Installation Requirements

ZEISS Crossbeam 350, 550, 550L

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Original Manual

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1 About these Installation Requirements

This document describes the location requirements for the installation of a Crossbeam, hereinafter referred to as "microscope".

It helps to determine a suitable location within facilities and to prepare the location before delivery of the microscope. The suitability of a location depends on various factors such as:

- Room size
- Floor stability
- Environmental conditions
- Availability of supplies

The room size should be able to accommodate the microscope as well as potential accessories and 3rd party systems that may be attached to the microscope. For servicing the equipment, adequate access space is also required. The selected location should conform with the correct environmental conditions to ensure the safe and ideal operation of the microscope and its application whilst still ensuring the safety and comfort of the operators. Environmental conditions are often influenced by surrounding installed systems or activities. We can distinguish between:

- Vibrations
- Magnetic stray fields
- Electrical fields
- Acoustic noise

The customer is responsible for ensuring that the conditions specified in this document are met and that the required equipment is available before delivery and installation. A ZEISS service representative will gladly assist you in examining the installation conditions and suitable measures.

1.1 Further Applicable Documents

Brochures and Certificates

For brochures, certificates (e.g. ISO, CSA, SEMI), and declarations of conformity (e.g. EU, UK) ask your ZEISS Sales & Service Partner.

Local and National Health and Safety Regulations

Observe local and national health and safety regulations for the location of installation and during the use of the microscope.

Consult with your ZEISS Sales & Service Partner if these regulations are in conflict with the installation requirements of the microscope.

System and Third-Party Components, Accessories

Information about the individual components, enhancements, and accessories can be obtained from your ZEISS Sales & Service Partner. Also refer to the documentation of third-party manufacturers.

2 Requirements

The following sections describe each requirement in detail.

2.1 Environmental Requirements

Environmental effects such as acoustic noise, floor vibration, magnetic stray fields and electrical fields, as well as the room temperature have a significant impact on the performance of the microscope and the ability to achieve the specified performance with particular regard to long term and sensitive workflows as well as equipment safety.

A site survey can be requested from your local ZEISS service representative prior to the installation.

2.1.1 Acoustic Noise

It is recommended that the microscope system is installed and operated in a quiet room. Sound waves, e.g. vibration of the air caused by air-conditioning and other systems producing acoustic noise, will affect the microscope and may cause image distortion.

Requirements for measuring acoustic noise:

- The microphone should be a minimum of 1.0-1.5 m from the ground to simulate measurements at the microscope chamber height

The following noise levels meet the specification of a quiet room and consider the potential resonance frequencies of damping tables and sample stages.

Allowable noise level (Resolution 2 Hz):	
50 to 120 Hz	less than 52 dB rms (Z class)
120 - 450 Hz	less than 43 dB rms (Z class)
above 450 Hz	less than 47 dB rms (Z class)

2.1.2 Air Conditioning and Quality

The correct air conditioning of the proposed site for the microscope is critical for achieving high quality, stable and repeatable results as well as ensuring a suitable working environment for the users.

Many components of a microscope require stable ambient conditions to ensure that the optimal resolution of the system is achieved as well as stable results. The most common impact of instability is a focus drift of the image (e.g. during a time series).

For best operating conditions for the microscope:

- The conditions around the microscope (ambient) should remain at the recommended chosen ambient temperature and humidity 24 h per day and 7 days a week.
- Take note that many energy saving initiatives typically include reducing the air conditioning efficiency of buildings over night and over weekends which may affect your laboratory too.
- The actual ambient temperature should remain in the recommended range for best optical performance to ensure the optics of the microscope will achieve the specified resolution.
- To ensure stability of the results and reduce drift issues, the optimal temperature change gradients are indicated. The temperature stability requirements are far more stringent than the absolute ambient temperature and may require special attention if a high degree of focus stability is required.
- The air conditioning system must be of the correct size for the room dimensions, heat dissipated from the systems and number of people in the room. The air outlets and intakes must not be directed towards the microscope.

- For applications requiring a high degree of stability, we recommend the use of temperature and humidity monitoring devices as a reference to monitor the stability of the ambient temperature.

	Value
Heat dissipation	See tables at the end of this chapter.
Ambient temperature (24 h per day, regardless of whether the microscope is in operation or switched off)	21 ± 4 °C
Recommended best temperature stability	± 0.5 °C/h
Long-term recommended stability	± 2 °C/24 h
Relative humidity	< 65 %
Atmospheric pressure / altitude	800 hPa / ≤ 2000 m above sea level
Pollution degree [▸ 7]	2

To ensure sufficient clean air circulation through the cooling systems, do not operate the system above the allowed altitude listed under *Location Requirements [▸ 9]*.

Dust can cause erratic errors or possibly irreversible damage to electronic devices. Care should be taken that the site is as dust free as possible.

It is possible to have the main microscope in the laboratory and the various utilities placed in a separate room outside of the lab to reduce noise and heat in the laboratory. The following nominal power usage for the system and possible accessories are shown in Watts and BTU (British Thermal Units). To maintain a more constant room temperature, the size of an air-conditioned should be well matched to the size of the room and the heat generated.

Equipment	Heat Dissipation
Microscope	1150 W (3930 BTU)
Backing pump	350 W (1200 BTU)
Water chiller	725 W (2480 BTU)
Crossbeam Full System	2225 W (7600 BTU)

Tab. 1: Heat Dissipation

Common options	Heat Dissipation
EDS system	500 W (1700 BTU)
UPS on line	250 W (850 BTU)
Damping system	50 W (170 BTU)
VP option	350 W (1200 BTU)
Extra PC	100 W (350 BTU)
User/per person	100 W (350 BTU)
ToF SIMS System	250 W (850 BTU)

Tab. 2: Accessories adding to the Heat Dissipation

2.1.3 Pollution Degrees

Defines the design consideration of electronic components for the occurrence of conductive and non-conductive air borne particles that could damage high voltage electrical components. According to EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use. Part 1: General requirements

Dust can cause erratic errors or possibly irreversibly damage to electronic devices. Care should be taken that the site is as dust free as possible. The pollution degree does not specify the number and size of airborne particles that should be measured but rather the location of where the product should be safely used. Air pollutants and air borne particulate matter limits are country and time of year specific to encompass acceptable industrial and possible pollen particulates.

Pollution Degree	Description
1	No pollution or only dry, nonconductive pollution occurs. The pollution has no influence. Typical for equipment used in clean rooms and sealed environments.
2	Only nonconductive pollution occurs. Occasionally, temporary conductivity caused by condensation is to be expected. Typical for equipment used in a standard office environment, laboratory environment, homes and test laboratories where air-conditioning ensures a minimal dust level.
3	Conductive pollution occurs, or dry nonconductive pollution occurs that becomes conductive due to condensation that is to be expected. Typical for equipment used in industrial non air-conditioned areas exposed to the outside environment on a regular basis.
4	The pollution generates persistent conductivity caused by conductive dust or by rain or snow. Typical for equipment used in the outside environment not sheltered from the weather at all.

2.1.4 Electromagnetic Compatibility (EMC)

This microscope is designed to be operated in an electromagnetic controlled environment according to EN 61326-1. In order to avoid image interference and/or instability of the system, we recommend the following precautions should be taken.

- Mobile phones or other radio wave transmitting devices should not be used in the proximity of the system.
- It is not recommended to install the system in the close vicinity of other high electromagnetic radiation industrial equipment (e.g. SEMI fabline).
- Where the system shares a mains distribution with other industrial equipment, it is recommended to install a UPS to prevent the unintended shut down and restart of the system due to an interruption on the mains distribution board.

The microscope system EMC is classified for an industrial EMC environment. Should any 3rd party device be added to the microscope with a different EMC environment classification, (e.g. domestic), the combined EMC classification will change to Electromagnetic Controlled Environment. We recommend that the correct precautions are taken regarding electromagnetic fields and their potential impact on the microscope from these devices.

2.1.5 Magnetic Stray Fields

Magnetic stray fields can be generated by machines, by supply lines when carrying heavy loads, by power distribution panels and transformer stations. Any large mobile metal objects, such as elevators, motor vehicles or trains in close proximity to the SEM will deflect the earth's magnetic field which can have an impact on the stability of the images.

Requirements for measuring magnetic stray fields:

- Measurements need to be done in time domain
- The sensor should be a minimum of 1.0-1.5 m from the ground to simulate measurements at the microscope chamber height
- Three positions should be measured
- The positions need to cover a triangle over the area where the microscope will be installed
- At each position, measurements in X, Y and Z need to be taken
- The X axis is along the front of the microscope

Allowable magnetic stray fields (Resolution 1 Hz):	
Near DC component	0.5 mG (50 nT) peak to peak / 5 min or less
AC component	less than 1 mG (100 nT) peak to peak between 1 Hz and 1 kHz at 1 mm working distance

2.1.6 Vibrations

Vibrations can be caused e.g. by heavy-duty machinery installed on the same floor or even in the same building as well as transport facilities operated nearby. Depending on the floor stability and construction, even walking in the room or in the hallways may effect the image quality.

Requirements for measuring vibrations:

- Three positions should be measured
- The positions need to cover a triangle over the area where the microscope will be installed
- At each position, measurements in X, Y and Z need to be taken
- The X axis is along the front of the microscope

Allowable horizontal vibration values (Resolution 0.5 Hz):	
up to 10 Hz	less than 5 µm/s rms
10 - 60 Hz	less than 10 µm/s rms
above 60 Hz	less than 14 µm/s rms

Allowable vertical vibration values (Resolution 0.5 Hz):	
up to 10 Hz	less than 4 µm/s rms
10 - 60 Hz	less than 14 µm/s rms
above 60 Hz	less than 20 µm/s rms

2.2 Location Requirements

If the microscope is to be delivered with additional options, please discuss the additional requirements for these options with a ZEISS service representative. The options may require additional health and safety considerations, space, power points or other resources.

The microscope may only be operated in closed rooms. The microscope should not be installed near radiators or windows with direct sunlight.

Compliance with the installation requirements of the microscope is the responsibility of the customer. The requested supplies have to be readily available at the time of installation.

Installation site	Exclusively inside buildings
Operating range	≤ 2000 m above sea level

Info

Harmful gases and fumes that may be used on the microscope must be safely extracted from the microscope and site in accordance with local safety regulations.
The microscope must not be set up in areas with potential danger by explosives.

2.2.1 Space Requirements

Recommended room size	Min. 4.0 m x 5.0 m x 2.3 m
Service and safety clearance area	0.5 - 1 m around the microscope (depending on additional options)
Entrance	Min. 0.9 m, recommended 1.1 m wide
Hallways	Min. 1.3 m wide
Corners	Min. 1.5 m wide
Transport ways	Free of staircases
Power connection	Not more than 1.5 m from system

The following layouts are recommended for optimal accessibility, airflow and stability, depending on the options purchased with the system. For possible changes in preferential layout, please discuss with your ZEISS representative. The placing of the user table can vary depending on available space and cable lengths.

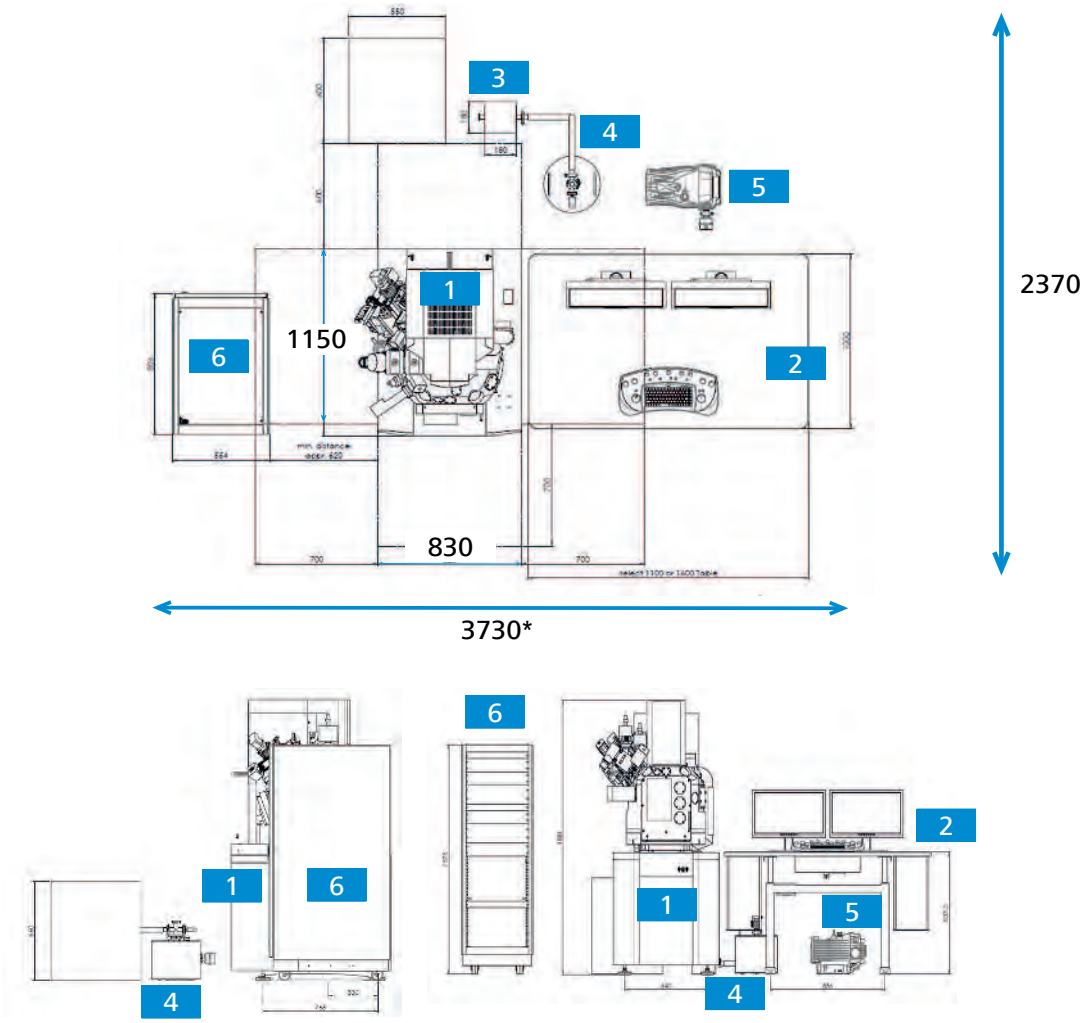


Fig. 1: Crossbeam 550 L (Weight and Sizes [▸ 31])

1	Plinth	2	Workstation
3	Static damping block	4	Eco quiet mode (optional)
5	Pre-vacuum pump	6	FIB rack

*3180 with small desk

2.2.2 Layout and Connections

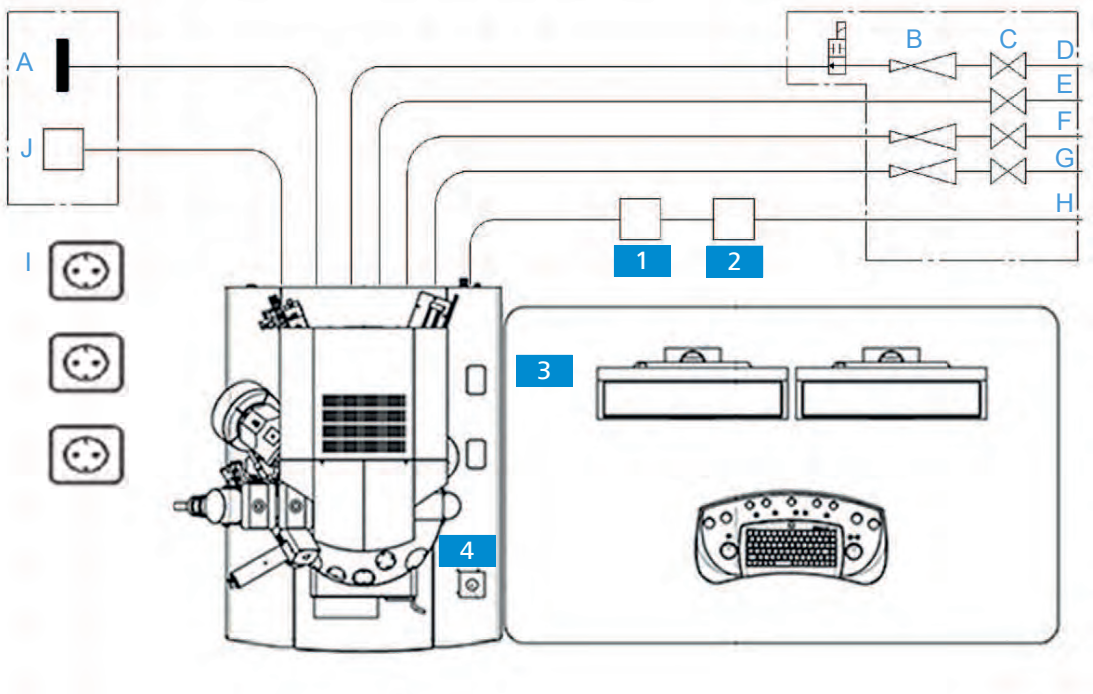


Fig. 2: Assembly Plan

1	Static vibration damper	A	Equipotential bonding bar
2	Pre-vacuum pump	B	Pressure reducer (water, nitrogen, compressed air)
3	Computer workplace	C	Main shut-off valves
4	Emergency Off (EMO) button (optional)	D	Water supply
		E	Water runback
		F	Nitrogen supply
		G	Compressed air supply
		H	Exhaust line
		I	Additional standard local mains power sockets, max. 13 A
		J	Mains power supply 208...230V/ 25A, 1/N(L2)/PE

Info

Energy Supply Connections

All energy supply connections to the microscope such as electrical power, cooling water, gaseous nitrogen and compressed air, as well as attaching connectors for PC, monitor, rotary pump etc. are located at the rear of the microscope plinth.

2.2.3 Cooling Water Supply

Major components of the microscope such as electron-optic lenses, parts of the electronics and the turbo molecular pump are water-cooled.

Certain requirements need to be fulfilled in order to prevent corrosion and contamination of the water cooling lines.

General Requirements

Microscope:

Water flow rate	60 - 70 l/h
Pressure	Adjustable up to 3 bar
Water temperature	20 - 22 °C
Stability	max 0.5 °c within 10 minutes for normal imaging. Longer workflows, at a constant working condition, ±0.2 °c.
Heat dissipation	Max. 1 kW
Connection hose	Two 10 m hoses are supplied. Outside diameter 12 mm. Inside diameter 6 mm.

Tab. 3: General Requirements (any cooling solution has to fulfill these requirements)

Wetted Materials

Materials used in the microscope that come in direct contact with cooling water:

- Copper
- Brass
- Red brass
- Stainless steels
- Plastics
- Elastomers

Water-Quality Requirements (Microscope)

pH-Value	7,5 – 9,0
Conductivity	> 60 – 500 µS/cm
Total Hardness	< 5 °dH respectively < 1 mmol/l
Chloride Content	< 50 g/m³
Total Colony Count	< 1.000 CFU/ml
Particles	< 80 µm

Tab. 4: Water-Quality Requirements

It is recommended to add a corrosion inhibitor and a biocide to the cooling water and to periodically check that the cooling water still fulfills the requirements.

System Connection

Two quick exchange fittings are supplied to fit the the supplied 6 mm ID hosing.

Cooling Solutions

There are three different ways to provide the required cooling (each has a separate section following below; depending on the country, the different kinds of cooling solutions may come from different suppliers. Always refer to the manufacturer's documentation for requirements on the water quaility and the installation site):

- **Air-Cooled Chiller**:

  This is the easiest method. The cooling device consists of a third-party closed cooling water circuit that is being cooled by air. No further water supplies are required.

- **Water-Cooled Chiller connected to In-House Water Supply**:

  This method requires an in-house water supply to cool the third-party closed-circuit water cooler. The in-house water supply has to fulfill the manufacturer's requirements.

- **In-House Water Supply alone**:

  This method only uses the in-house water supply to cool the microscope. The in-house water supply has to fulfill ZEISS requirements.

Air-Cooled Chiller

ZEISS recommends using an air-cooled closed-circuit cooling device (Recommendation: Kühlmobil air-cooled part no. 345980-9023-100 (110/230 V 50/60 Hz); documentation available on the service website).

Due to heat dissipation, acoustic noise and vibrations, the closed-circuit cooling device should be installed in a separate room close to the microscope. Ensure the performance of the air conditioning system in the room is sufficient. Refer to the manufacturer's documentation for details.

Water-Cooled Chiller connected to In-House Supply

Alternatively, a water-cooled closed-circuit cooling device can be used (Recommendation: Kühlmobil water-cooled part no. 345980-9024-100 (110/230 V 50/60 Hz); documentation available on the service website).

The specified water temperature and water supply quality must be guaranteed. Refer to the manufacturer's documentation for details.

The following devices have to be installed on the in-house supply side:

- Opaque hoses with 3/8" internal-thread fitting from in-house water supply to the chiller

  (PVC fiber-reinforced, inner diameter 6 mm, wall thickness 3 mm).

- Humidity sensor: A device that detects leaking cooling water

- Main shut-off valve secured against accidental re-activation, e.g. a ball valve AKT 15TN88 with optional lock 420-1/4-1/2 (manufacturer: G. Kromschröder AG, Osnabrück, Germany, resp. Kromschroder Inc, Hudson, OH 44236, USA) or equivalent.

  Main shut-off valves have to be easily accessible. They must close off the connections to the corresponding media when needed. As the user is responsible for installing the main shut-off valves, he/she should also provide instructions how to operate the main shut-off valves properly.

  Energy isolating devices should be mounted near the microscope in such a way that the person actuating or inspecting an energy isolating device should not be exposed to serious risks.

- particle filter < 80 µm, respectively a dirt separator at an appropriate space within the system-water circuit

- pressure reducers with two manometers

For insurance-technical reasons, all installations have to be carried out by professionals.

For ecological reasons, do not use water from the water supply with an open drain.

In-House Water Supply alone

As there is no cooling device in between microscope and in-house water supply, the temperature stability (20 - 22 °C ±0,5° /10 min) is very important.

Water-Quality Requirements (Microscope)

pH-Value	7,5 – 9,0
Conductivity	> 60 – 500 µS/cm
Total Hardness	< 5 °dH respectively < 1 mmol/l
Chloride Content	< 50 g/m³
Total Colony Count	< 1.000 CFU/ml
Particles	< 80 µm

Tab. 5: Water-Quality Requirements

The following devices have to be installed on the in-house supply side:

- Opaque hoses with 3/8" internal-thread fitting from in-house water supply to the chiller

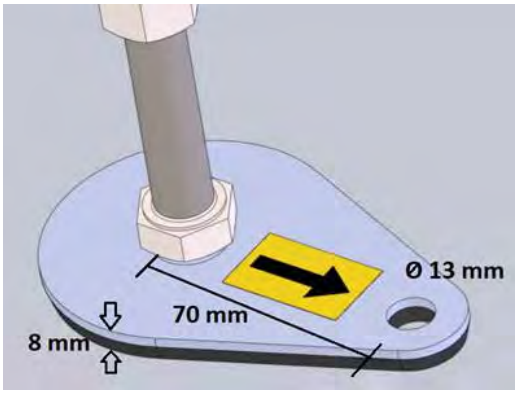
  (PVC fiber-reinforced, inner diameter 6 mm, wall thickness 3 mm).
- Humidity sensor: A device that detects leaking cooling water
- Main shut-off valve secured against accidental re-activation, e.g. a ball valve AKT 15TN88 with optional lock 420-1/4-1/2 (manufacturer: G. Kromschröder AG, Osnabrück, Germany, resp. Kromschroder Inc, Hudson, OH 44236, USA) or equivalent.

  Main shut-off valves have to be easily accessible. They must close off the connections to the corresponding media when needed. As the user is responsible for installing the main shut-off valves, he/she should also provide instructions how to operate the main shut-off valves properly.

  Energy isolating devices should be mounted near the microscope in such a way that the person actuating or inspecting an energy isolating device should not be exposed to serious risks.
- particle filter < 80 µm, respectively a dirt separator at an appropriate space within the system-water circuit
- pressure reducers with two manometers

2.2.4 Seismic Protection/Restraints

In areas of seismic activity, ZEISS recommends the use of seismic restraints. Customers are responsible for the preparation of the installation site and the selection and installation of the anchoring mechanism as these are integral to specific customer facilities.



ZEISS recommends the Fischer heavy duty anchor TA M10 T25 S for securing the SEM plinth and the electronics racks, where applicable. The correct positioning of the bolts in the floor can only be done on delivery and correct placement of the SEM. Approval should be given by the facility officials to fix these bolts into the floor of the selected site. Diameter 15 mm, Depth 95 mm.

2.2.5 Anchor Points

For GeminiSEM and Crossbeam series microscopes, the following anchor points are to be used for seismic protection.

Component	Distance	Number and Diameter	Anchor Type
Electronics Rack	605x350	4x Ø15	M10
Microscope	780x765	4x Ø13	M10
Pre-vacuum Pump	230x120	4x Ø9	M6

Tab. 6: Anchor Points

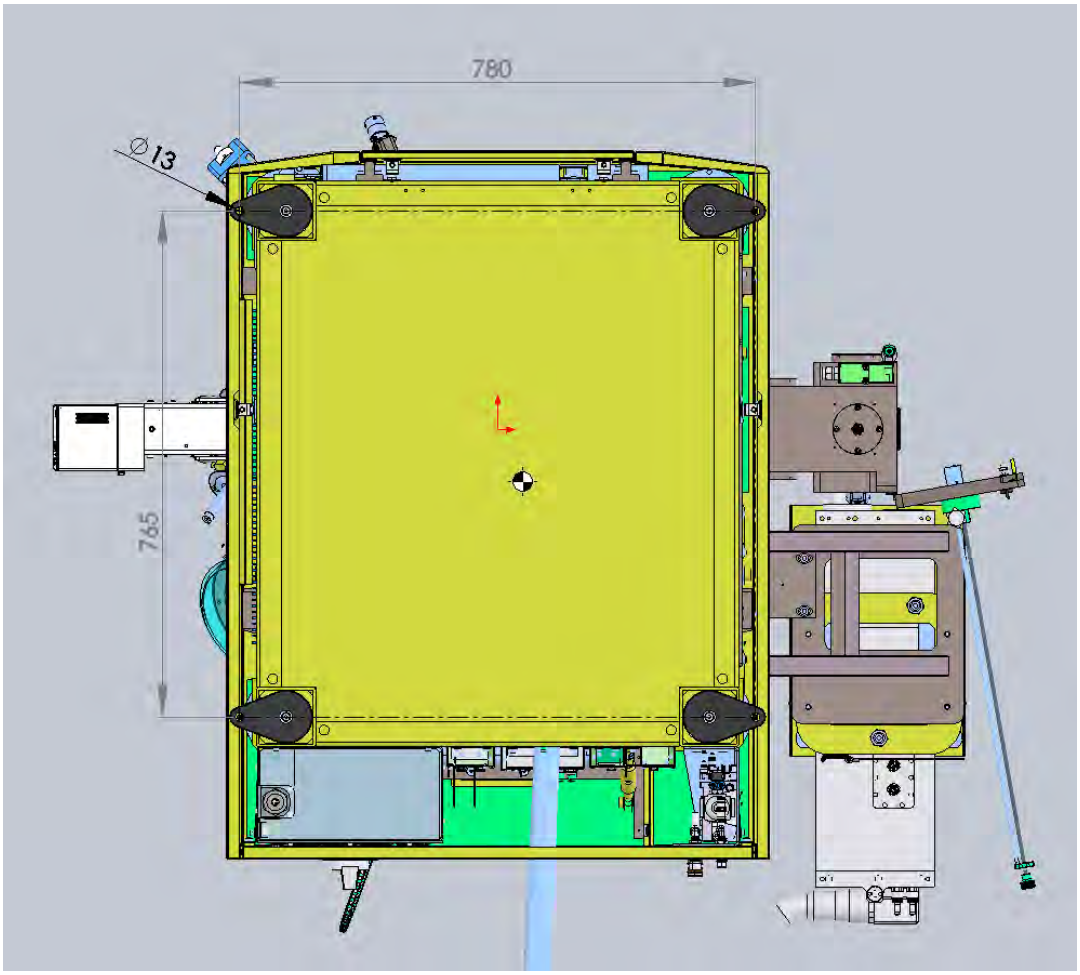


Fig. 3: Anchor Points on the Bottom of the Plinth

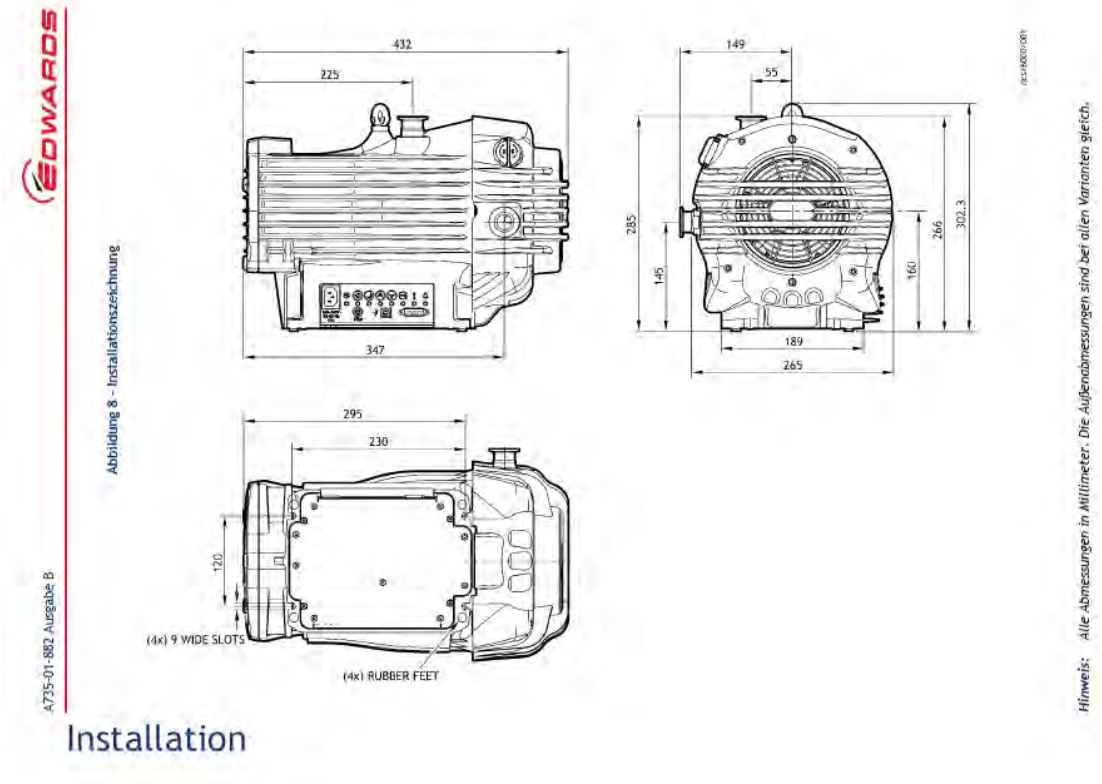


Fig. 4: Anchor Points on the Edwards Pre-Vacuum Pump

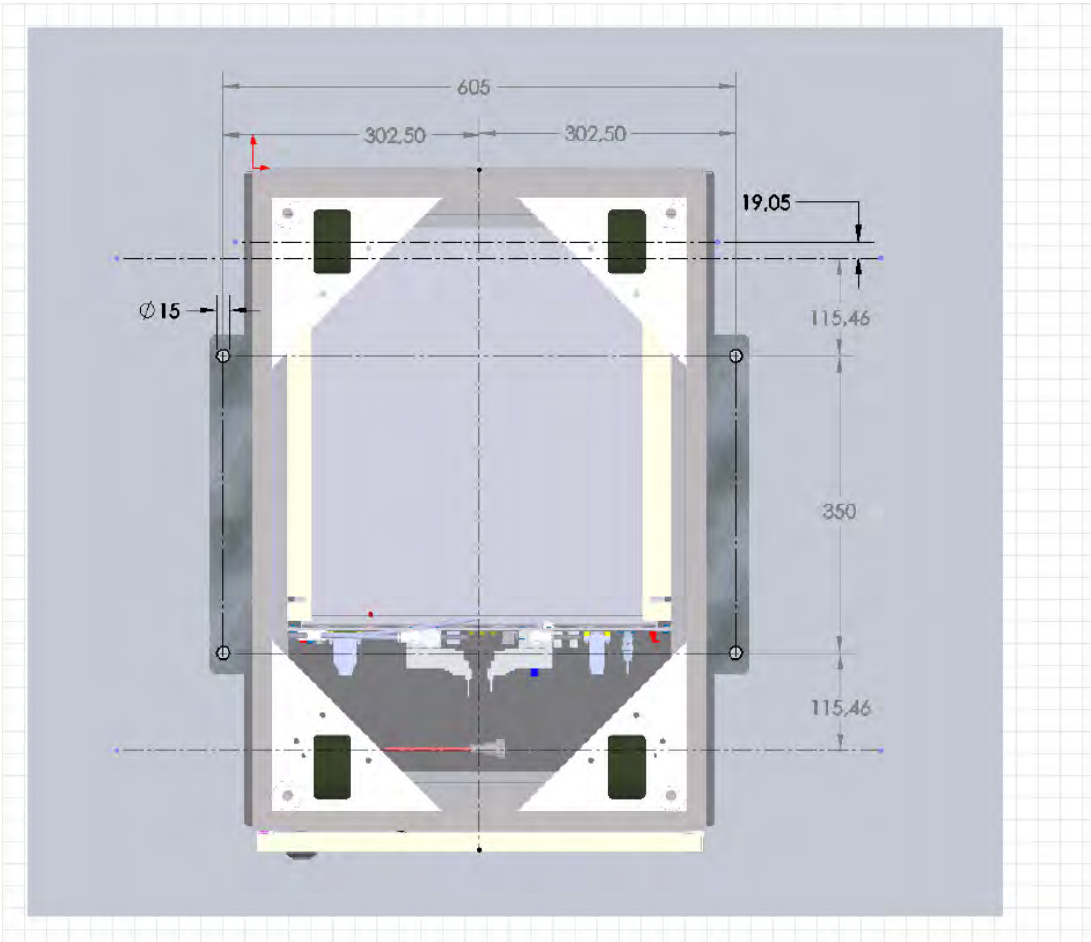


Fig. 5: Anchor Points of the Electronics Rack

2.3 Electrical Supplies

The microscope must be properly installed with the power cords and supplied socket with protective ground contact securely connected.

The provided electrical connection must be in accordance with the applicable electrical codes for the country of installation. In order to avoid disturbance from other installed machines, you must use a separate power connection.

- Do not extend or modify the supplied 3 m power cords.
- Do not connect electrical systems that are not authorized by ZEISS on the supplied power supply cords.

	Value
Nominal AC voltage	L1/N/PE 230 VAC ± 10 % L1/L2/PE 208 VAC ± 10 %
Nominal frequency	50 / 60 Hz
Power consumption (typical)	1-3 kVA, dependent on accessories
Addition building PE	The system must be connected to a building earth point at all times.
Accessories mains power	3 standard local 120 V or 230 V mains sockets (13 A)
Maximum current	16 A at 230 V

	Value
Circuit breaker	25 A (type K) according to IEC EN 60898 RCD (Residual Current Device) of maximum 100mA is recommended depending on the local electrical safety regulation pertaining to a mains plug and socket connection. 
Leakage current (relevant for Residual Current Device)	15-25 mA depending on configuration and system type
Ampere interrupting capacity (AIC)	1500 A rms without external EMO box 10000 A rms with external EMO box
Short Circuit Current Ratio (SCCR)	3.5 kA
Momentary interruption	Less than a half cycle
Overvoltage Category [▸ 20]	classified as II wired to a safety switch
Protection class	I (permanently earthed)

Fig. 6: Kit 349500-8104-000

If the microscope is to be delivered with additional options, please discuss the additional requirements for these options with a ZEISS service representative. The options may require additional health and safety considerations, space, power points or other resources.

Electrical Supplies with Eaton UPS (option)

If the site requires an UPS, refer to the following table for information on the recommended EATON UPS. If a different UPS is used, please contact the supplier for information.

	Value
Nominal AC voltage	L1/N/PE 230 VAC ± 10 % L1/L2/PE 208 VAC ± 10 %
Nominal frequency	50 / 60 Hz
Power consumption (typical)	1-3 kVA, dependent on accessories
Addition building PE	The system must be connected to a building earth point at all times.
Accessories mains power	3 standard local 120 V or 230 V mains sockets (13 A)
Maximum current	21.7 A at 230 V (PW9130i5000T-XL) 26.1 A at 230 V (PW9130i6000T-XL)
Circuit breaker	Two pole circuit breaker is mandatory. 40 A (Type D) according to IEC EN 60898 Installations making use of the EATON UPS recommended by ZEISS, will require a RCD (Residual Current Device) of maximum 300 mA. Check the RCD recommendations for any other brand of UPS that may be used. 
Overvoltage Category [▸ 20]	classified as II wired to a safety switch
Protection class	I (permanently earthed)

2.3.1 SEMI Compliance

For full SEMI (Semiconductor Equipment and Materials International) compliance, ordering and installing the external EMO box is mandatory. All components where the electrical supply voltage shall be cut-off must be connected to the EMO box outlets or the outlets of the AC-unit of the electron microscope.

2.3.2 Overvoltage Category

The IEC defined the term Overvoltage Category (sometimes referred to as Installation Category) to address transient voltages. Category IV devices can handle the largest transients relative to the normal working voltage. Category I devices can handle only small transients.

Voltage transients are defined as short duration surges of electrical energy. Repeatable transients are frequently caused by the operation of motors, generators, or the switching of reactive circuit components. Random transients, on the other hand, are often caused by lightning and electrostatic discharge. Ensure that the possibility of transient voltages on the mains line are minimal to prevent damage to the system.

	Max. transient voltage in V		
Nominal Voltage (VAC)	**Category I**	**Category II**	**Category III**
50	330	500	800
100	500	800	1500
150	800	1500	2500
300	1500	2500	4000
600	2500	4000	6000
1000	4000	6000	8000

Tab. 7: IEC Definitions of tolerated Transient Voltages for each Overvoltage Category

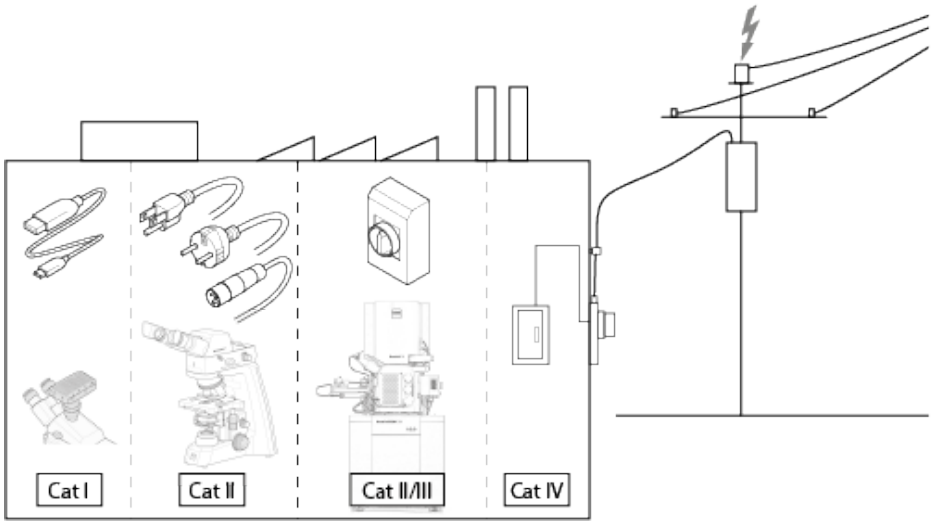


Fig. 7: Overvoltage Categories for plugs

Category	Description
I	For connection to circuits in which measures are taken to limit transient over-voltages to an appropriately low level. Examples: Protected electronic circuits.
II	Equipment intended to be supplied from the building wiring. Applies both to plug-connected equipment and to permanently connected equipment. Examples: Appliances, portable tools, and other household and similar loads. Measurement equipment intended to measure the voltage levels of these loads must be rated at this overvoltage category.

Category	Description
III	Equipment intended to form part of a building wiring installation and for cases where the reliability and the availability of the equipment is subject to special requirements. Examples: Switches in fixed installation and equipment for industrial use with permanent connection to the fixed installation; measurement equipment intended to measure the voltage levels of these fixed installations must be rated at this overvoltage category.
IV	Used at the origin of the installation. Examples: Electricity meters and primary overcurrent protection equipment.

Info

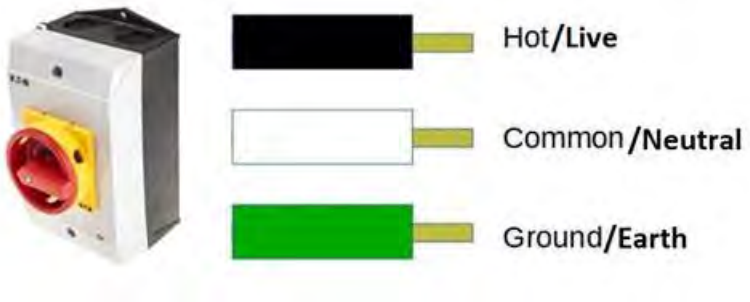
For further information on Overvoltage Categories refer to EN 60664-1.

2.3.3 Mains Power Plug

The workstation is delivered with a power cord 3x AWG10 UL-style (5 m long) with crimps at the wires for a fixed connection. Those are labeled according to EU standards:

- Black - LIVE
- White - NEUTRAL
- Green - PROTECTIVE EARTH

A fixed connection of the microscope requires an additional mains switch in close proximity to the microscope which complies with IEC 60947-1 and IEC 60947-3 regulations.



Connection with UPS

The workstation is delivered with a power cord 3x AWG10 UL-style (5 m long) with crimps at the wires for fixed connection to the UPS.

The mains connection of the UPS shall also be a fixed connection. Requirements for the wire:

- Minimum diameter 6 mm^2 / AWG10
- Maximum diameter 10 mm^2 / AWG8
- Maximum length 3 m

The fixed connection of the UPS with the microscope requires an additional mains switch in close proximity to the UPS/microscope which complies with IEC 60947-1 and IEC 60947-3 regulations.

2.3.4 Protective Ground

High leakage currents are present in the workstation. Therefore, the workstation has to be connected to an equipotential bonding bar. An exclusive grounding connection to earth must be provided, i.e. the grounding terminal must not be common to other electrical equipment. A grounding wire AWG10 (3 m long) is delivered with the workstation.

The additional protective ground must have a diameter of at least 10 mm^2 for copper and 16 mm^2 for Aluminum according to EN 60204-1.

To avoid offset currents between both protective ground connections of the workstation, a Separate Protective Earth connection according to local regulations is required. It is an auxiliary earth wire between the potential equalization bar/equipotential bonding bar (PA) and the protective ground (PE) of the facility installation close to the microscope's mains connection.

This drawing shows two different possibilities to connect the Separate Protective Earth according to the country's supply voltage. The Separate Protective Earth connection is shown in red. Note that Evo is always connected according to variant 2, even in countries with 110 V supply voltage.

This auxiliary equipotential conductor is in accordance with the German Standard DIN V VDE V 0800-2:2011-06; VDE V 0800-2:2011-06 - Part 2: Equipotential bonding and earthing (additional specifications).

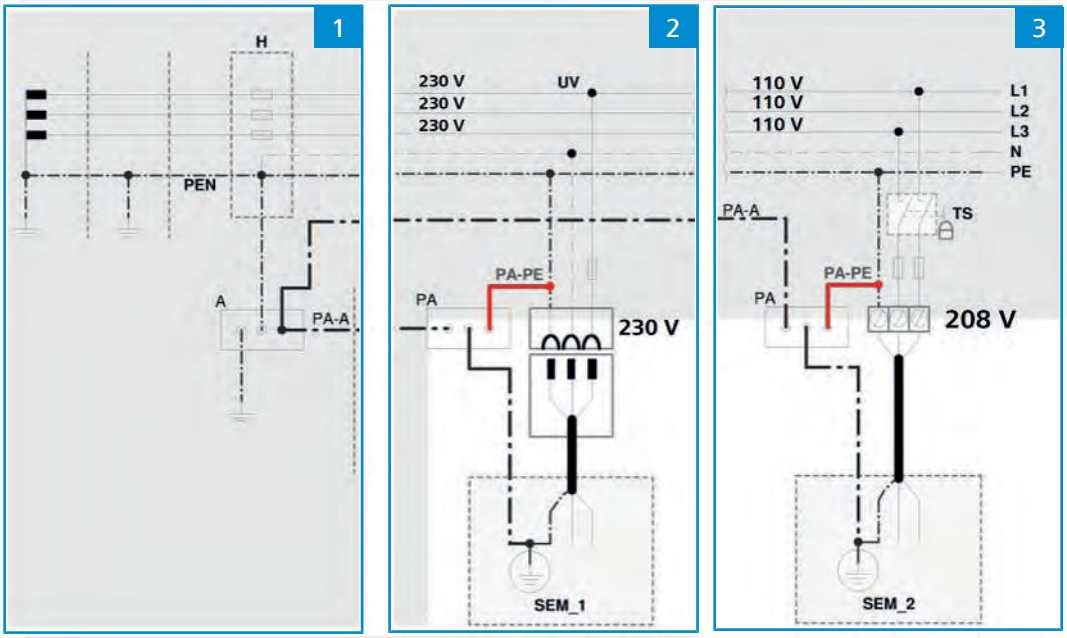


Fig. 8: Separate Protective Earth

1 Common part

2 Connection to 230 V (all microscopes) / 110 V (EVO only) L1/N/PE

3 Fixed Connection 208 V 2/PE (all microscopes except Evo)

PEN	Neutral conductor
A	Main earth distribution
H	Main distribution board
UV	Sub distribution
L1, L2, L3	Phase
N	Neutral conductor
PE	Protective ground

TS	Lockable supply circuit disconnecting device
PA	Equipotential bonding bar
PA-A	Equipotential conductor between PA and A
PA-PE	Auxiliary equipotential conductor between PA and PE at the microscope mains connection
SEM_1	Workstation with plug connection @ 230V L1/N/PE
SEM_2	Workstation with fixed connection @208V L2/PE

Tab. 8: Abbreviations

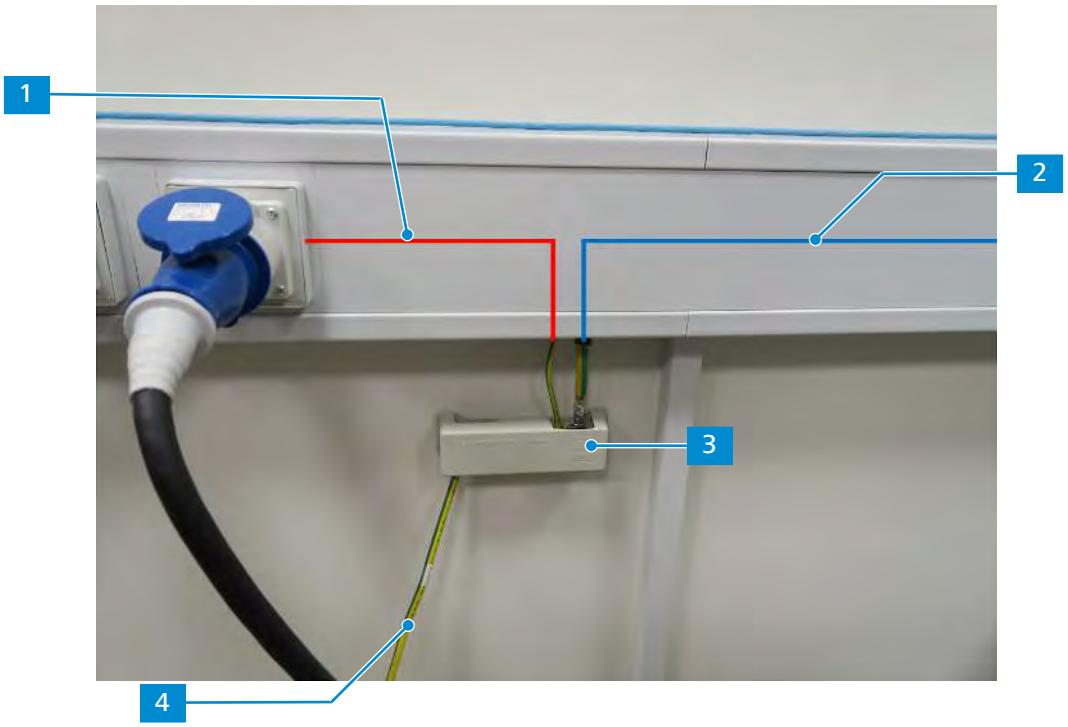


Fig. 9: Separate PE - Example

1	Separate Protective Earth Connection PA-PE	2	Protective Earth PE
3	Potential Equalization Bar/Equipotential Bonding Bar PA	4	Supplied AWG 10 Cable connection to microscope

2.3.5 UPS Requirements

If the site requires a UPS (Uninterruptable Power Supply), please ensure the KVA rating of the UPS meets the ratings of the microscope and all third-party items that may also be connected, e.g. water chiller, air compressor, sample prep equipment, EDS or WDS, etc.

This will ensure that the complete system will continue to function during a blackout or brownout long enough to allow the user to save any experiments and data and to shut off the system properly.

As battery performance deteriorates over time, always overestimate the time (typically 2x) you require for the UPS to maintain power in a blackout (long mains interruption) or brownout (short fluctuation of the mains supply) situation. The UPS only serves to bridge the time of a blackout or brownout until normal mains is restored. Please ensure to switch off the microscope before the batteries run low in a blackout.

UPS Batteries are a consumable item and will need to be replaced over time depending on charge cycles and usage. They are typically not covered under a ZEISS support contract, unless specified.

In areas where the mains supply is very unstable or not very clean, the most stable mode of UPS is the online mode, where the UPS constantly generates the output mains supply.

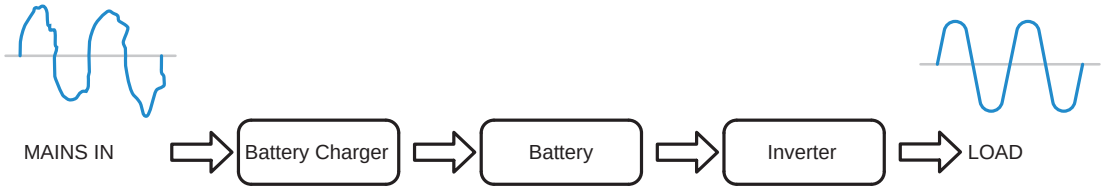


Fig. 10: Block diagram of online UPS

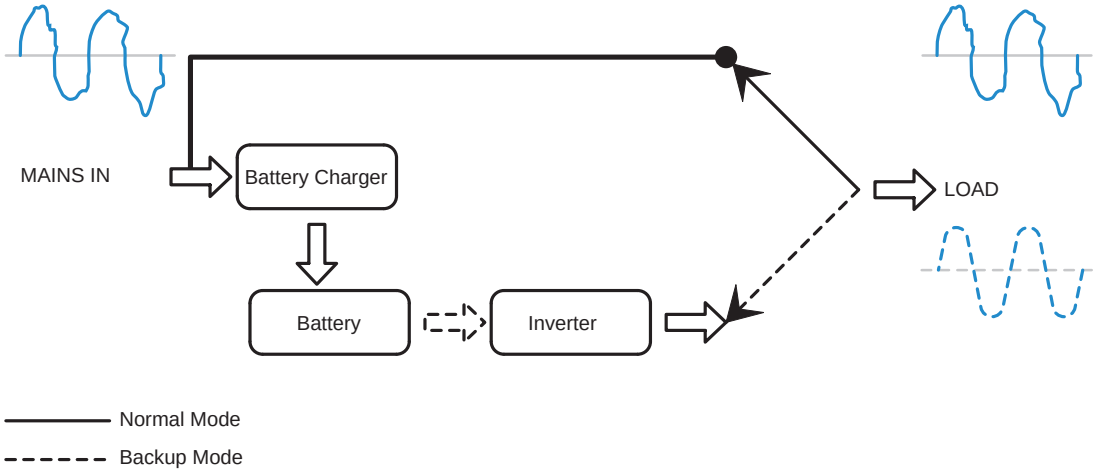


Fig. 11: Block diagram of offline UPS

2.4 Network Connectivity

In order to provide remote diagnostics, ZEISS recommends connecting the computer to the internet in a safe and secured method.

As a guideline, ask your ZEISS service representative about recommendations for data security policy on ZEISS Systems.

Cable type	CAT-6a
Connector type	RJ45 (IEC 60603-7 8P8C Modular connector)
Cable length	Site dependent – customer supplied. Not to exceed total length of 100 m.
Protocol	Ethernet 10BASE-T/100BASE-TX/1000BASE-T

2.4.1 ZEISS Predictive Service

ZEISS Predictive Service is used for condition monitoring by systematic retrieval of relevant instrument health information and its server based processing. The goal is to detect deviations in the instrument performance before they impair the user's result or even result in unplanned downtime. For details, ask the ZEISS service representative about recommendations for data security policy on ZEISS Systems.

For predictive service, we require the above network connectivity and predictive service will operate under the parameters shown in the table below.

Ports	443
Protocols	HTTPS, secure websocket
URL of ZEISS server	predictive-service.zeiss.com
IP addresses	52.174.243.245
Connection security	TLS 1.2 with AES 256 bit
Supported proxy settings for installation	▪ No authentication ▪ Basic authentication ▪ Digest authentication ▪ NTLM authentication
Available and patched local area network connected to ZEISS system PC	RJ 45 connector for LAN
Security patches and measures according to your local IT security standards	e. g. antivirus software, installed and maintained by customer/operator For details, ask your ZEISS Sales & Service Partner about recommendations for data security policy on ZEISS Microscopy Systems.

2.5 Safety and Radiation Information

2.5.1 Biosafety Level of the Laboratory

The customer should inform ZEISS of the biosafety level of the installation site. Access to the system, safety training, correct safety dress code and use of tools and test equipment needs to be clarified for specified laboratories (World Health Organisation Laboratory Biosafety Manual 3).

Biosafety Level	Description
1	Suitable for work with well-characterized agents which do not cause disease in healthy humans. In general, these agents should pose minimal potential hazard to laboratory personnel and the environment.
2	Laboratories maintain the same standard microbial practices as BSL-1 labs, but also includes enhanced measures due to the potential risk of the aforementioned microbes. Personnel working in BSL-2 labs are expected to take even greater care to prevent injuries such as cuts and other breaches of the skin, as well as ingestion and mucous membrane exposures.

Biosafety Level	Description
3	Laboratory typically includes work on microbes that are either indigenous or exotic, and can cause serious or potentially lethal disease through inhalation. Examples of microbes worked within a BSL-3 include yellow fever, West Nile virus, and the bacteria that causes tuberculosis.
4	Labs are rare. However, some do exist in a small number of places in the US and around the world. As the highest level of biological safety, a BSL-4 lab consists of work with highly dangerous and exotic microbes. Infections caused by these types of microbes are frequently fatal, since there are no available treatments or vaccines. Two examples of such microbes include Ebola and Marburg viruses.

Tab. 9: Biosafety Level

2.5.2 Exhaust Line

The exhaust of the pumps can contain harmful fumes from the pumps, samples or special gases used in the GIS. Necessary precautions and services should be arranged by the customer to filter and/or exhaust these fumes out side of the microscope room.

Observe national rules and guidelines.

To connect the pre-pump to the exhaust line, a DN25KF vacum fitting (connector flange with hose) has to be provided (e.g. Pfeiffer Vacuum: part number: 120ASC025-16 Hose Connector, Stainless Steel 304/1.4301, DN 25 ISO-KF).

When samples are processed by laser radiation, gases, aoerosols or dusts can be produced which are dangerous to health.

- The pre-vacuum pump of the laser preparation chamber must be connected to an exhaust line
- A cross piece with DN25 connectors is supplied with the microscope
- Check that sufficient hosing is available

2.5.3 X-Ray Information

X-rays are generated during operation of the microscope. The user must observe the country specific national X-ray regulations on installation, start-up, operation and maintenance of the microscope. The microscope is equipped with several radiation protection devices, which ensure - under regular operation conditions - that the radiation levels are in accordance with the EC Directive 2013/59/Euratom and the German 2018 StrlSchV (Strahlenschutzverordnung). These regulations require that the X-ray dose rate does not exceed 1µSv/h (micro Sievert per hour) at 0.1 m (10 cm) from the microscope. Appropriate X-ray labelling should be attached to the microscope according to the requirements of the local jurisdiction of the country of installation.

2.6 Gas Supplies (where applicable)

Make sure the gas bottles are stored safely in or outside of the building according to local safety and fire safety regulations.

The gas regulators should be supplied by the User.

The connection must be equipped with an appropriate pressure reducer and a main shut-off valve that is secured against accidental re-activation, e.g. a ball valve AKT 10TN88 with optional lock or equivalent. The user is responsible for the installation of a main shut-off valve at the site of installation, he/she should also provide instructions how to operate the main shut-off valves properly. Main shut-off valves have to be easily accessible. They must close off the connections to the corresponding media when needed. The main shut-off valves have to be lockable in their off position in order to prevent accidental re-activation.

Shut-off valves should be mounted near the microscope in such a way that the person actuating or inspecting the shut-off valve is not exposed to risks.

To prepare for the gas connections, it is recommended to discuss with the installation engineer to have converters available (see below) to be able to connect different size hosing depending on what sizing units are standard in your country.

Fig. 12: Converters (example)

2.6.1 Compressed Air

Compressed air is used to operate several valves and the auto levelling system.

The necessary compressed air can be either generated by a compressor (part no. 345596-0000-000) or taken from a gas cylinder or from an in-house supply system.

Typical flow rate	Approx. 12 l/min @ 0.6 MPa pressure during air leveling system inflation
Pressure	0.6 - 0.8 MPa (6 - 8 bar)
Quality	Oil-free ISO 8573-1:2010 Class (7:4:4)
Connection hose	A 10 m long PAN Vo – 8 x 1 hose is supplied. Outside diameter, with fire-retardant, 10 mm. Inside Diameter 6 mm.

Regarding the purity level of the compressed air, please refer to ISO 8573-1:2010, or rather see table below.

ISO 8573-1:2010 Class (7:4:4) is recommended in this case:
for particles class 7, humidity/liquid water class 4 and oil class 4.

Class	Solid particles		Water		Oil
	Max. number of particles per m^3	Mass concentration	Pressure dew point	Liquid	Total oil content (liquid, aerosol and vapour)

	0.1 - 0.5 µm	0.5 - 1 µm	1 - 5 µm	mg/m³	°C	g/m³	mg/m³
0	In accordance with specifications by the device user, stricter requirements than Class 1						
1	≤ 20,000	≤ 400	≤ 10	-	≤ -70	-	0.01
2	≤ 400,000	≤ 6,000	≤ 100	-	≤ -40	-	0.1
3	-	≤ 90,000	≤ 1,000	-	≤ -20	-	1
4	-	-	≤ 10,000	-	**≤ +3**	-	**5**
5	-	-	≤ 100,000	-	≤ +7	-	-
6	-	-	-	≤ 5	≤ +10	-	-
7	-	-	-	**5 - 10**	-	≤ 0.5	-
8	-	-	-	-	-	0.5 - 5	-
9	-	-	-	-	-	5 - 10	-
X	-	-	-	> 10	-	> 10	> 10

System Connection

Quick exchange connector. One is delivered with the microscope.

Facility Installation

The connection must be equipped with an appropriate pressure reducer and a shut-off valve that is secured against accidental re-activation, e.g. a ball valve AKT 10TN88 with optional lock 420-1/4-1/2 (manufacturer: G. Kromschröder AG, Osnabrück, Germany, resp. Kromschroder Inc, Hudson, OH 44236, USA) or equivalent.

The user is responsible for the installation of a main shut-off valve at the site of installation. Main shut-off valves have to be easily accessible. They must close off the connections to the corresponding media when needed. The main shut-off valves have to be lockable in their off position in order to prevent accidental re-activation.

As the user is responsible for installing the main shut-off valves, he/she should also provide instructions how to operate the main shut-off valves properly.

Energy isolating devices should be mounted near the microscope in such a way that the person actuating or inspecting an energy isolating device should not be exposed to any risk.

The compressed-air hose on the microscope side has an external diameter of 8 mm for the facility installation: We use outside calibrated hoses with an outer diameter of 8 mm. (e.g. company Festo, QuickStar series QS; company SMC, series KQ2 or similar). If using a hose connector, it has to be dimensioned for 6 mm inner diameter.

Remarks

Due to acoustic noise and vibrations, the compressor should be installed in a separate room close to the microscope. Make sure there is enough room for air circulation to the sides and at least 100 cm to the back of the compressor. Refer to the manufacturer's documentation for further details.

2.6.2 Nitrogen

Gaseous dry nitrogen is used to ventilate the specimen chamber during specimen exchange. The nitrogen can be taken either from a gas cylinder or from an in-house supply system.

Connection hose	10 m long PUN 8 x 1.75 Outside diameter 8 mm Inside diameter 4.5 mm

Pressure	0.30 - 0.35 MPa (3.0 - 3.5 bar)
Flow rate	Approx. 40 l/min for ventilation of specimen chamber with chamber door open
Quality	4.6 with nitrogen content > 99.996 %
System Connection	Quick exchange connector. One is delivered with the microscope.

2.7 Transport and Storage

Info

The microscope is shipped under vacuum. In order to maintain the vacuum level, it has to be connected to power as soon as possible.

Info

24 hours before installation of the microscope it is required that the boxes be at recommended room temperature to avoid ingress of humidity and to ensure effective stability of the microscope during installation and testing.

The following regulations must be observed before and during transport:

- Use devices (e.g. handles, fork lifts or hand pallet trucks) to transport the microscope safely to the installation room. The microscope may only be transported in air-suspended vehicles. Devices for transporting the microscope must be rated to handle its full weight and dimensions.
- Moving parts must be secured during transport to prevent them from slipping or tipping over.
- Avoid rocking the transport boxes back and forth.
- Note the weight information on the package and on the shipping document.
- Where possible, the original packaging must be used for shipping or transport.

Fork lift and a hand pallet truck

For on-site transport and unloading a fork lift and a hand pallet truck are necessary.

- To remove the microscope from the wooden transport box a forklift has to be used.

  The forklift used must have a sufficient load capacity.
- To move the microscope a narrow gauge hand pallet should be used (less than 600 mm wide to fit between the plinth supports).

  Ensure all hallways and corners are wide enough to be passed with the hand pallet truck.
- Please check the location requirements for door and hallway widths.
- Check the entrance to the building and to the final site for suitable ramps and compliant elevators that can match the weights of the system where necessary.
- Some components, such as the tables, are large, heavy or bulky and may require extra assistance to get the units into the allocated site.

Maximum shock resistance

- Do not drop or bump the boxes during movement or storage. Acceleration must not exceed 10 g.
- Evaluate packaging shock and tilting sensors on delivery and after internal transport.

Allowable temperature

Allowable temperature during transportation to or between sites:

- Between -20 °C and 55 °C for a maximum of 16 hours
- Relative humidity less than 65 %

Allowable temperature during storage at site:

- Between 10 °C and 30 °C
- Relative humidity less than 65 %

With GIS Option The microscope may only be shipped if all precursors have been removed. The precursor has to be shipped separately in a special transport container. For shipment always enclose a print-out of the respective material safety data sheet (MSDS).

Precursor	Temperature
Gold	-20°C
Platinum	< 5°C
XeF_2	< 5°C

Tab. 10: Allowable Temperatures during Storage and Transport

All other reservoirs are allowed to be stored and transported without cooling. However ZEISS recommends to cool all reservoirs during transport.

2.7.1 Floor Stability

Sufficient floor stability is mandatory not only for the installation room, but also for all passage ways and storage areas that may be used to store or move the system along.

Make sure that the whole transport route fulfills the requirement listed below (including hallways and elevators).

Floor loading	>1000 kg/m^2

2.7.2 Weight and Sizes of the Transported Goods

For the weight and sizes of the transported goods for your specific system configuration, please contact your ZEISS Sales & Service Partner.

Below is an example of the transport boxes that may be delivered:

Box contents	Length (mm)	Width (mm)	Height (mm)	Weight (kg)
Main box (Crossbeam)	1550	1560	2200	1300
Main box (Crossbeam with large chamber)	1550	1560	2200	1510
Accessories box	1770	1150	1005	400
FIB Electronics Rack	670	730	1150	113

2.7.3 Weight and Sizes

The tables below give some indication on the approximate weight and sizes of the unpacked items.

Main Components	Size appr. (mm)	Weight (kg)	Distribution of load (kg)	Footprints (mm)
Plinth + column	820 x 1083 x 1750	Crossbeam 350/550: 890/870 Crossbeam 550 L: 1140	Crossbeam 350: 4 × 222.5 Crossbeam 550: 4 × 217.5 Crossbeam 550 L: 4 × 285	4 × Ø 80
Plinth + column + Capella FIB	940 x 1083 x 1750	Crossbeam 350/550: 920 Crossbeam 550 L: 1190	Crossbeam 350: 4 × 230 Crossbeam 550 L: 4 × 297.5	4 × Ø 80
Plinth + column + Capella FIB + 200-mm-airlock	1080 x 1083 x 1750	Crossbeam 350/550: 950 Crossbeam 550 L: 1220	Crossbeam 350: 4 × 238 Crossbeam 550 L: 4 × 305	4 × Ø 80
Plinth + column + 200mm-airlock	960 x 1083 x 1750	Crossbeam 350/550: 900 Crossbeam 550 L: 1170	Crossbeam 350: 4 × 225 Crossbeam 550 L: 4 × 292.5	4 × Ø 80
Plinth + column + Capella FIB + ToF SIMS	940 x 1083 x 1750	Crossbeam 350/550: 956 Crossbeam 550 L: 1226	Crossbeam 350: 4 × 239 Crossbeam 550 L: 4 × 306.5	4 × Ø 80
Plinth + column + Capella FIB + ToF SIMS + 200mm-airlock	1080 x 1083 x 1750	Crossbeam 350/550: 986 Crossbeam 550 L: 1256	Crossbeam 350: 4 × 247 Crossbeam 550 L: 4 × 314	4 × Ø 80
Standard table with PC	1133 x 1076 x 826	85	4 × 21.25	4 × Ø 50
Large table with PC	1600 x 1076 x 826	95	4 × 23.75	4 × Ø 50
Static damping block	180 x 180 x 160	12	1 × 12	180 × 180
Eco quiet mode option	324 diameter x 300	18	1 × 18	32 diameter

Main Components	Size appr. (mm)	Weight (kg)	Distribution of load (kg)	Footprints (mm)
Pre-vacuum pump (depending on system configuration)	430 x 250 x 290	26	1 × 26	200 × 180
FIB rack	560 x 810 x 1600	200	4 x 50	on wheels
ToF SIMS Power Supply	550 x 600 x 660	56	4 x 14	on wheels
Chiller (optional, water- or air-cooled)*	530 x 640 x 740	90	4 x 22.5	on wheels
Compressor*	281 x 139 x 239	25	1 x 25.0	281 x 139

*Depending on the amount of pumps (one or two) needed for the microscope configuration.

3 Additional Requirements for Optional Components

If the microscope is to be delivered with additional options, please discuss the additional requirements for these options with a ZEISS service representative. The options may require additional health and safety considerations, space, power points or other resources.

Company name:	
Address:	
Contact person:	

Option	Requirements fulfilled
EDX Systems	☐
Cryo Options	☐
	☐
	☐
	☐

4 Applicable Standards and Regulations

Observe all general and country-specific safety regulations as well as applicable environmental protection laws and regulations.

The microscope is in compliance with the requirements of the following regulations and directives:

2006/42/EC	Machinery Directive
2011/65/EU and 2015/863	RoHS Directive
2014/30/EU	Electromagnetic Compatibility
EN 60204-1:2018	Safety of machinery – Electrical equipment of machines – Part 1: General requirements
DIN EN 61010-1:2020	Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements
EN IEC 61326-1:2021	Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements
EN ISO 12100:2010	Safety of machinery – General principles for design – Risk assessment and risk reduction
EN ISO 13849-1:2015	Safety of machinery – Safety related parts of control systems – Part 1: General principles for design
EN IEC 63000:2018	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances
DIN EN 60825-1:2022	Safety of laser products - Part 1: Equipment classification and requirements
KS C 9811:2019	Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement
KS C 9610-6-2:2019	Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments

RoHS directive According to directive 2011/65/EU (RoHS) the microscope and its accessories have been classified as instrument category 9 (Monitoring and control instruments including industrial monitoring and control instruments). They also fall under 2012/19/EU (WEEE).

部件名称	有害物质					
	铅（Pb）	汞（Hg）	镉（Cd）	六价铬（Cr(VI)）	多溴联苯（PBB）	多溴二苯醚（PBDE）
Cable and Cable Assy	○	○	○	○	○	○
Electronics	○	○	○	○	○	○
Optics	×	○	○	○	○	○

Metals	×	○	○	○	○	○
Plastics	○	○	○	○	○	○

本表格依据SJ/T 11364的规定编制。

○: 表示该有害物质在该部件所有均质材料中的含量均在GB/T 26572规定的限量要求以下。

×: 表示该有害物质至少在该部件的某一均质材料中的含量超出GB/T 26572规定的限量要求。

（企业可在此处，根据实际情况对上表打"×"的技术原因进行进一步说明。）

Korea EMC environment

The following EMC user notice is for Korea only:

기종별	사용자안내문
A급기기(업무용방송통신기자재)	이기기는업무용(A급) 전자파적합기기로서 판매자또는사용자는이점을주의하시기바라며, 가정외의지역에서사용하는것을목적으로합니다.

Brochures and Certificates

For brochures, certificates (e.g. ISO, CSA, SEMI), and declarations of conformity (e.g. EU, UK) ask your ZEISS Sales & Service Partner.

Environment Management System

ZEISS works according to a certified Environment Management System according to ISO 14001. The microscope and its components were developed, tested, and produced in accordance with the valid regulations and guidelines for environmental law of the European Union.

5 Responsibility Checklist

The following is a checklist summarizing the requirements from the preceding sections of this document. The customer should internally evaluate the proposed site to verify its compatibility with all the requirements presented in this document. A ZEISS service representative can assist with the checklist to evaluate which requirements are already met, and which requirements are yet to be completed. ZEISS can be requested to assist with the checking of the environmental conditions.

Environmental conditions in and around a system can change with time due to various changes to the building, new equipment being installed or other reasons. Should the environmental conditions change due to changes to the building or other potential external influence after a site inspection was done, the customer should notify ZEISS to potentially redo the environmental inspection.

Company name:	
Address:	
Contact person:	

Requirements	Fulfillment				Comments
	Yes (Checked and complete)	Partially (Partially fulfilled)	No (Checked but not fulfilled)	N/A (not applicable)	
Environmental Requirements	☐	☐	☐	☐	
▪ Acoustic noise	☐	☐	☐	☐	
▪ Air Quality	☐	☐	☐	☐	
▪ Electromagnetic Compatibility	☐	☐	☐	☐	
▪ Magnetic Field	☐	☐	☐	☐	
▪ Vibration	☐	☐	☐	☐	
Location Requirements	☐	☐	☐	☐	
▪ Installation Plan	☐	☐	☐	☐	
▪ Space Requirements	☐	☐	☐	☐	
▪ Air Conditioning	☐	☐	☐	☐	
▪ Earthing	☐	☐	☐	☐	
Mains Connection	☐	☐	☐	☐	
Network Connection	☐	☐	☐	☐	
Safety and Radiation Information	☐	☐	☐	☐	
▪ X-Ray	☐	☐	☐	☐	
▪ Laser Safety	☐	☐	☐	☐	

Requirements	Fulfillment				Comments
	Yes (Checked and complete)	Partially (Partially fulfilled)	No (Checked but not fulfilled)	N/A (not applicable)	
▪ Biosafety Level of the Laboratory	☐	☐	☐	☐	
Cooling Water Supply	☐	☐	☐	☐	
▪ Cooling liquid and/or chemicals	☐	☐	☐	☐	
Exhaust Line	☐	☐	☐	☐	
Gas Supplies	☐	☐	☐	☐	
▪ Compressed Air	☐	☐	☐	☐	
▪ Nitrogen	☐	☐	☐	☐	
▪ Additional Gas	☐	☐	☐	☐	
Transport, storage and floor load	☐	☐	☐	☐	

Place, date	Name	Signature

The above signature conveys that the Installation Requirements have been read and understood. The customer further understands that some of these requirements are necessary to help assure the safety of personnel, or to prevent damage to the equipment or the facility. The customer further understands that some of the requirements must be fulfilled in order for the equipment to meet its full performance capabilities and for the equipment to be successfully installed.

Comments:

Space for Comments

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Installation Requirements ZEISS Crossbeam 350, 550, 550L
en-US | Rev. 13 | 10/2023