



Instruction Manual

ZEISS LSM 980

Laser Scanning Microscope - Sensitive, Spectral Confocal
Imaging



ZEISS LSM 980

Original Manual

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1 About this Instruction Manual

This Instruction Manual is considered to be part of the LSM 980, hereinafter referred to as microscope.

This document contains basic steps and safety information that must be observed during operation and maintenance. Therefore, the document must be read by the operator prior to commissioning and must always be available at the place of use of the product.

This document is an essential part of the product and, if the product is resold, the document must remain with the product or be handed over to the new owner.

1.1 Text Conventions and Link Types

Explanation	Example
Software controls and GUI elements.	Click Start .
Hardware controls and elements.	Press the Standby button.
Key on the keyboard.	Press Enter on the keyboard.
Press several keys on the keyboard simultaneously.	Press Ctrl + Alt + Del .
Follow a path in the software.	Select Tools > Goto Control Panel > Airlock .
Text to be entered by the user.	Enter <i>example.pdf</i> in this field.
Anything typed in literally during programming, for example macro codes and keywords.	Enter <code>Integer</code> in the console.
Link to further information within this document.	See: <i>Text Conventions and Link Types</i> [▶ 6].
Link to a website.	https://www.zeiss.com/corporate/int/home.html

1.2 Explanation of Warning Messages and Additional Information

DANGER, WARNING, CAUTION, and NOTICE are standard signal words used to determine the levels of hazards and risks of personal injury and property damage. Not only the safety and warning messages in the **Safety** chapter are to be considered also all safety and warning messages in other chapters. Failure to comply with these instructions and warnings can result in both personal injury and property damage and involve the loss of any claims for damages.

The following warning messages indicating dangerous situations and hazards are used in this document.

DANGER

Type and source of danger

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING**Type and source of danger**

WARNING indicates a potentially hazardous situation which, if not avoided, may result in death or serious injury.

⚠ CAUTION**Type and source of danger**

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTICE**Type and source of danger**

NOTICE indicates a potentially harmful situation which, if not avoided, may result in property damage.

Info

Provides additional information or explanations to help operator better understand the contents of this document.

1.3 Explanation of Symbols

CE marking (Conformité Européene)



CSA label: product tested by CSA to meet U.S. and Canadian standards. CSA approval master number optionally given adjacent to this symbol



UKCA marking (UK conformity assessed)



Manufacturer



Country of manufacture. "CC" is the country code, e.g. "DE" for Germany, "CN" for China. Date of manufacture optionally given adjacent to this symbol



Importer



Serial number



Catalogue number



WEEE label: Do not discard as unsorted waste. Send to separate collection facilities for recovery and recycling

1.4 Further Applicable Documents

Please observe further applicable documents:

Installation Requirements	For more details on technical data, refer to the corresponding Installation Requirements.
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.
	Observe the additional instruction manuals: <ul style="list-style-type: none"> ▪ Definite Focus ▪ Stands (Axio Observer 7, Axio Imager.Z2 or Axio Examiner.Z1) ▪ ELYRA 7 ▪ Illumination units (e.g. X-Cite Xylis, Colibri 5 & 7) ▪ Incubation (e.g. PeCon, Ibidi) ▪ Cameras (e.g. AxioCam) ▪ Scanning stages ▪ Z-Piezo devices ▪ Tunable ultrafast lasers (e.g. Coherent, Spectra) ▪ User PC and monitor
Software	For detailed information on how to use ZEN, refer to its manual (e.g. Online Help, Software Manual) or ask your ZEISS Sales & Service Partner.
Safety Data Sheets	Observe the enclosed safety data sheets. The instructions and guidelines given in the respective safety data sheets must be complied with.
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.

1.5 Contact

If you have any questions or problems, contact your local ZEISS Sales & Service Partner or one of the following addresses:

Headquarters

Phone: +49 1803 33 63 34

Fax: +49 3641 64 3439

Email: info.microscopy.de@zeiss.com

Microscopy Courses, Training, and Education

For information on microscopy courses, training, and education contact us on our homepage (<https://www.zeiss.com/microscopy/int/service-support/training-and-education.html#contact>).

ZEISS Portal

The ZEISS Portal (<https://portal.zeiss.com/>) offers various services that simplify the daily work with your ZEISS systems (machines and software). It is constantly improved and extended to meet your needs and requirements better.

ZEISS Sales & Service Partner

You can find a ZEISS Sales & Service Partner in your area under <https://www.zeiss.com/microscopy/int/website/forms/sales-and-service-contacts.html>.

Service Germany

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2 Safety

This chapter contains general requirements for safe working practices. Any person using the microscope or commissioned with installation or maintenance must read and observe these general safety instructions. Knowledge of basic safety instructions and requirements is a precondition for safe and fault-free operation. Operational safety of the supplied microscope is only ensured if it is operated according to its intended use.

If any work is associated with residual risks, this is mentioned in the relevant parts of this document in a specific note. When components must be handled with special caution, they are marked with a warning label. These warnings must always be observed.

2.1 Intended Use

The LSM 980 as well as its options and accessories have been designed for imaging and optical manipulation of cellular or sub-cellular fluorescence-labelled structures of fixated or live cells in grown cell formations, organs or entire model organisms (for research purposes only, not for medical diagnostics, therapy or treatment).

Please consider that the LSM 980 is a high-precision optical-electronic device. Improper use can quickly lead to an impairment of its functionality or even damage. The manufacturer cannot be held liable for damage caused by incorrect operation, negligence or unauthorized interventions, particularly the removal, modification or exchange of components. Laser safety cannot be guaranteed in such cases. Third-party devices or components that have not explicitly been approved by ZEISS must not be used.

2.1.1 Optical Risk Grouping

According to EN 62471 sources of optical radiation are classified into risk groups subject to their potential photobiological hazard. Sources are classified into the following four groups according to hazard, based on the emission limit as well as permissible exposure time before hazard exceeded.

Risk group	Description
Exempt	No photobiological hazard.
1	No hazard due to normal behavioural limitations on exposure.
2	No hazard due to the aversion response to very bright light sources or thermal discomfort.
3	Hazardous even for momentary exposure.

The following table lists the risk grouping of the available light sources/illumination units according to the mentioned standard:

Light source/Illumination unit	Risk group
Colibri 5 & 7	3 (high risk)
X-Cite Xylis	3 (high risk)
HXP 120 V	3 (high risk)
HAL 100	2 (moderate risk)

2.1.2 EMC Information

The microscope fulfils the EMC requirements according to EN 55011 Class A (intended operation in industrial environments). When using the microscope in residential and smallscale commercial areas, interference with other devices due to wire-based or radiated emissions may occur. Special protective EMC measures must be taken in this case. Own IT-equipment can influence the EMC.

In special circumstances (e.g. nearby X-ray devices) it is possible that the image acquisition will be disturbed. This interference is not damaging to the microscope and is not caused by the defect in the microscope. But the image acquisition can be continued. Image interference can be caused by overvoltage on the power supply line, which can occur, for example, as a result of an indirect lightning bolt. To avoid such interferences, an overvoltage protection can be installed in the facility power system.

The following EMC user notice is for Korea only:

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

2.2 General Safety Information

This document must be read before commissioning in order to ensure safe and uninterrupted operation. Pay particular attention to all listed safety notes. Make sure, that

- the operating personnel has read and understood this manual, associated documents and particularly all safety regulations and instructions, and applies them.
- the local and national safety and accident prevention regulations must be observed, as well as the applicable laws and regulations in your country.
- this document is always available at the place of use of the microscope.
- the microscope is always in perfect condition.
- the microscope is secured against access by unauthorized persons.
- maintenance and repair work, retrofitting, removal or replacement of components, as well as any other intervention in the microscope not described in this document, may only be carried out by the manufacturer ZEISS or persons expressly authorized by ZEISS to do so.

Especially for the operation of the LSM 980 make sure, that

- the microscope is operated only by persons who have been instructed in laser safety.
- the laser safety officer is informed prior to commissioning, if necessary or required by law.

2.2.1 Requirements for Operators

The microscope, components, and accessories may only be operated and maintained by authorized and trained personnel. The microscope may only be used in accordance with this document. If the microscope is not used as described, the safety of the user may be impaired and/or the microscope may be damaged.

Any unauthorized intervention or use other than within the scope of the intended use shall void all rights to warranty claims. The regional regulations on health protection and accident prevention must be observed at all times and during all work on and with the microscope.

Training Authorized ZEISS personnel will provide basic training in operating the microscope, as well as information on equipment safety and maintenance work that can be conducted by the operator. The training will be documented by ZEISS and its completion is to be confirmed by the operator.

Special application training is offered for a fee. Current training dates, additional information and the registration form can be found at <https://www.zeiss.com/microscopy/int/service-support/training-and-education.html>.

2.2.2 Safe Operating Conditions

If circumstances occur which impair safety and cause changes in operating behavior, the microscope must be shut down immediately and a ZEISS service representative should be informed.

The microscope may only be operated after correct installation by a ZEISS service representative and if the operating conditions are adhered to.

- Do not operate the microscope until you have completely read and understood the entire documentation.
- Make sure that all protective cover panels are installed and all warning labels are available and legible.
- Ensure conditions and take measures to prevent the build up of electrostatic charge on the workplace.

The use of operating and calibration equipment or processes other than the equipment and processes mentioned in this manual may result in hazards caused by coherent optical (laser) radiation.

2.2.3 Safe Use of Laser Equipment

The LSM 980 is classified as laser class 3B if no *ultrafast laser* [▶ 79] (laser class 4) is operated. The operator of the laser equipment is responsible for conformance with protective measures and safety requirements. The operation of class 3R, 3B and 4 laser systems must be communicated to the competent authority.

The following measures for safe use of laser equipment are always to be observed:

- Recommendations by the World Health Organization (WHO) on health and safety provisions when handling laser systems.
- If required (by law), the laser safety officer must be informed prior to commissioning of the laser.
- The microscope is operated only by persons who have been trained in laser safety and the effects of laser radiation.
- The microscope is fitted with e.g. a main switch and a key switch. The laser protection keys must be stored in a location to which persons who are not authorized to operate the lasers have no access.
- Never look or reach into the laser beam. This includes attempts to inspect the Sample/Specimen with or without optical instruments.
- Do not introduce reflective objects into the beam path that are not intended for observations with the microscope. Tools, accessories and calibration devices used in the laser area should not have any highly reflective surfaces to prevent dangerous reflections.
- Never remove covers or cover panels during operation.
- Always cover unused positions e.g. ports or in the objective turret.
- Suitable protective measures are required if harmful gases, dust or vapors, secondary radiation or explosive substances could form on the sample due to the laser radiation. The operator of the laser equipment is responsible for conformance with protective measures.
- The laser area is to be kept free from combustible material and the formation of explosive atmospheres is to be prevented. If such materials are required for a specific laser application, only the required minimum quantities may be present in the laser area. Measures to prevent the ignition of these materials are to be implemented.
- The operating personnel has read and understood this manual, associated documents of the external lasers and particularly all safety regulations and instructions, and applies them.

2.2.4 Order and Use of Spare Parts

Using spare parts that are not provided by ZEISS can be hazardous or can lead to property damage.

- Unless authorized by ZEISS, all spare parts should be installed by a ZEISS service representative.
- Contact your ZEISS service representative for information on spare parts order.
- Only genuine parts supplied by ZEISS are to be used in servicing the microscope.

2.3 Prevention of Hazards

This section summarizes potential hazards and recommended safety precautions. Failure to follow the safety instructions and instructions may result in personal injury and property damage.

2.3.1 Mechanical Hazards

Crushing Hazards due to Motorized Components The microscope contains motorized components. Fingers could be trapped. Do not reach into the working area of motorized components when they are in operation.

2.3.2 Electrical Hazards

Voltage Hazards Risk of electric shock in case of contact with live parts.

The microscope must be plugged into a properly installed power socket with protective earth contact using the supplied mains cable. The protective earth connection must not be impaired by the use of extension cables.

Detachable mains supply cords must not be replaced with inadequately rated cords. Always use the power cords supplied by ZEISS. When an unsuitable power cord is used, ZEISS can no longer guarantee the electrical safety and functionality of the microscope.

- Shut down the microscope, when not using the microscope.
- Disconnect the power supply before cleaning.

2.3.3 Thermal Hazards

Heat Accumulation Hazards Covering the ventilation openings can lead to heat accumulation that may damage the microscope and, in extreme cases, can cause a fire.

- Always keep ventilation openings unobstructed.
- Do not obstruct ventilation.
- Comply with minimum distance from walls.
- Do not cover devices or openings emitting heat with any light protection cloth or similar.

In order to be classified as a "flame resistant" material, the light protection cloth must not be washed.

Burning Hazards Hot surfaces, radiation and/or aggressive chemicals can cause burns.

- Use suitable protective equipment / protective clothing if mandatory.
- Always observe the cooling time of the hot surfaces.

2.3.4 Hazards Generated by Radiation

Radiation Hazards There are various radiation hazards that pose risks to people and the environment. In general, the following applies to every type of hazard:

- Avoid exposure of eyes and skin to radiation.
- Do not introduce reflective objects into the beam path.
- Never remove covers or cover panels during operation.
- Do not disable or remove any interlock elements.
- Use suitable protective equipment / protective clothing (e.g. laser safety goggles) if required.

Laser Class 4 Radiation Hazards Lasers with a wavelength above 780 nm cannot be seen by the human eye. This laser type is a high power laser that can be a significantly hazardous to humans and environment in case of unintended use. Laser radiation emitted by class 4 laser devices is so powerful that it must be assumed that any exposure of eyes or skin will cause damage. The laser radiation may cause a fire and explosion hazard.

- The use of laser safety goggles may be required to provide protection from direct, reflected, or diffusely scattered laser radiation. Looking directly into the beam must be avoided, even with protective goggles. The type of protective goggles for your microscope with laser class 4 can be requested from your ZEISS service representative.
- Sufficient measures for protection against fire and explosion hazards are to be taken.
- Before subjecting a material to intense laser radiation, it must be checked whether processes such as vaporizing, combusting or chemical reactions can emit hazardous concentrations of gases, vapors, dust, mists, or explosive mixtures. Class 4 lasers can ignite combustible materials such as fabric or paper. Never introduce such materials into the beam path.
- Never reach into the laser beam in the sample compartment.
- Never remove the housing components of the free beam coupling between the ultrafast laser and the scan module. Otherwise laser radiation class 4 emerges.
- Observe *Safe Use of Laser Equipment* [▶ 12].

Laser Class 3B Radiation Hazards Class 3B lasers can cause severe damage to the human eye if looking directly into the beam. The skin is not damaged from brief exposure.

- Looking directly into the beam is to be avoided, even with protective goggles.
- Use the appropriate protective equipment when working with the microscope.
- Avoid direct exposure of the skin to the light.

Optical Radiation Hazards Gas discharge lights, LED lights and other sources of white light emit strong optical radiation (e.g. UV, VIS, IR). Optical radiation may cause damage to the skin and eyes. The extent of the damage depends on the parameters such as wavelength, exposure time and mode of operation (continuous or pulsed).

2.3.5 Hazards Generated by Materials and Substances

Consumable Hazards Incorrect handling of consumables and cleaning agents can lead to property damage or skin and eye injuries. Consumables that are not approved by ZEISS can lead to property damage. Consult your ZEISS Sales & Service Partner to learn what consumables you can order and how to handle them.

Hazardous Substances The microscope and other components can come into contact with various specimens and substances that can be hazardous to humans and the environment.

- Make sure that the microscope was not in contact with hazardous substances (check the laboratory logbook); otherwise, the microscope must be cleaned/decontaminated/disinfected.
- Check the components also. If necessary, clean the components as meticulously as possible. Label contaminated/infected components that cannot be properly cleaned.
- Contaminated parts shall not be returned to any ZEISS department. Decontaminated parts can be sent to ZEISS accompanied by a signed „Customer Declaration of Decontamination“.
- Wear gloves.

- Infection Hazards** Direct contact with the eyepieces can be a potential way of passing on bacterial and viral infections.
- The risk can be lowered by using personal eyepieces or eyecups. If eyepieces need to be disinfected frequently, ZEISS recommends to use the eyepieces without eyecups.
 - To avoid infections, the use of personal protective equipment (PPE), e.g. gloves, for operation, cleaning, and decontamination is highly recommended. Disposable gloves can be decontaminated with alcohol for example, if necessary, or should be changed frequently to minimize the risk of contamination.
- Flammable Solvents and Specimens** Flammable solvents and specimens may damage the microscope due to high radiation of the laser beam, in extreme cases, can cause fire or explosions.
- Flammable solvents and specimens should not be kept near the microscope.
 - Do not use flammable solvents and specimens.
 - Do not use solvents or specimens which could cause explosions when processed with high energy.
 - Do not use solvents or specimens which could create explosive or easily inflammable dust or gases.
 - Keep a logbook of processed materials.

2.3.6 Ergonomic Hazards

- Prevention of Musculoskeletal Disorders** Musculoskeletal disorders (MSDs) affect the muscles, nerves, blood vessels, ligaments and tendons. Workers in many different industries and occupations can be exposed to risk factors at work, such as lifting heavy items, bending, reaching overhead, pushing and pulling heavy loads, working in awkward body postures and performing the same or similar tasks repetitively. Employers are responsible for providing a safe and healthful workplace for their workers.

2.3.7 Hazards Generated with the Operating Environment

- Dirt, Dust, and Moisture** Dirt, dust, and moisture can impair the microscope's functionality.
- Shut down the microscope whenever it is not used and cover it with a dust protection cover.
 - Always cover unused openings/ports.
 - Perform regular maintenance and cleaning according to the instructions in this manual.
 - Make sure that no cleaning liquid or moisture gets inside the microscope.
 - Make sure that the electrical parts never come into contact with moisture.
 - Never expose the microscope to inadmissible climate conditions (high humidity and temperature).

2.4 Labels and Lights

This chapter shows labels and, where applicable, indicator lights.

All parts that may pose specific hazards are marked with warning labels.

Always observe **all** warning labels!

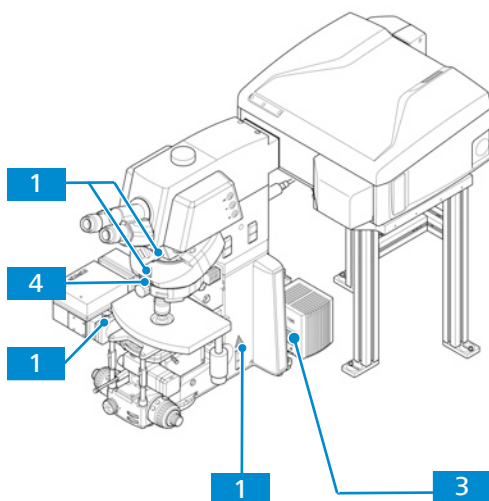
- Check all warning labels for availability and legibility.
- Immediately replace damaged or illegible warning labels.

In case a label is missing please contact your ZEISS service representative for free of charge replacement.

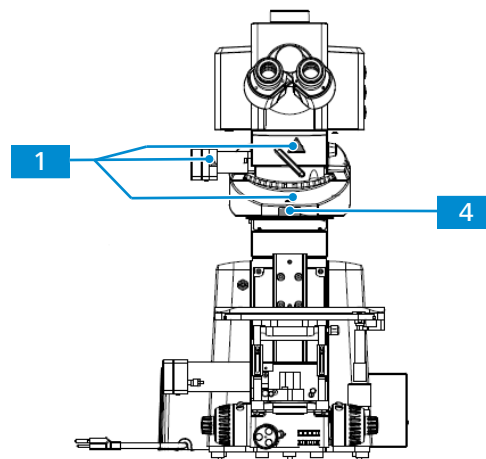
2.4.1 Labels on Stands

The following labels mark hazards and warn e.g. of hazards related to laser radiation, hot surfaces or hand injuries on the stand.

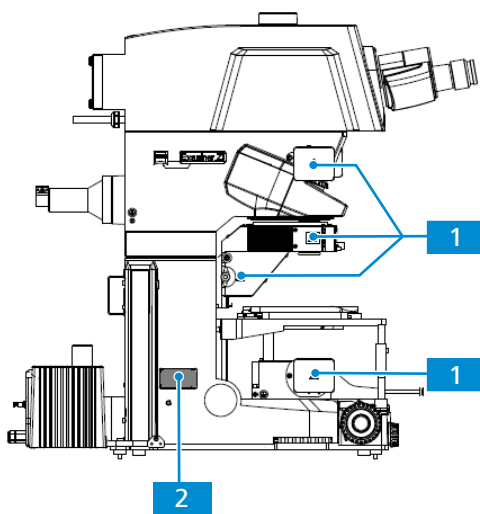
2.4.1.1 Labels on Axio Examiner Z.1



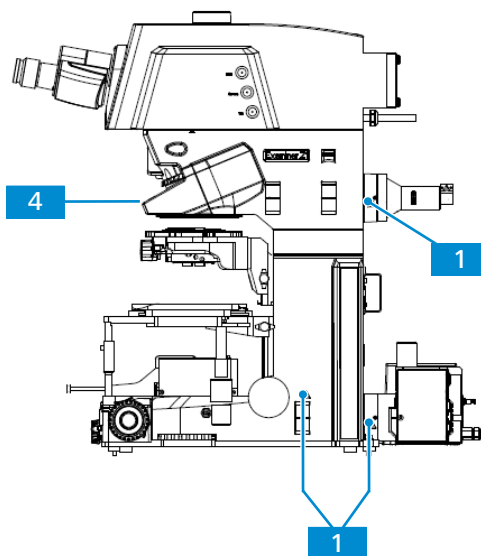
Full view




Front view



Left side view

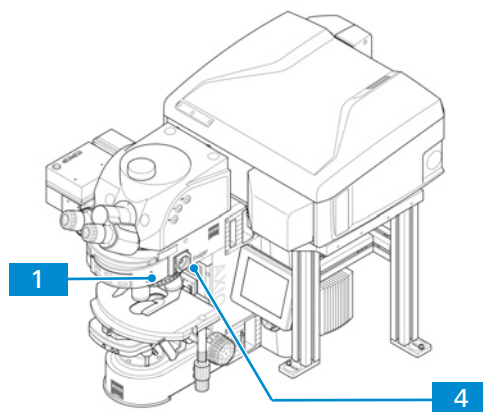


Right side view

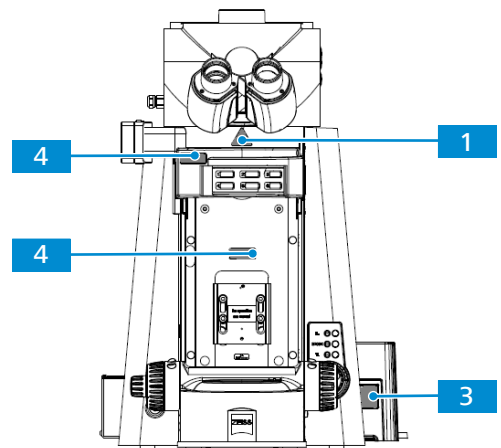
Pos.	Symbol	Description
1		Laser radiation! Avoid exposure to radiation.

Pos.	Symbol	Description
2		<p>DANGER - Visible and invisible class 4 laser radiation!</p> <p>Avoid eye or skin exposure to direct or scattered radiation.</p>
	<p>INFO: USA only.</p>	
3		<p>ATTENTION!</p> <p>Avoid direct irradiation of eyes when cover is open. Switch off lasers before changing the lamp!</p>
4		<p>Laser aperture</p>

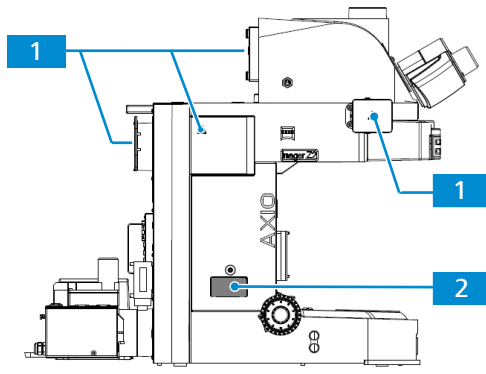
2.4.1.2 Labels on Axio Imager Z.2



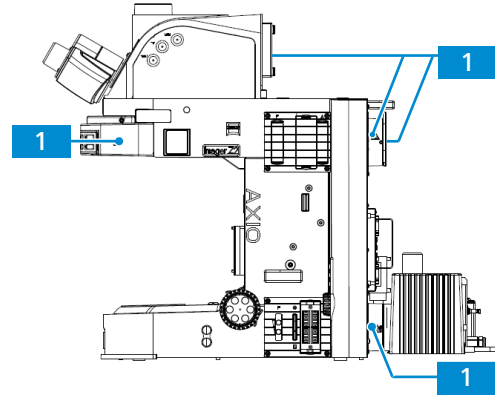
Full view



Front view



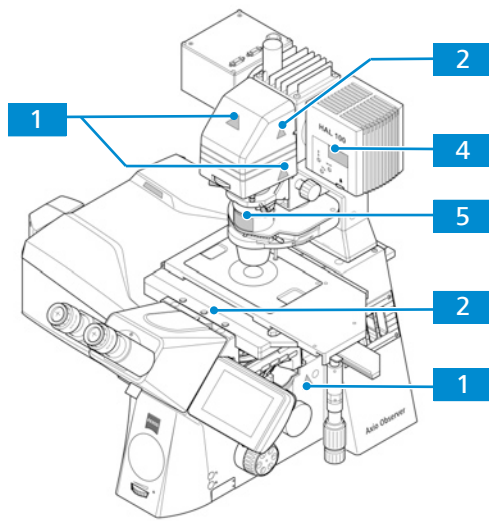
Left side view



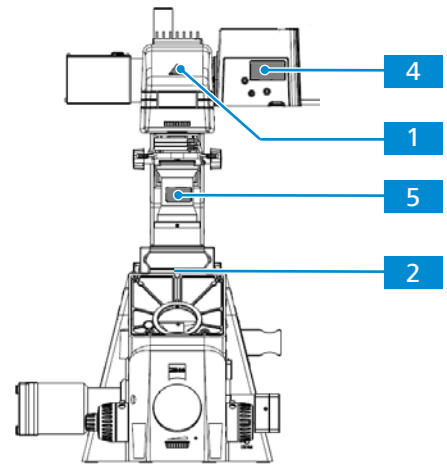
Right side view

Pos.	Symbol	Description
1		Laser radiation! Avoid exposure to radiation.
2		DANGER - Visible and invisible class 4 laser radiation! Avoid eye or skin exposure to direct or scattered radiation.
	<p>INFO: USA only.</p>	
3		ATTENTION! Avoid direct irradiation of eyes when cover is open. Switch off lasers before changing the lamp!
4		Laser aperture

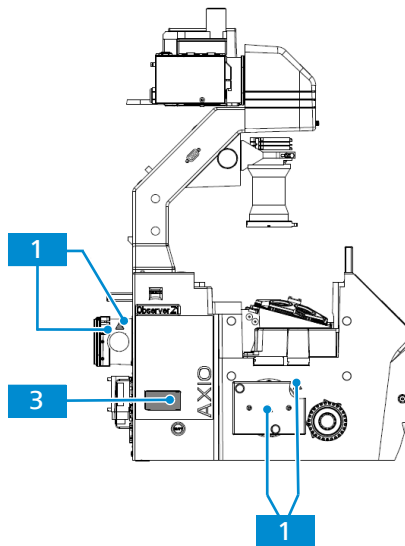
2.4.1.3 Labels on Axio Observer 7



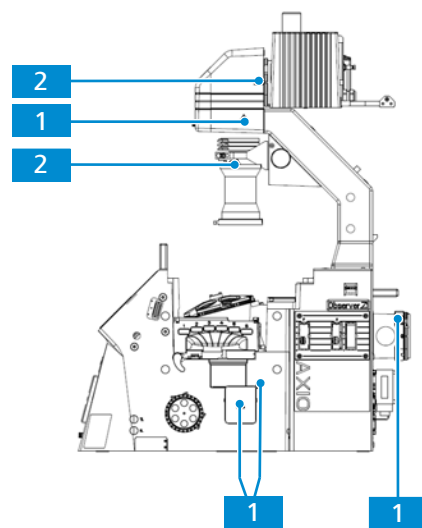
Full view





Front view




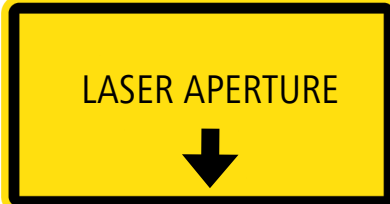
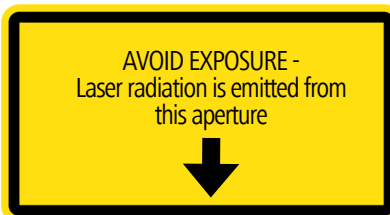


Left side view



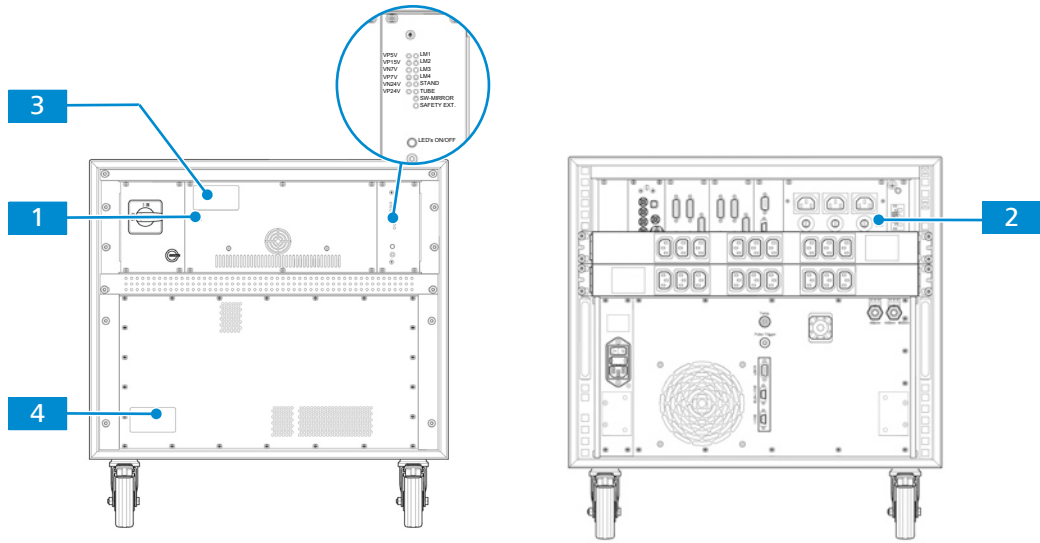
Right side view

Pos.	Symbol	Description
1		Laser radiation! Avoid exposure to radiation.
2		Observe notes in the instruction manual and the supplied documents.

Pos.	Symbol	Description
<p>3</p>	 <p>DANGER VISIBLE AND INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 4 LASER PRODUCT</p> <p>INFO: USA only.</p>  <p>DANGER VISIBLE AND INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION 350 - 1300 nm, max. 3 W CLASS IV LASER PRODUCT</p>	<p>DANGER - Visible and invisible class 4 laser radiation!</p> <p>Avoid eye or skin exposure to direct or scattered radiation.</p>
<p>4</p>	 <p>ATTENTION! Switch off laser before changing the lamp.</p>	<p>ATTENTION!</p> <p>Avoid direct irradiation of eyes when cover is open. Switch off lasers before changing the lamp!</p>
<p>5</p>	 <p>LASER APERTURE</p> <p>INFO: USA only.</p>  <p>AVOID EXPOSURE - Laser radiation is emitted from this aperture</p>	<p>Laser aperture</p>

2.4.2 Labels and Lights on the Laser and Power Supply

The Laser and Power Supply supplies the individual modules with power and processes their safety signals.



Front side

Back side

Pos.	Label or light	Explanation
1		High voltage! Must only be opened by trained electrical engineering personnel.
2		Observe notes in the instruction manual and the supplied documents.
3		Pull the power plug before opening.
4		WARNING - Visible and invisible class 3B laser radiation! Avoid exposure to the beam.

INFO: USA only.



There are LEDs for every safety signal on the front.

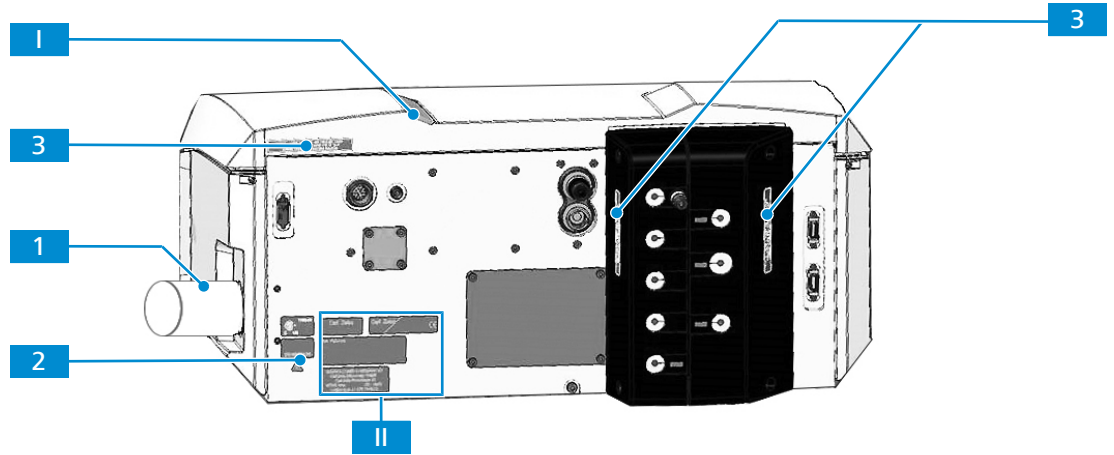
- LM 1: Laser safety LSM scan module
- LM 2: Laser safety AOM box 2 NLO (only with NLO option)
- LM 3: Laser safety ELYRA 7 module (only with ELYRA 7 option)
- LM 4: Laser safety HR laser module (only with ELYRA 7 option)
- STAND: Laser safety microscope stand
- TUBE: Laser safety motorized LSM tube (option)
- SW-MIRROR: Laser safety switching mirror (selector switch between HAL lamp and optional T-PMT detector)
- SAFETY EXT.: Operator-specific laser safety signal, e.g. door contacts on the connection for external safety device.

signal	Meaning
LED lights up continuously	The available components are activated, initialized and operational in a laser-safe state.
LED does not light up	<ul style="list-style-type: none"> ▪ Component not activated. ▪ Component not available. ▪ LED faulty or fault in power supply. Contact your ZEISS service representative.
LED flashes	The connected component is unsafe and safe operation is not possible. Should individual LEDs blink continuously even after LSM operation has been activated in the software, check component and contact your ZEISS service representative if required.
All LEDs flashing	The microscope cannot be operated in a laser-safe manner. Contact your ZEISS service representative.

Tab. 1: Meaning of LEDs on the front of the Laser and Power Supply



2.4.3 Labels and Lights on the LSM Scan Module

A status LED **I** on the LSM scan module lights up when laser radiation is emitted and a scan is executed.

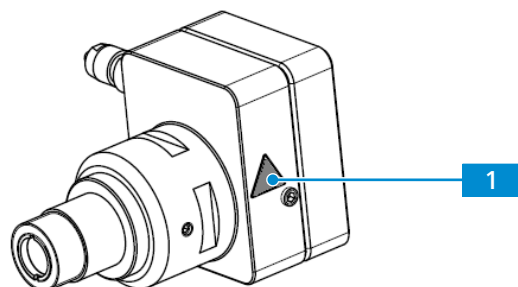



I Status LED

II Information on manufacturer and product

Pos.	Label or light	Explanation
1		Laser radiation! Avoid exposure to radiation. Only available if BiG.2, NIR and/or Airyscan 2 is/are connected to DC-Out port.
2		Observe notes in the instruction manual and the supplied documents.
3	<div data-bbox="507 1361 909 1422" style="border: 1px solid black; padding: 2px;"> <p>DANGER - CLASS 4 VISIBLE AND INVISIBLE LASER RADIATION WHEN OPEN. AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION</p> </div> <p>INFO: USA only.</p> <div data-bbox="507 1534 909 1594" style="border: 1px solid black; padding: 2px;"> <p>DANGER - visible and invisible laser radiation when open. AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION.</p> </div>	<p>Applies to ZEISS service representative. Do not open the covers.</p> <p>DANGER - Visible and invisible class 4 laser radiation when cover is open!</p> <p>Avoid eye or skin exposure to direct or scattered radiation.</p>

2.4.4 Labels on the DC-Out Adapter



Pos.	Label or light	Explanation
1		Laser radiation! Avoid exposure to radiation.

2.4.5 Labels on the Laser Safety Kits

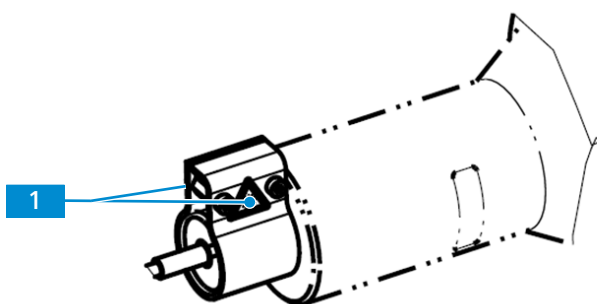


Fig. 1: Warning Label on Laser safety Port Adapter of the Fiber-coupled reflected light illumination

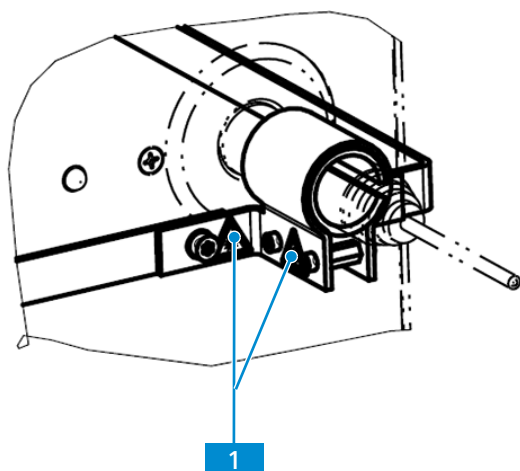


Fig. 2: Warning Label on Laser Safety Adapter for Xylis on both sides

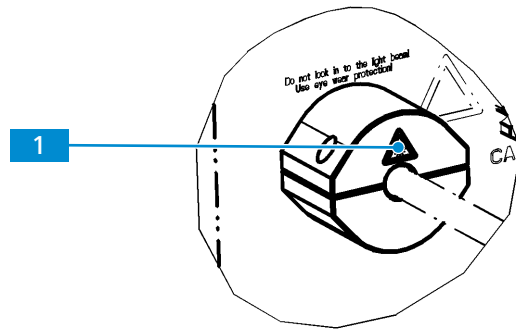

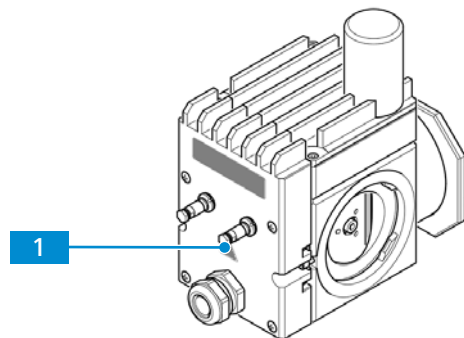



Fig. 3: Warning Label on Locking ring for HXP

Pos.	Label or light	Explanation
1		Laser radiation! Avoid exposure to radiation.

2.4.6 Labels on the Switching Mirror



Pos.	Label or light	Explanation
1		Laser radiation! Avoid exposure to radiation.

2.5 Safety Devices and Interlocks

In order to prevent injuries and/or property damage, the microscope is equipped with several safety devices and interlocks. In case of defect or damage, the affected parts and the microscope must be taken out of operation immediately and must be secured against unintentional use.

To verify the safety of the microscope, contact your ZEISS service representative and keep the service logs and logbooks.

2.5.1 Active Safety Interlocks

The active safety interlocks prevent unintentional emission of light or laser radiation. In case interlock sensors detect unsecured opening of the housing covers and the safety shutter in the LSM scan module is kept shut. The safety interlocks are failsafe according to IEC 61508.

The safety interlock is activated in case of the following actions:

- Transmitted light arm of the Axio Observer 7 tilted back.
- Observation beam path switched to eyepiece (VIS) or camera (TV).
- Access to the reflector turret Axio Imager.Z2, Axio Observer 7 and Axio Examiner.Z1 opened.
- Empty position in the reflector turret of the Axio Imager.Z2, Axio Observer 7 (side port only) and Axio Examiner.Z1.
- *Blind caps* [▶ 26] removed and/or a port is not equipped.
- *External safety interlock* [▶ 27] not active.
- Filter insert removed from BiG.2/NIR.

2.5.2 Blind Caps

Purpose The blind caps prevent unintentional emission of light or laser radiation.

Position Unequipped ports such as those for BiG.2, NIR, T-PMT/T-PMT 2 or HAL 100 as well as the openings for direct coupling of incident light illumination must be closed with blind caps.



Fig. 4: Blind cap for opto-mechanical interfaces with safety sensors

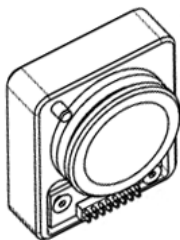


Fig. 5: NDD blind cap for opto-mechanical interface with safety contacts

Function Interlocking with blind caps via opto-mechanical interface works when the sensors at the port are pushed in by the blind cap's pins. Interlocking with NDD blind caps works when the safety contacts are closed. Only when the blind caps are closed, is the microscope in a laser-safe state and can be operated.

2.5.3 Sensors and Contact Pins

Purpose The sensor and contact pins prevent unintentional emission of light or laser radiation.

Position Components such as lights or detectors that are directly coupled to the stand or the motorized switching mirror (not coupled via fiber) are fitted with sensors / sensor rings and complementary contact rings.

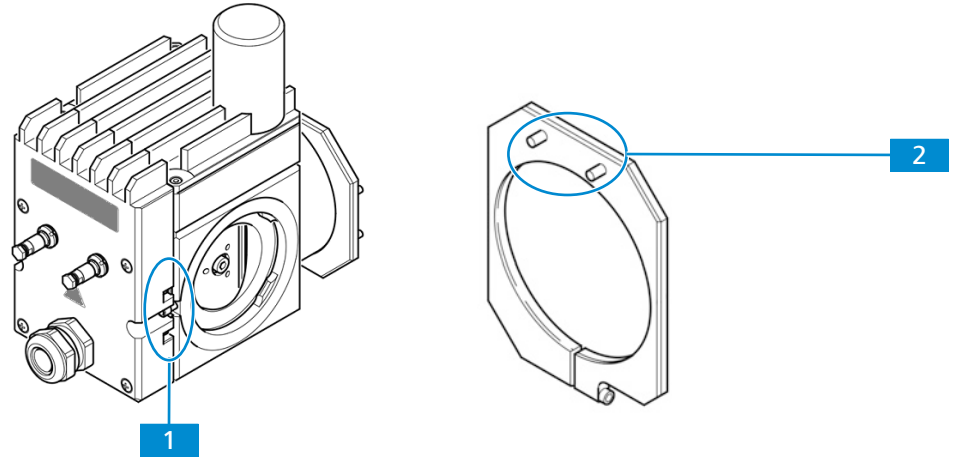


Fig. 6: Sensors on the switching mirror and contact ring with pins

Function Interlocking works when the sensors **1** are pushed in by the pins **2** of the contact ring. The contacts must be closed in order to enable laser-safe operation. Otherwise, the microscope is not laser-safe and operation of the laser is not possible.

2.5.4 Connection for External Safety Device

To connect the microscope to external safety devices for laser safety, they must be connect to the **Safety Interlock** connection. The connection is located on the rear of the laser and power supply unit behind the power strip. The safety interlock connector must either be wired to a dummy or to an external safety device, otherwise the safety interlock will not allow operation of the microscope with lasers.

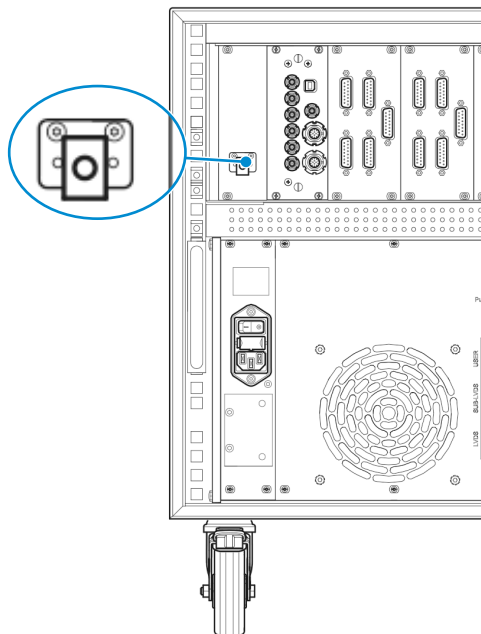


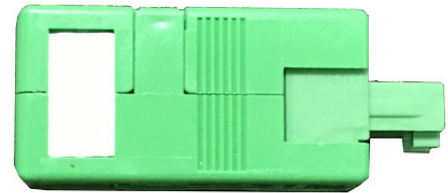
Fig. 7: Safety interlock on the back side of the laser and power supply unit

2.5.4.1 Connecting Safety Interlock

- Procedure**
1. Disconnect the safety interlock connector from the Laser and Power Supply.



2. Remove the connector's cover.



3. Remove jumper wires.
4. Connect wires of the external interlock.
5. Close cover.
6. Connect the safety interlock connector with the Laser and Power Supply.

2.5.5 Laser Safety Kits

The Laser Safety Kits prevent unintentional emission of light or laser radiation. The laser kits are laser safety equipment (e.g. port adapters or locking rings) that must not be removed or modified under any circumstances, otherwise laser safety can no longer be guaranteed.

3 Product and Functional Description

Confocal laser scanning microscopes scan samples sequentially point for point and line for line to create an image. The pixel information is combined to form an image. Optical sections of the sample are scanned with high contrast and high resolution in X, Y and Z direction.

The LSM 980 is available in various configurations and with different lasers.

Info

For additional information and detailed descriptions, refer to further applicable documents or ask your ZEISS Sales & Service Partner.

3.1 Main Components of the LSM 980

The LSM 980 comprises the following main components:

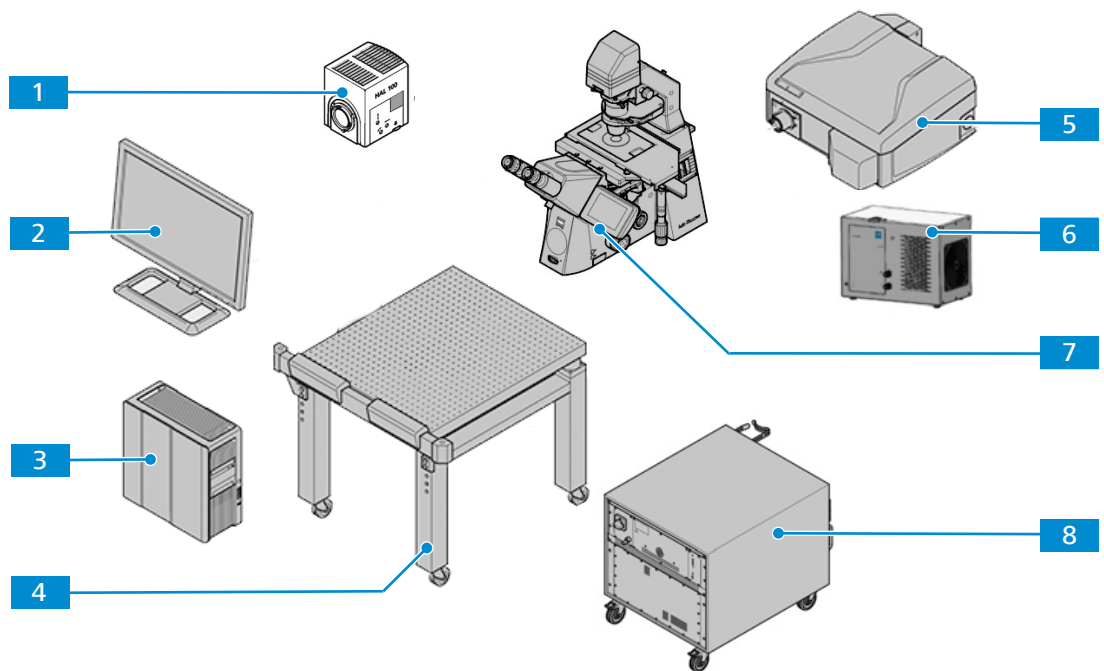


Fig. 8: Main components of the LSM

- | | | | |
|----------|--|----------|------------------------|
| 1 | HAL 100 Light Source [▶ 77] | 2 | TFT monitor |
| 3 | User PC and realtime electronics | 4 | System table |
| 5 | LSM scan module | 6 | Cooling unit |
| 7 | Microscope stand <ul style="list-style-type: none"> ▪ Axio Examiner.Z1 ▪ Axio Imager.Z2 ▪ Axio Observer 7 | 8 | Laser and Power Supply |

3.1.1 Main Switch and Key Switch

Purpose The main switch supplies the microscope and any connected components with power. It is a separator for all system components connected to the electrical connection unit (ECU).

The key switch activates/deactivates the laser beam. The laser and power supply unit must be positioned in such a way that the switches are easy to reach.

Position The switches are located on the front panel of the laser and power supply unit.

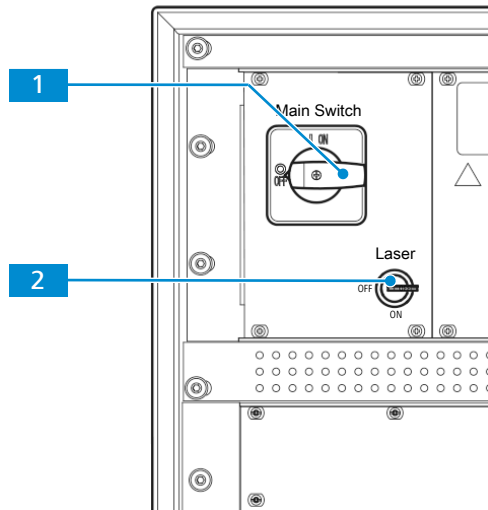


Fig. 9: Main and key switch on the front panel of the Laser and Power Supply

1 Main switch

2 Key switch

Function If the main switch **1** is set to **ON**, the connected components are supplied with power.

If the key switch **2** is set to **ON**, the lasers in the laser and power supply unit are active. No additional (external) lasers that can also be operated with the microscope are activated. If the microscope is not used for a longer time, store the laser protection key in a location to which persons who are not authorized to operate the lasers have no access.

3.1.2 Remote Power Control Switch

Purpose The remote power control switch is to switch electronic components (except system PC and monitor) on and off.

Position It is usually located next to the microscope stand. The switch is connected to the ECU.

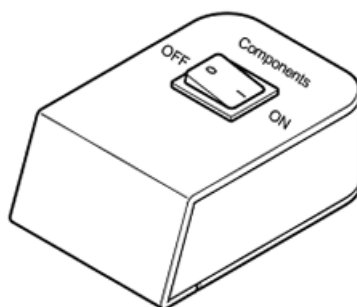


Fig. 10: Remote power control switch

Function The electronic components are supplied with power and initialized depending on the switch position.

3.1.3 Liquid Cooling Unit

Purpose The liquid cooling unit cools the coolant in a cooling circuit.

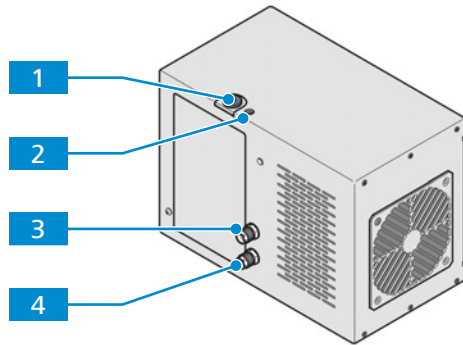


Fig. 11: Liquid cooling unit

1 Filling/refilling port

3 Return line

2 Vent valve

4 Supply line

3.2 Software Description

The microscope is delivered with the actual tested and released version of ZEN (blue edition) software. The software is released with a special version of Windows and a patch. The software version can be upgraded but must not be downgraded. The installed version of the Windows Operating System must not be changed unless released and supported by ZEISS.

Info

Further information on the software and its operation is available in the software's online help.

3.2.1 User Interface

The software user interface is divided into three main areas.

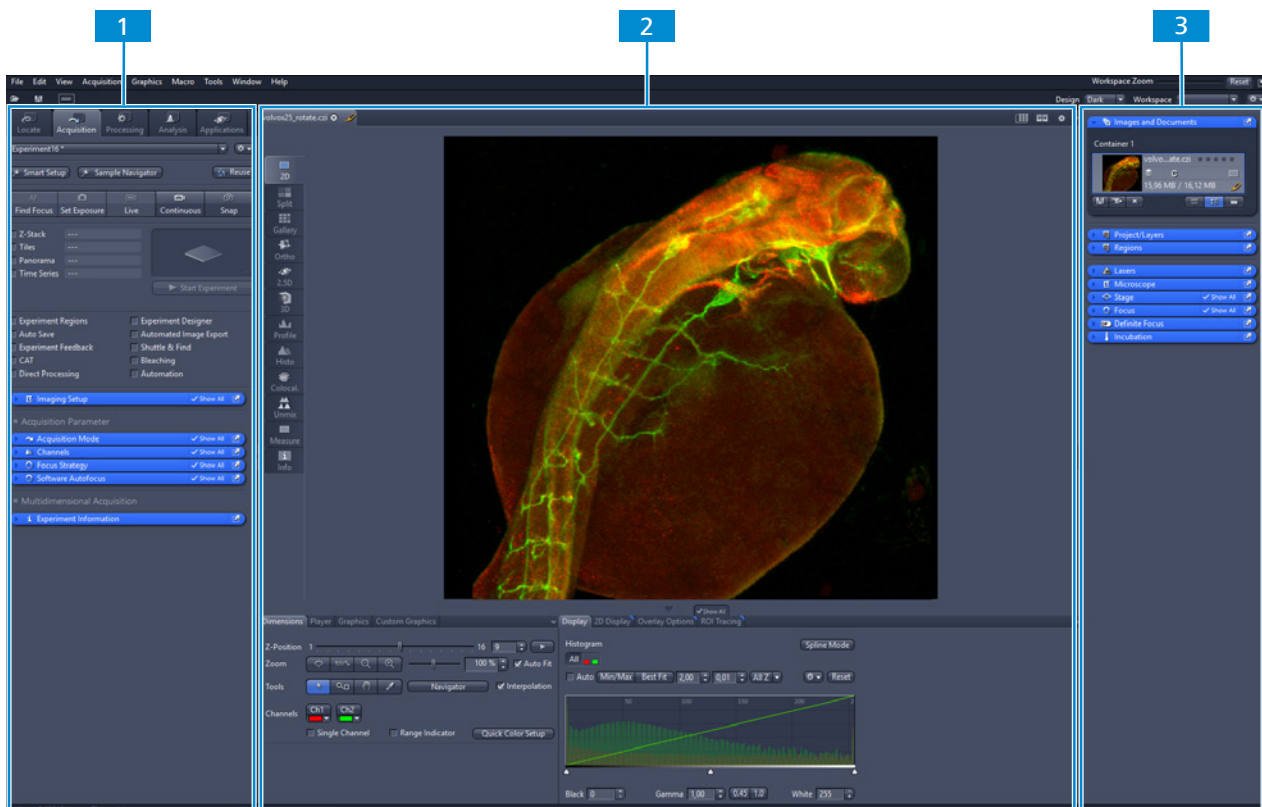


Fig. 12: User interface

1 Left Tool Area

With the tabs you can access all the main tools for microscope control (Locate Tab), acquisition (Acquisition Tab), image processing (Processing Tab), image analysis (Analysis Tab), and applications (Applications Tab).

2 Center Screen Area

This area is used to display your images with several image views available.

3 Right Tool Area

Here you find the Images and Documents Tool, the Objective Selection and the Stage and Focus controls. Additionally system specific tools can be available here (e.g. **Definite Focus** and **ZEN Connect** controls).

3.3 Control Elements and Indicators on the Stand

The description of control elements and indicators on your stand is available in the associated instruction manual.

4 Installation

Installation and commissioning are carried out by an authorized ZEISS service representative. The installation requirements are to be observed and adhered to.

After installation or retrofitting, thoroughly check that the microscope and its components are in a safe operational state, making sure in particular that all protective covers (e.g. protection against laser radiation) have been installed.

5 Operation

This chapter describes switching on/off the microscope as well as the operating steps with the microscope.

Info

For additional information and detailed descriptions, refer to further applicable documents or ask your ZEISS Sales & Service Partner.

Info

Further information on the software and its operation is available in the software's online help.

5.1 Prerequisites for Operation

The following basic prerequisites are necessary for commissioning and operation:

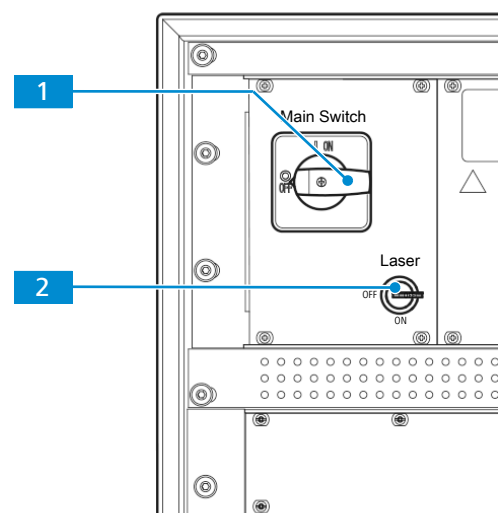
- This document was read prior to commissioning or operation and kept for further use.
- The chapter **Safety** was read and understood.
- The operator is acquainted with the general Windows®-based programs.
- If required: Basic training and safety briefing were successfully completed.

Especially for the operation of the LSM 980 make sure, that

- the laser safety officer is informed prior commissioning.
- the LSM 980 must not be operated without a fully working cooling unit.

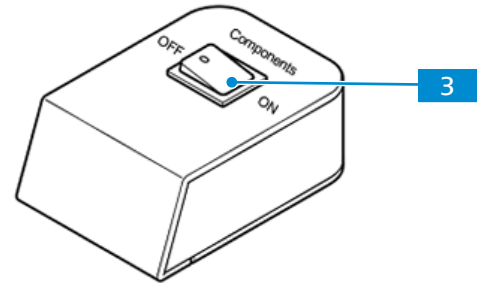
5.2 Switching On the LSM 980

- Procedure**
1. Set the **Main Switch** **1** to **ON**.
 2. Set the **Laser** key switch **2** to **ON**.



3. Switch the computer and monitor on.
4. Enter username and password to log in.
5. Click **OK**.
 - The computer is operational and can be used independently from the microscope.

6. Set the remote power control switch **3** to **ON**.
 - The **Laser ON** LED on the LSM scan module lights up for approx. one minute after initialization. The electronic components are initialized and operational.




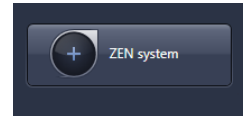
7. Check whether all separately controllable electronic components are switched on.
8. *Start the software* [▶ 35].

5.3 Starting the ZEN Software

- Prerequisite**
- ✓ The microscope is switched on.
 - ✓ Components initialized successfully and operational.

Procedure

1. Double click the **ZEN** icon  on the desktop.
 - The software starts up. The **Start Application** dialog will start after a short time.
2. Click **ZEN system**.



- The hardware is initialized automatically while the program starts and the ZEN program interface is displayed.

5.4 Acquiring a Confocal Image

The image can be acquired in various modes:

- Live (Image cannot be saved. Acquisition mode for optimizing the acquisition parameters.)
- Continuous (Continuous scan of an image. Optimization of acquisition parameters possible.)
- Snap (Acquisition of an individual image.)
- Start experiment (Acquisition in multi-mode, e.g. for time series and Z stacks.)

In order to acquire confocal images, the acquisition parameters must first be set and the experiment must be configured. We recommend using **Smart Setup** as it will automatically provide certain suggestions for the experiment configuration such as Airyscan acquisition or camera-based acquisition.

Info

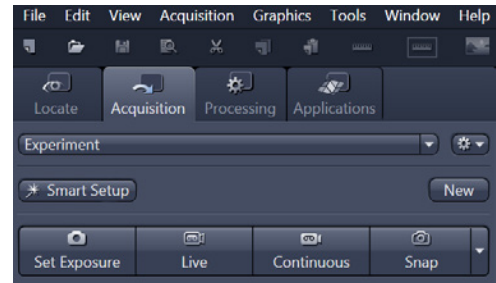
The following instructions are for using **Smart Setup** and to acquire an initial confocal image in the **continuous** mode. As there is a large number of samples (and suitable experiment configurations), this manual only covers the required basics. For more information, see the Online help.

5.4.1 Selecting Coloring and Contrasting Method

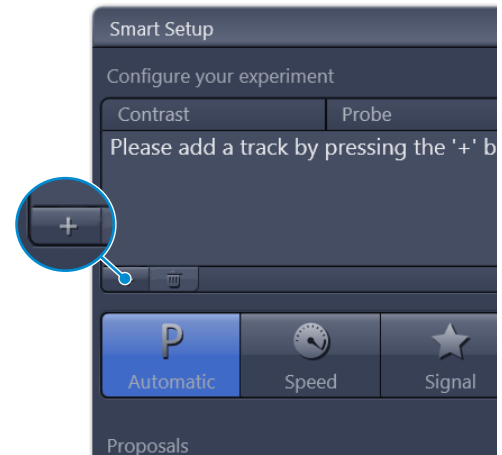
The easiest way to add fluorescence markings for sample coloring is via **Smart Setup**. The coloring can be added from a database library that contains almost all commonly used fluorescence markers. A color configuration table can contain up to four colors.

- Prerequisite**
- ✓ The microscope is switched on and ready for operation.
 - ✓ Software started.

- Procedure**
1. Go to the **Acquisition** tab in the left tool area.



2. Click **Smart Setup**.
 - The **Smart Setup** dialog opens.
3. Click **Add**.
 - The **Add color or contrasting method** dialog opens.

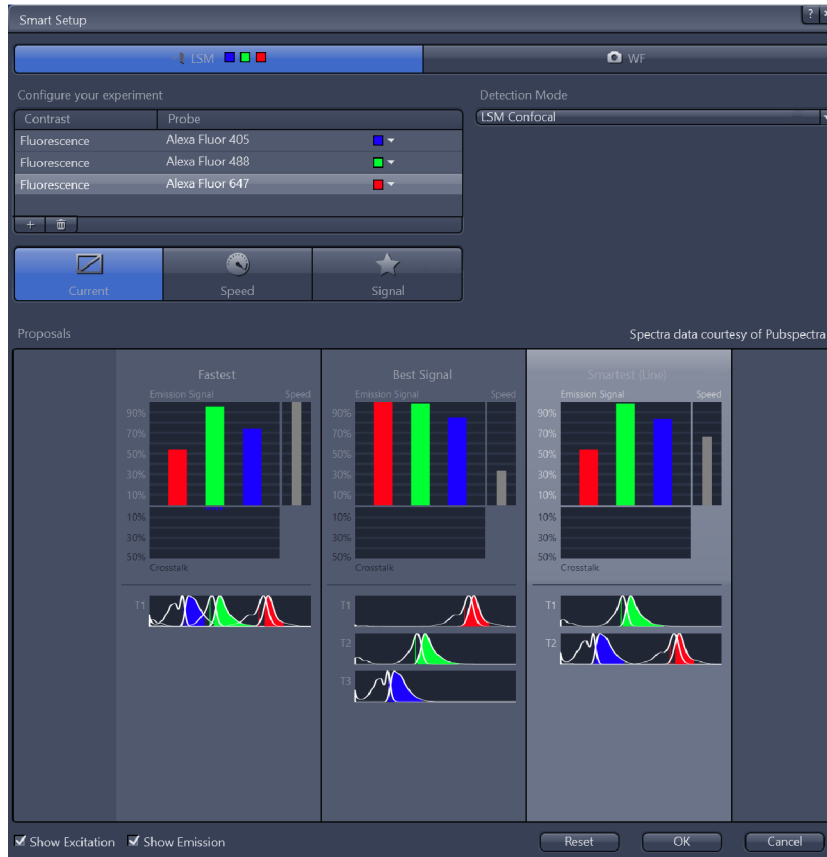


4. Select coloring and contrasting method.
5. Click **Add**.

→ The dialog closes.



6. Click **OK**.

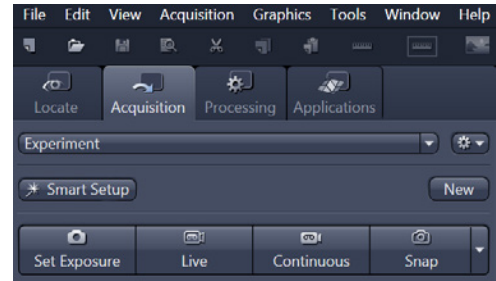


→ Closes **Smart Setup**.

5.4.2 Acquiring and Saving an Image

- Prerequisite**
- ✓ Objective selected.
 - ✓ Suitable immersion medium for the objective used has been applied.
 - ✓ Sample is inserted and in focus.
 - ✓ Coloring and contrasting method is set.

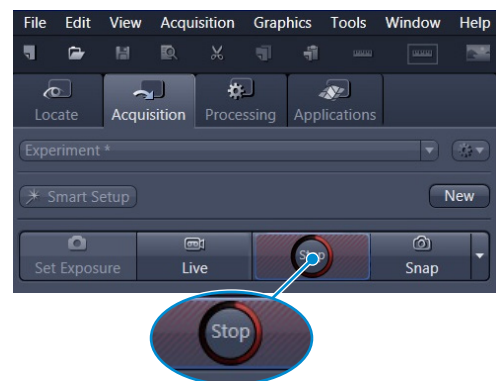
- Procedure** 1. Go to the **Acquisition** tab in the left tool area.



2. Click **Continuous**.
3. Fine-adjust object level.
4. Select an exact point on the sample.
5. Double-click in the central monitor area to center a point in the image.

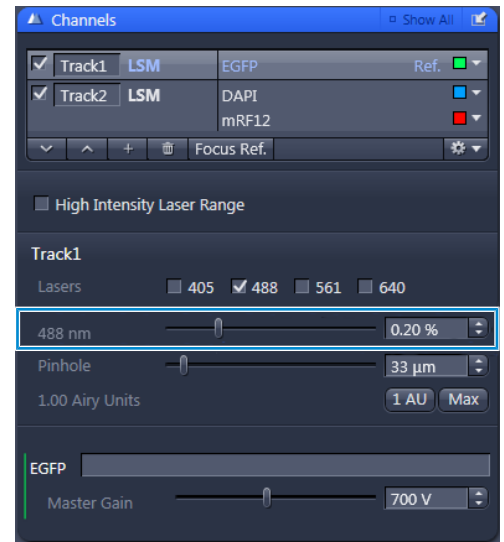
Info If no powered scanning stage is used, these options are not available in the software. In this case, the sample is aligned using the manual drive of the object stage.

6. Click **Stop**.



7. Click **Set Exposure**.
 - Optimizes the gain and offset settings (only the exposure time is adjusted in cameras) of all active channels and tracks, independently from the set laser power.
8. Open **Channels** tool.

- Increase or reduce the laser power with the **laser power** slider of the corresponding fluorescence channel.



- Adjust laser intensity during a running continuous scan as required.
- Click **Snap**.
- Go to **File** menu.
- Click **Save**.

5.5 Closing the ZEN Software

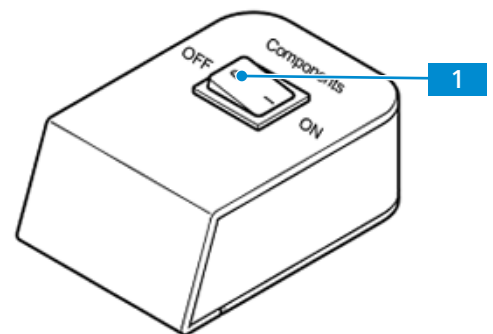
Prerequisite ✓ File saved or discarded.

- Procedure**
- Go to **File** menu.
 - Click **Exit**.

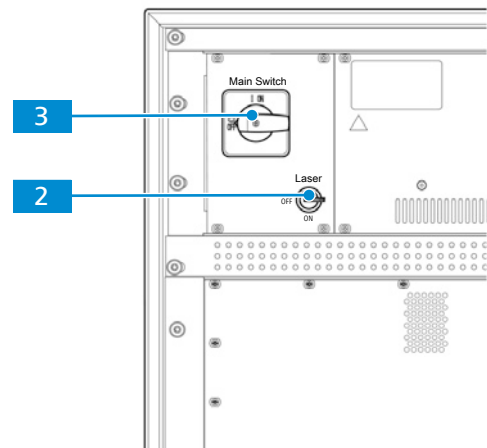
5.6 Switching Off the LSM 980

Prerequisite ✓ Software closed.

- Procedure**
- Shut down the computer and switch off the monitor. **Info** If you want to continue using the computer, make sure that ZEN Service is closed or do not switch off the components within 1 minute after closing the software.
 - Set the **Remote Power Control Switch** **1** to **OFF**.



3. Set the **laser key** switch **2** to **OFF**.



4. Set the **Main Switch** **3** to **OFF**.
→ If **NLO System**: Also set the key switches of the external ultrafast lasers to **OFF**.
5. Cover stand with dust cover after the cooling period.
6. Secure the microscope against unauthorized access.

6 Care and Maintenance

To ensure the best possible performance of the microscope, maintenance must be performed on a regular basis. Please keep the service logs for your microscope.

To maintain operational safety and reliability of the microscope, we recommend entering into a **ZEISS Protect Service Agreement**.

Info

For additional information and detailed descriptions, refer to further applicable documents or ask your ZEISS Sales & Service Partner.

6.1 Safety During Cleaning and Maintenance

Only conduct preventive measures described here. All tasks of maintenance and cleaning not described may only be performed by an authorized ZEISS service representative.

Any unauthorized intervention or any operation outside the scope of the intended use can lead to injuries and property damage and voids all rights to warranty claims. Only original spare parts from ZEISS may be used.

DANGER

Electric shock due to live parts

When the microscope is still switched on, coming in contact with live parts can lead to electric shock or burn.

- ▶ Switch off the microscope prior to opening or cleaning.
- ▶ Disconnect live parts from the power supply.

NOTICE

Functional impairment due to dirt and moisture

Dirt, dust and moisture can impair the microscope functionality and can cause short-circuits.

- ▶ Use the dust protection cover if the microscope is not used.
- ▶ The ventilation slots must be unobstructed at all times.
- ▶ Perform regular maintenance and cleaning according to the instructions in this document and according to the instructions in the applicable documents.
- ▶ Make sure that no cleaning liquid or moisture gets inside the microscope.
- ▶ In case of damage, the affected parts of the microscope must be taken out of operation.

6.2 Maintenance Schedule

The recommended intervals for maintenance depend on the total uptime of the microscope.

Interval	Part/component	Activity
2 - 3 months	Cooling unit	<ul style="list-style-type: none"> ▪ <i>Filling Distilled Water</i> [▶ 43]. <p>If distilled water must be replenished more often, contact your ZEISS service representative.</p>
1 year	Cooling unit	<ul style="list-style-type: none"> ▪ <i>Testing the pH Value</i> [▶ 43].
2 years	Cooling unit	<ul style="list-style-type: none"> ▪ <i>Exchanging the Coolant</i> [▶ 44].
as required	Cleaning	<ul style="list-style-type: none"> ▪ Remove dust and loose particles from visible surfaces using brush, blower brush, cotton buds, optics cleaning cloth or cotton cloth. ▪ Clean surfaces in case of severe contamination. See: <i>Cleaning and Disinfecting Surfaces</i> [▶ 50].
as required	Contamination	<ul style="list-style-type: none"> ▪ Remove any contamination in line with the requirements for accident prevention. See: <i>Decontamination</i> [▶ 57].
as re-quired*	Scanner	<p>Calibrate scanner in the LSM scan module if high speeds (13 and up) are frequently used or if the system is generally heavily used.</p> <ul style="list-style-type: none"> ▪ <i>Calibrating the Scanner</i> [▶ 46].
as required	Pinhole to MBS calibration	<ul style="list-style-type: none"> ▪ <i>Calibrating Pinhole to MBS</i> [▶ 45].
as required	Fuse	<ul style="list-style-type: none"> ▪ Change fuses: <ul style="list-style-type: none"> – <i>Exchanging Fuses in the ECU</i> [▶ 48]. – <i>Exchanging Fuses T 5.0 A/H 250 V of the Laser Module</i> [▶ 49]. – <i>Exchanging Fuses T 10 A/H 250 V for the Power Strip</i> [▶ 47]. <p>If fuses blow frequently, the cause for this must first be found and a possible technical fault must be properly rectified before replacing fuses.</p>

* Scanner needs recalibration if the resulting images look bent or wobbly. This is more obvious when looking at geometric structures like a grid.

Info

Spare Parts are available from your ZEISS service representative.

6.3 Maintenance Work

6.3.1 Servicing the Cooling Unit



The following maintenance work must be performed during running operation. In case of any irregularities in the mechanical components or any unusual noise, the cooling unit is to be switched off immediately and a ZEISS service representative is to be consulted. The microscope must not be operated without a fully functional cooling unit.

If a ZEISS Protect service agreement has been concluded, the ZEISS service representative will take care of this check within the scope of maintenance work conducted.

6.3.1.1 Testing the pH Value

In extended periods of operation, the corrosion protection agents may be used up, leading to a decreasing pH value.

Parts and Tools

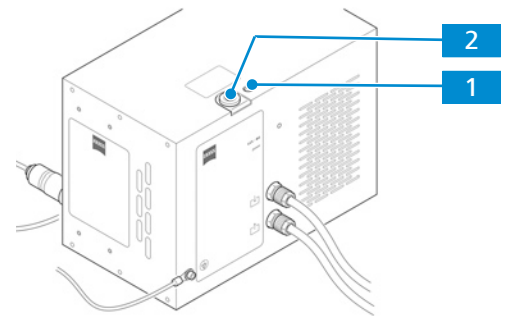
-  Hex Key, 8.0 mm
-  Test kit for coolant

Prerequisite

- ✓ The microscope is switched off.
- ✓ Cooling unit separated from power supply.

Procedure

1. Close the vent valve **1**.



2. Open the refilling port **2**.
3. Remove sample with a pipette.
4. Apply liquid on test strip.
 - The pH value should be between 8 and 9.
 - If the pH value is below 7.7: *Exchanging the Coolant* [[▶ 44](#)].
5. Close the refilling port.
6. Open the vent valve.

6.3.1.2 Filling Distilled Water

Distilled water should not be refilled more often than every two to three months.

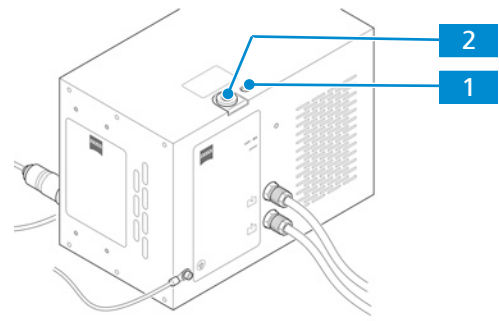
Parts and Tools

-  Hex Key, 8.0 mm
-  Distilled water

Prerequisite

- ✓ The microscope is switched off.
- ✓ Cooling unit separated from power supply.
- ✓ pH value tested and found to be above 7.7.

Procedure 1. Close the vent valve **1**.



2. Open the refilling port **2**.
3. Refill distilled water.
4. Close the refilling port.
5. Open the vent valve.

6.3.1.3 Exchanging the Coolant

If flocculation and deposits occur in the system, it indicates that the cooling circuit has been contaminated or that the service life of the coolant has been exceeded significantly (usually accompanied by a pH value around 7). Complete draining is required and it is recommended to flush the cooling circuit with demineralized water. Flushing should be done immediately after draining. If the coolant requires exchange more often than indicated, a ZEISS service representative must be consulted.

CAUTION

Hazards generated by coolant

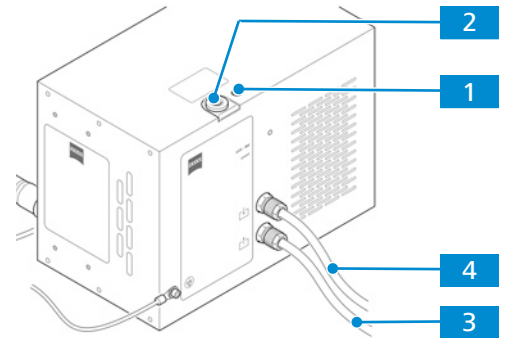
The coolant may be irritating to the skin and mucous membranes. The coolant may break down and release toxic decomposition products in the presence of open fire or hot surfaces. The separate safety data sheet contains additional information.

- ▶ Observe the common safety measures for handling chemicals.
- ▶ Do not swallow coolant.
- ▶ Avoid inhaling vapor/aerosol.
- ▶ Wear hand protection: chemical-resistant protective gloves (EN374).

- Parts and Tools**
- 🔧 Hex Key, 8.0 mm
 - 🔧 Drain hose
 - 🔧 Innovatek Protect IP coolant - 1 liter – 35%

- Prerequisite**
- ✓ The microscope is switched off.
 - ✓ Cooling unit separated from power supply.

- Procedure**
1. Close the vent valve **1**.
 2. Separate the supply **3** and return line **4** from the cooling unit.

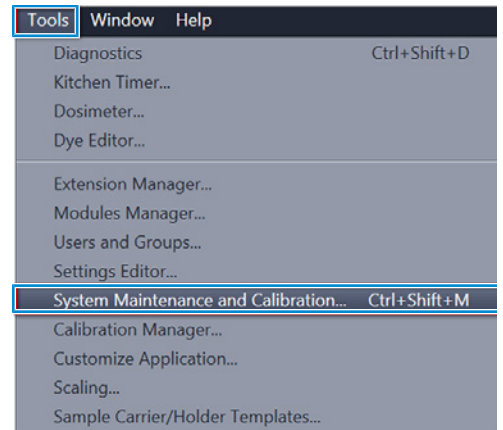


3. Connect the drain hose.
4. Place the hose end in a collection tray.
5. Open the refilling port **2**.
→ Coolant flows out of the cooling unit through the drain hose.
6. Remove the drain hose as soon as the flow of coolant stops.
7. Refill coolant through the refilling port.
8. Connect the supply and return line to the cooling unit.
9. Refill coolant until the max. water level is reached and remains constant.
10. Close the refilling port.
11. Open the vent valve.

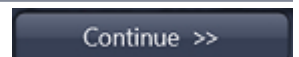
6.3.2 Calibrating

6.3.2.1 Calibrating Pinhole to MBS

- Procedure**
1. Go to **Tools** menu.
 2. Click **System Maintenance and Calibration...**
→ The **System maintenance and calibration** dialog is opened.

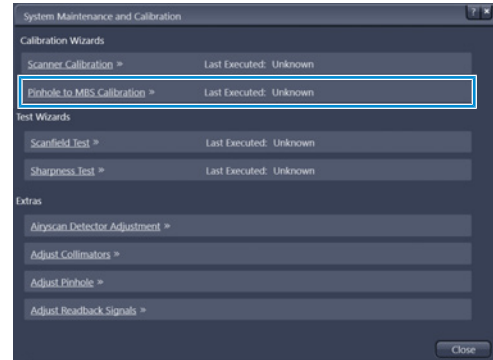


3. Click **Continue >>**.



- The **System maintenance and calibration** dialog shows the available calibration procedures.

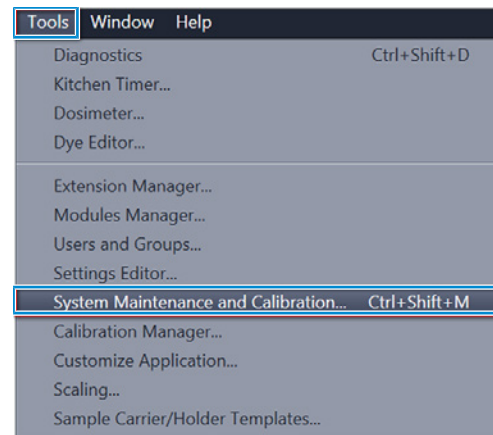
4. Click **Pinhole to MBS Calibration >>**.
→ The calibration wizard is opened.



5. Follow the instructions of the calibration wizard.

6.3.2.2 Calibrating the Scanner

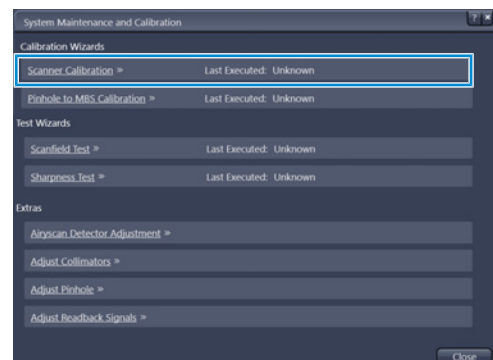
- Procedure**
1. Go to **Tools** menu.
 2. Click **System Maintenance and Calibration...**
→ The **System Maintenance and Calibration** dialog is opened.



3. Select desired user group.
4. Click **Continue >>**.



- The **System Maintenance and Calibration** dialog shows the available calibration procedures.
5. Click **Scanner Calibration >>**.
→ The calibration wizard is opened.



6. Follow the instructions of the calibration wizard.

6.3.3 Exchanging Fuses

WARNING

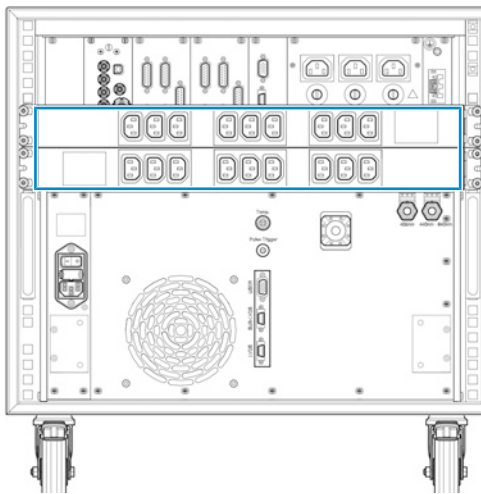
Fire Hazard due to wrong fuses

Fuses with the wrong fuse value can cause smoke or fire.

- ▶ Only use fuses as specified.
- ▶ Disconnect the power supply before cleaning or changing fuses.

6.3.3.1 Exchanging Fuses T 10 A/H 250 V for the Power Strip

The fuses for the power strip are located on the back panel of the Laser and Power Supply. The fuses are located on the side of the power strips where the corresponding cable is connected.



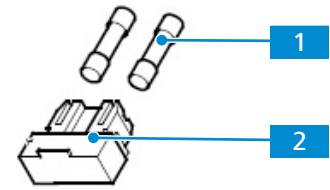
Parts and Tools  2x Fuse type 10A/H/250V

Prerequisite  The microscope separated from power supply.

Procedure 1. Pull the fuse holder from power strip



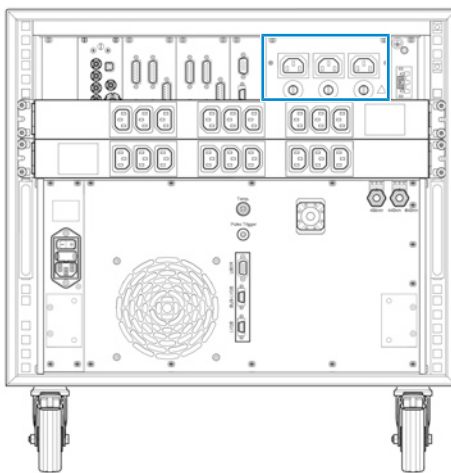
- Remove fuses **1** from the fuse holder **2**.



- Insert new fuses.
- Push the fuse holder back into the fuse compartment until it locks in place.
- Put the microscope back into operation.

6.3.3.2 Exchanging Fuses in the ECU

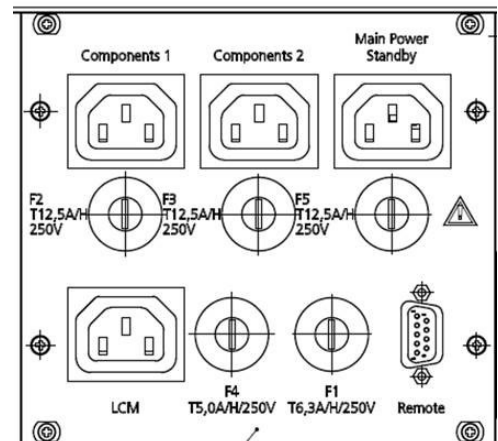
The fuses of the ECU are located on the back panel of the Laser and Power Supply behind the power strips.



- Parts and Tools**
- 1x Fuse type T5.0A/H/250V (F4)
 - 3x Fuse type T12.5A/H/250V (F2, F3, F5)
 - 1x Fuse type T6.3A/H/250V (F1) **NOTICE** For safety purposes, this fuse must be obtained directly from ZEISS!
 - Screwdriver, flat head

Prerequisite The microscope separated from power supply.

- Procedure**
- Open the fuse holder (F1 - F5) with a screwdriver.



- Remove the fuse holder.

- Remove fuses from the fuse holder.



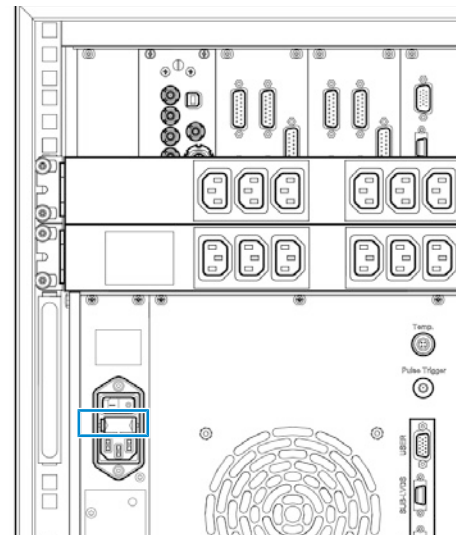
- Insert new fuse.
- Screw the fuse holder back into the fuse compartment as far as possible.
- Put the microscope back into operation.

6.3.3.3 Exchanging Fuses T 5.0 A/H 250 V of the Laser Module

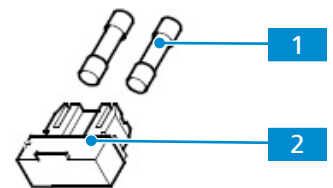
Parts and Tools  2x Fuse type T5A/H

Prerequisite  The microscope separated from power supply.

- Procedure**
- Remove the fuse holder on the back panel of the laser module.



- Remove the fuses  from the fuse holder .



- Insert new fuses.
- Push the fuse holder back into the fuse compartment until it locks in place.
- Put the microscope back into operation.

6.3.4 Cleaning and Disinfecting Surfaces

The type of the contaminated surface and its condition affects the disinfection process:

- smooth and nonporous surfaces are easier to disinfect
- rough, scratched and damaged surfaces can trap biological agents and therefore require a longer contact time or higher concentration of disinfectant.

Surface	Cleaning and disinfecting method
Exterior casing and mechanical external surfaces	<ul style="list-style-type: none"> ▪ <i>Removing Water-soluble Contamination</i> [▶ 51]. ▪ Wipe with a clean cloth that is dampened with a disinfectant. See <i>Disinfecting a Surface</i> [▶ 52].
Internal components and optical surfaces	Only ZEISS service representatives, who have specialized knowledge, are permitted to clean the internal components of the microscope.
Eyepieces	<ul style="list-style-type: none"> ▪ <i>Cleaning an Optical Surface</i> [▶ 51]. ▪ It is recommended to have personal eyepieces and to use safety goggles while operating a microscope. For disinfection, only wipe the external surface of the eyepiece with disinfectant. Frequent disinfection can cause deterioration of the optical coating of the eyepiece lens and can effect the rubber parts (e.g. eyecups). If frequent disinfection is necessary, we recommend omitting the eyecups. <p>NOTICE Never immerse (dip) the entire eyepiece into disinfectant. This will damage the eyepiece and make it unusable.</p> <p>The disinfectant leaves a chemical residue on the surface. To remove the residue, clean the optical surface.</p>
Objective front lens	<ul style="list-style-type: none"> ▪ Gently wipe the front lens using lens paper which is damped in ZEISS Optical Cleaning Solution L. Frequent cleaning can cause deterioration of the coating of the front lens. ▪ See <i>Cleaning an Optical Surface</i> [▶ 51] and the ZEISS brochure The Clean Microscope. NOTICE The material of the objective front lens is sensitive to chemicals. Don't use disinfectant on the front lens.
Soft plastic parts Rubber surfaces	<ul style="list-style-type: none"> ▪ <i>Removing Water-soluble Contamination</i> [▶ 51]. ▪ <i>Disinfecting a Surface</i> [▶ 52]. <p>Discoloration can occur if alcoholic or other disinfectants are used regularly on a rubber surface or soft plastic parts. If the surface is frequently contacted, it is strongly recommended to wear gloves as a preventive measure while operating the microscope.</p>
IT equipment	For disinfection of IT equipment please consult the manufacturer. NOTICE If own IT equipment or accessories are used, this can affect the EMC.
TFT	<ul style="list-style-type: none"> ▪ <i>Removing Water-soluble Contamination</i> [▶ 51]. <p>Wipe with a clean cloth that is slightly dampened with a disinfectant.</p>

The surfaces mentioned above have been tested with the substances specified in this document. Keep in mind that not all components and materials of your microscope can resist chemicals. For example, rubbers, glues, plastic components or surface coatings of optical components could be adversely affected by certain disinfectants.

6.3.4.1 Cleaning an Optical Surface

NOTICE

Damage of optical surfaces due to improper cleaning

- ▶ Remove dust from the optical surface slowly and carefully.
- ▶ Remove dust on optical surfaces with a natural-hair brush or blow it off with a rubber bellows.
- ▶ Avoid touching optical surfaces with fingers.

- Parts and Tools**
- 🔧 Clean cloth
 - 🔧 Cotton swab
 - 🔧 Optical cleaning solution (85% n-hexan and 15 vol% isopropyl alcohol (IPA))
 - 🔧 Lint-free cloth

- Procedure**
1. Moisten a cotton swab or a clean cloth with an optical cleaning solution, if necessary.
 2. Wipe optical surfaces in a circular motion towards the edge of the optics with slight pressure.



WRONG

CORRECT

3. Dry with a lint-free cloth.

6.3.4.2 Removing Water-Soluble Contamination

- Parts and Tools**
- 🔧 Clean cloth
 - 🔧 Lint-free cloth

- Procedure**
1. Moisten a clean cloth with water.
 - A mild detergent may be added to the water (no solvent!).
 2. Wipe off the area with the cloth.
 3. Dry with a lint-free cloth.

6.3.4.3 Disinfecting a Surface

NOTICE

Scratched surfaces due to abrasive compounds

Abrasive compounds can scratch surfaces and thus could have a negative effect on the protective coatings.

- ▶ Never use abrasive compounds or cleaners.

- Parts and Tools**
- 🔧 Disinfectant
 - 🧻 Clean cloth

- Prerequisite**
- ✓ Always read the disinfectant label, safety data sheets and product information before use.
 - ✓ Check surfaces for resistance to the active ingredient solution before disinfection.
 - ✓ Make sure that the surface is clean before disinfection. If necessary, use warm soapy water to clean it before disinfection.
 - ✓ The disinfectant is within its shelf life.
 - ✓ Put on appropriate personal protective equipment (such as: gloves, respiratory protection) necessary to handle contamination and disinfectant.
 - ✓ The microscope is switched off and all components have cooled down.

- Procedure**
1. Moisten the clean cloth with disinfectant. Do not use excessive amounts of disinfectant liquids.
 2. Gently wipe surfaces so that they are completely wetted with the active ingredient solution.
 3. Leave the disinfectant on the surface for the required exposure time. **NOTICE Some disinfectant products may evaporate before the full exposure time passes. If this happens, the disinfectant must be reapplied on the surface and left for the remaining time to ensure that full exposure time is achieved.**
 4. Let the surface dry.
 - Surfaces must not be rubbed dry.
 5. If the disinfectant leaves any chemical residue that could harm skin, damage the surface, or impede proper functionality of the microscope, this residue must be removed.
 6. Dispose any material used during disinfection according to local health and safety regulations.
 7. Wash hands after each disinfection procedure.

6.3.4.4 Cleaning the Light Protection Blanket

- Parts and Tools**
- 🧻 Clean cloth

- Procedure**
1. Carefully brush the light protection blanket.

In case of heavy contamination:

- Procedure**
1. Moisten a clean cloth.
 2. Carefully wipe the light protection blanket.

The light protection blanket must not be washed in order to retain its classification as "flame resistant". A replacement blanket is available from your ZEISS Sales & Service Partner.


7 Troubleshooting

The following table provides information about solving common problems.

Info

If you cannot solve the problem or if you are unsure about a certain technical difficulty, contact your local ZEISS service representative.

Symptom	Cause	Measure
Acoustic signal in the cooling unit	Coolant level too low.	<i>Fill in distilled water [▶ 43].</i>
Error message during/ after ZEN (blue edition) software start-up	Remote power control switch set to OFF .	Set Remote power control switch to ON .
	Electronic component not activated.	Check whether all electronic components are initialized and operational.
Image cannot be acquired in laser operation	Key switch is set to OFF .	Set the key switch to ON .
	Active safety interlocking.	Check <i>safety interlocks [▶ 26]</i> and fix if required.
Image acquisition is disturbed	Image interference can be caused by overvoltage on the power supply line, which can occur, for example, as a result of an indirect lightning strike.	In special circumstances (e.g. overvoltage on the power supply line) it is possible that the image acquisition will be disturbed. This interference is not damaging to the microscope and is not caused by the defect in the microscope. But the image acquisition can be continued. To avoid such interferences, an overvoltage protection can be installed in the facility power system.
Microscope is not reacting	Hardware is switched off.	<i>Switch on the Microscope [▶ 34].</i>
	No voltage supply.	Check whether the microscope is connected to the mains.
	Defective fuse.	Check whether a fuse is defective and replace if required.
The microscope cannot be restarted after a power failure during use	The power failure damaged the microscope.	Contact your ZEISS service representative.

Symptom	Cause	Measure
Hardware failure	<p>A shut down of the hardware when ZEN (blue edition) or ZEN Service are still communicating with the hardware might put the hardware into an undefined state which can lead to severe problems when the system is started the next time, even leading to hardware failure.</p> <p>ZEN Service is running as long as the microscope icon is present on the task bar.</p> 	<ol style="list-style-type: none"> 1. <i>Close the software</i> [▶ 39]. 2. Wait until ZEN Service has shut down. 3. Set the remote power control switch to OFF. 4. <i>Switch on the Microscope and start the software</i> [▶ 34].
Software freezing or software crash	e.g. system overload.	<p>Restart the software:</p> <ol style="list-style-type: none"> 1. <i>Close the software</i> [▶ 39] if not yet shut down. 2. Wait approx. 1 minute. 3. <i>Start the software</i> [▶ 35].

8 Decommissioning and Disposal

This chapter contains information on the decommissioning and disposal of the microscope and its expansions/components or accessories.

8.1 Decommissioning

If the microscope and its components are not used for an extended period of time such as several months, they should be shut down completely and secured against unauthorized access.

Complete decommissioning of the microscope and its components should be executed by your ZEISS service representative.

DANGER

Electric shock due to live parts

When the microscope is still switched on, coming in contact with live parts can lead to electric shock or burn.

- ▶ Switch off the microscope prior to opening or cleaning.
- ▶ Disconnect live parts from the power supply.

- Procedure**
1. Switch off the microscope. [[▶ 39](#)]
 2. Pull the mains plug.
 3. Pull off the laser protection key.

8.2 Transport and Storage

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. In clean-room environments, this check is mandatory. 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.

Info

Detailed information on transport and storage is available from your ZEISS Sales & Service Partner.

Forklift and hand pallet truck For on-site transport and unloading, a forklift and/or a hand pallet truck are necessary.

- Ensure all hallways and corners are wide enough to be passed by.
- Check the entrance to the building and to the final site for suitable ramps and compliant elevators that can match the weights of the microscope 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. Any acceleration shall be < 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 %

Info

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

8.2.1 Weight and Sizes of the Transported Goods

For the weight and dimensions of the shipment boxes for your specific system configuration, please contact your ZEISS Sales & Service Partner.

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

Box	Box contents	Length (mm)	Width (mm)	Height (mm)	Approx. Weight (kg)
Main box 1	Laser and Power Supply unit, LSM scan module, cables	1040	940	1440	134
Main box 2	Microscope Stand	960	890	940	50
Small box for accessories	The content of the boxes depends on the system configuration:	1080	900	820	100 - 300
Large box for accessories	<ul style="list-style-type: none"> System computer LCD TFT monitor LCS cooling unit Additional accessories e.g. Definite Focus, X-Cite Xylis, AxioCam 	1350	900	1000	
Table box	System table, small (depending on the configuration)	1120	1120	1030	134
	System table, medium (depending on the configuration)	1720	1100	1080	219

8.3 Disposal

The microscope and its components must not be disposed of as domestic waste or through municipal disposal companies. They must be disposed of in accordance with applicable regulations (WEEE Directive 2012/19/EU). ZEISS has implemented a system for the return and recycling of devices in member states of the European Union that ensures suitable reuse according to the EU Directives mentioned. The customer is responsible for decontamination.

Info

Detailed information on disposal and recycling is available from your ZEISS Sales & Service Partner.

8.4 Decontamination

A decontamination statement must be submitted before returning any used objects to the ZEISS location.

If reliable decontamination cannot be guaranteed, the hazard must be marked according to applicable regulations. In general, a well-visible warning sign must be affixed to the article itself and to the outside of the packaging, together with detailed information on the type of contamination.

9 Technical Data and Conformity

This chapter contains important technical data as well as information on the conformity.

9.1 Performance Data and Specifications

Compliance with the installation requirements of the LSM 980 and the availability of the requested supplies is the responsibility of the customer and has to be provided at the time of installation.

The microscope must be plugged into a properly installed power socket with protective earth contact using the supplied mains cable. The protective earth connection must not be impaired by the use of extension cables.

Info

Your ZEISS Sales & Service Partner will provide you with the detailed installation requirements.

Location requirements The microscope must only be operated in closed rooms. The microscope should not be installed near radiators or windows with direct sunlight. The microscope must be placed securely on the table surface to prevent slipping and falling.

Compliance with the installation requirements of the microscope and the availability of the requested supplies is the responsibility of the customer and has to be readily available at the time of installation.

Installation site	Exclusively inside buildings and closed rooms It is recommended to install the microscope in a dark room where artificial illumination, sunlight or other light sources cannot interfere with image acquisition. The microscope should not be installed near windows with direct sunlight or radiators.
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Altitude	Max. 2000 m above sea level
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Air conditioning and quality

Optical Resolution Performance

Ambient temperature	22 °C
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Range for best optical performance	± 3 °C
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Reduced optical performance operation (out of range for best optical performance)	15 to 19°C and 25 to 35 °C
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Ambient temperature for reduced performance operation with incubation components from ibidi (out of range for best optical performance)	18 to 19 °C and 25 to 30 °C
---	-----------------------------

Image and Data Stability

Recommended best temperature stability	± 0.5 °C/h
--	------------

Long-term recommended stability	± 2 °C/24h
---------------------------------	------------

General

Relative humidity	< 65 %
Microscope max. heat Dissipation	Max. 1500 W
Warm-up time	1 h
Warm-up time (for highly precise and/or long-term measurements)	≥ 3 h
Pollution degree	2

Weight and sizes The table below gives some indication on the approximate weight and sizes of the unpacked items. The weight of the LSM 980 is approx. 305 - 373 kg. The total weight may be higher, depending on the configuration and the options added.

Main Components	Length (mm)	Width (mm)	Height (mm)	Approx. Weight (kg)
System table:	Size includes corner piece.			
<ul style="list-style-type: none"> ▪ small ▪ air damped ▪ level regulated ▪ pressured air supply necessary ▪ long and short side open with breadboard 	900 (1000)	750 (850)	810 - 870	130
<ul style="list-style-type: none"> ▪ small ▪ air damped ▪ level unregulated ▪ long and short side open with breadboard 	900 (1000)	750 (850)	810 - 870	130
<ul style="list-style-type: none"> ▪ mid size ▪ air damped ▪ level regulated ▪ pressured air supply necessary ▪ long or short side open with breadboard 	1200 (1300)	900 (1000)	810 - 870	180
Microscope stand:				
Axio Examiner.Z1	470	330	720	38
Axio Imager.Z2	500	390	720	40
Axio Observer 7	800	290	700	37 – 47
LCS cooling unit	300	170	220	6.5
LSM scan module	550	450	220	25 - 30
Laser and Power Supply unit	600	500	650	70
System computer	550	200	450	25
LCD TFT monitor	730	240	610	10 - 14

Info

The table for the system computer is provided by the customer. ZEISS recommends a table with the dimensions 1200 x 800 x 750 mm.

Mains connection The microscope must be plugged into a properly installed power socket with protective earth contact using the supplied mains cable. The protective earth connection must not be impaired by the use of extension cables.

Nominal AC voltage	L+N+PE 100 to 127 VAC or 230 VAC \pm 10 %
Nominal frequency	50 - 60 Hz
Main Power Plug	CEE blue, L+N+PE (200 - 230 V, 16 A) NEMA L5-15, L+N+GND (100 - 125 V, 15 A) Optional: CEE red, 3L+N+PE (only one phase used, 200 - 230 V, 16 A) CEE yellow, L+N+PE (100 - 130 V, 16 A)
Power consumption	max. 1600 VA
Max. current	7 A at 230 V 13 A at 120 V
IEC earth class	Class I of IEC 61140 All chassis are connected to electrical earth by the earth cable in the mains cable.
Overvoltage Category	II

Laser data These types of lasers are intended for use in the microscope.

Laser	Laser wavelength (nm)	Class	Typical power ex fiber (mW)	Minimal acceptable power ex fiber (mW)*	Expected lifetime (h)
Diode laser	405	3B	14	10	> 10000
Diode laser	445	3B	7.5	5	> 10000
Diode laser	488	3B	10	7	> 10000
Diode laser	514	3B	10	7	> 10000
DPSS	543	3B	10	7.5	> 10000
DPSS	561	3B	10	7.5	> 10000
DPSS	594	3B	2.5	1.5	> 10000
Diode laser	639	3B	7.5	5	> 10000
Diode laser	730	3B	9.5	6.5	> 10000

*Ex fiber power levels can decrease due to long term external influences on mechanics and optics.

9.2 Arrangement and Installation Plan for LSM 980

Laser devices of classes 1M, 2M, 3A, 3B, 3R and 4 as well as all devices in the beam path are to be arranged or set up in such a way that an unintentional change in their position and beam direction is prevented. Rooms in which lasers are used must be marked with warning signs. Only authorized persons may enter marked rooms, which may also be subject to prior instructions or training. No combustible or explosive materials should be stored in the work room.

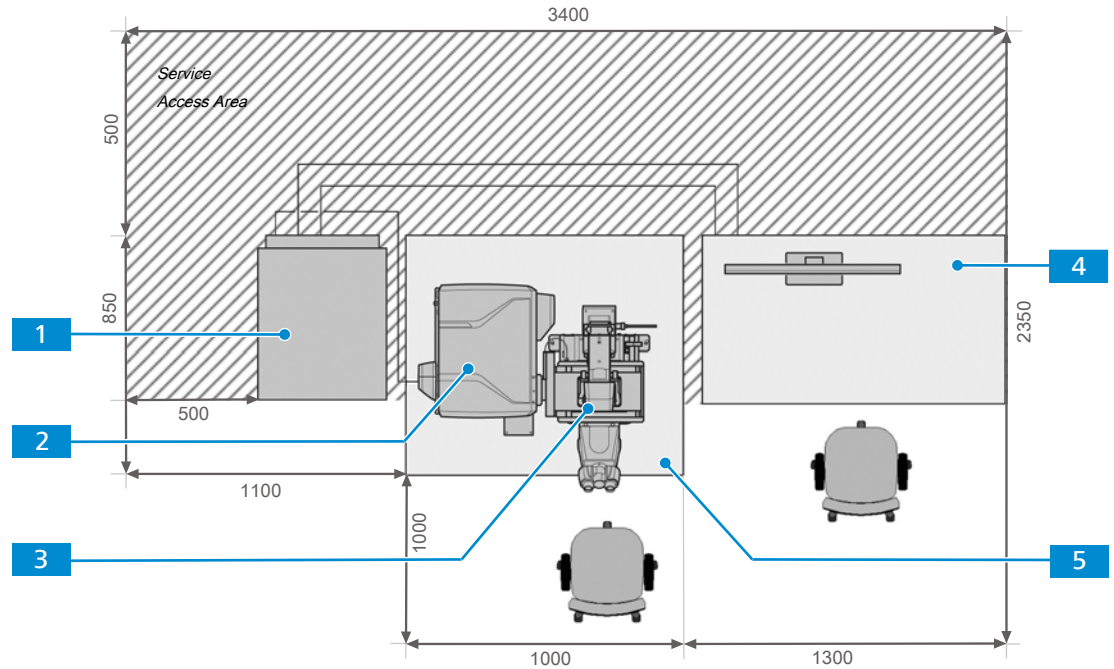


Fig. 13: Arrangement of Axio Observer 7 with LSM 980 on side port

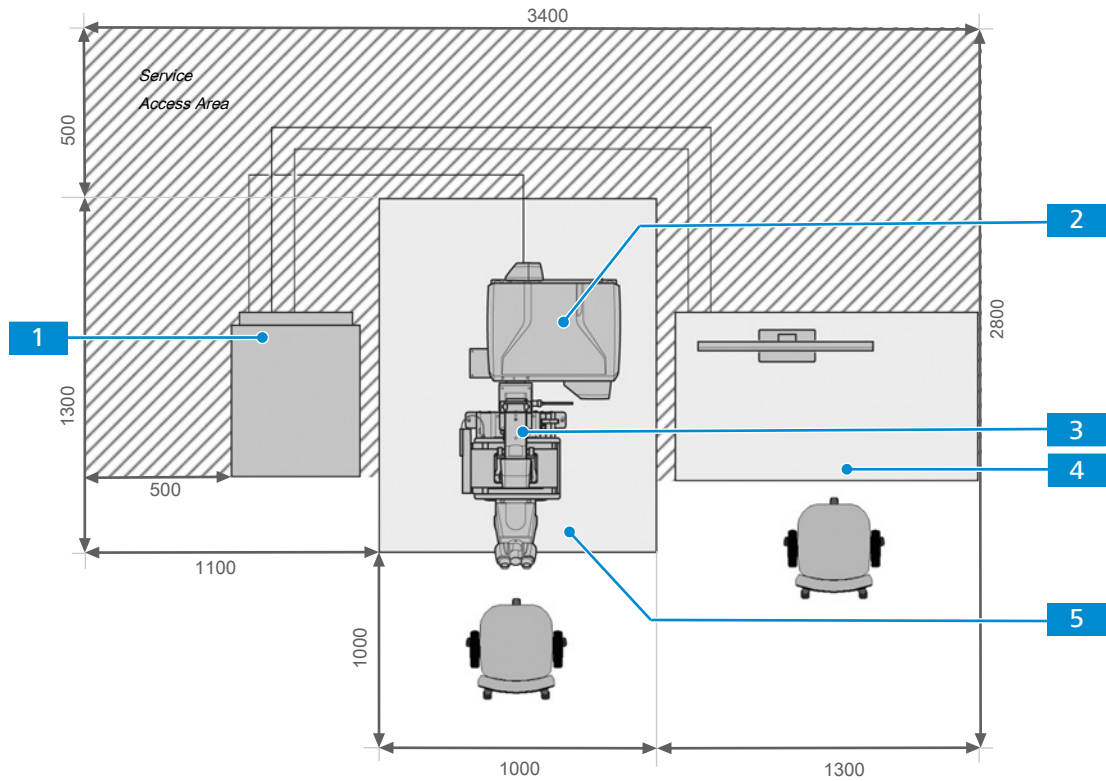


Fig. 14: Arrangement of Axio Observer 7 with LSM 980 on rear port (similar for Axio Examiner.Z1 and Axio Imager.Z2)

- | | |
|---------------------------------|-------------------------------|
| 1 Laser and Power Supply | 2 LSM scan module |
| 3 Microscope stand | 4 Computer workstation |
| 5 System table | |

9.3 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:

2011/65/EU

Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)

2015/863/EU

Commission Delegated Directive (EU) 2015/863 of 31 March 2015 amending Annex II to Directive 2011/65/EU of the European Parliament and of the Council as regards the list of restricted substances (RoHS Directive III)

2014/30/EU	Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to electromagnetic compatibility
2014/35/EU	Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits
KS C 9610-6-2:2019	Korean EMC standards EMC Immunity Testing of Industrial Environments
KS C 9610-6-4:2017	Korean EMC standards EMC Emission Testing of Industrial Environments
EN 60825-1:2015	Safety of laser products - Part 1: Equipment classification and requirements
EN 61010-1:2020	Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements
EN 61326-1:2013	Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements
EN 62471:2009	Photobiological safety of lamps and lamp systems

Unauthorized modifications of the microscope will cancel this declaration.

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).

In addition to the European and international guidelines and standards, the 21 CFR §1040.10: "Performance Standards for light emitting products - laser products" applies for the USA.

European and International Directives / Standards: For more information on ISO and CSA certificates or CE Declarations of Conformity, contact your ZEISS Sales & Service Partner.

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.

ZEISS introduced a procedure for the return and recycling of the instruments within the member states of the European Union which ensures suitable recycling procedures conforming to the EU directives.

For more information on disposal and recycling please consult your ZEISS Sales & Service Partner. The microscope may not be disposed of in the household waste or through municipal waste disposal services. If the microscope is resold, the seller shall be obliged to inform the buyer that the microscope must be disposed of in accordance with the regulations.

10 Accessories and optional System Expansions

Only the following accessories may be used with the microscope as their safe use has been confirmed by ZEISS. Only original parts from ZEISS may be used. Check in advance whether your microscope can be retrofitted with a system expansion or accessories.

After installation or conversion it must be carefully checked whether the microscope and its system expansions/accessories are in a safe operational state and whether unused ports are closed. For details and safety measures please refer to the associated documents.

Installation and commissioning are carried out by authorized ZEISS personnel. All interface ports which can potentially emit laser radiation are equipped with special TORX safety screws which must not be loosened by the user.

All interfaces described in this manual can be operated by the user. All non described interfaces must not be operated by the user even if accompanying manual (e.g. Instruction Manual for the microscope stand) list them as user interfaces. Always switch off the microscope before removing parts connected to a user interface, and do not leave a user interface uncovered during operation of the microscope.

The accessories/system expansions (with the exception of ultrafast lasers) are integrated in the microscope's power supply and are activated with the *Remote Power Control Switch* [▶ 30].

Info

Further information on the software and its operation is available in the software's online help.

Info

For additional information and detailed descriptions, refer to further applicable documents or ask your ZEISS Sales & Service Partner.

Name	Description/info
AiryScan 2	Detector for super resolution and high speed.
AxioCam	Camera family.
BiG.2	The <i>BiG</i> [▶ 69] detector is an additional external sensor with two special and highly sensitive GaAsP PMTs. It can be used both as descanned or non-descanned detector but cannot be cascaded.
Definite Focus	Compensates a focus drift and keeps the sample in focus even in time lapse experiments. Only available with Axio Observer 7.
Various objectives	The objective affects the performance of your microscope like no other system component. Best image quality can only be achieved with the objective that best suits your experiment, whether you work with histological samples, cell samples or entire organisms. More detailed information on available and recommended objectives can be found at https://www.micro-shop.zeiss.com/de/de/shop/objectives or ask your ZEISS Sales & Service Partner.

Name	Description/info
Various sample/scanning stages	These stages are used to position the sample in x and y either manually or software controlled. Travel range and movement precision vary between the types offered.
ELYRA 7	ELYRA 7 is a camera-based system for super resolution microscopy. It can be operated alternately with LSM 980.
Filter sets	Filters are available for various dyes and dye combinations. More detailed information on available and recommended filters can be found at https://www.micro-shop.zeiss.com/de/de/shop/filterAssistant or ask your ZEISS Sales & Service Partner.
GaAsP NDD 2 channels	<p>The <i>GaAsP NDD</i> [▶ 70] can be used instead of the standard objective holder. The detectors are used to detect emission signals generated by ultrafast excitation.</p> <p>Only available with Axio Examiner.Z1 with NLO System.</p>
Incubation accessories for live cell observation	ZEISS incubation systems unite simple setup procedures in the imaging software with optimized stability of the environmental parameters for even the most sensitive of live samples. Set the incubation temperature for your samples and save the environmental parameters in your software.
Light sources	<p>The following light sources for observing fluorescent samples are available:</p> <ul style="list-style-type: none"> ▪ HXP 120 V ▪ X-Cite Xylis ▪ Colibri 5 & 7
NDD.2	<p>The non-descanned detection modules can be used in the reflective or transmitted-light path (transmission <i>NDDs</i> [▶ 72] not available for Axio Imager.Z2) or simultaneously in both beam paths. That means that up to 12 <i>NDD</i> channels (depending on the stand) can be configured.</p> <p>When <i>NDD</i> channels are assigned to the transmitted-light path, no T-PMT/T-PMT 2 can be implemented on the Axio Observer 7. In non-descanned detection the radiation emitted by the sample is guided directly towards the detector without passing the scanning mirrors again.</p>
NIR	<i>NIR</i> [▶ 69] is an additional external detector with two special and highly sensitive GaAsP and GaAs PMTs for applications in the NIR region.
Integration of NLO System lasers	<i>NLO</i> [▶ 79] lasers excite fluorescence dyes only in the focus using tunable ultrafast lasers.
Z-Piezo for single objectives	Piezo-electric drive for Z stack image acquisition.

Name	Description/info
PMT transmitted-light module	The <i>T-PMT</i> [▶ 74] is a detector recording the contrast light of the sample in transmission.
Z-Piezo stage insert	Motorized stage insert for fast acquisition in Z direction. Can only be used in combination with suitable scanning stages.

10.1 Arrangement and Installation Plan for LSM 980 with additional System Expansions

Laser devices of classes 1M, 2M, 3A, 3B, 3R and 4 as well as all devices in the beam path are to be arranged or set up in such a way that an unintentional change in their position and beam direction is prevented. Rooms in which lasers are used must be marked with warning signs. Only authorized persons may enter marked rooms, which may also be subject to prior instructions or training. No combustible or explosive materials should be stored in the work room.

Info

Your ZEISS Sales & Service Partner will provide you with the detailed installation requirements.

10.1.1 Arrangement and Installation Plan for LSM 980 with Airyscan 2

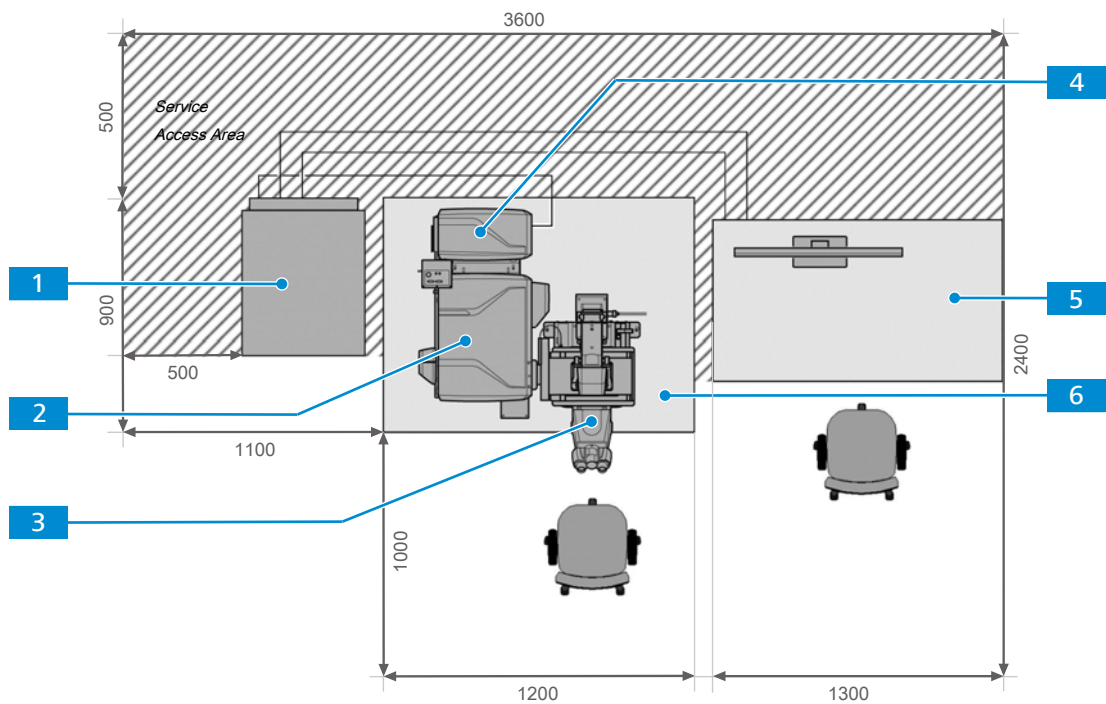


Fig. 15: Arrangement of the LSM 980 on side port with Airyscan 2

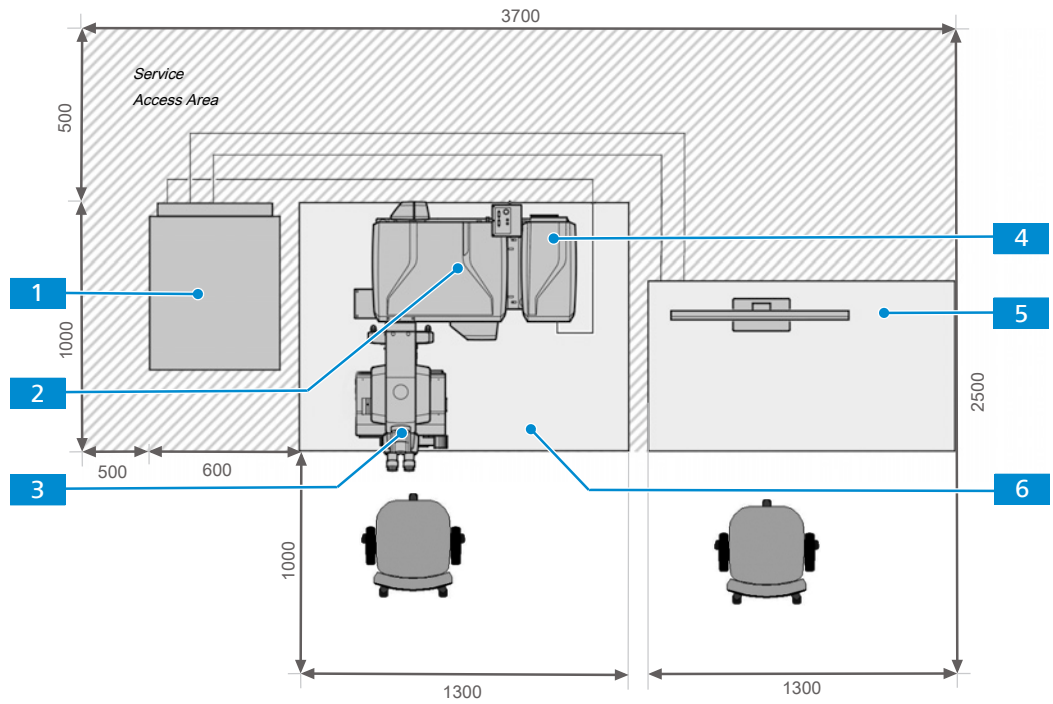


Fig. 16: Arrangement of the LSM 980 on rear port with Airyscan 2

- | | |
|---------------------------------|--------------------------|
| 1 Laser and Power Supply | 2 LSM scan module |
| 3 Microscope stand | 4 Airyscan 2 |
| 5 Computer workstation | 6 System table |

10.1.2 Arrangement and Installation Plan for LSM 980 with ELYRA

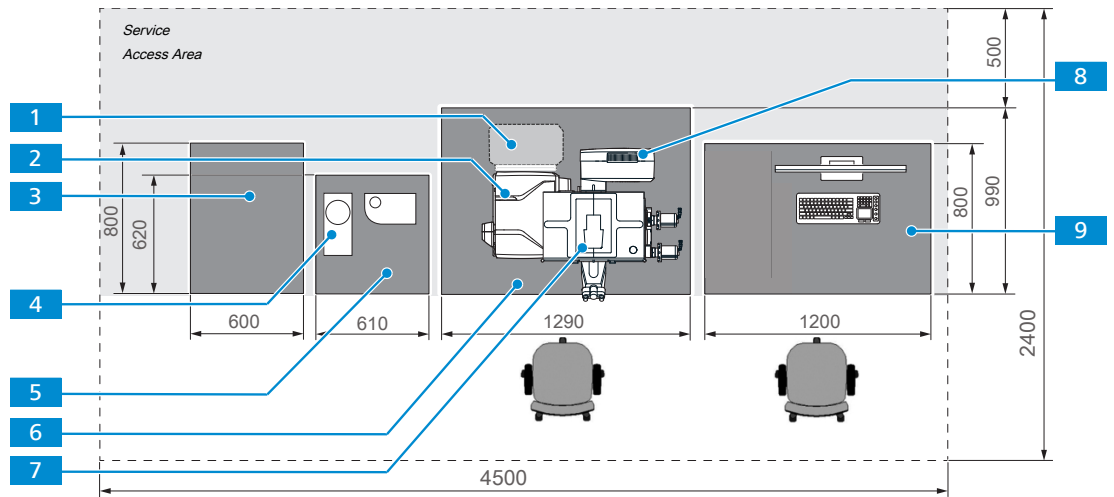


Fig. 17: Arrangement of the LSM 980 on side port with ELYRA

- | | |
|--|--------------------------------------|
| 1 Airyscan* | 2 LSM scan module |
| 3 Laser and Power Supply | 4 Light source HXP 120 V* |
| 5 Laser module for super-resolution | 6 System table, medium |
| 7 Microscope stand | 8 ELYRA 7 illumination module |
| 9 Computer workstation | |

*optional

10.1.3 Arrangement and Installation Plan for External Detectors (exemplary)

The following figure is intended to show an example of the position of the external detectors on the LSM 980. The position of the external detectors may differ depending on the configuration.

Info

For additional information and detailed descriptions, refer to further applicable documents or ask your ZEISS Sales & Service Partner.

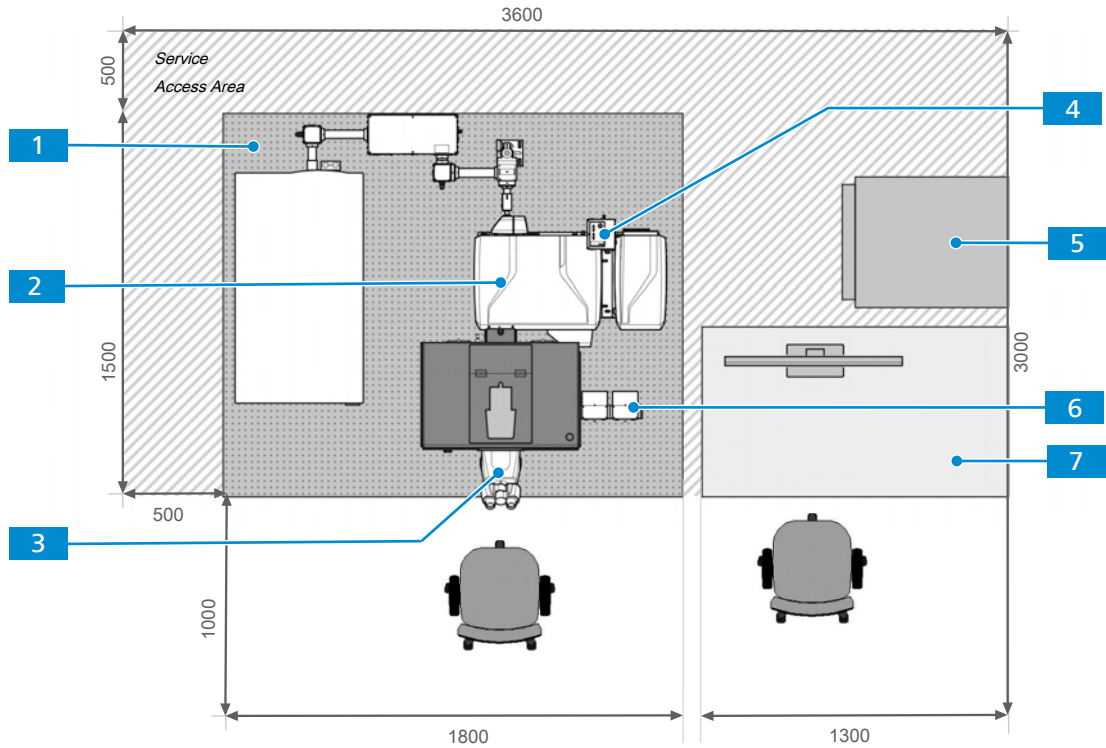


Fig. 18: Arrangement of the LSM 980 on rear port with External Detectors (exemplary)

- | | |
|---------------------------------|--------------------------|
| 1 System table | 2 LSM scan module |
| 3 Microscope stand | 4 BiG.2 or NIR |
| 5 Laser and Power Supply | 6 NDD.2 |
| 7 Computer workstation | |

10.2 External Detectors

10.2.1 BiG.2

Purpose BiG.2 is an additional external sensor that uses two special and highly sensitive GaAsP PMTs. It can be used both as a descanned and non-descanned detector. BiG.2 cannot be cascaded.

Position BiG.2 is installed either on the DC-Out port of the LSM scan module then being operated in descanned mode. Or the unit is mounted to a NDD port and operated as non-descanned detector when used for multiphoton imaging.

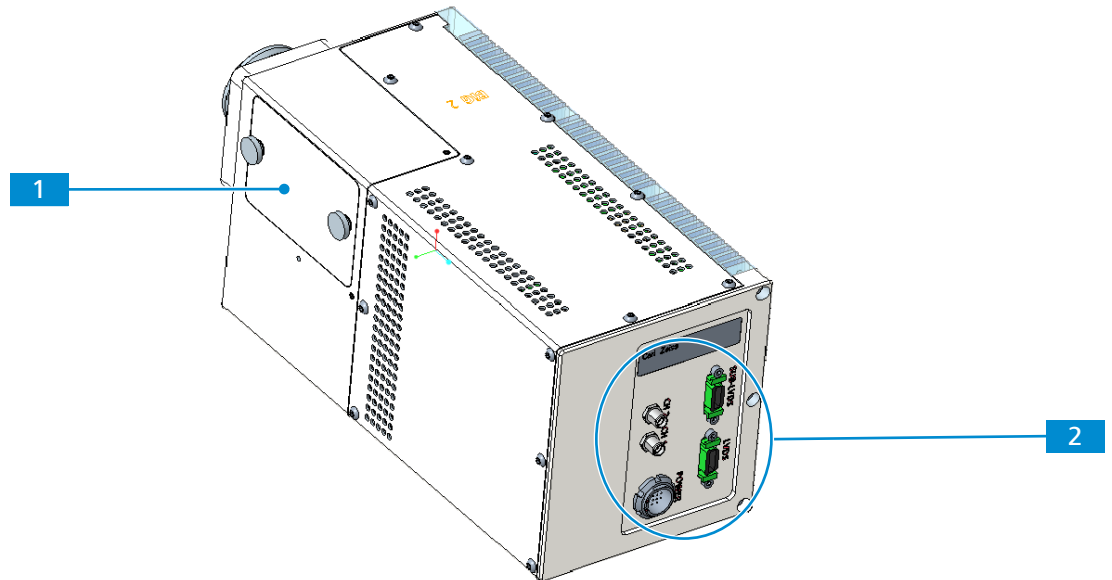


Fig. 19: BiG.2

1 Push&Click filter

2 External connections

10.2.2 NIR

Purpose NIR is an additional external detector with two special and highly sensitive GaAsP and GaAs PMTs for applications in the NIR region.

Position NIR is installed on the DC-Out port of the LSM scan module being operated in descanned mode.

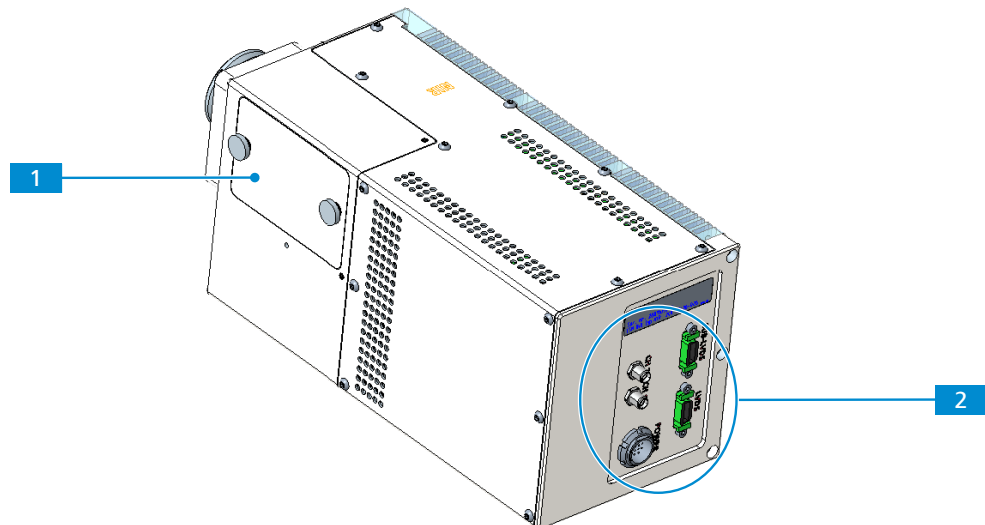


Fig. 20: NIR detector

1 Push&Click filter

2 External connections

Function NIR has a detection range up to 900 nm and special improved sensitivity. It can be equipped with a Push&Click Emission Filter (EF) for best performance. The Push&Click Filter can be inserted/changed manually by customer

10.2.3 NDD Detectors

The NLO System can be fitted with optional NDD detectors:

- *GaAsP NDD 2 Channels* [[▶ 70](#)]
- *NDD.2* [[▶ 72](#)]

Info

For additional information and detailed descriptions, refer to further applicable documents or ask your ZEISS Sales & Service Partner.

10.2.3.1 GaAsP NDD 2 Channels

The GaAsP NDD 2 channels can be used instead of the standard Axio Examiner.Z1 objective holder on the stand. The module features two highly sensitive GaAsP detectors. The detectors are used to detect emission signals generated by multiphoton excitation.

The module is fitted with a dichroic filter separating the excitation and the emission light, transmitting the emission light directly to the two detectors. The module also features a special filter module that contains two emission filters and one dichroic filter. This filter module separates and filters the emission signals directly before the detectors. Both filter units are set and operated manually. The module can be exchanged for other objective holders.

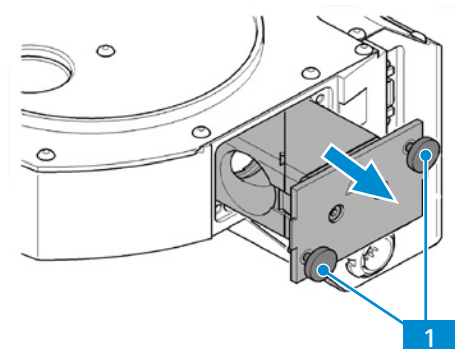
Info

Storage

For storage of the unused detector, it needs to be packed into a special light-tight casing. This is required because the sensor of the detector is highly light sensitive and can be influenced by (room-) light.

10.2.3.1.1 Exchanging Emission Filters

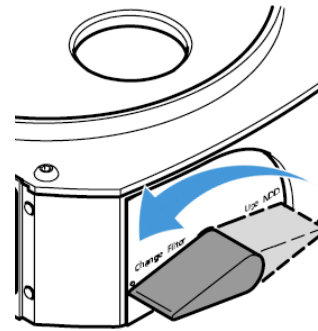
Procedure 1. Loosen the knurled thumb screws **1**.



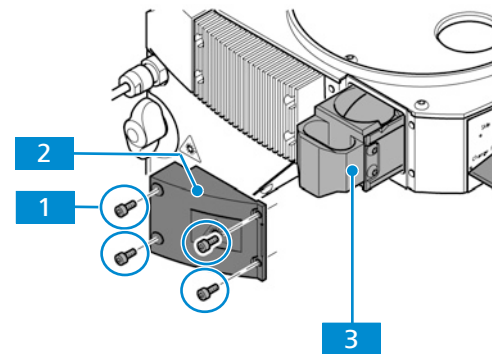
2. Remove filter insert from the compartment.
3. Insert new filter insert into the compartment.
4. Tighten the knurled thumb screws.

10.2.3.1.2 Exchanging Dichroic Filters

Procedure 1. Set the switch to **Change Filter**.



2. Loosen the four screws **1** on the left side.



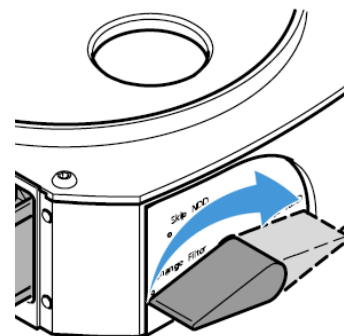
3. Remove cover **2**.

4. Remove filter holder **3**.

5. Insert new filter holder.

6. Attach cover.

7. Set switch to **Use NDD**.



10.2.3.2 NDD.2

Purpose NDD.2 is an external additional sensor collecting light directly from the sample. In non-descanned detection, the radiation emitted by the sample is guided directly towards the detector without passing the scanning mirrors again.

Position The non-descanned detection modules can be used in the reflective or transmitted-light path (transmission NDDs not available for Axio Imager.Z2) or simultaneously in both beam paths. Therefore up to 12 NDD channels (depending on the stand used) can be configured. NDD.2 modules can be cascaded. The module with 2 channels can be expanded with up to two additional 1-channel modules. They are supplied with power by the 2-channel module and are integrated in terms of both electronics and optics. Alternatively, a *BiG.2* [▶ 69] can also be cascaded on the NDD.2.

When NDD channels are assigned to the transmitted-light path, no T-PMT/T-PMT 2 can be implemented on the Axio Observer 7.

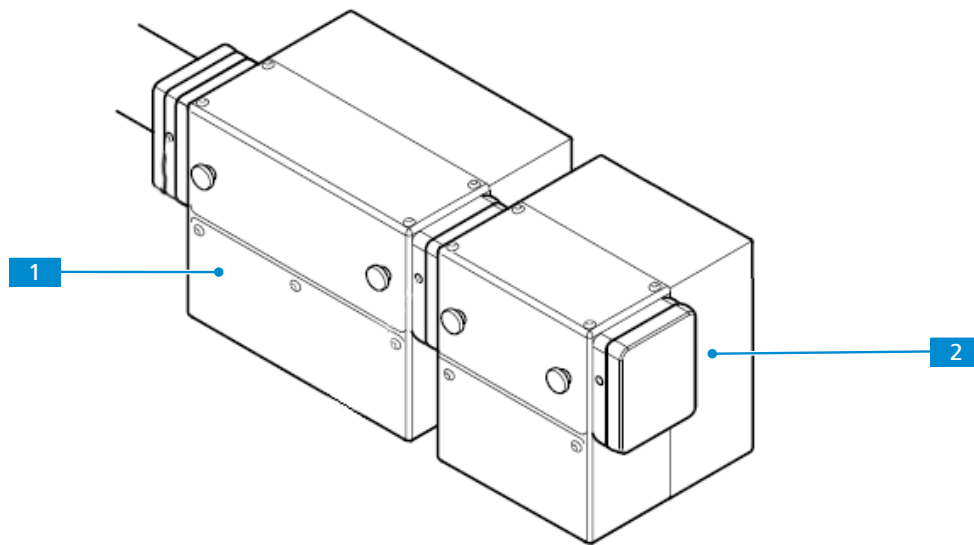


Fig. 21: NDD.2

1 NDD.2 with 2 detection channels **2** NDD.2 with one detection channel

10.2.4 Assembling/Removing a Detector Module

There are two screws **1** at each connection port to fix the detector modules (e.g. *BiG.2*, NDD.2, NIR) to the port or to each other. The ports are electronic connections which are linked to the safety monitoring of the system. Be careful when removing or mounting the modules.

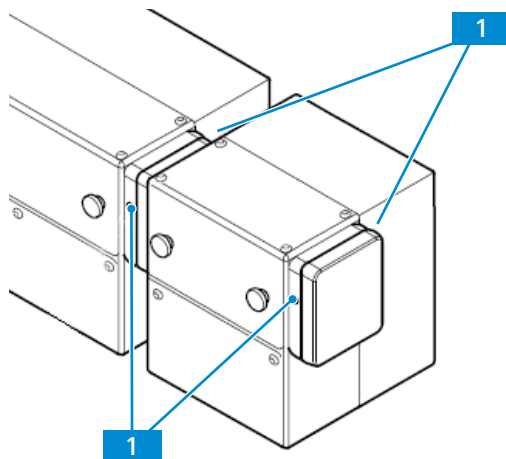


Fig. 22: Assembling or Removing a Detector Module (e.g. NDD.2)

Parts and Tools  Hex Key, 2.5 mm

Prerequisite  The microscope is switched off and disconnected from the mains.

- Procedure**
1. Loosen the two fastening screws of the adapter port.
 2. Slowly remove the detector away from the port.
 3. Assemble the detector to the port. **NOTICE** **Property damage due to bent pins. For mounting the detector module onto any port, make sure the pins and the electronic connections of the safety interface match closely.**
 4. Fasten the two fastening screws.
 5. Install the *blind cap* [▶ 26], if no detector is attached to the port.

10.2.5 Connections of External Detection Modules for Signal Transmission to Real Time Electronics

Purpose When adding a new module or completely removing an existing module, the cabling needs to be changed. When simply changing the position, the signal cabling can be kept as it is.

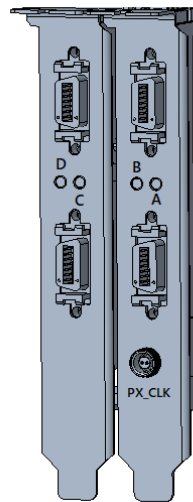


Fig. 23: LVDS connectors on the back of the system computer

The LVDS cabling connects the various modules in rows attached to the available connectors. The cabling goes from main connector to LVDS on a component, then from the components Sub-LVDS connector to the next components LVDS connector and so on. With the maximum possible number of external detectors present the cabling scheme is set up as follows (pointing out the external modules):

LVDS port	Connection
A	BiG.2 (first module) or NIR followed by other main system components
B	Other main system components
C	Reflected light NDDs followed by GaAsP NDD 2 channels and then another system components
D	BiG.2 (second module) followed by Transmitted light NDDs or NIR

The NDD channels 3 and 4 only have to be connected to the NDD.2 but don't need a connection to LVDS or to power supply.

If an external module (BiG.2, NIR or NDD.2) is not part of the system set up or is removed from the system the subsequent module takes its place. If a module is added, it has to be placed at the position described in the table. In addition to the LVDS connection the modules need to be connected or disconnected to /from the power supply. There are multiple power connectors available on the back side of the Laser and Power supply unit.

Info

Adding, removing and changing the position of external modules finally needs to be updated in the MTB configuration of the system. Please contact your ZEISS service representative.

10.2.6 T-PMT / T-PMT 2

Purpose T-PMT / T-PMT 2 is an external sensor which allows recording of transmitted light images in brightfield and transmitted contrast modes (including transmitted fluorescence for Sample Finder and Sample Navigator).

Position T-PMT / T-PMT 2 is located at the transmitted light path of the stand, at the same focal plane as the light sources.

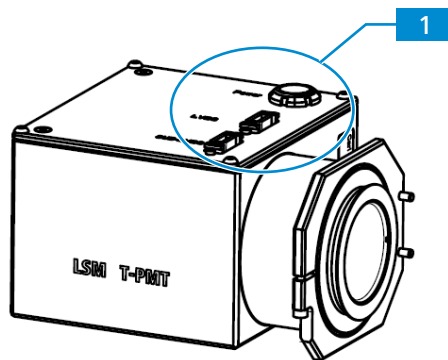



Fig. 24: T-PMT

1 External connections

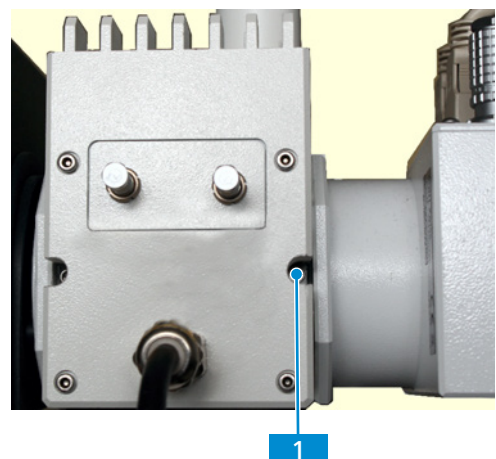
Function PMT module with a detector for transmitted light. Detects signals with the help of the microscope condenser. The contrast methods of the condenser can be used.

10.2.6.1 Removing the T-PMT from the switching mirror

Parts and Tools  Hex Key

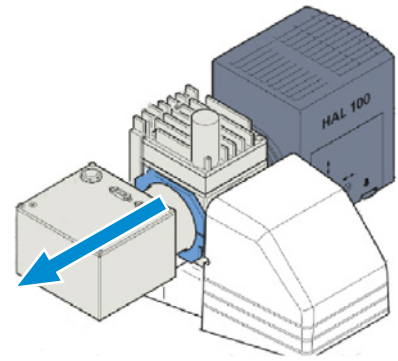
Prerequisite  The microscope and the illumination are switched off.

Procedure 1. Unscrew the clamping screw **1**.



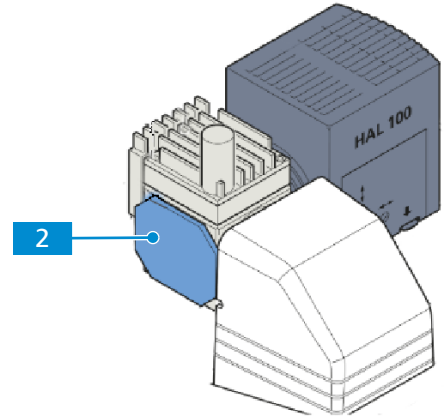
- Remove the T-PMT with the *Sensors and Contact Pins* [▶ 27] from the switching mirror.

Info You do not need to disconnect the power cable of the T-PMT from the ECU. You can leave the T-PMT connected if the cable length allows to store the T-PMT in a convenient place after its disassembly.



- Cover the unused port of the switching mirror with a *blind cap* [▶ 26] **2**.

CAUTION For laser safety reasons, always fit the T-PMT detector to a switching mirror – never directly to the transmitted light port. Always unused ports must be closed with blind caps.



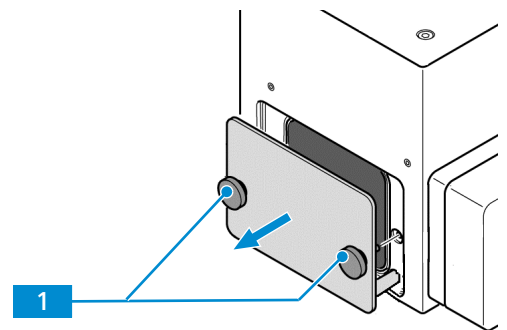
Info

For a complete deinstallation or a reinstallation, please contact your responsible ZEISS service representative.

10.2.7 Exchanging the Push&Click Filter

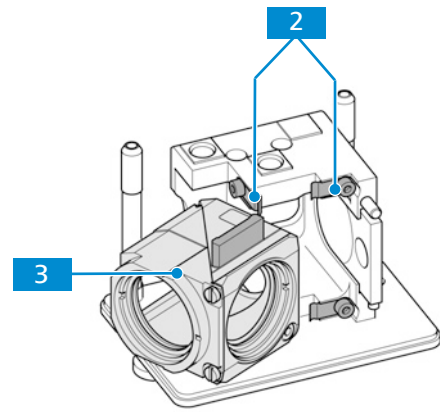
Procedure

- Loosen the knurled thumb screws **1**.
- Remove the filter insert from the compartment.



- Place the filter insert on its cover side.

4. Separate the filter cube **3** from the spring element **2**.



5. Remove the filter cubes from the filter insert.
6. Insert the new filter cube into the spring elements.
7. Press the filter cube against the spring elements until the cube locks into place.
8. Insert the filter insert into the compartment.
9. Tighten the knurled thumb screws.

10.3 HAL 100 Light Source

Purpose The halogen lamp HAL 100 serves as a light source for the transmitted light process.

Position The HAL 100 is installed on the switching mirror.

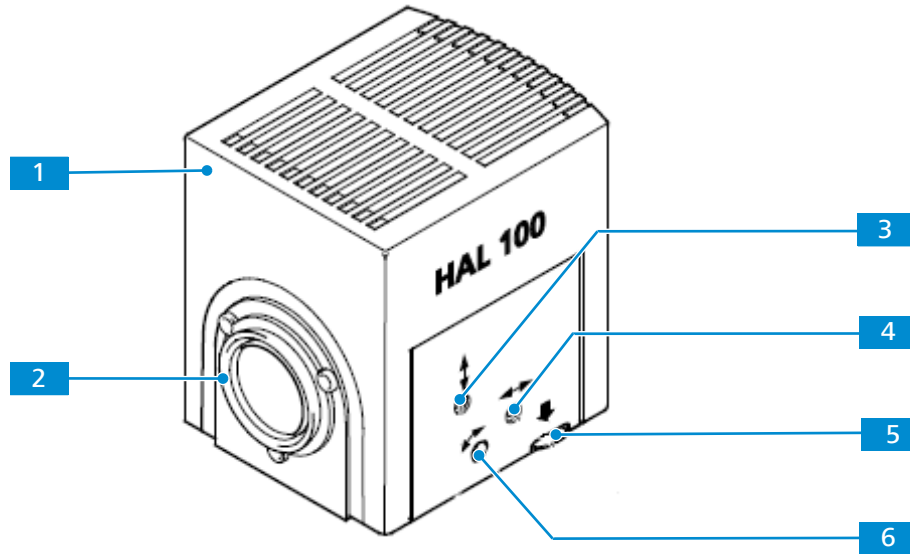
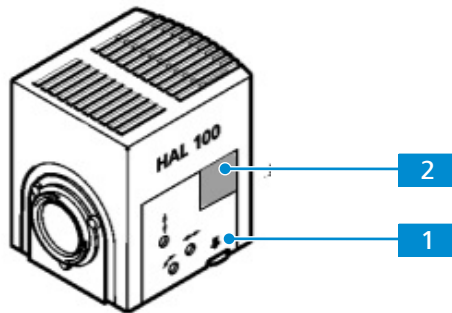


Fig. 25: HAL 100

- | | |
|-----------------------------------|-------------------------------------|
| 1 Lamp housing | 2 Dovetail ring |
| 3 Vertical adjusting screw | 4 Horizontal adjusting screw |
| 5 Unlocking button | 6 Adjusting screw |

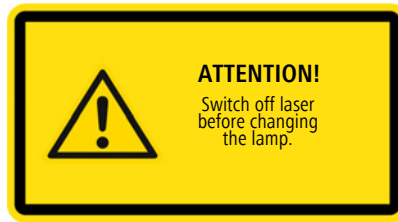
10.3.1 Warning Labels on the HAL 100 Light Source

For safe functioning of the light source together with the microscope, the instruction manual of the light source is to be observed.



Hot surface! Do not touch.

2



CAUTION!

Avoid direct irradiation of eyes when cover is open. Switch off lasers before changing the lamp!

Info

Always consider all warning labels and lights on the complete microscope. They are to be kept in clean and easily legible condition. Damaged or illegible warning labels must be replaced immediately.

10.3.2 Adjusting the HAL 100

CAUTION

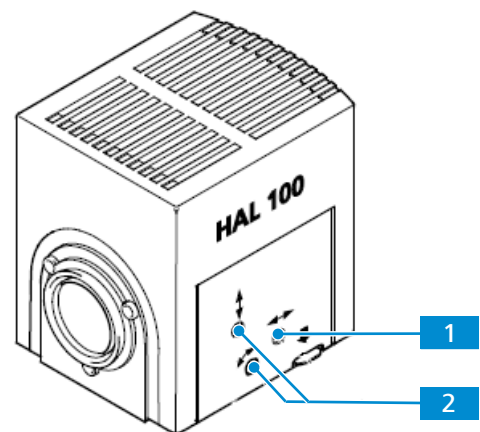
Eye injury due to light emission

Directly looking into emitted light can damage the eye.

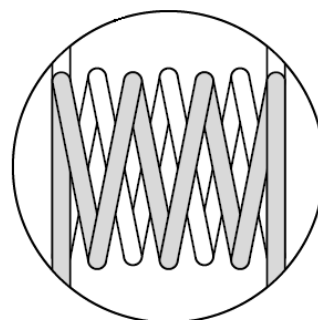
- ▶ Do not look into the light exit aperture of the light source.

Parts and Tools  Screwdriver, 3.0 mm, ball head

- Procedure**
1. Loosen clamping screw on the port.
 2. Remove halogen lamp.
 3. Switch on the microscope.
 4. Direct light beam to a projection surface (wall) with a minimum distance of 3 m.
 5. Set adjusting screw **1** so that both images of the lamp filaments are visible on the projection surface as sharply as possible.



6. Set adjusting screws **2** so that the lamp filaments of one image exactly covers the gaps of the reflector image.



7. Attach halogen lamp to port.
8. Tighten clamping screw.

10.4 NLO System

The NLO System (non-linear optics) is operated with a Tunable Ultrafast Laser (multiphoton laser). Ultrafast lasers for multiphoton microscopy are integrated in the LSM scan module via a free beam guidance. The laser power used for sample illumination is set by software controlled AOM technology. The wavelength and, if applicable, the dispersion compensation of the laser can be set in the software as well.

DANGER

Hazards generated by Laser Radiation Class 4

Class 4 laser radiation hazard.

- ▶ Avoid eye or skin exposure to direct or scattered radiation.
- ▶ Use suitable protective equipment / protective clothing.

Info

Observe technical documents and instruction manuals of external lasers

Information on the external lasers is available in the documents provided by the laser manufacturer. Particularly observe the notes by the laser manufacturer.

10.4.1 Safety

This chapter contains general requirements for safe working practices with the NLO System. Any person using the NLO System or commissioned with installation or maintenance must read and observe the *general safety instructions* [▶ 10] of the LSM 980 Basic System and the safety instructions of the NLO System. Operational safety of the supplied NLO System is only ensured if it is operated according to its *intended use* [▶ 10].

Improper use can quickly lead to an impairment of its functionality or even damage. The manufacturer cannot be held liable for damage caused by incorrect operation, negligence or unauthorized interventions, particularly the removal, modification or exchange of components. Laser safety cannot be guaranteed in such cases. Third-party devices or components that have not explicitly been approved by ZEISS must not be used.

If any work is associated with residual risks, this is mentioned in the relevant parts of this document in a specific note. When components must be handled with special caution, they are marked with a warning label. These warnings must always be observed.

10.4.1.1 Safe Use of Ultrafast Lasers

In order to determine measures to be implemented in each individual case, the lasers are divided in classes according to their hazard potential. The LSM 980 with an ultrafast laser is categorized as Laser Class 4. The safety information in the *Safety* [▶ 10] chapter and the laser manufacturer's instruction manuals must be observed at all times.

Laser Class 4 Radiation Hazards Lasers with a wavelength above 780 nm cannot be seen by the human eye. This laser type is a high power laser that can be a significantly hazardous to humans and environment in case of unintended use. Laser radiation emitted by class 4 laser devices is so powerful that it must be assumed that any exposure of eyes or skin will cause damage. The laser radiation may cause a fire and explosion hazard.

- The use of laser safety goggles may be required to provide protection from direct, reflected, or diffusely scattered laser radiation. Looking directly into the beam must be avoided, even with protective goggles. The type of protective goggles for your microscope with laser class 4 can be requested from your ZEISS service representative.
- Sufficient measures for protection against fire and explosion hazards are to be taken.

- Before subjecting a material to intense laser radiation, it must be checked whether processes such as vaporizing, combusting or chemical reactions can emit hazardous concentrations of gases, vapors, dust, mists, or explosive mixtures. Class 4 lasers can ignite combustible materials such as fabric or paper. Never introduce such materials into the beam path.
- Never reach into the laser beam in the sample compartment.
- Never remove the housing components of the free beam coupling between the ultrafast laser and the scan module. Otherwise laser radiation class 4 emerges.
- Observe *Safe Use of Laser Equipment* [▶ 12].

Reflection Hazards In NLO Systems that are equipped with a special push & click filter for NDD imaging, the NDD reflector module in the reflector turret can lead to a strong reflection of the light in the object level and the eyepiece. The NDD reflector module should not be used when looking at the object through the eyepiece. The flash of light is not hazardous, however, it is unpleasant. The reflex to close the eyes is sufficient protection here.

10.4.1.2 Active Safety Interlocks in a NLO System

The active safety interlocks prevent unintentional emission of light or laser radiation. In case interlock sensors detect unsecured opening of the housing covers and the safety shutter in the LSM scan module is kept shut. The safety interlocks are failsafe according to IEC 61508.

For systems with ultrafast lasers is an additional laser safety shutter within the AOM-Box box which is placed before the safety shutter in the LSM scan module. If one shutter fails, the other shutter blocks the laser radiation.

The safety interlock is activated in case of the following actions:

- *General Active Safety Interlocks* [▶ 26]
- *Blind caps* [▶ 26] / NDD blind cap removed and/or a port is not equipped.
- Filter insert removed from BiG.2, NIR or NDD.2.
- Filter insert removed from GaAsP NDD 2 channels.

10.4.1.3 Labels and Lights

This chapter shows labels and, where applicable, indicator lights.

All parts that may pose specific hazards are marked with warning labels.

Always observe **all** warning labels!

- Check all warning labels for availability and legibility.
- Immediately replace damaged or illegible warning labels.

In case a label is missing please contact your ZEISS service representative for free of charge replacement.

10.4.1.3.1 Labels on the Laser integration accessories

For safe functioning of the AOM-Box and Periscope together with the microscope, the associated instruction manuals must be observed.

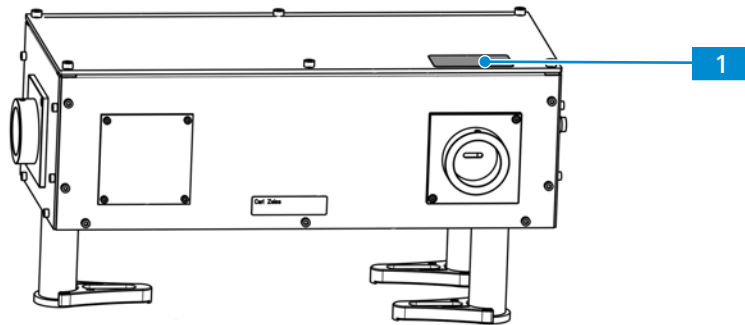


Fig. 26: Warning Labels on the AOM-Box

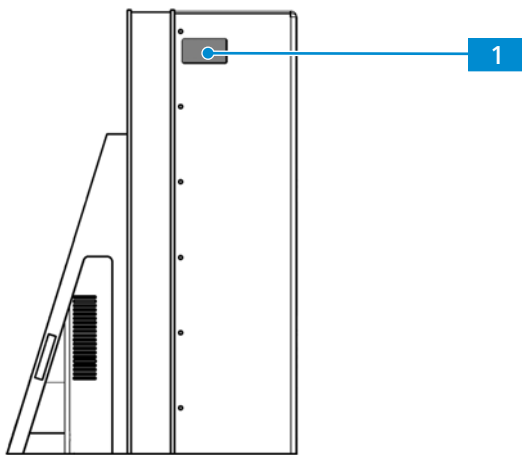
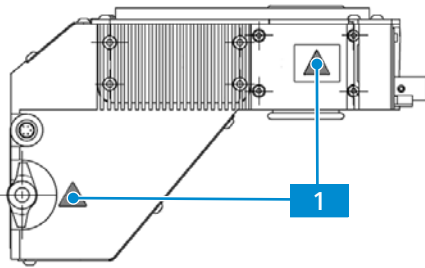


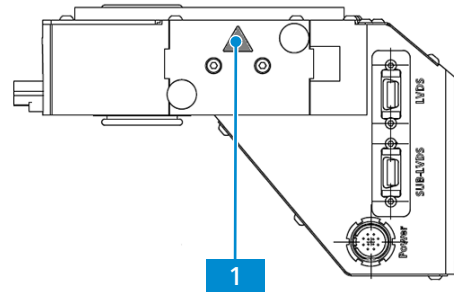
Fig. 27: Warning Labels on the Periscope

Pos.	Symbol	Description
1		<p>DANGER - Visible and invisible class 4 laser radiation!</p> <p>Avoid eye or skin exposure to direct or scattered radiation.</p>
	<p>INFO: USA only.</p>	

10.4.1.3.2 Labels on the GaAsP NDD



Left side view



Right side view

Pos.	Symbol	Description
1		Laser radiation! Avoid exposure to radiation.

10.4.1.3.3 Labels on the NDD

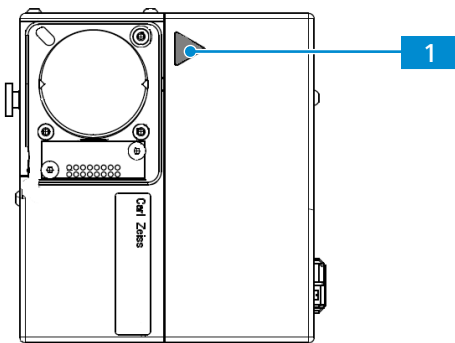


Fig. 28: Warning Labels on the NDD

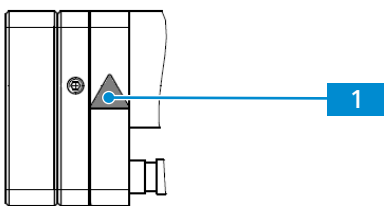


Fig. 29: Warning Labels on the NDD Sideport Adapter

Pos.	Symbol	Description
1		Laser radiation! Avoid exposure to radiation.

10.4.2 Main Components of the LSM 980 NLO System

The LSM 980 NLO System comprises the following main components including the LSM 980 Basic System (*Main Components of the LSM 980* [▶ 29]).

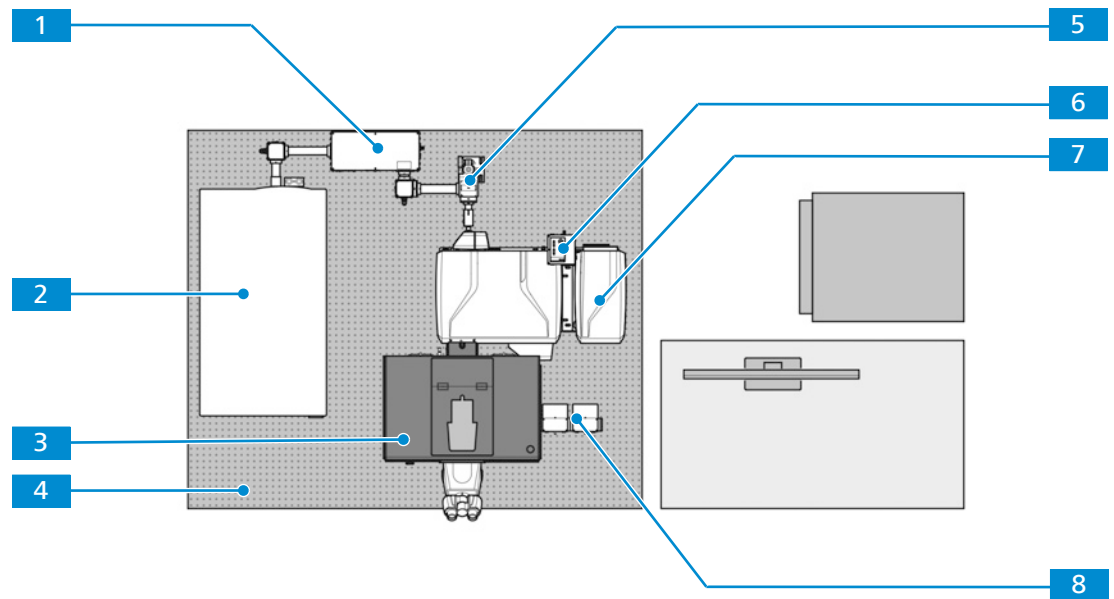


Fig. 30: Main components of the LSM 980 NLO System

- | | |
|----------------------|---------------------------|
| 1 AOM-Box | 2 Ultrafast laser |
| 3 Incubation* | 4 NLO System table |
| 5 Periscope | 6 BiG.2* or NIR* |
| 7 Airyscan 2* | 8 NDD.2* |

*optional

10.4.2.1 Key Switch

In addition to the *Main Switch and Key Switch* [▶ 30] of the LSM 980, there are additional key switches on the ultrafast laser modules. The key switch activates/deactivates the laser beam.

If the LSM 980 NLO System is not used for a longer time, store the laser protection keys in a location to which persons who are not authorized to operate the lasers have no access.

Info

Observe technical documents and instruction manuals of external lasers

Information on the external lasers is available in the documents provided by the laser manufacturer. Particularly observe the notes by the laser manufacturer.

10.4.3 Performance Data and Specifications of the NLO System

It is recommended to install the LSM 980 NLO System in a dark room where artificial illumination, sunlight or other light sources cannot interfere with image acquisition. The LSM 980 NLO System should not be installed near windows with direct sunlight or radiators. Laser Class 4 operation must be indicated by a warning light at the entries to the laser area.

For daily or weekly operation, the tunable ultrafast lasers should be kept in standby mode. Laser cooling must not be interrupted during standby operation. The laser should be entirely shut down only if it is not used for more than two weeks. This must be done according to the laser manufacturer's instruction manual. Shutting down and starting up can take up to an hour.

Compliance with the installation requirements of the LSM 980 NLO System and the availability of the requested supplies is the responsibility of the customer and has to be provided at the time of installation. Due to continuous development, we reserve the right to change specifications without notice. All information provided on the LSM 980 (see: *Performance Data and Specifications [▶ 58]*) and the following performance data apply:

Weight and sizes The total weight of the LSM 980 NLO System is approx. 508 - 669 kg.

Components	Length (mm)	Width (mm)	Height (mm)	Approx. Weight (kg)
NLO system table				
<ul style="list-style-type: none"> ▪ threads of millimeter or inch scheme ▪ air damped ▪ level regulated 	2500	1500	910	625
<ul style="list-style-type: none"> ▪ threads of millimeter or inch scheme ▪ air damped ▪ level regulated 	1800	1500	910	475
<ul style="list-style-type: none"> ▪ threads of millimeter or inch scheme ▪ air damped ▪ level regulated ▪ openings for cables 	1800	1800	910	515
Extension electronics for external laser	150	250	700	13

Weight and sizes of the transport boxes For the weight and sizes of the transport boxes for the ultrafast laser components, please contact the laser manufacturer.

The table below give some indication of the weight and sizes of the transport boxes for the accessories delivered by ZEISS.

Box	Box contents	Length (mm)	Width (mm)	Height (mm)	Approx. Weight (kg)
Small box for accessories	The content of the boxes depends on the system configuration:	1080	900	820	100 - 300
Large box for accessories	<ul style="list-style-type: none"> ▪ AOM-Box ▪ Periscope ▪ NLO-tubing ▪ Additional accessories e.g. Definite Focus, X-Cite Xylis, AxioCam 	1350	900	1000	

The following types of lasers are currently intended for use. The use of lasers other than those listed below is only possible on request from ZEISS. The power values of the directly integrated ultrafast lasers correspond to the rated laser power. Please consult the laser manufacturer for additional information on technical data of the individual lasers.

Supplier	Laser	Laser wavelength (nm)	Class	Typical power (W)	Expected lifetime (h)
Coherent	Chameleon (depending on model)	max. 690-1080	4	3	> 5000
	Chameleon Discovery NX	max. 660-1320	4	6.5	> 5000
Spectra Physics	Mai Tai (depending on model)	max. 690-1040	4	3	> 5000
	InSight X3	max. 690-1300	4	5.5	> 5000
	InSight X3+	max. 690-1300	4	6.5	> 5000

10.4.3.1 Arrangement and Installation Plan for LSM 980 NLO System (single line)

Laser devices of classes 1M, 2M, 3A, 3B, 3R and 4 as well as all devices in the beam path are to be arranged or set up in such a way that an unintentional change in their position and beam direction is prevented. Rooms in which lasers are used must be marked with warning signs. Only authorized persons may enter marked rooms, which may also be subject to prior instructions or training. No combustible or explosive materials should be stored in the work room.

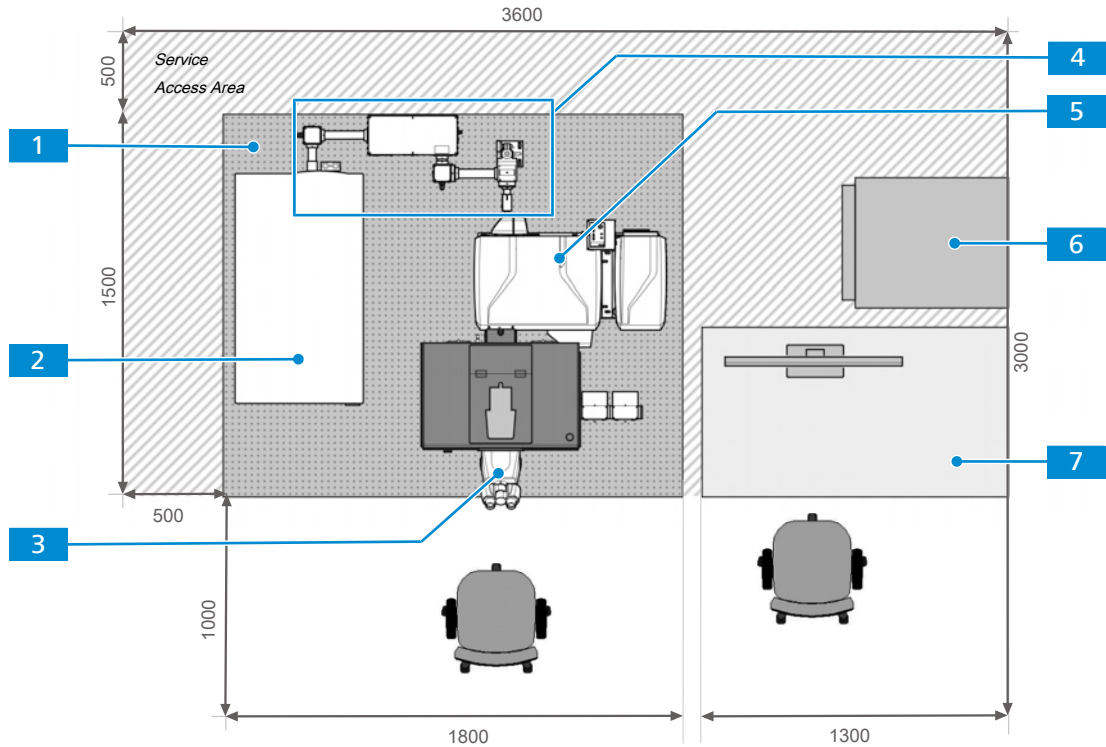


Fig. 31: Arrangement of Axio Observer 7 with LSM 980 NLO single line system (similar for Axio Examiner.Z1 and Axio Imager.Z2)

- | | |
|-------------------------------|--|
| 1 NLO System table | 2 Ultrafast laser |
| 3 Microscope stand | 4 Laser integration accessories |
| 5 LSM scan module | 6 Laser and Power Supply |
| 7 Computer workstation | |

10.4.3.2 Arrangement and Installation Plan for LSM 980 NLO System (dual line)

Laser devices of classes 1M, 2M, 3A, 3B, 3R and 4 as well as all devices in the beam path are to be arranged or set up in such a way that an unintentional change in their position and beam direction is prevented. Rooms in which lasers are used must be marked with warning signs. Only authorized persons may enter marked rooms, which may also be subject to prior instructions or training. No combustible or explosive materials should be stored in the work room.

Revision History

Revision	Date of Issue	Introduced Modifications
5	12/2022	<ul style="list-style-type: none">▪ Editorial rework▪ Implementation of UKCA marking▪ Rework of section "Troubleshooting"▪ Implementation of revision history

Tab. 2: Revision History

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Abbreviations

DPSS

Diode-pumped solid state. Laser operation mode.

ECU

Electrical connection unit. Power Supply in the Laser and Power Supply

EMC (Electromagnetic compatibility)

Ability of equipment to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to other equipment in that environment.

Emission filter (EF)

Color filter for emitted light in fluorescence microscopy; blocks high-energy excitation light.

GaAsP (Gallium arsenide phosphide)

An alloy of gallium arsenide and gallium phosphide used as a semiconductor material for manufacturing red, orange and yellow light-emitting diodes.

HAL

Halogen lamp (light). White light for illuminating the sample in the visible spectrum.

LSM (Laser scanning microscope)

Microscope in which the object is scanned by a laser beam.

Main Beam Splitter (MBS)

Beam splitter that reflects the laser excitation light to the sample and lets the fluorescence light through to the PMT detector.

NDD

Non descanned detector. A detector with the shortest possible light path for the emitted light, avoiding the reducing signal loss. It also has no pinhole and fewer optical elements in the path.

NIR (Near infrared)

Light above approx. 700 nm wavelength.

NLO (Nonlinear optics)

Collective term for effects occurring at high light intensities which are caused by a non-linear reaction of a medium to the action of light. In NLO systems, lasers excite fluorescence dyes in the focus only using tunable ultrafast lasers.

PMT (Photomultiplier)

A vacuum tube, and more specifically vacuum phototube with secondary electron multiplier, that is an extremely sensitive detector of light in the UV, visible, and NIR ranges.

PPE (Personal protective equipment)

Equipment used to protect persons from harm in the working environment.

T-PMT

PMT module for transmitted light. A detector recording the contrast light emitted by the sample.

Glossary

Blind cap

A cap that closes an opening evenly with the part in which it is inserted.

DC port

Directly coupled connection

Dust Cover

A cover for protecting a device from dust.

Laser and power supply

The Laser and Power Supply comprises an ECU and a laser module.

Sample or Specimen

A representative part or a single item from a larger whole or group especially when presented for inspection or shown as evidence of quality.

Shelf life

Shelf life (or expiration date) is the length of time the disinfectant product may be stored before the active ingredients begin to break down, and thus the disinfectant will no longer be able to reduce the biological agents to a safe level. The shelf life is noted on the disinfectant container. The shelf life of the disinfectant may be reduced if it is not stored appropriately.

Stand

Chassis that carries the mechanical and optical parts of a microscope.

Switching Mirror

An optical switching device that can connect two and more illumination sources.

ZEISS Sales & Service Partner

The Sales & Service Partner is generally in the field for customer support in a regional area and / or a clearly defined customer group.

ZEISS service representative

Specially trained service expert, either ZEISS staff or authorized service partner of ZEISS.

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