your vacuum vessel in order to allow rapidly evaporating liquid gases to escape in case of a cryostat failure.

Make sure dewars are fitted with a suitable over-pressure relief valve (maximum total chamber pressure is 1.2 bar) or have an open vent.

Make sure the safety valves are functioning at all times (must not be blocked by ice).

Caution

LHe/He and LN_2/N_2 can cause rapid suffocation without warning. Store and use in areas with adequate ventilation.

Note that evaporated N_2 accumulates on the ground. Take care particularly when picking up parts from the floor.

In case of symptoms like headache, drowsiness, dizziness, vomiting or unconsciousness remove victim to fresh air. Give oxygen or artificial respiration if necessary. Seek medical assistance immediately.

LHe and LN_2 can cause severe frostbite. Do not touch frosted pipes or valves. Always wear suitable long sleeved full length clothing, as well as splash goggles and cryogenic gloves when handling cold gases.

- In case of frostbite rapidly warm affected skin areas with warm water (< 40°C). Do not rub and protect injured tissue from further damage and infection. If eyes are involved flush thoroughly with warm water for at least 15 minutes. Seek medical assistance immediately.

Caution

This product is only to be used:

- 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
- Condensation of humidity, particularly on water-cooled equipment, must be avoided.

3. Installation

Before unpacking please inspect the transport case for obvious damage. If any damage can be seen **do not unpack** and contact your local Scienta Omicron agent **immediately!**

Otherwise carefully remove the wooden boxes and inner packaging materials. In case of obvious transport damage at the UHV system contact your local Scienta Omicron agent **immediately**. Information on service procedures and addresses can be found in the back of this manual.

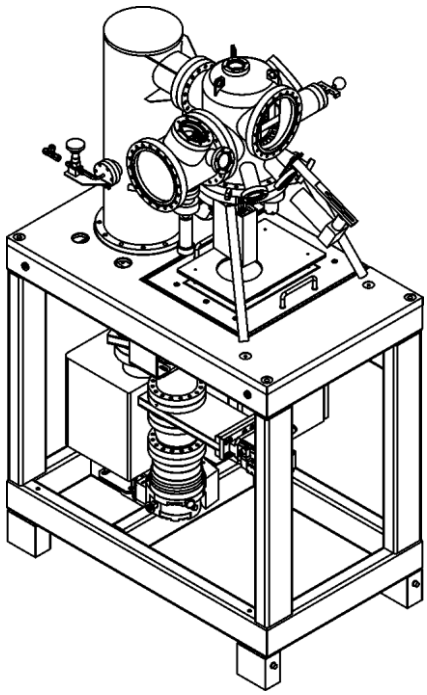


Figure 1. Isometric drawing of the system. Note that some elements may be optional or are not shown.

After inspection the system should be taken to the laboratory. A trolley (capacity 1000 kg) is needed for moving the UHV system.

Parts of the system (e.g. magnetically coupled transfer, manipulators, foreline pumps, etc.) may have been removed for shipping. During shipment the UHV system is under vacuum.

Notice

When venting the system please use dry nitrogen.

When handling viewports use lint free gloves and avoid contact with glass and the knife edge seal.

When bolting up viewports ensure bolts are uniformly tightened and flanges are evenly clamped together.

- The bench of the UHV system stands on four standard system legs.
- The Pirani gauge should be attached with the pumping tee to the roughing line of the turbo pump.

Site Preparations Scienta Omicron UHV Systems

RECEIPT OF GOODS

Scienta Omicron's sensitive instrumentation is packaged per best practices for shipments via international air freight and/or air ride ground transportation. It is the responsibility of the recipient/end user to inspect all received shipments for obvious visible damage BEFORE signing any receiving documentation. Any obvious damage or tripped indicators must be noted with the freight forwarding company before signing. This is required to avoid disclaiming liability statements and preserve possible insurance claims.

If any damage can be seen **do not unpack** and contact your local Scienta Omicron agent **immediately.** Otherwise carefully remove the wooden boxes and inner packaging materials. In case of obvious transport damage at the UHV system contact your local Scienta Omicron agent **immediately.**

Scienta Omicron must be notified with a damage report comprising a precise description and evidence, e.g. photographs, within 48 hours.

Scienta Omicron Headquarters may also be contacted via e-mail:

sales@scientaomicron.com

services@scientaomicron.com

After inspection the system should be taken to the laboratory. While the electronics rack is mounted on castors, a trolley (capacity 1000 kg) is needed for moving the UHV system. **The customer is responsible for providing suitable equipment for moving the vacuum system to its location.**

PRE-REQUISITES

A successful installation operation and acceptance test needs certain pre-requisites to be provided by the customer. It is the customers responsibility to provide all necessary means listed in this document and in the instrument specific sections "Special requirements for acceptance test conductance…".

If the completion of the installation and/or acceptance test is delayed or made impossible because of reasons not caused by Scienta Omicron, e.g. insufficient preparation of the installation site, the resulting extra cost for a prolonged stay or repeated visit of the Scienta Omicron installation engineer will be charged to the customer.

Notice

Some components described in this document may be optional. The delivery volume depends on the ordered configuration.

WEIGHT AND DIMENSIONS

Please make sure that the system can be taken to the intended lab regarding door and corridor widths, floor stability etc.

- Transport needs a door width of 850 mm.
- The system is mounted on four feet with dimensions 50 mm x 100 mm.
- Required floor load capacity: >500 kg/m2
- Bakeout panel installation requires a minimum height clearance of 2000 mm.

- System operation requires 500 mm clearance at all sides (incl. 19" rack).
- Cooling versions require additional clearance for the LHe / LN_2 dewars close to the scanning probe microscope.
- All indications of weight are estimated values.

Scienta Omicron will ship the system as completely assembled as possible. Therefore, please check that the outer dimensions of your ordered system comply with your building dimensions, particularly passageways, door frames and elevators/lifts. In case of any issues please contact your sales representative well in advance of system shipment.

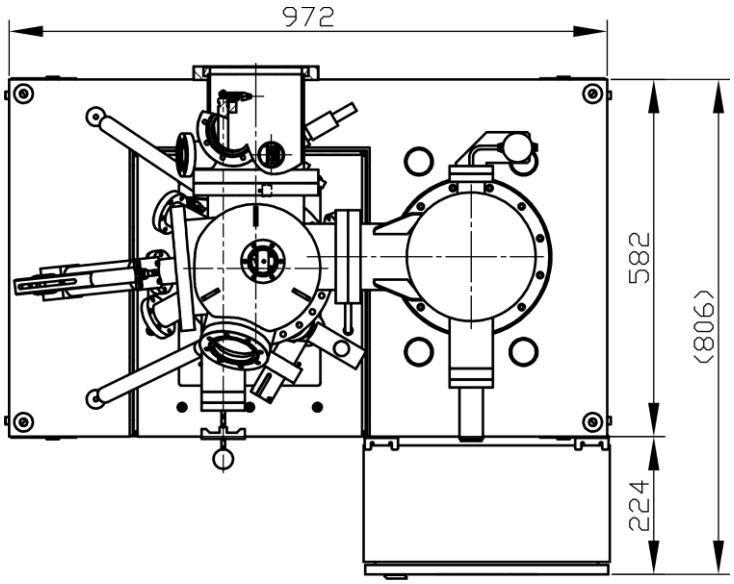


Figure 2. Customer system drawing, top view. Please note: Electronic box not part of the delivery.

Notice

The MULTIPROBE system is shipped fully assembled with wobblestick and magprobe removed in a wooden crate (for dimensions please see table below). Please make sure all relevant doors allow the passage of the 810 mm wide system.

Customers with non-standard system orders will receive drawings for approval in advance. Please make sure the given dimensions are within the capability of door frames pathways and lifts/elevators.

If the wooden crate cannot be stored in a dry, sheltered place until the arrival of the Scienta Omicron personnel, disassembling instructions can be obtained from the Scienta Omicron service department.

Item	Typical lateral Dimensions (mm x mm)	Typical Height (mm)	System Weight (typ. values in kg)
VT Subsystem	800 x 100	1700	350

MAINS SUPPLY EUROPE

This unit is supplied with a 5-pin mains connector for three phase ac input of 200-240 volts ±10% and 50 or 60 Hz, 5 (star) wires, see below. The wire insulations of the standard 5-lead mains cable are coloured in accordance with the following code:

Black or "1"	Live
Brown or "2"	Live
Black or "3"	Live
Blue or "4"	Neutral
Green/Yellow	Earth

The system is shipped together with a 3 phase power cord (8m) and a standard plug (32A) according to the destination. No additional supply is necessary for bakeout. Each phase shall be supplied fused at 16A **by the customer**. The 32A plug is standard, however all internal fuses supplied by Scienta Omicron are 16A.

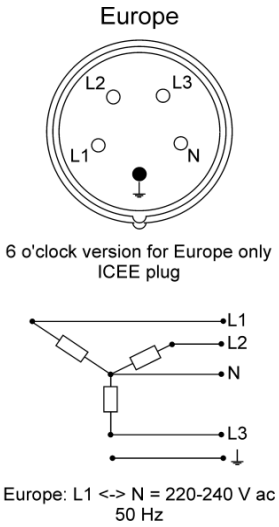


Figure 3. Three-phase power socket type to be supplied by the customer.

The MATRIX needs a 16 A single phase connection (Schuko). This is to be provided by the customer.

Caution

The installation of the UHV system to the mains power supply must be established by authorised specialist staff. This is not part of the installation procedure performed by an Scienta Omicron service representative.

Caution

Note that all Scienta Omicron instruments are only to be used indoors, in laboratories meeting the following requirements:

- 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)
- Condensation of humidity on water-cooled equipment must be avoided.

COMPRESSED AIR

For electropneumatic gate valve 5 m hose with 4 mm i.d. and hose clamps are included. To be provided by the customer:

- 4-6 bar (58-87 PSI) dry and clean compressed air (minor oil contamination acceptable), manometer and, if necessary, pressure regulator with hose nozzle 4 mm o.d.

Scienta Omicron uses quick couplings type “Rectus”, series 26 female (NW 7.2 mm). This coupling is compatible with many other suppliers, e.g. Rectus (25, 26, 1600, 1625), TEMA (1600), CEJN (320), Legris (25,26), Parker (PE, PEF). Scienta Omicron provides male fittings, customer has to provide female fittings.

LIQUID HELIUM (LHE) REQUIREMENTS FOR COMPONENTS

In this section only the fluid requirements are mentioned. For further details regarding soft- or hardware components please refer to the acceptance document.

VT STM XA 50/500

- Customer provides > 30 l LHe (to be confirmed 4 weeks prior to the installation)
- Customer ensures compatibility with LHe transfer tube, if LHe dewar is not supplied by SCIENTA OMICRON (to be confirmed 4 weeks prior to the installation)

PUMP EXHAUST

The roughing pump is shipped together with an oil mist trap. The pump exhaust may alternatively be connected to a hose leading outside or to a common exhaust pipe (exhaust connections ISO-KF 25).

SYSTEM VENTING

For system venting the following items have to be provided by the customer:

- Nitrogen, purity better than 4.0 (5.0 recommended), quantity about 1000 bar l
- Hose 6 mm i.d. to connect gas cylinder to system and hose clamps.

GENERAL

For the installation process and acceptance test the following items / consumables have to be provided by the customer:

- Aluminium foil.
- Ethanol / isopropanol in a wash bottle or syringe.
- Helium for leak detection.
- Mains extension leads and multiple socket adapters with earth connection.
- Splash goggles and cryogenic gloves in case of LN_2 or LHe use during installation.
- All gas cylinders which are connected to the UHV system must be equipped with a 0.2 bar over-pressure relief valve, particularly if used for venting.

- Additional items may have to be provided for components. Please see the instrument specific sections "Special requirements for acceptance test conductance…" for further information.

Electrical Box (Special)

The electrical box is mounted on the customer's rack. It takes the power input from the wall socket, distributes it to other units connected to the UHV system and additionally provides a number of safety functions:

- Control of all different currents/voltages for the various consumers,
- Protection of all currents and voltages in the system,
- Mains on/off switch for the entire system.

Mains Protection	Circuit breakers for the 3-phase mains supply (this is also the master switch).
Fuses	For a listing of the fuses please see table 2.

Notice

All fuses are located inside the box.

Fuse Name	Value	Description
F1	B16A	HEATER (2,5 kW)
F2	B10A	HEATERS (Flexible Panels)
F3	B10A	MAINS (for Rack and SYSTEM [Rotary])

Table 2. Fuses of the switch box.

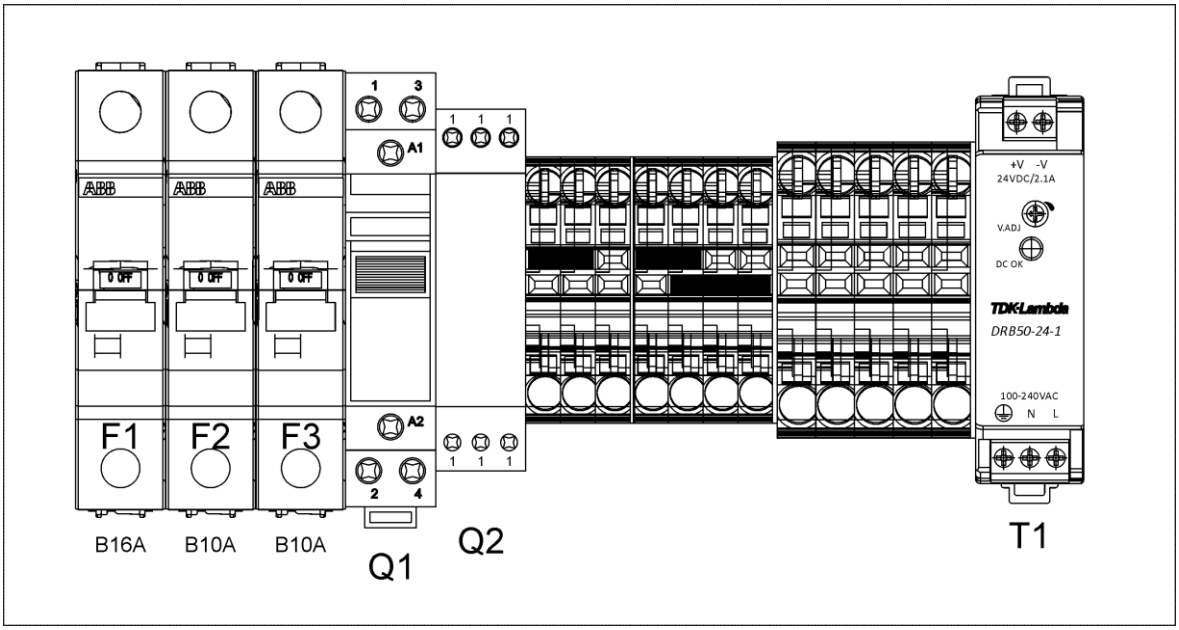


Figure 4. Electrical box, schematic diagram.

Startup

- Connect all components with dedicated cables to controllers.
- Connect Mains of the electronic box to a power strip.
- Connect controllers with power cable to power strip.
- Connect power strip to a mains outlet.

4. System Start-Up

Pumping

The schematic pumping system diagram of your system variant is shown in figure 5 on page 24.

The VT chamber is pumped by an ion getter pump and an additional titanium sublimation pump (TSP). A turbo-molecular pump with a diaphragm pump is used to pump the vacuum system down from atmospheric pressure or when high dynamic gas loads are to be pumped (e.g. sputter gun).

An electro-pneumatic gate valve separates the turbo pump and the vacuum chamber. This valve is interlocked to avoid unintentional venting of the vacuum chambers. It closes automatically if the turbo pump switches off or mains power fails.

Turbo pumps will automatically vent after running down.

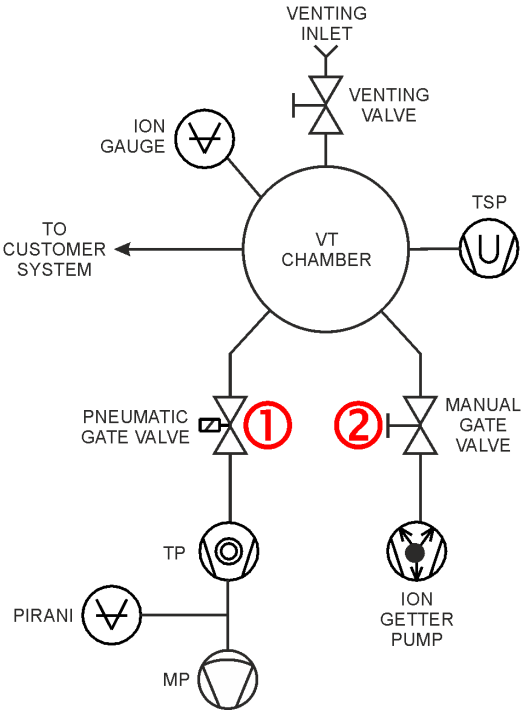


Figure 5. Pumping system diagram.

Valve Number	Start-Up Bakeout	Normal Operation	Venting Shut-Down	Remarks
1	open*	closed	closed	open for high gas loads and during bakeout
2	open	open	open	

Table 3. Valve setting for start-up, bakeout, venting and normal operation. *) This valve is part of the bakeout interlock: bakeout is only possible with this valve open.

Notice

Make sure that all venting valves and gas inlet valves are closed during bakeout. These valves are not numbered and are not listed in table 3 above.

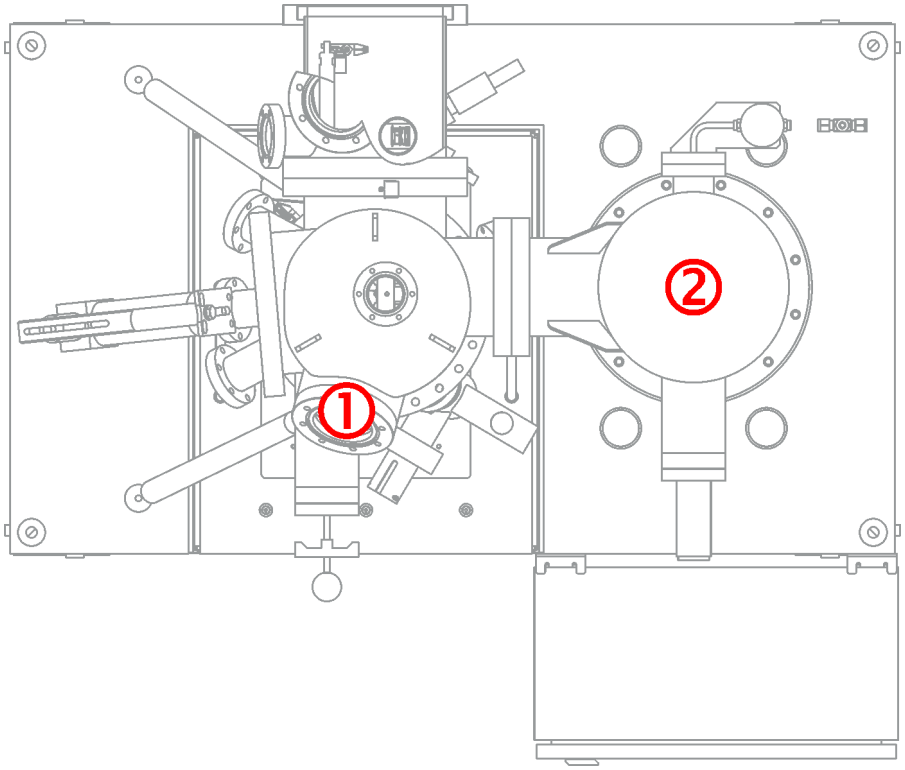


Figure 6. Positions of the valves in table 3.

Notice

Some of the valves indicated in figure 6 may be located under the system bench.
Note also that the gas inlet and venting valves are not indicated in figure 6 above.

Pumping Down the System

After all vacuum chambers have been vented completely, use the following procedure for evacuation:

1. Set all gate valves according to table 3 on page 24 "Start-Up".

Attention

Make sure the gate valve to the adjacent system is closed.

2. Open the gate valve(s) between chamber(s) and turbo pump(s).
3. Start the main turbo pump(s). The related roughing pump starts automatically.

Notice

Do not open the gate valve with a pressure difference greater than 20 mbar between both sides of the valve.

5. After the turbo pump has reached its maximum speed, wait for additional 10 minutes.

6. Now switch on the ion gauge and set the emission current to 0.1 mA or to automatic mode. The typical pressure now shown by the ion gauge is ~10^{-4} mbar to 10^{-5} mbar.

7. Ion getter pump(s) can be switched on when the pressure is below 10^{-5} mbar. The pressure may rise initially due to the warming up of the ion getter pump. It is not recommended to operate ion getter pumps at a pressure above $2 \cdot 10^{-4}$ mbar. In case of increasing pressure, switch off the ion getter pump until the pressure falls below 10^{-5} mbar and restart.

8. Perform a leak check, especially if new accessories have been mounted on the system. The recommended way to do this is to use a mass spectrometer and perform a helium leak check. Alternatively a leak may be found using the built in leak test mode of the pressure gauge controller while wetting flanges or seals with isopropanol.

System Bakeout

Ultra high vacuum conditions in the range below 10^{-9} mbar can only be reached after a few days and when the system has been baked for a sufficient amount of time (minimum 12 hours, typically 24 to 60 hours). Note that some configurations require a much longer bakeout time.

Caution

Some connectors have been supplied with short circuit plugs in order to **avoid charge build up** during bakeout due to the **pyroelectric effect.** Fit all such feedthroughs with their **short circuit plugs prior to bakeout.**

Notice

Protect viewports with aluminium foil during bakeout.

Notice

Manual gate valves are Viton® sealed with a max. temperature allowance of 200°C in the closed and 250°C in the opened position.

All metal right angle valves have a max. bakeout temperature of 250°C in closed position.

Check the following points are ok prior to bakeout:

- Turbo pump(s) with their roughing pump(s) are operating at full speed.
- All gate valves are set according to column "Bakeout" in table 3 on page 24.

- Ion getter pump(s) and TSP are switched off.
- Emission circuit(s) for the ion gauge(s) are set to 0.1 mA or automatic mode.
- Pressure is below $1 \cdot 10^{-6}$ mbar for systems with Channeltron® included, or below $1 \cdot 10^{-4}$ mbar otherwise.

All parts connected to the main system via CF-flanges should be pumped during bakeout in order to avoid oxidation of the metal surfaces. In particular, oxidised copper gaskets may cause vacuum leaks.

Bakeout procedure

Remove all non-bakeable parts and cables from the attached components and adapters and prepare them for bakeout. For details please refer to the component manuals.

Attention

To prevent pressure build-up always disconnect water lines from the coolant manifold and make sure all cells are completely dry before starting bakeout!

Tip Prep Tool

- Remove power and HV cables.

VT STM XA

- Remove the sample from the VT STM stage and park it in the carousel.
- Fit all FT12 and D-sub feedthroughs with their respective short circuit plugs.
- Bring the PPM to its upper position.
- Remove the cabling, the **LHe** cryostat fast coupling port, the **LHe** probe and the CCD camera
- Remove the cabling, all non-bakeable parts, the LN2 pumping line including all KF connections, the CCD camera and the LED spotlight.

UHV system

- Protect all viewports with aluminium foil.
- Check that all turbo pumps are running and valves are set according to table 3 on page 24.
- Assemble the bakeout panels and connect all heaters fitted to the bakeout panels (if any).
- Fit all heater shrouds for magnetic probes and between bench top plate and pumps, if any, and plug them into the respective socket on the distribution box.
- Check the preselected maximum bakeout temperature with respect to table **4**.
- Start the bakeout process via the PVCx bakeout controller.

- Make sure the pressure does not rise above 10^{-5} mbar during bakeout for systems with Channeltron® included. If necessary reduce the temperature slope, see page 33ff. Non-observation may severely damage some of the components included.

Notice

The BAKEOUT function is only available if

- The electro-pneumatic gate valve is open.
- The setpoint of the related turbo pump has been reached.

This gate valve (normally the gate valve to the main turbo pump) is labelled with an asterisk in table 3 on page 24. If it closes (e.g. in case of a turbo pump or power failure) the bakeout procedure is stopped. In this case check for power, accidental switch-off and turbo pump problems. To continue bakeout switch the turbo pump back on if off and wait until they have gained full speed, then open the gate valve manually and restart the bakeout process.

After Bakeout

- After the system has cooled down to ≈100°C degas each TSP filament at least three times for 1 minute. As this causes a pressure rise in the chamber, deactivate the vacuum interlock ("OVERRIDE") during the outgassing process and reactivate when finished.
- Switch on the ion getter pumps. In case of increasing pressure switch back off and restart after the pressure is below 10^{-5} mbar.
- When the system has cooled down to room temperature and the bakeout process is finished disassemble the bakeout panels.
- Disconnect the short circuit plugs and re-install removed parts.
- Increase the emission current of the ion gauge according to table 7 or switch to automatic mode. Outgas **both** built-in filaments.

Notice

Remember that, due to thermal isolation, some components inside may need much longer to cool down than the UHV chamber itself.

Make use of the fact that in some cases the temperature at the sample stage can be checked using a built-in temperature sensor/thermocouple.

Notice

After bakeout make sure all water-cooled components are well below 100°C before starting cooling water flow.

Tip Prep Tool

- Degas the tip prep tool as detailed in the dedicated manual.

In general, the pressure in the vacuum chamber reaches the 10^{-9} mbar — 10^{-10} mbar range after 8 to 12 hours.

Bakeout Temperatures

Table 4 specifies the maximum and recommended bakeout temperatures of the system, typical bakeout cycle: 18-20 hours. We generally recommend to stay some 10-20°C below the maximum allowed bakeout temperatures in order to prevent premature ageing of sensitive components.

Configuration	**Maximum Bakeout Temperature**
Multiprobe Systems	200°C (180°C recommended)
Component Attached	**Maximum Bakeout Temperature**
Tip Preparation Tool	170°C
VT STM XA	170°C
Customer's System	**170°C**
Limiting component	**VT STM XA, Tip Prep Tool**

Table 4: Bakeout temperatures for customised system configuration.

5. System Operation: Electronics

Before you operate the system make sure that:

- All ports are closed.
- All newly established flange connections are tightened with new copper gaskets.
- No cables under the bench touch the heaters.
- All rotary pumps are filled with oil (see manufacturers manual).

Notice

Rotary pumps are **not** filled with oil when shipped overseas.

Please also read the additional manufacturers manuals:

- Turbo pump and the associated controller
- Getter pump and associated controller
- Ion gauge controller
- Titanium sublimation pump and controller

IGP and TSP Controller

The Multiple Pump Controller (MPCe) is an ion pump power supply controller. With a Remote TSP Control Option it can additionally operate a titanium sublimation pump.

Ion Getter Pump Controller

Attention

The system must be evacuated to a minimum pressure of 1 x 10^{-5} mbar before you turn on the IGP.

- Start the pump by pressing the START button for a couple of seconds. This button also stops the pump.
- The main menu is shown after switching on the controller. It leads to the configuration and information menus. The supply section shows pressure, current and voltage readings simultaneously.
- Setpoints can be adjusted in the setpoints menu.
- The system controller is connected to the IGP controller and reads the setpoints to activate the protected supplies.

Notice

For further information on the IGP controller please refer to the manufacturer's manual.

Titanium Sublimation Pump Controller

The pumping effect of a titanium sublimation pump (TSP) for nitrogen, hydrogen and other chemically active gases is due to chemisorption. The sublimator is a titanium-molybdenum filament which is heated to the sublimation temperature of titanium. Titanium vapour from the electrically heated filament condenses on the interior walls of the chamber and forms a highly active getter film. With increasing saturation of the titanium layer the pumping effect decreases and fresh getter material is deposited by sublimation.

Notice

The TSP controller is interlocked with the IGP controller.

For further information on the TSP controller please refer to the Gamma Vacuum Controller Instruction Manual

Handling

The TSP parameters are controlled through the MPCe Menu screen. Available are the TSP config and the TSP settings menu.

- In the TSP settings menu adjust parameters for firing the TSP.
- If the control mode is set to PROGRAM the evaporation time and cycle periods can be adjusted.

The TSP cartridge has three independent filaments which can be selected via a switch (position 1, 2 and 3) on the controller. The TSP is used intermittently with short evaporation times (1 minute recommended) and longer periods in-between. The length of the periods depends on the pressure in the UHV system, see table 5. Period and evaporation time can be selected with the timer on the TSP controller. If the controller is switched on, the timer begins with the evaporation time. The following values may serve as a guide:

Pressure (mbar)	Period (minutes)	Pressure (mbar)	Period (minutes)
1×10^{-6} mbar	10	5×10^{-9} mbar	200
1×10^{-7} mbar	20	1×10^{-9} mbar	400
5×10^{-8} mbar	30	5×10^{-10} mbar	600
1×10^{-8} mbar	60	1×10^{-10} mbar	800

Table 5. Recommended periods at specified pressures for titanium sublimation pumps.

Notice

These periods are selected automatically if the TSP controller is operated in PROGRAM mode.

The TSP control mode can also be set to MANUAL. In this mode only the filament setting, the active filament and maximum amperage or wattage can be selected.

The filament current can be adjusted:

- Normal operation value: 30 A - 50 A (default = 50 A).
- When using a TSP please try to use the filaments equally.

Notice

The TSP controller is interlock with the IGP controller.

For further information on the TSP controller please refer to the Gamma Vacuum Controller Instruction Manual

PVCx Ion Gauge Controller

Each ion gauge has two thoriated iridium filaments. Select the filament to be used by means of a toggle switch on the rear panel of the ion gauge controller.

Notice

Both filaments should degassed.

If you want to use the electron bombardment degas use the following procedure:

- Select the MEDIUM DEGAS mode on the controller.
- Ensure that the pressure in the system is sufficiently low, i.e. below 10^{-5} mbar
- Ensure that the gauge (both filaments) has been running for some 30 minutes at maximum 10 mA emission current.

Notice

The **maximum allowed degas power** for thoriated iridium filaments is typically **30 watts,** in order to avoid evaporating the thorium coating.

The following emission currents are typical for normal operation of the ion gauge:

10^{-4} mbar	to	10^{-6} mbar:	low	(typically	0.1 mA	/	0.3 mA /	0.5 mA)
10^{-6} mbar	to	10^{-9} mbar:	medium	(typically	0.7 mA	/	1 mA /	3 mA)
10^{-9} mbar	to	10^{-11} mbar:	high	(typically	5 mA	/	7 mA /	10 mA)

Table 6. Typical emission currents for the ion gauge, values depending on controller version.

Alternatively use the automatic mode for setting the emission currents.

The following ion gauge controller settings should be used for normal operation. (For detailed information on the ion gauge controller please refer to the manufacturer's manual.)

Sensitivity S for the ion gauge:	19
Maximum filament current LIM:	3 A

Table 7. Parameter settings recommended for the ion gauge.

Value	Application	Pressure Standard
Trip 1	Interlock	1 x 10^{-7} mbar
Trip 2	X-ray	1 x 10^{-7} mbar
Trip 3	Suspend	1 x 10^{-4} mbar
Trip 4	Terminate	1 x 10^{-3} mbar

Table 8. Pressure trip value settings recommended by Omicron.

PVCx Bakeout Controller

The bakeout controller is integrated in the PVCx ion gauge controller. It allows increasing the bakeout temperature slowly up to a pre-set maximum temperature, holding it there for a selectable period of time and reducing it slowly back to room temperature.

- On the PVCx controller press the book button until ***Bake-out menu*** appears and enter it via pressing the check mark button.
- Adjust time (BakeTime2) and temperature (BakeTemp2) by scrolling through with the book button, changing with arrows and saving with the check mark button.
- To start bakeout select ***BakeOut*** and press the check mark button.

For more details please refer to the PVCx Process Vacuum Controller User Handbook.

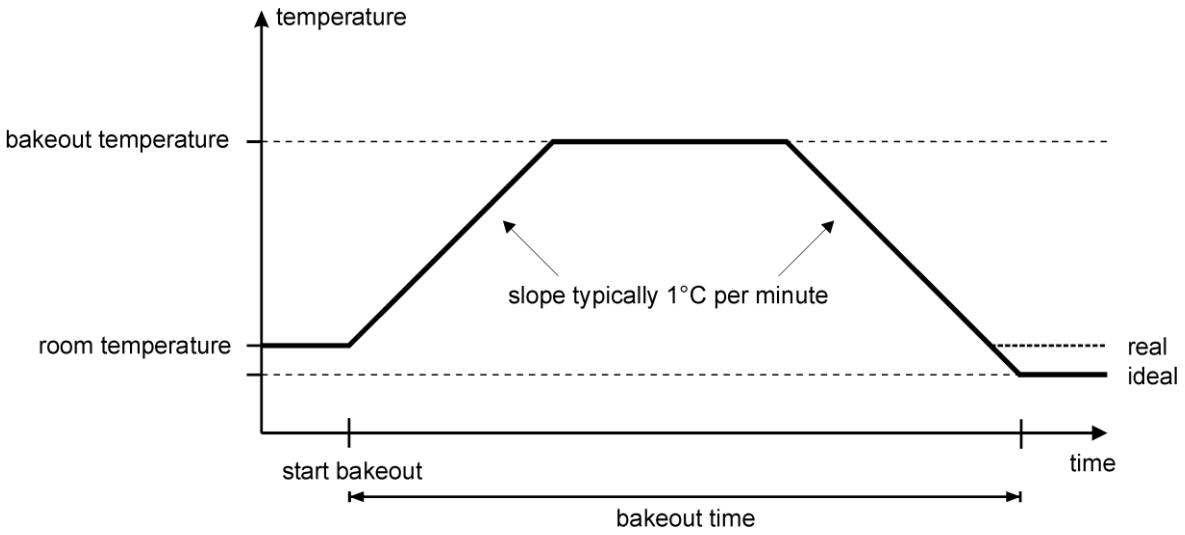


Figure 7. Bakeout parameters, schematic diagram.

Step	1	2	3	4	5	6
BO Temperature	160°C	160°C	20°C	20°C	20°C	20°C
BO Time in hours	2	24	2	0	0	0

Table 9. Typical settings for the PVCx bakeout controller, see also PVCx Process Vacuum Controller User Handbook.

6. System Operation: Sample Entry, Handling and Transfer

Samples and tips can be introduced into the system without breaking the UHV conditions via a connection to the customer system.

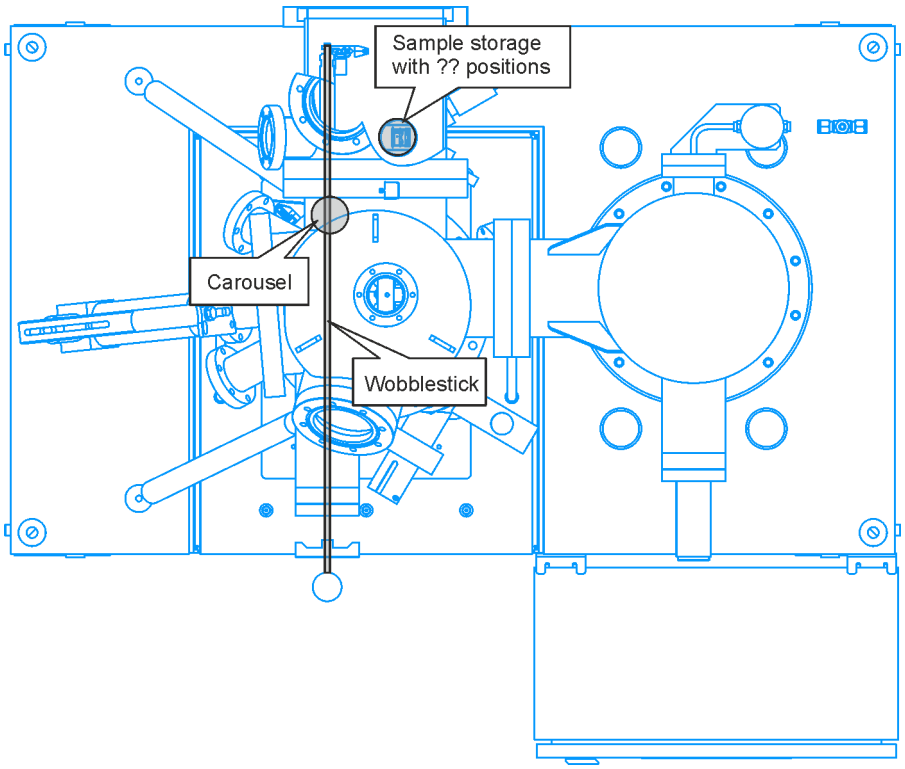


Figure 8. Sample transfer system diagram.

Sample Entry via RTTA

1. Make sure the sample on the sample reception of the RTTA is upside-down.
2. Make sure the pressure in the two systems is about the same. Open the gate valve between the RTTA chamber and the SPM system (valve #1). A pressure increase in the 10^{-9} -10^{-8} mbar range is normal.
3. Move the sample towards the transfer stage.
4. Transfer the sample onto the tip prep tool or VT carousel upside-down.
5. Retract the RTTA arm and close the gate valve.

7. System Shut-Down

Venting the System

The system is vented via the turbo pump(s). For this purpose a dry nitrogen supply must be connected to the venting port of the turbo pump.

Caution

Never exceed a total pressure of 1.2 bar inside the vacuum chamber. All gas cylinders which are connected to the UHV system must be equipped with a suitable over-pressure relief valve, particularly if used for venting.

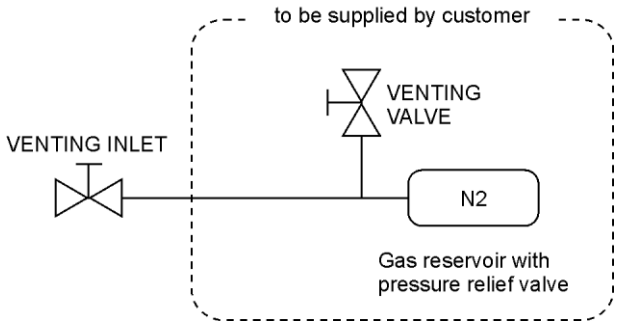


Figure 9. Venting assembly to be provided by the customer. Please note that a pressure relief valve is required if connecting a pressurised gas cylinder for venting.

Caution

- Viewport windows may explode causing injury due to flying glass pieces.
- All gas cylinders which are connected to the UHV system must be equipped with a suitable over-pressure relief valve.

Venting Procedure

1. Close the gate valves to all chambers which are not be vented.
2. Switch off hot filaments including the ionisation gauge.
3. Switch off all connected components (e.g. ion getter pumps, TSP) of the chamber(s) to be vented.
4. Wait 30 min before venting to allow for filaments to cool down (important for LEED LaB_6 filament).
5. Connect a reservoir of dry nitrogen (< 4 ppm impurities) to the venting inlet tube. This allows all chambers to be vented using the same dry nitrogen reservoir.
6. Open the venting valves to all chambers which are to be vented and wait until atmospheric pressure is reached.

7. Close all venting valves.

Releasing Residual Pressure

After venting with dry nitrogen from the reservoir close the pressure relief valve of the connected gas cylinder and open the additional venting valve to atmosphere in order to make sure that no pressure remains in the system.

Notice

This procedure is required for all components that are operated with pressurised air, e.g. double-bellows and pneumatic gate valves.

Electrical Shut-Down

- Switch off all controllers of the analytical instruments connected to the vacuum system. For detailed instructions please refer to the dedicated components manuals.
- Switch off the controllers of the ion gauge, TSP and ion getter pump.
- Switch off all turbo pumps – pneumatic gate valves close automatically.

Notice

If the system has not been vented before electrical shut-down, it will remain under vacuum, while the turbo pump will vent automatically after a while.

8. Service and Maintenance

Maintenance Requirements

Notice

The standard service interval is 12 months.

The following service procedures have to be performed once every 12 months.

TSP Filaments

TSP filaments are consumables that need to be replaced from time to time, depending on the abrasion of the filament. Remove the filament flange and visually inspect the three filaments. They should wear evenly. Recommended replacement interval is about 12 month. For instructions on filament replacement please refer to the manufacturer's manual.

Ion Gauge Filaments

Ion gauge filaments are consumables that need to be replaced from time to time, depending on the abrasion of the filament. Remove the ion gauge and visually inspect the two filaments. They should wear evenly. Recommended replacement interval is about 2 years. For instructions and safety requirements for filament replacement please refer to the manufacturer's manual.

Fan Assisted Heaters

Without the bakeout tent set up visually inspect heaters for proper operation of the fans. Placing your hand close but not touching the heater feel if it generates a hot air stream. Attention: do not touch the heaters as they may become very hot.

Transfer Components

Check all transfer components such as magprobes, wobblesticks etc. for smooth running operation. Make sure that the bore of the magnet drive (handle) is free from ferrous particles and that the transporter housing is clean and free from scratches. For all other maintenance and repair work the unit must be returned to the manufacturer. Note that magprobes and wobblesticks do not require lubrication.

Renew lubricants on translators (e.g. z-shift on the DAR400 x-ray source). Recommended lubricant: silicone grease FS3451 from Dow Corning (not UHV compatible). For further details please refer to the manufacturers' manuals.

We also recommend lubricating external bolts and nuts in order to prevent the nuts from sticking to the bolts when the system is baked.

Turbo Pumps

Inspect the pump for proper operation. Make sure there are no unusual noises upon start-up or during operation. The lubricant reservoir should be replaced at least every three years. For detailed instructions please refer to the manufacturer's manual.

Diaphragm Pumps

In case of normal wear the lifetime of the diaphragms and valves is >10000 operating hours. Inspect the pump for proper operation. Under normal operating conditions the pumps need no servicing. It is not necessary to check the operating fluid. Valves and diaphragms are subject to wear and tear. At the latest when the attained pressure level begins to deteriorate the diaphragms and valves should be cleaned and checked for cracks. For further instructions please refer to the manufacturer's manual.

Thermocouples for Bakeout Temperature

Check that all thermocouples used for bakeout indicate ambient temperature (temperature read-out via bakeout controller) under normal conditions and show a slight increase in temperature when you warm them up with your hand.

Operating Media

Check the connections and supply pipes of all operating media for leaks. Operating media are

- Nitrogen gas for venting,
- Compressed air for damping legs, double bellows and pneumatic valves,
- Cooling water for X-ray source and Gemini.

Please note that the customer is responsible for all supply lines up to the Scienta Omicron system.

Viewports

Visually inspect all viewports. In case of scratches or any other visible marks, abrasions or imperfections exchange viewports immediately.

Lead Glass Covers

Make sure all lead glass covers are installed correctly. In case of scratches or any other visible marks, abrasions or imperfections exchange lead glass covers immediately.

Cable Connections and Interlock

Check all cable connections. Particularly check the interlock functionality of those cables that have to be removed during bakeout. Visually inspect for mechanical defects and corrosion of the contact pins.

For further maintenance instructions please refer to the manufacturer's manuals.

Scienta Omicron Flange Definitions

Port CF	Rot. Tap.	Tube Outer Diameter	Tube Inner Diameter	Tube Tolerance	Scienta Omicron Naming Convention
34-18	Fixed Bored Rot. Bored Fixed Tapped Rot. Tapped	18 mm	16 mm	-0.3 mm	NW 16 CF (1.33" O.D.)
34-19	Fixed Bored Fixed Tapped	19 mm	17.2 mm	-0.3 mm	NW 16 CF (1.33" O.D.)
70-41	Fixed Bored Rot. Bored Fixed Tapped Rot. Tapped	41.3 mm	38.0 mm	-0.3 mm	NW 38 CF (2.75" O.D.)
70-44	Fixed Bored Fixed Tapped	44.4 mm	40 mm	-0.5 mm	NW 40 CF (2.75" O.D.)
114-70	Fixed Bored Rot. Bored Fixed Tapped Rot. Tapped	69.9 mm	65.1 mm	-0.5 mm	NW 65 CF (4.5" O.D.)
150-108	Fixed Bored Rot. Bored Fixed Tapped Rot. Tapped	108 mm	101.5 mm	-0.5 mm	NW 100 CF (6" O.D.)
200-156	Fixed Bored Rot. Bored Fixed Tapped Rot. Tapped	156 mm	150 mm	-0.5 mm	NW 150 CF (8" O.D.)
250-210	Fixed Bored Rot. Bored Fixed Tapped Rot. Tapped	209.6 mm	200 mm	-0.5 mm	NW 200 CF (10" O.D.)
336-273	Fixed Bored Rot. Bored Fixed Tapped Rot. Tapped	273 mm	263.5 mm	-0.5 mm	NW 250 CF (13.25" O.D.)

Table 10. Scienta Omicron flange definitions.

Vacuum Pictograms

	roughing pump		valve
	scroll pump		manual valve
	diaphragm pump		leak valve
	roots pump		pneumatic valve
	cryo pump		right angle valve
	turbo pump		angle tap
	ion getter pump		shutter
	sublimation pump		flexible hose
	oil mist filter		conical connection
	sorption trap		flange connection
	vacuum measurement		KF connection
	vacuum vessel		analogue pressure display

Table 11. Vacuum pictograms used in this manual.

Service at Scienta Omicron

Should your equipment **require service**

- Please **contact Scienta Omicron** headquarters or your local Scienta Omicron representative to discuss the problem. An up-to-date address list is available on our website

  http://www.scientaomicron.com/

- Make sure all necessary information is supplied. Always **note the serial number(s)** of your instrument and related equipment (e.g. head, electronics, preamp…) or have it at hand when calling.

If you have to **send any equipment back to Scienta Omicron**

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

For ALL vacuum equipment:

- Include a filled-in and signed copy of the "Declaration of Decontamination" form which can be found at the back of the equipment manual.

No repair of vacuum equipment without a legally binding signed decontamination declaration !

- Wear suitable cotton or polythene gloves when handling the equipment.
- **Re-insert all transport locks (**if applicable**).**
- Cover the instrument with aluminium foil and/or place it in a polythene bag. Make sure no dust or packaging materials can contaminate the instrument
- Make sure the **plastic transport cylinder (**if applicable**) is clean**.
- Fix the instrument to its plastic cylinder (if applicable).

Index

A
adjustments 11

B
bakeout
  controller 33
  panels 27
  procedure 26
burst disk 15

C
charge build up 26
controller
  bakeout 33
copyright 2

D
decontamination declaration 44

E
emission currents 32

F
fault finding 11
filaments
  thoriated iridium 32
  titanium 31
flange definitions 40

I
installation 17
introducing tips or samples 35
ion gauge 32

L
leak check 26
lethal voltages 11
limitations 16

M
manipulator 35
measurements
  fault finding 11

O
oil, rotary pump 30

P
pictograms 41
pumping
  diagrams 24
  procedure 25
pyroelectric effect 26

R
requirements 16
rotary pumps 30

S
safety information 11
service procedure 42
short circuit plugs 26
specifications 10
symbols, vacuum technical 41

T
temperature
  bakeout 29
thoriated iridium filaments 32
titanium
  filament 31
  sublimation pump 31

V
venting
  procedure 36
viewports 15
voltage
  lethal 11

W
warnings, liquid gas 15
warranty 2
Waste Electric and Electronic Equipment 3

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 dangerous 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.
- **"*Dangerous substances*"** are defined in European Community Countries as materials and preparations according to Article 2 of the Dangerous Preparations Directive **1999/45/EC**.

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/service _____

3. Equipment condition

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

- toxic substances? Yes ☐ No ☐
- corrosive substances ? Yes ☐ No ☐
- flammable substances? Yes ☐ No ☐
- explosive substances? Yes ☐ No ☐
- microbiological substances (incl. sample material)? Yes ☐ No ☐
- radioactive substances (incl. sample material)? Yes ☐ No ☐
- ionising particles/radiation (α,β,γ, neutrons, …)? Yes ☐ No ☐

For all dangerous 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 dangerous 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 dangerous 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:**