Operating Manual
Cell Observer SD

Knowledge of this manual is required for the operation of the instrument. Would you therefore please make yourself familiar with the content of this manual and pay special attention to information concerning safe operation of the Cell Observer SD.

Subject to alterations in the interest of technical progress; the manual is not covered by an update service.

Issued by: **Carl Zeiss MicroImaging GmbH**

P O Box 4041, D - 37030 Göttingen
Phone: +49 (0) 551 5060 660
Fax: +49 (0) 551 5060 464
E-mail: micro@zeiss.de

www.zeiss.de

Print no.: M60-2-0021 e

Date of issue: Version 6, 30.01.2009

CONTENTS

1 NOTES ON INSTRUMENT SAFETY

1.1 General Notes

The Cell Observer SD consists of the following two main components: CSU-X1 spinning disc unit and Axio Observer.Z1. It has been designed and built to meet the requirements under DIN EN 61010-1 (IEC 61010-1) "Standard rules regarding the safety requirements for electrical equipment for measurement, control, and laboratory use", DIN EN 60825-1 (IEC publication 60825-1) "Safety of laser products" and DIN EN 61326-1 "Electrical equipment for measurement, control and laboratory use – EMC requirements".

When combined with an Axio Observer.Z1, the CSU-X1 spinning disc unit complies with the requirements of Directive 98/79/EC (In Vitro Diagnostic Medical Device Directive). It carries the CE - mark.

The Cell Observer SD must be disposed in accordance with the WEEE Directive 2002/96/EC.

The following warning and information symbols are used throughout this Manual. They will help you to promptly understand the type and purpose of advisory or alert notes contained herein.

NOTE
This symbol indicates a note that should be closely followed.

CAUTION
This symbol indicates a possible hazard to the instrument or system.

DANGER
This symbol indicates a possible hazard to the user of the instrument.

ACHTUNG
Disconnect power supply before any kind of intervention into the system!

DANGER
Laser radiation!

DANGER
Keep the laser zone clear of flammable and combustible materials.

DANGER
Dangerous electrical voltage!

Always bear in mind: The time you invest in making yourself familiar with the equipment will pay off many times in your work.

In addition to this manual of the Cell Observer SD, please observe the information given in detail in the following operating manuals:

- Operating Manual for Axio Observer Mikroscope (B 46-0111)
- Operating Manual AxioVision (B 48-0019 e)
- Operating Manual – Installation Manual for Peripherals (B 40-650 d)
- Operating Manual for computer system
- Operating Manual for Camera (AxioCam MRm, HSm, HRm or Photometrics EMCCD)
- Operating Manual for Confocal Scanner Unit CSU-X1 from Yokogawa (IM 85A07C25-01E)
- Operating Manual for CSUX1CU Control Unit from Yokogawa Electric Corporation (IM 85A07C25-01E) , including accessories to CSUX1 (IM 85A07C26-01E and IM 85A07C27-01E)
- Operating Manual for Signal Distribution Box SVB1 (M60-2-0032)
- Operating Manual for Definite Focus (M60-2-0006)
- Operating Manual for HXP 120

1.2 Safety Instructions

1.2.1 Notes on Laser Radiation

The Cell Observer SD relies on a class 3B laser device for operation and is labeled accordingly (maximum 300 mW of output power). Laser instruments must be operated and handled in accordance with the regulations concerning health and industrial labor protection. Furthermore, the operator must observe all provisions of statutory law.

If operated conformingly, the Cell Observer SD does not create any risk of radiation exposure for operating personnel. The following warning notes must be followed in all cases:

Inform your Laser Protection Officer before you begin with procedures for initial start-up of the Cell Observer SD.

- Do not expose yourself to the laser beam!
- Do not introduce reflective objects into the beam path!
- Never open shielding or covers at the microscope system while the laser is operating!
- Never look – with or without optical aids – into the laser beam, not even in order to view a specimen. **Non-observance will cause risk of eye damage!**
- Cover up unused positions of the lens turret and protect unused camera ports with dust caps!
- Take appropriate protective measures if laser radiation causes the emergence of harmful gases, dust and vapor or secondary radiation or explosive matter at the sample.

Keep the laser operating zone clear of flammable and combustible materials.

Additional national laser protection requirements must be duly observed!

Do not remove shielding from the fiber coupling and the joint between the microscope and the CSU-X1 spinning disc unit.

1.2.2 Installation Instructions

The Cell Observer SD system may only be installed or set-up by Carl Zeiss MicroImaging GmbH Customer Service technicians or personnel specially authorized by the Manufacturer.
Carl Zeiss MicroImaging GmbH Customer Service will provide such services on a chargeable basis.

Do not install the Cell Observer SD near heat sources, e.g. radiators or direct sunlight. To avoid build-ups of heat, the ventilation slits at the microscope system must not be obstructed.

Do not operate the system, including standard-supplied accessories, in an explosive atmosphere, in the presence of such volatile anaesthetics or flammable solvents as alcohol, gasoline or similar substances.

The main power plug may only be inserted into a socket with PE contact, and its built-in protection device must not be rendered ineffective by using an extension cable without PE conductor.

The Cell Observer SD components must be powered via two or three separate line power cables, not via a common power distribution strip. This is necessary to prevent excessively strong leakage currents (refer to section 3.1.2 on page 38).

The earth cable which is included in delivery (AWG10 green/yellow) must be used for connecting the multi laser module to earth-ground. An earth-ground point must be available in the installation room.

Check that your actual voltage levels correspond to the voltages that are indicated on the nameplate of the laser module before you connect a line power cable.

For laser safety reasons, all TV outlets at the microscope must be connected to a camera or sealed with a cap.

Maintenance or repair, including work for modification, removal or replacement of components other than or in excess of the work scope described in this Operating Manual, as well as any type of intervention into the inner equipment space may only be performed by technicians of Carl Zeiss MicroImaging GmbH or persons expressly authorized to handle such work tasks on behalf of Carl Zeiss MicroImaging GmbH. In particular, this applies to the microscope system, the CSU-X1 spinning disc unit, the PC system and to cable connections.

Please note that the Cell Observer SD is an opto-electronic precision product. Improper handling may easily affect its function or even damage the system. All claims for warranty will be null and void in this case.

On completion of work for installation or retrofitting of the Cell Observer SD System, an authorized expert must perform a careful inspection to check for absence of defects. He/she must also make sure that all laser protection shields are properly mounted.

Tube openings and other unused connection terminal must always be protected from dust and moisture with appropriate sealing aids or anti-dust caps.

Do not operate the equipment delivered in potentially explosive atmospheres.

The Cell Observer SD is only approved for operation in closed rooms.

Establish a suitable workplace environment in order to prevent the formation of electrostatic charges in electronic components.

Always disconnect the instrument from the power outlet before opening it and changing the fuses.

Only use fuses appropriate for the rated current as specified. The use of makeshift fuses and short-circuiting of the fuse holders are not permitted.

On completion of work for installation or conversion of the Cell Observer SD System, an authorized expert must perform a careful inspection to check for proper working condition. He/she must also make sure that all laser protection shields are correctly mounted.

Tube openings and other unused connection terminals must always be protected from dust and moisture with appropriate sealing aids or anti-dust caps.

Dust and dirt may impair the instrument's performance. The instrument must therefore be protected as far as possible from such influences.

Clogged or covered ventilation slats may lead to heat build-up that will damage the instrument and, in extreme cases, cause a fire. Always keep the ventilation slats clear and ensure that no objects enter the instrument through the ventilation slats.

To prevent vibrations during Cell Observer SD operation, you should work with an Axio Observer anti-vibration plate.

If it is determined that protective measures are no longer effective, the instrument must be switched off and secured against inadvertent operation. Please contact a Zeiss service agency or the Carl Zeiss Microscopy Service to have the instrument repaired.

Read the Immersol 518 F® safety data sheet in all these cases.

Immersol 518 F® immersion oil causes skin irritation. Avoid any contact with your skin, eyes or clothing.
In case of actual skin contact, wash off with plenty of water and soap. In case of eye contact, rinse affected eye immediately with plenty of water for at least five minutes. See a specialized physician in case of persisting irritation.

Proper disposal: Do not drain Immersol 518 F® into surface water or sewer system.

Avoid touching the hot lamp housing. Allow the instrument to cool down for at least 15 minutes.

The instruments are not equipped with any special devices for protection from corrosive, potentially infectious, toxic, and radioactive or other substances that may be hazardous to health. Make sure to observe all legal regulations when handling such substances, particularly the relevant national accident prevention regulations.

Defective instruments must not be disposed of with household waste; they have to be disposed of in compliance with the relevant legal provisions.
Samples have also to be disposed of properly according to the applicable legal provisions and internal work instructions.

1.2.3 Service Interfaces

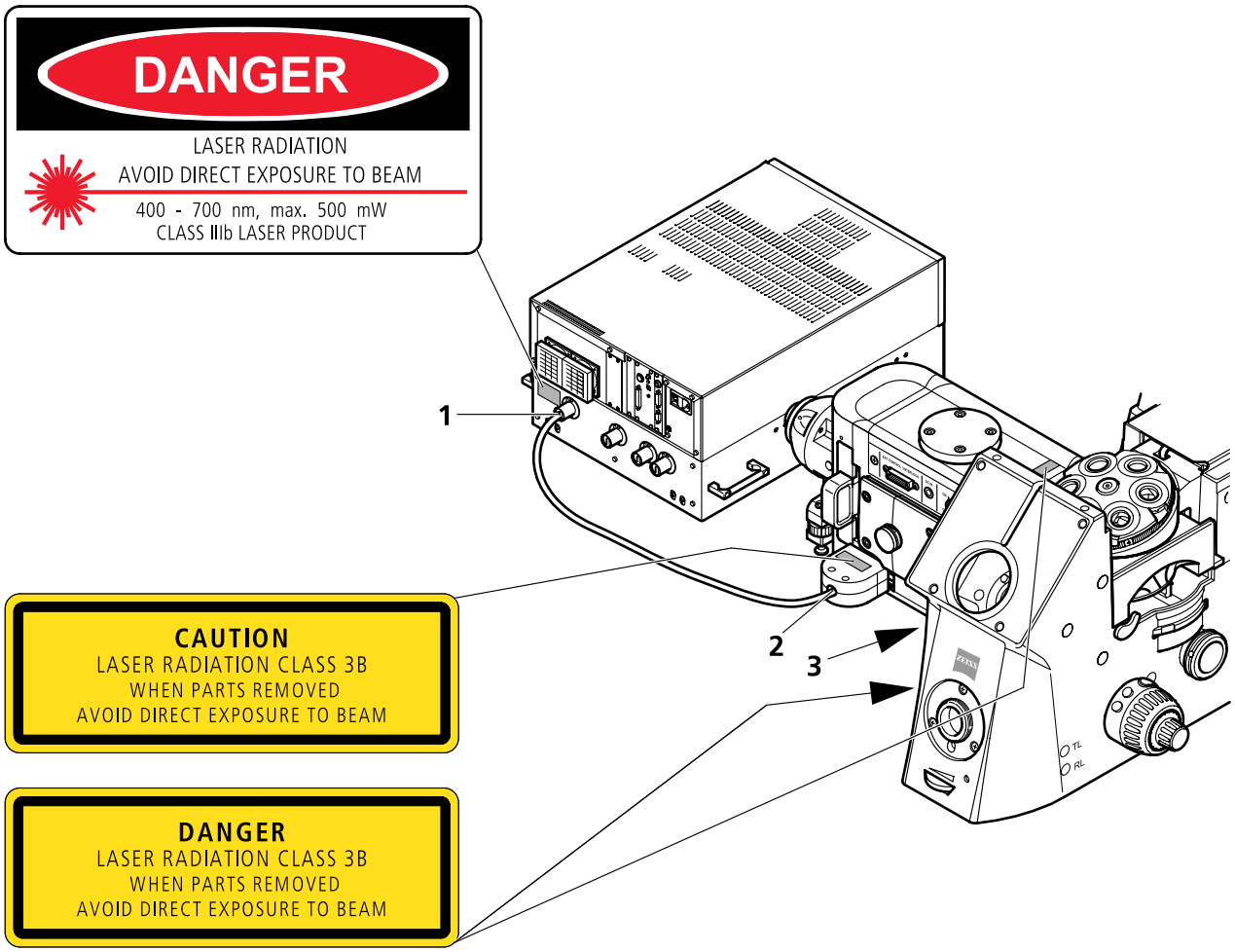


Fig. 1-1 Service interfaces at the Axio Observer.Z1 – CSU-X1 spinning disc unit – multi laser module

CAUTION
The fiber connectors (Fig. 1-1/**1** and **2**) may only be detached by Carl Zeiss service technicians.

If one fiber end is not firmly connected to the fiber mount, laser class 3B radiation will emerge!
Non-observance involves the risk of eye damage!

CAUTION
The cover (Fig. 1-1/**3**) at the joint between the CSU-X1 spinning disc unit and the Axio Observer.Z1 may only be removed by Carl Zeiss service personnel.

If the CSU-X1 spinning disc unit and the Axio Observer.Z1 are not firmly connected with each other, there may be emergence of class 3B laser radiation!
There may be eye damage if this rule is disregarded!

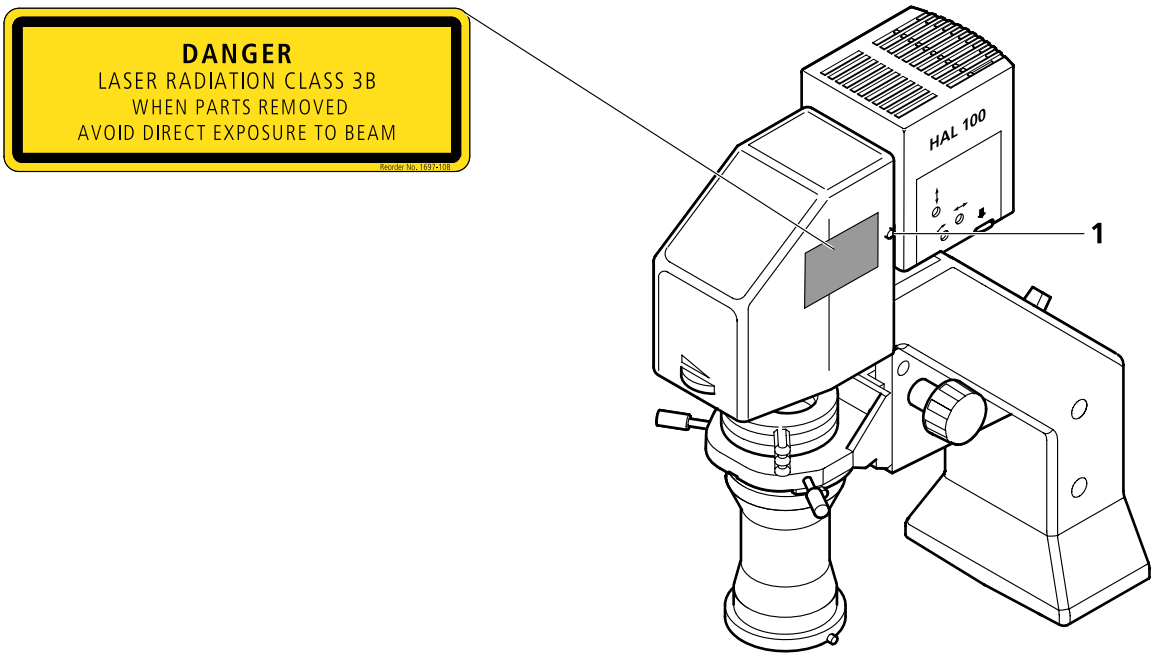


Fig- 1-2 Service interface between transmitted light illumination carrier and HAL lamp

CAUTION
Only Carl Zeiss service personnel are allowed to release the clamping screw (Fig- 1-2/**1**).

If the lamp housing is removed, laser class 3B radiation will emerge!
Non-observance involves the risk of eye damage!

CAUTION
Switch the laser off in any case prior to replacing the halogen lamp of the HAL illuminator!
Non-observance involves the risk of eye damage!

1.2.4 Warning and Information Labels on the Instrument

Follow all warning and information labels that are affixed to the Cell Observer SD and the Axio Observer microscope. Please check that all labels shown below are actually in place.
Contact Carl Zeiss MicroImaging GmbH if a sign or label is found to be missing. You will receive replacement free of charge.

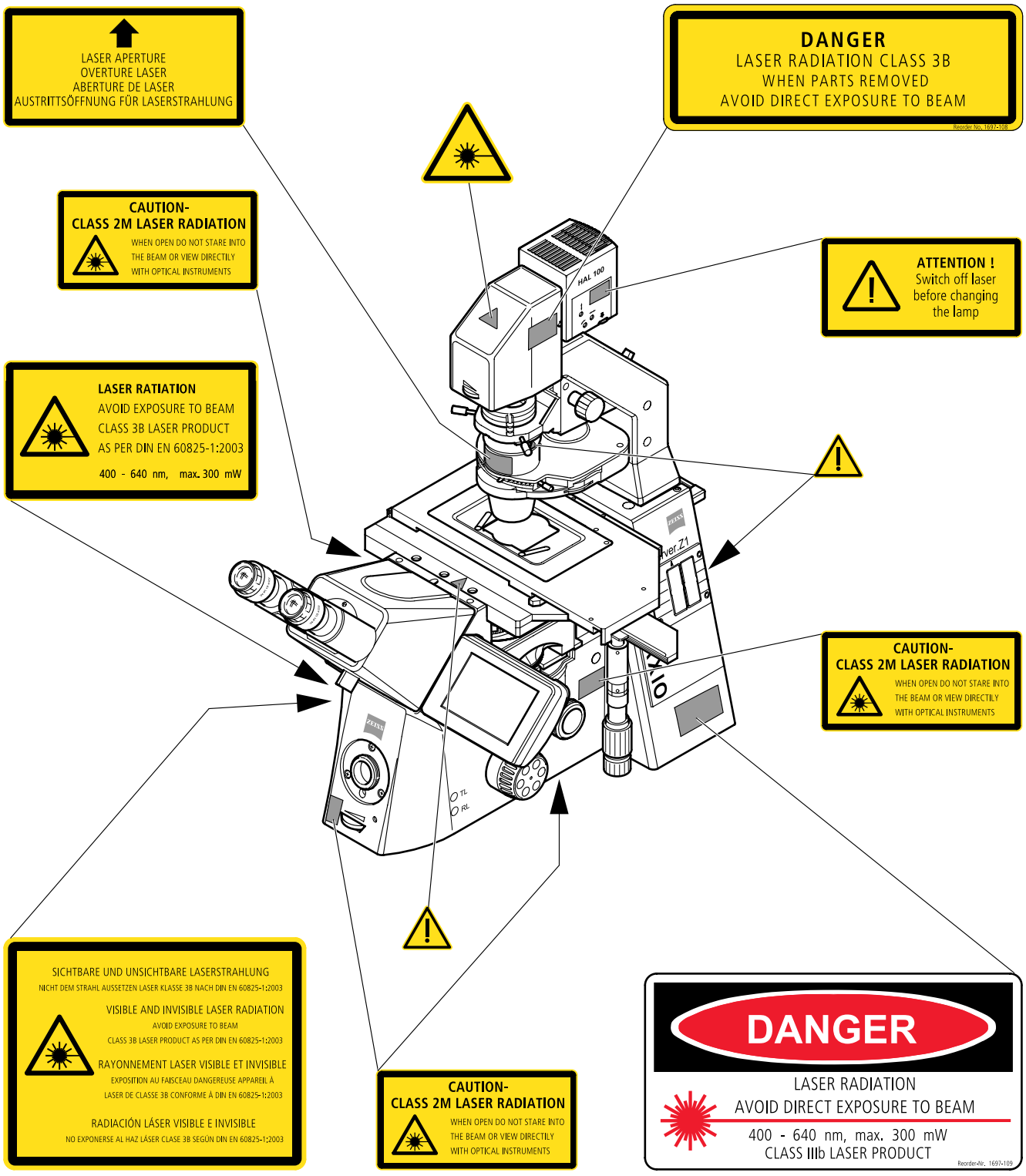


Fig. 1-3 Warning and information labels at the Axio Observer.Z1 microscope

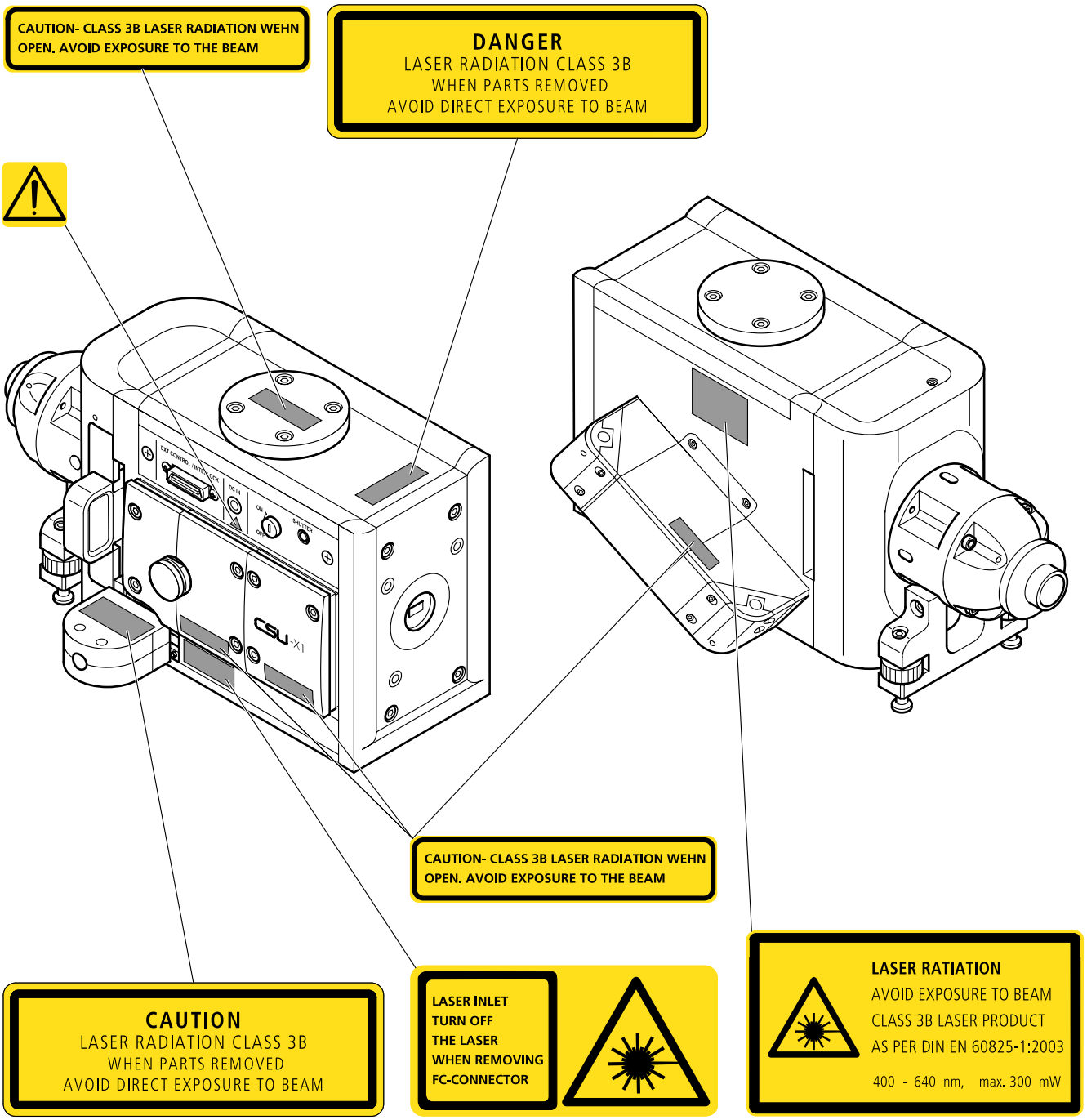


Fig. 1-4 Warning and information labels at the Cell Observer SD

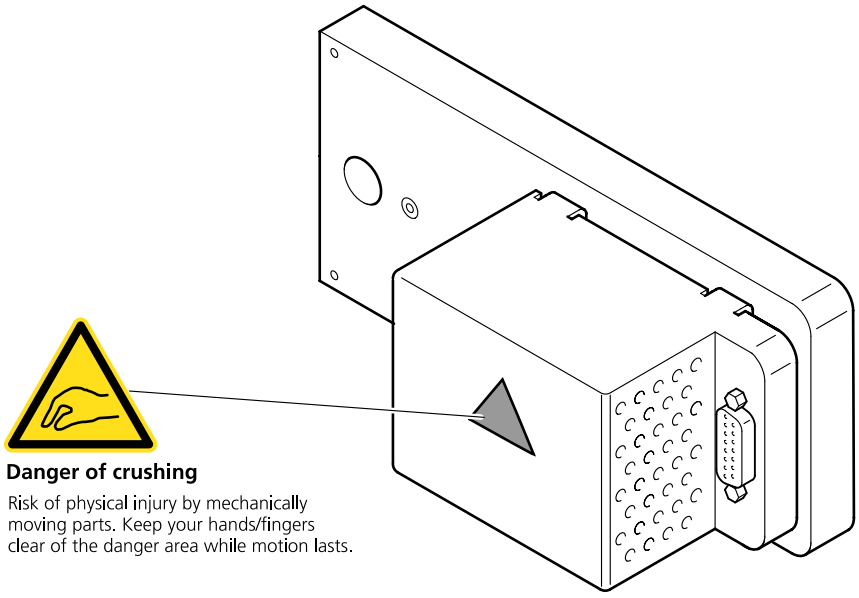


Fig. 1-5 Warning and information labels at the filter wheel

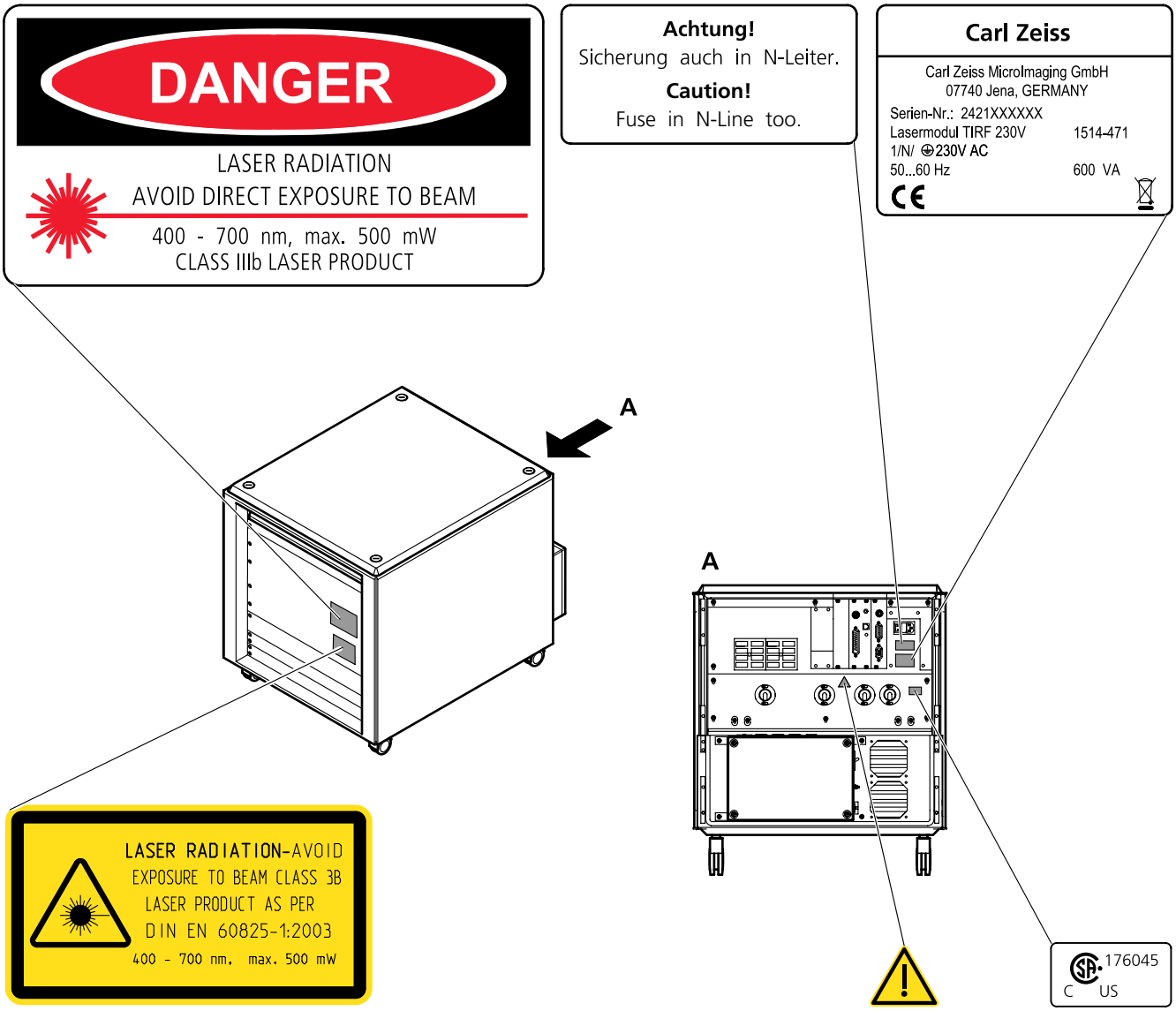


Fig. 1-6 Warning and information labels at the multi laser module

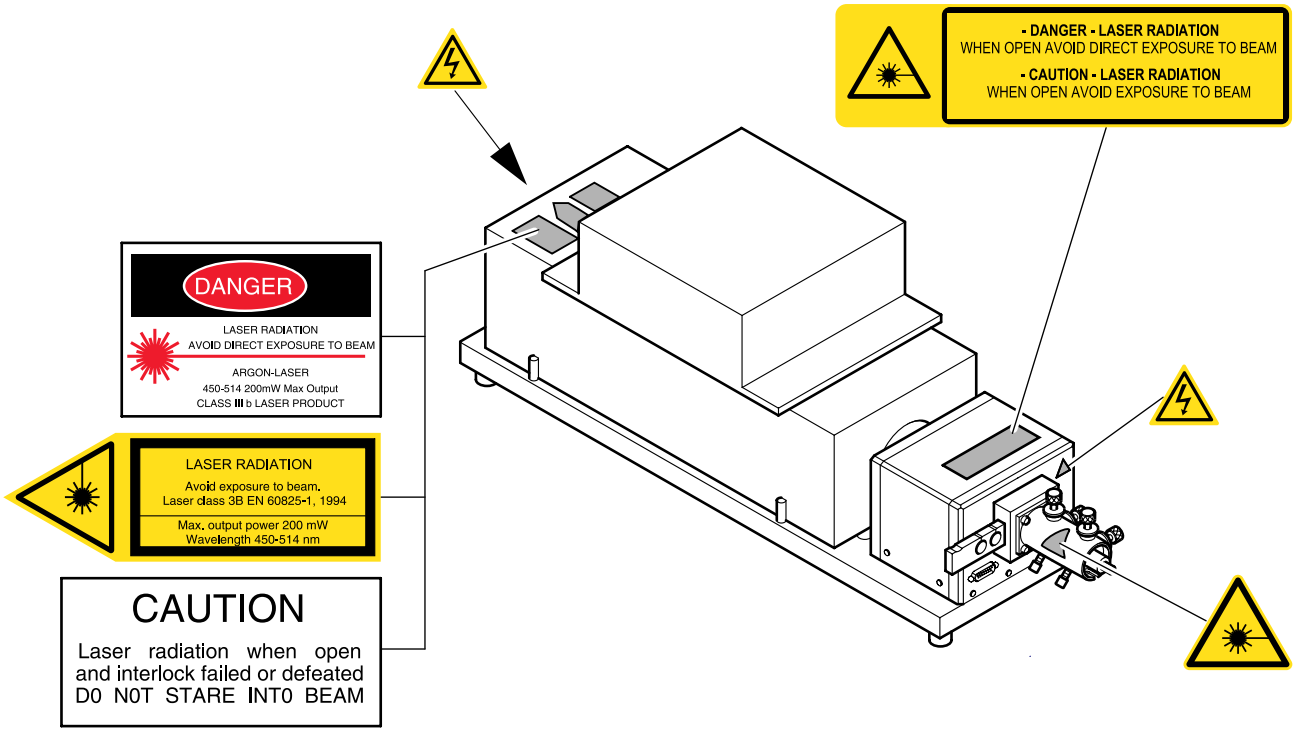


Fig. 1-7 Warning and information labels at the laser module, variant 1

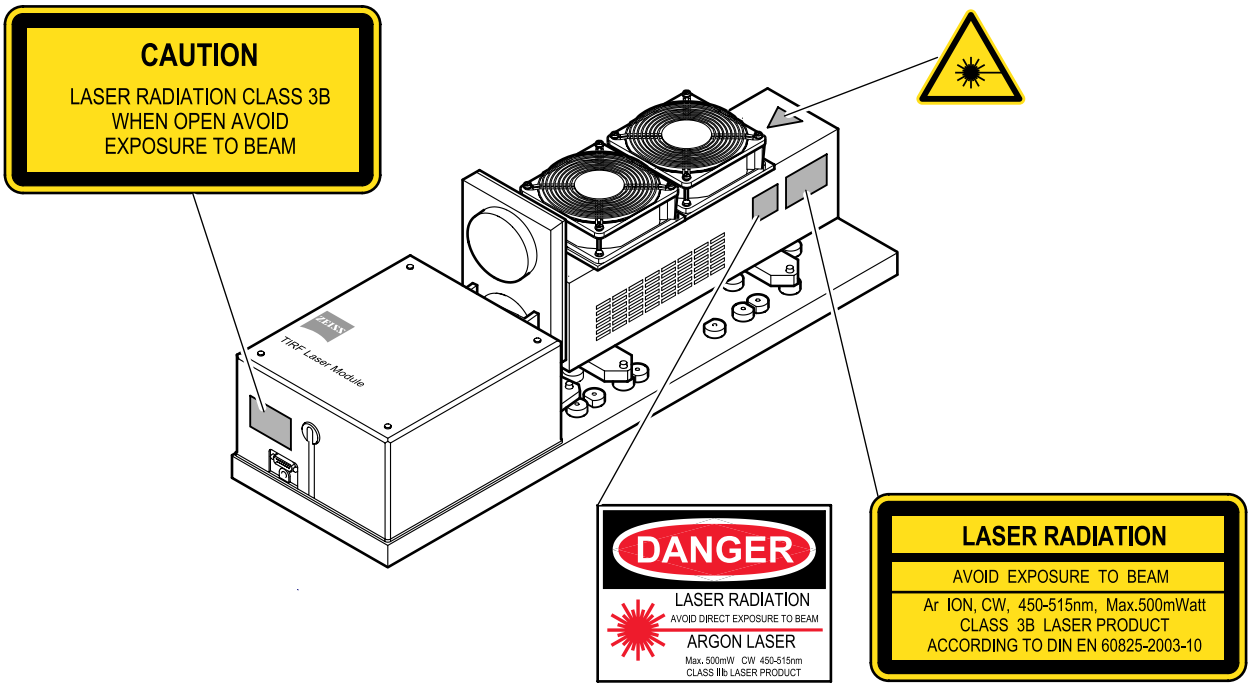


Fig. 1-8 Warning and information labels at the laser module, variant 2

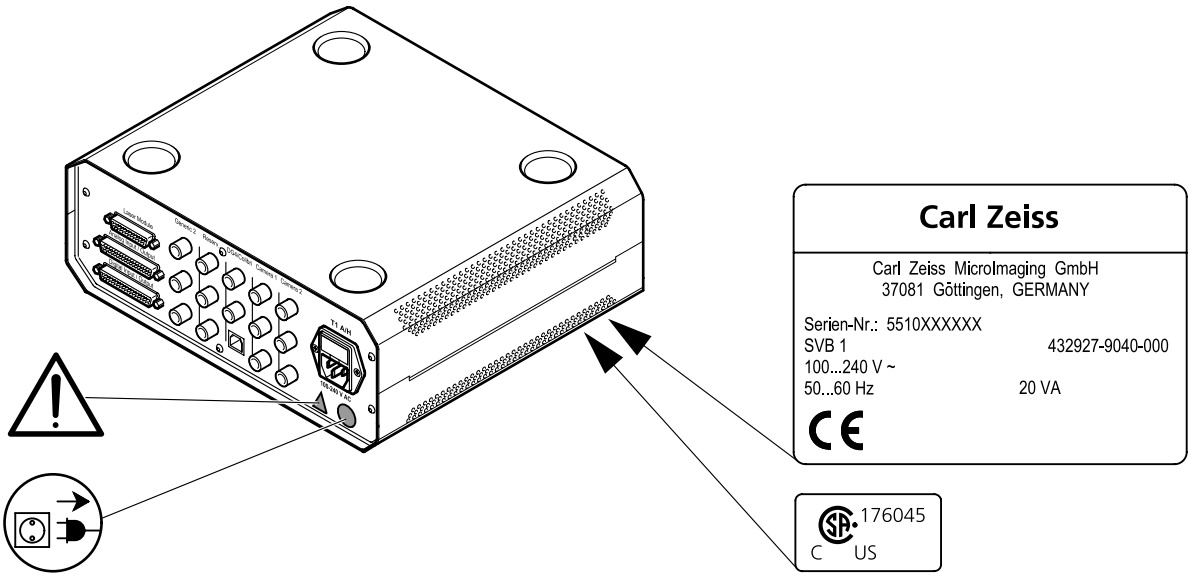


Fig. 1-9 Warning and information labels at the SVB 1 (optional component)

1.3 Notes on Warranty

The manufacturer guarantees that the instrument is free from material and production defects when delivered. Defects must be notified immediately on identification and maximum efforts must be undertaken in order to keep the damage as small as possible. On receiving notice of such a defect, the manufacturer will be under obligation to remove it, at its own option, either by providing adequate repair services or by delivering a faultless product for replacement. No warranty is given for defects caused by natural wear (wearing parts in particular) and improper use.

The manufacturer is not liable for damage resulting from faulty operation, negligence, or any other meddling with the instrument, particularly the removal or replacement of instrument components or the use of accessories from other manufacturers. Any such case will void the user's warranty claims.

Except for action which is explicitly described in this operating manual, no maintenance or repair work to the Cell Observer SD is allowed. Repairs may only be carried out by the Carl Zeiss Service or by persons specifically authorized by it. Should any malfunction occur, please get in touch with your local Carl Zeiss agency.

Customers using their own lasers will be solely responsible for overall laser safety of the Cell Observer SD system. They shall also check for further required laser safety precautions and validity of all laser warning labels that are affixed to the system, including the microscope.
The Manufacturer will refuse liability for modifications performed on the Cell Observer SD system.

2 INSTRUMENT DESCRIPTION

2.1 Intended Use

Product name: CSU-X1M 1800 spinning disc unit
CSU-X1M 1800 Dual Cam spinning disc unit
CSU-X1M 5000 spinning disc unit
CSU-X1M 5000 Dual Cam spinning disc unit
CSU-X1A 5000 spinning disc unit

When configured with a CSU-X1 spinning disc unit, the Cell Observer SD provides a system to capture confocal fluorescence pictures in real time. This is achieved with a multi-hole Nipkow scanning disc. A multi-laser module is used as the light source. Alternatively, a multi-line Ar-laser may be selected.

One or two CCD cameras perform real-time image capturing.

The spinning disc unit should only be operated when combined with an Axio Observer.Z1 microscope stand.

Human blood and tissue samples may be examined.

The laser modules (refer to configuration options, section 2.4 on page 30) may not be operated on the Cell Observer SD, unless combined with a basic safety kit for Z1 "Axio Observer" microscope stand (432927-9010-000).
Use the Cell Observer SD only with laser class 3B laser modules up to 300 mW of output power.

Carl Zeiss MicroImaging GmbH cannot warrant the proper function of microscope system components or the compliance with laser system safety requirements if lasers of a higher power rating are selected.

2.2 Functional Principle

The confocal CSU-X1 spinning disc unit scans hundreds of image points simultaneously. Compared to conventional spot scanners, distinctly higher image rates can thus be achieved. For detection of fluorescence, EM CCD cameras of high quantum efficiency can be used, which reduces the level of illumination intensity and phototoxicity to a required minimum.

A CSU-X1 confocal scanner includes a so-called Nipkow rotating disc with thousands of pinholes arranged in a spiral-like pattern. By illumination and through-disc detection, just as many image points can be imaged concurrently. Because the disc rotates, the sample surface is completely scanned a bit at a time. After rotation of 30°, the entire visual field of the camera has been fully imaged once.

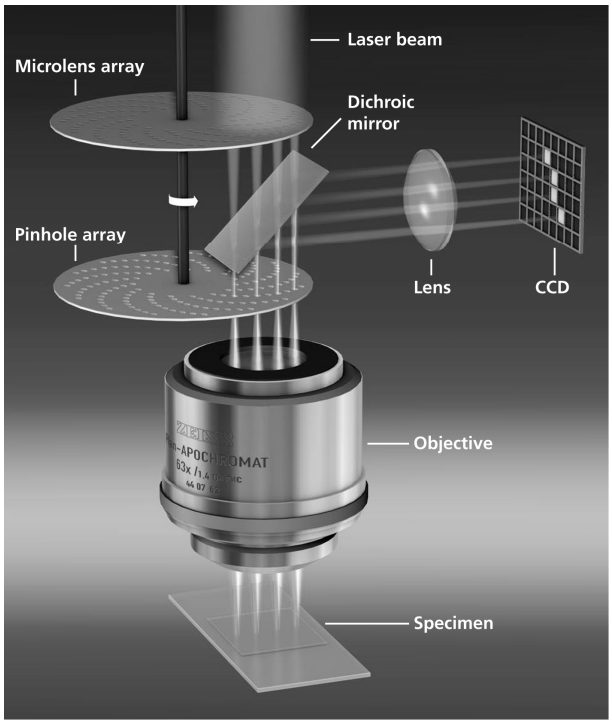


Fig. 2-1 Schematic view of CSU-X1 spinning disc unit

Since a large amount of incident light would be blocked by the areas between the pinholes, the scanning disc unit is equipped with a special tandem disc setup. The Nipkow disc acts in unison with a preceding second mechanically coupled disc. It contains micro lenses to exactly focus and direct the incident bundle of excitation light through the subsequent pinholes for increased light efficiency.

For optimal adaptation to the various operating requirements, the CSU-X1 scanning disc unit is available at different configuration levels.

Spin speed:
Depending on the dynamics of an application, the Nipkow disc's spin speed may vary. Available options are:

- a fixed rotation speed of 1800 rpm,
- variable speed settings from 1500 to 5000 rpm

Filter wheels:
Fast optional filter wheels reduce emission filter switch times to as little as 33 ms (purely mechanical switching time) between neighbouring positions. Combined with AOTF-based selection of a desired excitation wavelength, this facilitates express multi-channel experiments.

Dual camera operation:
The dual camera option provides two cameras for concurrent image acquisition in two different emission ranges. This prevents a time offset between a pair of channels and helps avoid inaccuracies during co-localization or ratio calculation tasks.

2.3 Instrument Description and Main Features

The following components are required for working with the Cell Observer SD with Axio Observer:

- Microscope Axio Observer.Z1,
- Laser safety device for microscope and peripheral units consisting of: eyepiece shutter (built into the microscope), safety distribution box and laser shutter inside the laser module,
- CSU-X1 laser safety kit,
- Observer-to-CSU matching parts,
- Laser module with multi-line argon laser, fiber coupling ports and laser safety components
  or
  Multi laser module with a maximum of four solid-state lasers, fiber coupling ports and laser safety components,
- High-resolution, high-aperture objective lenses, for example Plan-Apochromat 63x/1.4 Oil,
- PC with working memory not less than 512 MB,
- Monitor for image display,
- AxioCam MRm, AxioCam HRm, AxioCam HSm digital camera or Photometrics EMCCD cameras,
- AxioVision image processing software (Rel. 4.7 or higher),
- Anti-vibration table or anti-vibration plate for Axio Observer.

Please note that only lasers up to laser class 3B (with 300 mW maximum total output power within the 450 nm – 640 nm wavelength band) are permitted for operation of the Cell Observer SD imaging system. Per laser line, the energy must not exceed a level of 100 mW.

You are prohibited from using a laser of greater power. Carl Zeiss MicroImaging GmbH will not assume any warranty for components of the microscopic system and for maintenance of system laser safety in such cases.

For connection, use only the fiber that is included in delivery of the scanning disc unit.
The laser power which is injected into the fiber must not exceed a maximum of 100 mW.

2.3.1 Cell Observer SD

Five different scanning disc unit models are available for operation (also refer to CSU-X1 Operating Manual):

Model	Description
CSU-X1M 1800 spinning disc unit	Confocal scanner with one camera port and fixed spinning disc rotation speed (at 1800 rpm)
CSU-X1M 1800 Dual Cam spinning disc unit	Confocal scanner with two camera ports and fixed spinning disc rotation speed (at 1800 rpm)
CSU-X1M 5000 spinning disc unit	Confocal scanner with one camera port and variable spinning disc rotation speed (from 1500 to 5000 rpm)
CSU-X1M 5000 Dual Cam spinning disc unit	Confocal scanner with two camera ports and variable spinning disc rotation speed (from 1500 to 5000 rpm)
CSU-X1A 5000 spinning disc unit	Confocal scanner with one camera port, filter wheel and variable spinning disc rotation speed (from 1500 to 5000 rpm)

A CSU-X1 control box is available for upgrading a CSU-X1M 1800/1800 Dual Cam spinning disc unit to a CSU-X1M 5000 or a CSU-X1M 5000 Dual Cam spinning disc unit, respectively.

Furthermore, all X1M spinning disc units may be fitted with a filter wheel.

A second camera port may be retrofitted to the CSU-X1A spinning disc unit for upgrading into a Dual Cam version.

A C-mount camera adapter is intended for mechanical attachment of the spinning disc unit to one of the side ports or the base port of the microscope. The spinning disc unit is additionally linked up with the laser module via an optical fiber. The optical set-up of the CSU-X1 spinning disc unit allows for confocal multi-point scanning of a specimen.

The Cell Observer SD accepts camera adapters of 1.0x or 1.2x magnification as appropriate for the installed type of camera.

The laser light is introduced via an optical fiber.

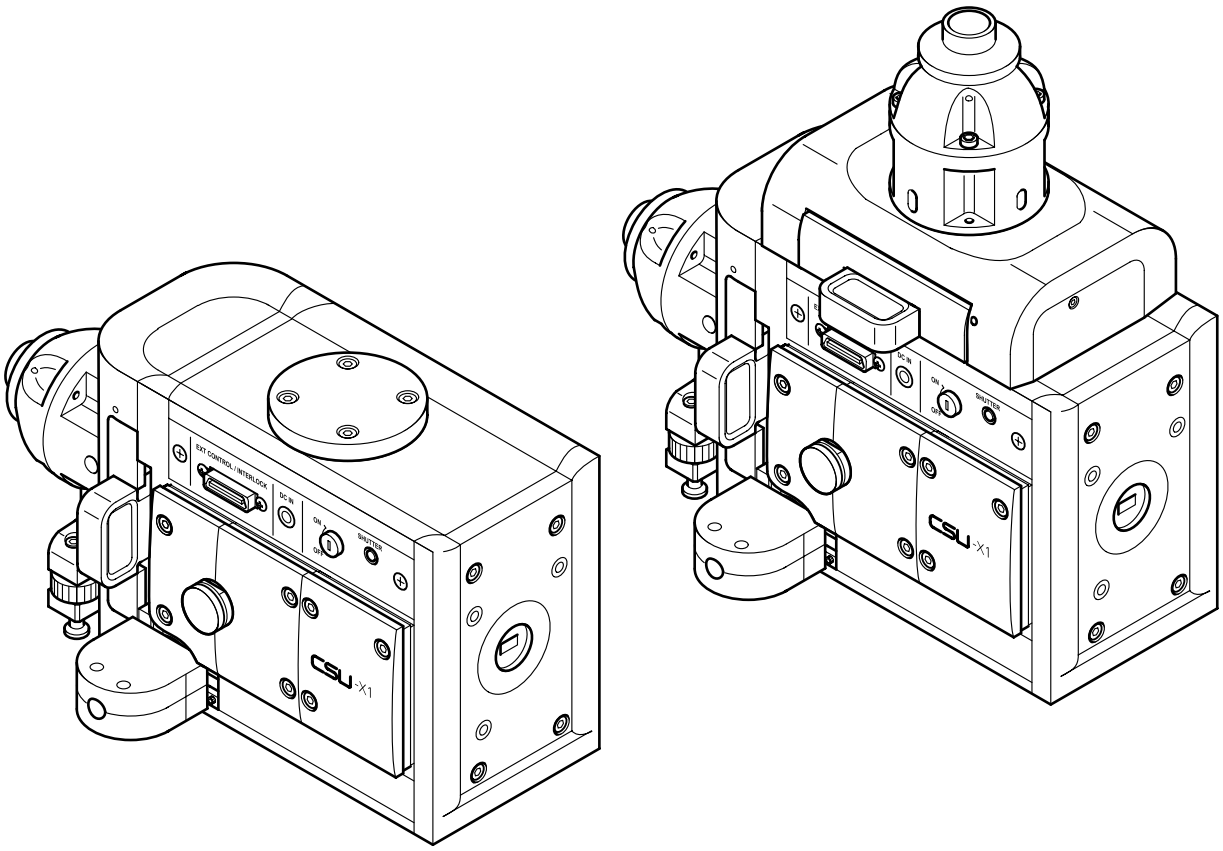


Fig. 2-2 Cell Observer SD (left) und Cell Observer SD with Dual Cam (right)

2.3.2 CSU-X1 Control Box

The CSU-X1 control box controls the scanning speed and the filter wheel actions. For compatibility issues, you should consult the system overview in section 2.4 (also refer to CSU-X1 Operating Manual).

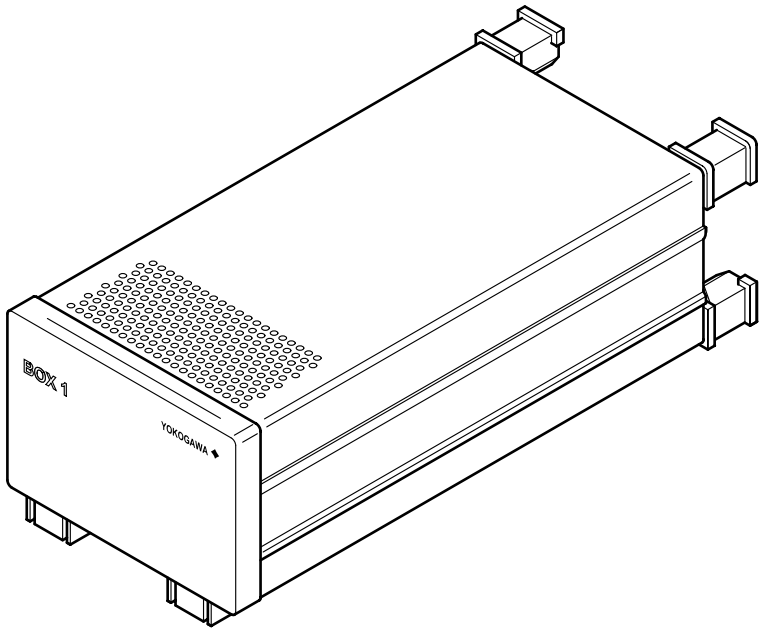


Fig. 2-3 CSU-X1 Control Box for CSU-X1 spinning disc unit

2.3.3 Multi Laser Module

The multi laser module contains the laser units for the individual laser lines and the corresponding electronic system. The laser modules can be configured for a maximum of four laser lines (refer to section 2.7 Technical Data).

An optical fiber cable links the laser module with the spinning disc unit.

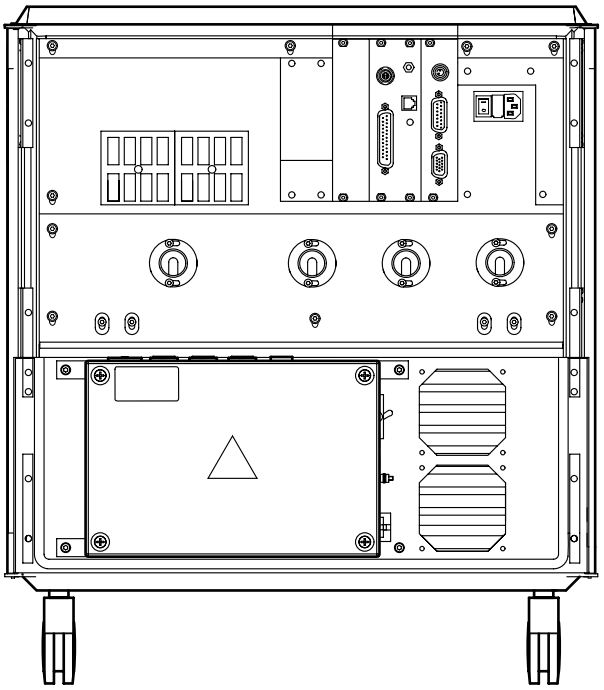


Fig. 2-4 Multi laser module

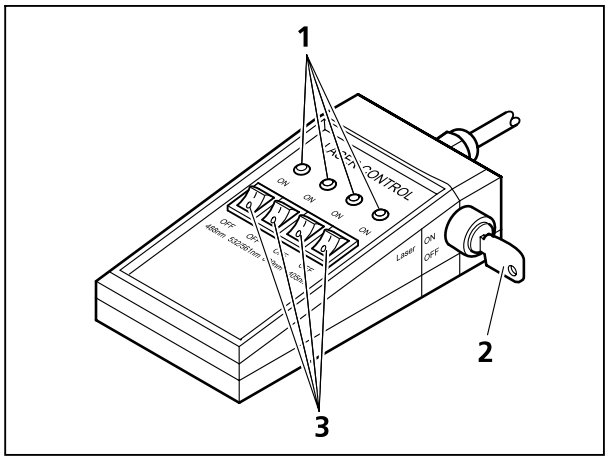


Fig. 2-5 Laser controller

The laser lines are controlled by means of the laser controller included in the delivery, which is connected to the multi laser module. The key-operated switch (Fig. 2-5/**2**) is used to switch the laser line system on and off.

The individual laser lines can be switched on by means of the corresponding switches (Fig. 2-5/**3**) of the laser controller. The status LEDs (Fig. 2-5/**1**) indicate the active laser lines. The laser lines are switched off by means of the key-operated switch.

2.3.4 Signal Distribution Box SVB 1

The signal distribution box is intended for connection of the various system components (refer to Signal Distribution Box SVB 1 operating manual).

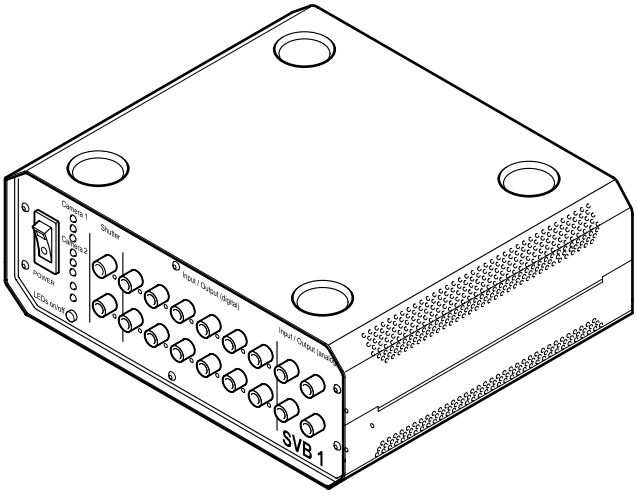


Fig. 2-6 Signal Distribution Box SVB 1

2.3.5 Filter Wheel

The filter wheel can be configured with a maximum of six filters. These are individually moved into, and out of, the optical beam path by motorized motion.

The filter wheel can be used with all types of CSU-X1 spinning disc unit, in which case it replaces the emission slide. It requires connection to a CSU-X1 control box for normal operation (refer to section 2.3.2).

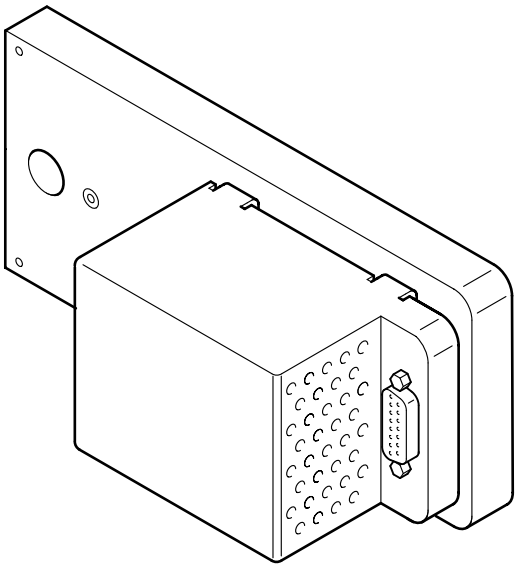


Fig. 2-7 Filter wheel for CSU-X1 spinning disc unit

2.3.6 Basic Laser Safety Kit

The basic laser safety kit includes an eyepiece shutter (factory-installed or retrofitted by service personnel), a laser safety board for the stand, a distribution box and sticker labels.

The distribution box for laser safety (Fig. 2-8/**3**) must be connected to the rear of the stand (Fig. 3-9) using a 15-pole sub-D connector (Fig. 2-8/**1**).

The four jack terminals of this distribution box (Fig. 2-8/**2**) are available for connection to the laser protection cover or laser protection incubator, the laser shutter and the multi-laser module.

Jumpers must be installed onto unused jack terminals of the distribution box. This is necessary to enable release motion for the laser shutter inside the laser module.

In addition to that, the distribution box contains a connection for a door interlock switch (Fig. 2-8/**4**) This connection is provided with a factory-installed crossover connector.

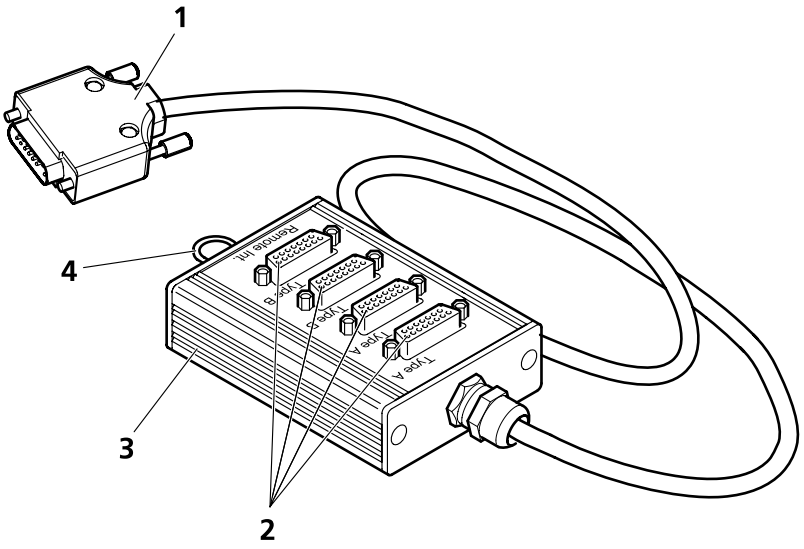


Fig. 2-8 Distribution box for laser safety

2.3.7 Safety Kit for Customer-Provided Laser Module

The safety kit for Customer-provided laser modules consists of a safety shutter for the laser module (laser shutter) and a connecting cable. Fig. 2-9 shows the components of a safety kit for Laser-TIRF

If you intend to use a self-provided laser module, place the safety shutter directly at the exit aperture of the laser beam between the coupling unit and the laser aperture before the first start-up. Plug the connector of the laser shutter (Fig. 2-9/**2**) into the converter board. Then connect the board to the distribution box for laser safety using the connection cable (Fig. 2-9/**3**). The laser beam must be completely blocked by the shutter blade (Fig. 2-9/**1**) in its lower (de-energized) position.

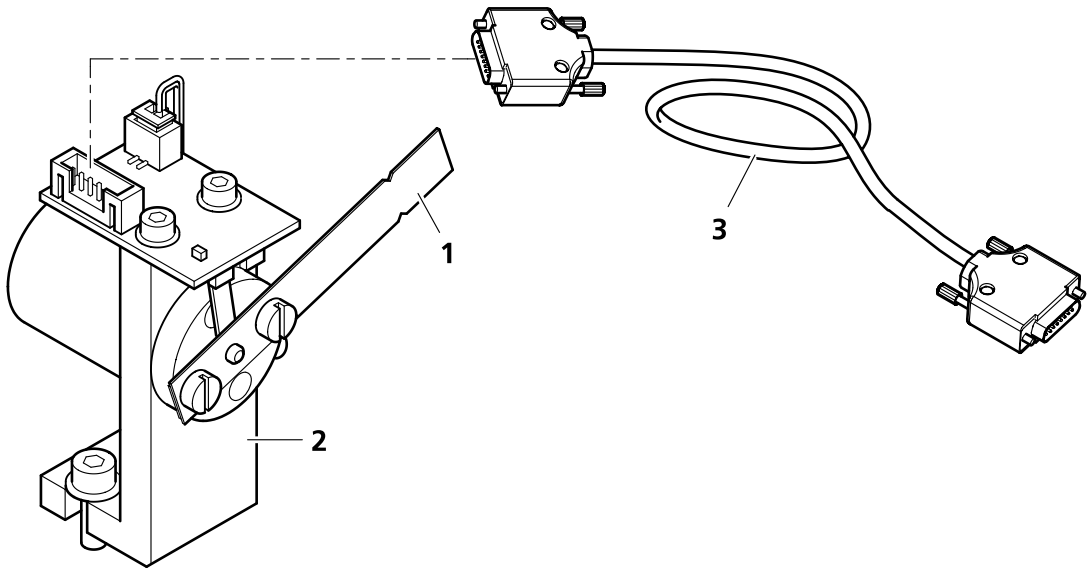


Fig. 2-9 Laser shutter, converter board and connection cable of safety kit for customer-provided laser modules

Customers using their own lasers will be solely responsible for overall laser safety of the Cell Observer SD system. They shall also check for further required laser safety precautions and validity of all laser warning labels that are affixed to the system, including the microscope.

To operate the system with a total laser power > 300 mW, further laser safety precautions are required for the microscope.

Where lasers with a total laser power > 300 mW or other wavelengths are used, the Cell Observer SD protection system must be reviewed for protective effect.

Notify your Laser Safety Officer before proceeding with the initial system start-up.
Valid national laser protection requirements must be met.

2.4 System Overview Cell Observer SD

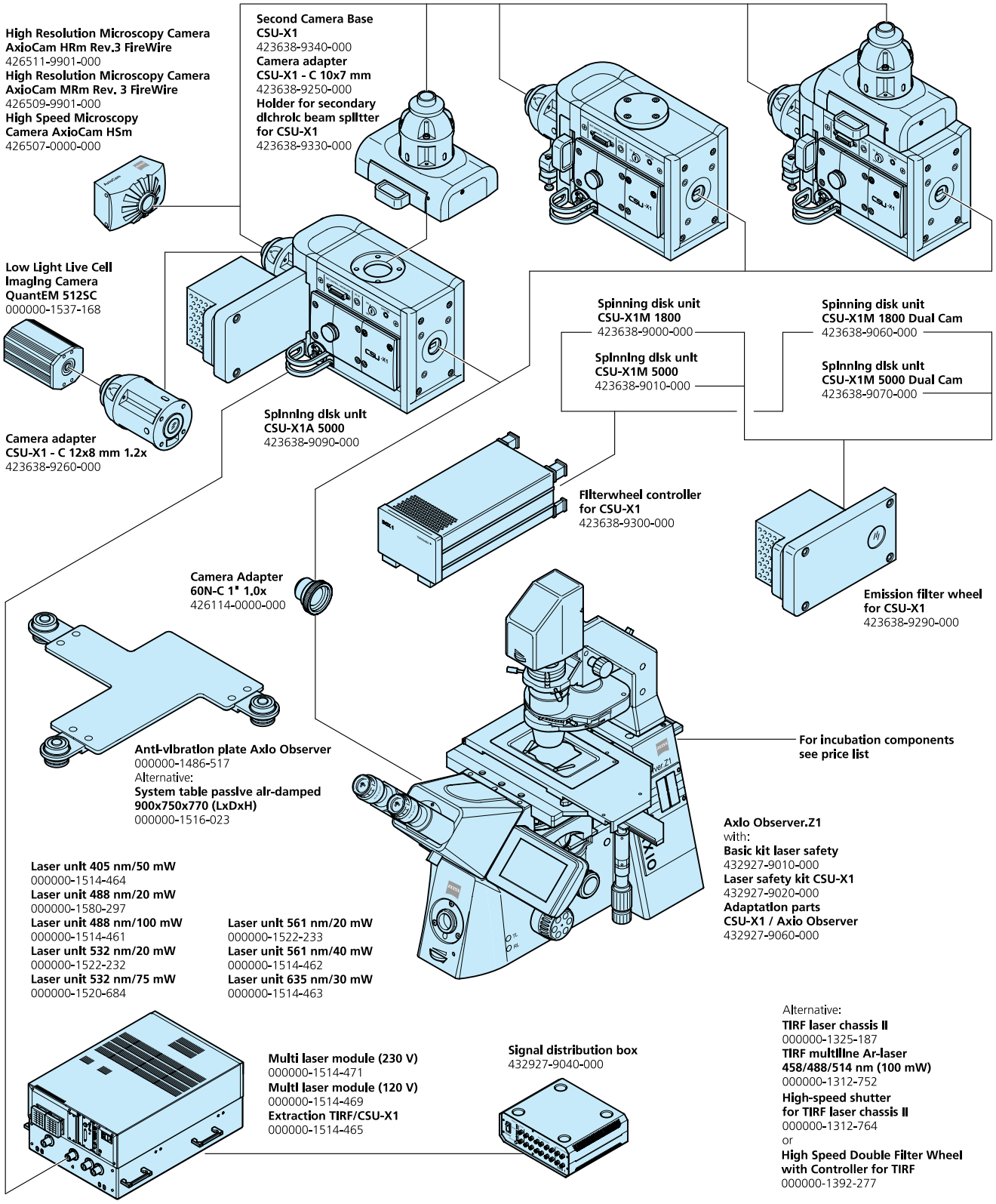


Fig. 2-10 System overview

2.5 Suitability of Objectives for the Use

The functional principle described in section 2.2 imposes certain requirements for selection of objectives.

The pinhole diameter is 50 µm, a pair of neighbouring pinholes are located at a distance of 250 µm from each other. The pinhole diameter is optimized for strongly magnifying objective lenses with a high numerical aperture (100x / 1.4 or similar).

Using the CSU-X1 with weakly magnifying objectives will result in specimen sections with a thickness by far greater than 1 AU (Airy Unit).

2.6 Suitability of Optical Fibers for Use in Cell Observer SD

For this application, the optical fiber cable is factory-shipped as an integral part of the spinning disc unit.

The total laser power which is injected into the fiber cable must not exceed a value of 100 mW!

2.7 Technical Data

Dimensions (width x depth x height)

CSU-X1M 1800/5000 spinning disc unit	approx. 324 mm x 213 mm x 175 mm
CSU-X1M 1800/5000 Dual Cam spinning disc unit	approx. 324 mm x 213 mm x 304 mm
CSU X1A 5000 spinning disc unit	approx. 324 mm x 301 mm x 175 mm
CSU-X1 control box	213 mm x 438 mm x 132 mm
Filter wheel	112 mm x 226 mm x 100 mm
Multi laser module with rack	600 mm x 700 mm x 692 mm
Stand for Axio Observer.Z1	approx. 295 mm x 805 mm x 707 mm
Signal distribution box	250 mm x 95 mm x 220 mm
Safety distribution box	30 mm x 55 mm x 85 mm
Definite Focus controller	250 mm x 95 mm x 220 mm
HXP120	130 mm x 210 mm x 290 mm

Weight

CSU-X1M 1800/5000 spinning disc unit	7.5 kg
CSU-X1M 1800/5000 Dual Cam spinning disc unit	9.5 kg
CSU X1A 5000 spinning disc unit	9.4 kg
CSU-X1 control box	5.2 kg
Filter wheel	1.9 kg
Multi laser module	approx. 90 kg
Axio Observer.Z1	approx. 15 kg
Signal distribution box	approx. 2 kg
Definite Focus controller	approx. 2.6 kg

Environmental conditions

Transport (in packaging)

Permissible ambient temperature	-20 to +70 °C
Permissible relative air humidity (no condensation)	5 % to 95 %

Storage

Permissible ambient temperature	+5 to +40 °C
Permissible relative air humidity (no condensation)	5 % to 95 %

Operation

Permissible ambient temperature	+15 to +40 °C
Permissible relative air humidity	20 % to 75 %
Atmospheric pressure	800 hPa to 1060 hPa
Max. altitude of installation site	2000 m
Pollution degree	2

Operating data

Axio Observer.Z1, motorized with external VP 231 power supply:

Intended site ..... closed rooms
Protection class I
Protection type ..... IP 20
Electrical safety ..... in compliance with DIN EN 61010-1 (IEC 61010-1)
under consideration of CSA and UL directives
Safety of laser devices ..... in accordance with DIN EN 60825-1 (IEC 60825-1)
Overvoltage category II
Radio interference suppression ..... in accordance with EN 55011 class B
Noise immunity ..... in accordance with DIN EN 61326-1

Line voltage ranges of Axio Observer.Z1

External VP 231 power supply, stabilized ..... 100 to 127, 200 to 240 VAC (± 10 %)
Change of instrument voltage setting is not necessary!
Line frequency ..... 50/60 Hz

Power consumption with internal power supply units:

Axio Observer.Z1 with external VP231 power supply unit ..... .280 VA
Power supply unit for XBO 75, 100 - 240 V AC ..... 130 VA
Power supply unit for HBO 100, 100 - 240 V AC ..... 155 VA

Fuses according to IEC 127

Axio Observer.Z1 stand
100 ... 240 V AC ..... T 6.3 A/H; 250 V; 5 × 20 mm

Light sources

Halogen lamp ..... 12 V / 100 W
Controllability of light source ..... continuously, approx. 3 V to 12 V
Mercury-vapor short-arc lamp HBO 103 W/2 ..... 100 W
Power ..... 100 W

Optical-mechanical data

Stand with stage focusing drives - coarse focusing drive ..... 2 mm/rotation
and fine focusing drive ..... 0.2 mm/rotation
Fine scale ..... 1 µm/scale division
Total focusing range ..... approx. 10 mm
Exchange of objectives ..... via 6x lens turret
Objectives ..... with M27x0.75 screw mount
Eyepieces, tube diameter ..... 30 mm
and with field-of-view number 23

Laser modules

Laser wavelengths ..... 405 to 640 nm
Laser class 3B
Laser power
- Ar/Multiline 458/488/514 ..... 25 mW resp. 100 mW
- Diode laser 405 nm ..... 50 mW
- DPSS laser 488 nm ..... 20 mW or 100 mW
- Diode laser 532 nm ..... 20 mW or 75 mW
- Diode laser 561 nm ..... 20 mW or 40 mW
- Diode laser 635 nm ..... 30 mW

Advisory notice regarding work with your own laser:
Use only a class 3B laser (with a total output power not greater than 300 mW). Contact Carl Zeiss MicroImaging GmbH if you intend to select a laser with a wavelength that is different from those specified above.

Customers using their own lasers will be solely responsible for overall laser safety of the Cell Observer SD system. They must check for further required laser safety precautions and validity of all laser warning labels affixed to the system, including the microscope.

Laser power supply unit (25 mW)

Line voltage ..... 115/230 V AC
Line frequency ..... 50/60 Hz
Power ..... max. 3 kVA

Laser power supply unit (100 mW)

Line voltage ..... 200 to 240 V AC
Line frequency ..... 50/60 Hz
Max. power consumption ..... 16 A

Multi-Lasermodul

Line voltage for 120 V fan module ..... 108 to 132 V AC
Line voltage for 230 V fan module ..... 207 to 253 V AC
Line voltage laser module ..... 108 bis 132 V AC/ 207 to 253 V AC
Line frequency ..... 50/60 Hz
Power ..... max. 600 VA
Protection class I
Protection type IP20
Overvoltage category 2
Fuses according to IEC 127:
- Laser module TIRF 120 V ..... 2x T6.3 A/E; 250 V, 5 x 20 mm
- Laser module TIRF 230 V ..... 2x T3.15 A/E; 250 V, 5 x 20 mm

SVB 1 (Signal distribution box)

Line voltage ..... 100 to 240 V ±10 %
Change of instrument voltage setting is not necessary!
Line frequency ..... 50/60 Hz
Maximum power consumption ..... 20 VA
Fuses ..... 2x T1.0 A/H
Intended site ..... closed rooms
Protection class I
Protection type ..... IP 20
Electrical safety ..... in compliance with DIN EN 61010-1 (IEC 61010-1)
under consideration of CSA and UL directives
Overvoltage category II
Radio interference suppression ..... in accordance with EN 55011 class B
Noise immunity ..... in accordance with DIN EN 61326-1

Control Box CSU-X1

Line voltage ..... 100 to 240 V ±10 %
Change of instrument voltage setting is not necessary!
Line frequency ..... 50/60 Hz
Maximum power consumption ..... max. 200 VA
Fuses ..... automatic circuit breaker
Intended site ..... closed rooms
Protection class I
Protection type ..... IP 20
Electrical safety ..... in compliance with DIN EN 61010-1 (IEC 61010-1)
Overvoltage category II
Noise immunity ..... in accordance with DIN EN 61326-1

HXP 120

Line voltage ..... 100 to 240 V ±10 %
Change of instrument voltage setting is not necessary!
Line frequency ..... 50/60 Hz
Maximum power consumption ..... max. 210 VA
Fuses ..... 2x T 2.5 A/H
Intended site ..... closed rooms
Protection class I
Protection type ..... IP 20
Electrical safety ..... in compliance with DIN EN 61010-1 (IEC 61010-1)

Definite Focus controller

Line voltage ..... 100 to 240 V ±10 %
Change of instrument voltage setting is not necessary!
Line frequency ..... 50/60 Hz
Maximum power consumption ..... 60 VA
Fuses ..... 2x T 2.0 A/H
Intended site ..... closed rooms
Protection class I
Protection type ..... IP 20
Electrical safety ..... in compliance with DIN EN 61010-1 (IEC 61010-1)
under consideration of CSA and UL directives
Overvoltage category II
Radio interference suppression ..... in accordance with EN 55011 class B
Noise immunity ..... in accordance with DIN EN 61326-1

Power supply for CSU-X1 spinning disc unit

Supply voltage ..... 100 to 240 VAC (± 10 %); 50/60 Hz
Max. power consumption ..... max. 38 VA

Optical-mechanical data

Scanning field ..... Standard 10 mm x 7 mm
Mechanical port for microscope ..... C-mount

Optical fiber

Fiber type ..... polarization-preserving mono mode fiber
Transmission ..... ≥ 50 %
Permissible wavelength range ..... 405 to 650 nm
Beam diameter at inlet opening ..... 0.65 mm
Type of fiber connection ..... FCP

3 START-UP

The Cell Observer SD is a laser class 3B system. It is provided with respective labeling (total maximum output power of 300 mW). You are obliged to meet the provisions of health protection and workplace safety when handling laser devices. In addition, users must comply with all applicable provisions of statutory law.

Notify your Laser Safety Officer before proceeding with the initial Cell Observer SD system start-up.

☞ The Cell Observer SD system may not be installed, retrofitted or adjusted by anyone other than service personnel of Carl Zeiss MicroImaging GmbH or persons duly authorized to do so by the Manufacturer. Intended and conforming use provided, the Cell Observer SD can be commissioned and operated by Customer personnel without further safety precautions (refer to section 2.1 on page 20).

☞ Before installing and starting up the instrument it is imperative to read carefully the Fehler! Verweisquelle konnte nicht gefunden werden..

3.1 Installation Requirements

3.1.1 Space Requirements

Fig. 3-1 shows the floor space required for system installation:

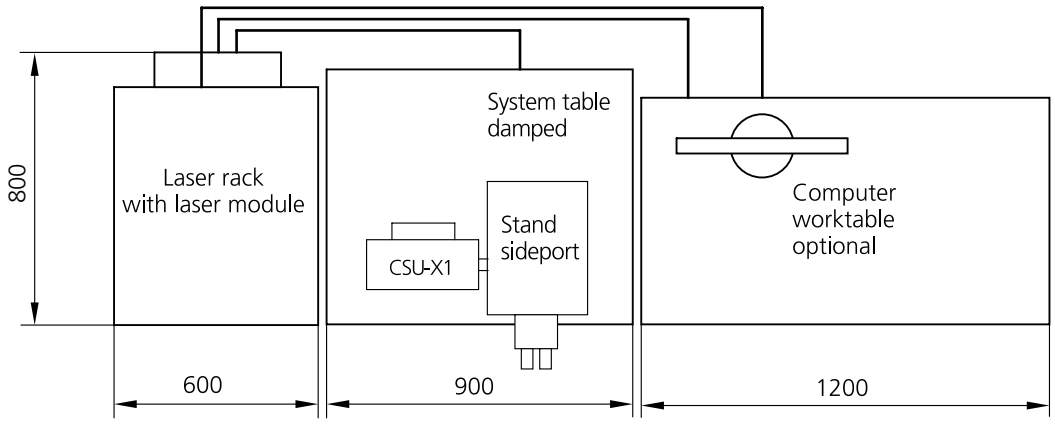


Fig. 3-1 Space requirements

For system installation, the following requirements must be met:

- floor area required: 7 m^2,
- stable laboratory worktable with system on vibration-isolated base plate or vibration-isolated, air-cushioned microscope table (with dimensions of 180 x 90 cm),
- space between system and wall: min. 50 cm.

3.1.2 Power Requirements

For line power supply, three wall sockets at a maximum distance of 1.5 m from the laser module are required.

Use the three power strips (included in delivery) for connection of the system components (refer to Fig. 3-2).

The multiple socket-outlets must not be connected in series!

The multi-laser module must be grounded. Delivery includes an earth cable (AWG10 green/ yellow) for this purpose (see Fig. 3-2).
At each end of the earth cable there are cable lugs of 8 mm inner diameter. The installation room must contain a fixed earth-ground connection point.

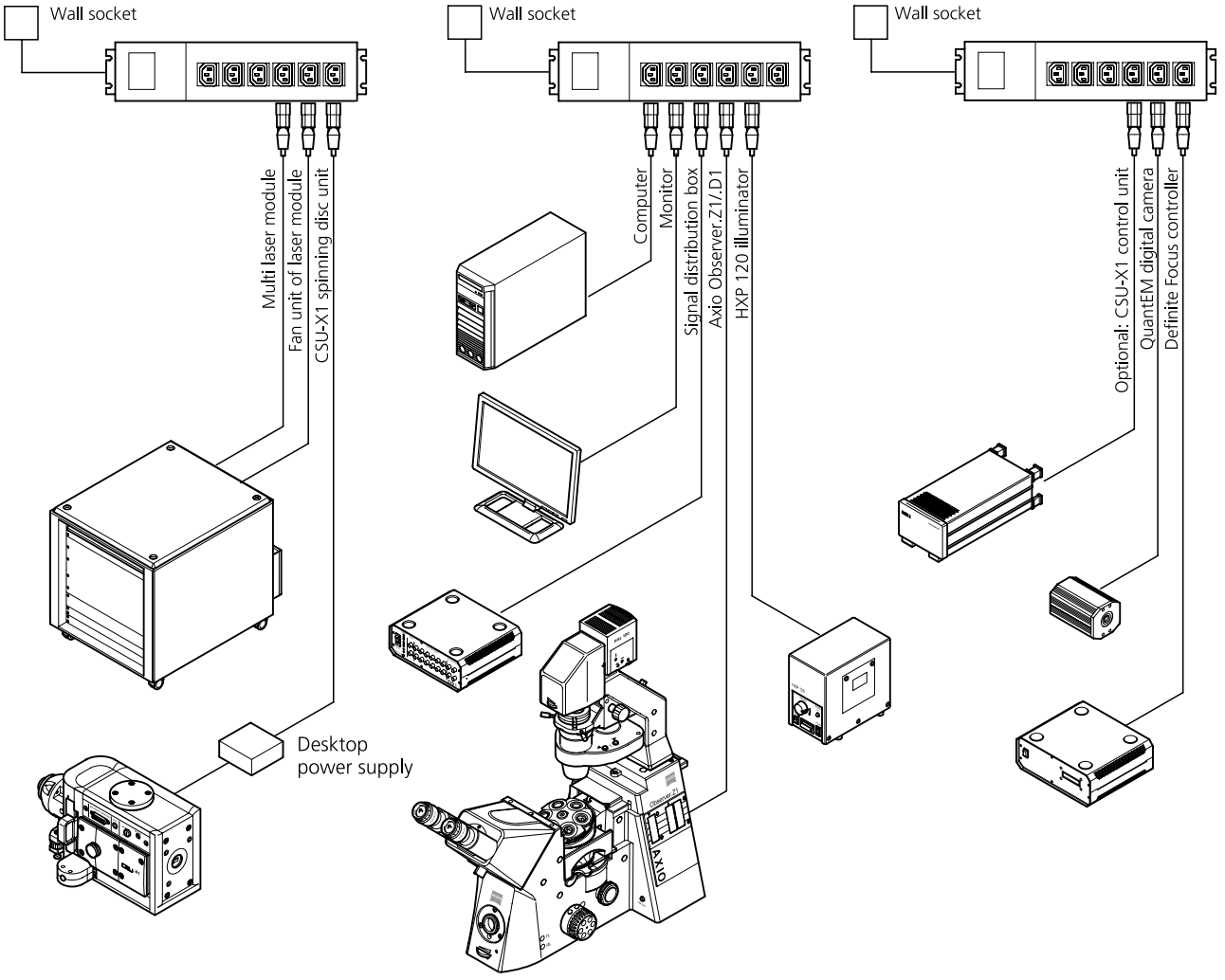


Fig. 3-2 Terminal assignments of connector strips

3.1.3 Environmental Requirements

1. Operation at specified power	T = 22 °C ±3 °C, uninterrupted (24 h per day, whether system is operational or in power off state)
2. Operation at reduced power	T = 10 °C to 35 °C, with all operating details modified against 1.
3. Warm up time	1 h; ≥ 2 h for high-precision and/or long-time measurements
4. Relative air humidity	< 65 % at 30 °C
5. Max. altitude of operating site	2000 m

☞ A stable temperature level of 22 °C is ideal for consistent and optimal system performance.

3.2 Requirements on Microscope Stand

The Cell Observer SD has been formally approved for combined operation with these types of microscope stand:

- Axio Observer.Z1 (431007-0000-000 or 431007-9901-000)

The manufacturer does not assume liability for any use that is unrelated to the intended use.
Combining the Cell Observer SD with an Axio Observer stand of an ordering code number that is different from those quoted herein will be deemed as non-conforming use.

In particular, no warranty can be assumed by Carl Zeiss MicroImaging GmbH regarding laser safety issues.

☞ Because the system includes highly magnifying objective lenses, it is recommended to work with a vibration-prevention device. Place the microscope on a vibration-dampened table or an anti-vibration plate, in order to ensure absence of mechanical vibrations.

☞ For long-time experiments it is necessary to maintain a stable ambient temperature, in order to prevent artefacts due to thermal extension.

Further required components for connection to the microscope:

- parts for CSU-X1-to-Axio Observer matching,
- basic laser safety kit,
- CSU-X1 laser safety kit.

3.3 Basic Microscope Settings

Installation and commissioning of the Cell Observer SD system may not be performed by anyone other than service personnel of Carl Zeiss MicroImaging GmbH or technicians duly authorized to handle such work by the Manufacturer.

- Connect the microscope to your computer (if not yet connected).
- Install AxioVision Rel. 4.7 image processing software on your computer (unless already installed).
- Mount objective lenses into the lens turret as described in the *Axio Observer Operating Manual* and keep Immersol 518 F® ready for this purpose.

Read in any case the Immersol 518 F® safety data sheet.

- Turn the lens turret into an empty position.

3.4 Height Setting of CSU-X1 Spinning Disc Unit

Before the CSU-X1 spinning disc unit can be mounted onto the microscope, the standard support legs of the Axio Observer must be replaced with special version legs. This will raise the unit by 5 mm.
For replacement of support legs, you should refer to the Axio Observer Operating Manual.

- Screw the C-mount camera adapter to the spinning disc unit.
- Use two fixing screws (Fig. 3-3/**1**) to attach the support leg assembly to the camera adapter of the spinning disc unit.
- Turn setting screws (Fig. 3-3/**2**) (3" Allen key) as necessary to adjust the vertical leg position. Use the ring nuts (Fig. 3-3/**3**) to lock the support legs in position.

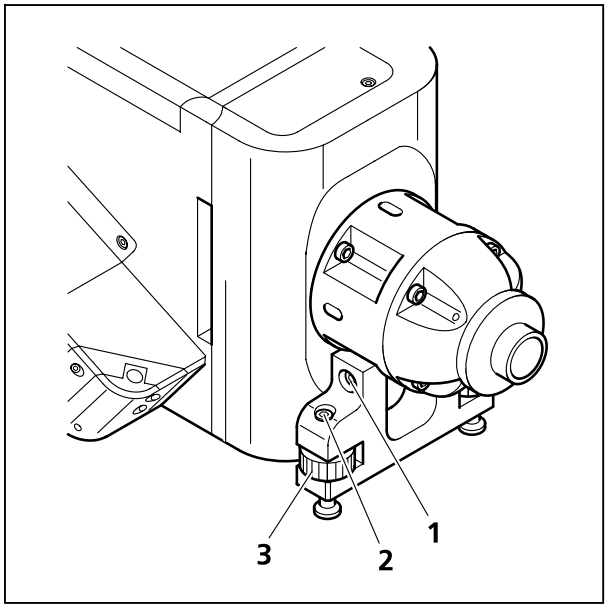


Fig. 3-3 Mounting the support legs

3.5 Mounting the Camera

The following cameras may be connected to the spinning disc unit:

1.0x camera adapter for:

- AxioCam MRm,
- AxioCam HRM,
- AxioCam HSm

1.2x camera adapter for:

- Photometrics QuantEM
  or other EMCCD camera from Photometrics or Hamamatsu

The procedure for installation is identical for both camera adapter types.

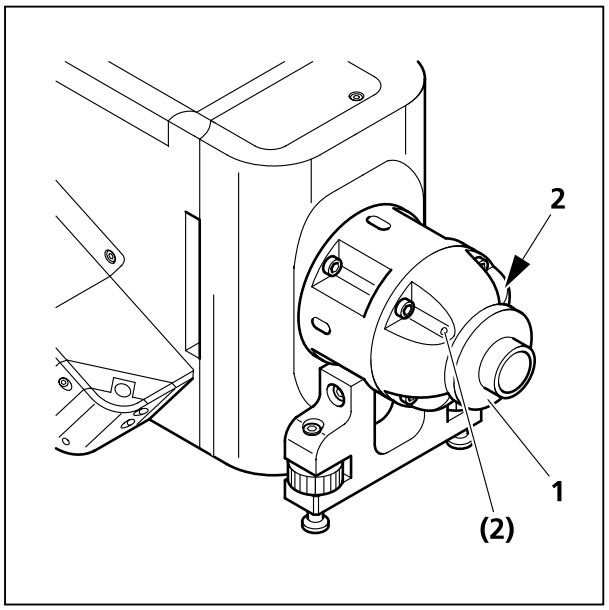


Fig. 3-4 Removal of adapter piece

- Release the two fixing screws (Fig. 3-4/**2**) at the camera adapter then take the adapter piece (Fig. 3-4/**1**) out.
- Remove anti-dust caps from adapter end piece and camera.

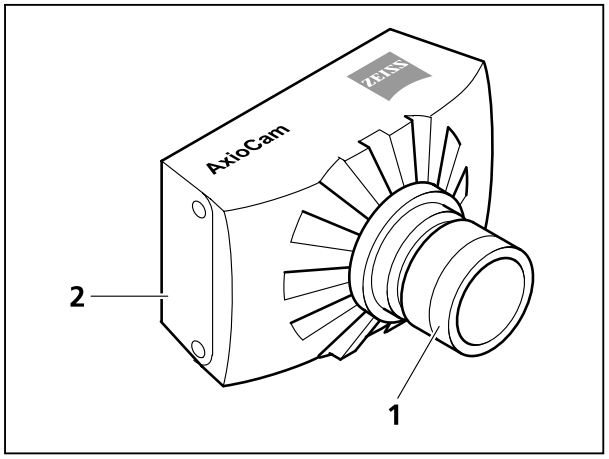


Fig. 3-5 Screwing the adapter piece to the camera

- Screw the adapter piece (Fig. 3-5/**1**) onto the camera (Fig. 3-5/**2**).
- Restore the adapter end piece to the camera adapter. Make sure that the camera is correctly oriented as you do this (horizontally, with inscription at the top).
- Tighten the two screws (Fig. 3-4/**2**) at the camera adapter.

3.6 Connection of Spinning Disc Unit

3.6.1 Connecting the CSU-X1M 1800/ 1800 Dual Cam Spinning Disc Unit

- Connect the power supply unit of the spinning disc unit table to the power strip (refer to section 3.1.2 on page 38).
- Connect the DC outlet of the power supply unit to jack **DC IN** (Fig. 3-6/**1**).
- Plug the interlock connector into terminal jack **Ext. Control / Interlock** (Fig. 3-6/**2**). The shutter can now be manually opened and closed by pressing the **Shutter** button (Fig. 4-1/**1**).

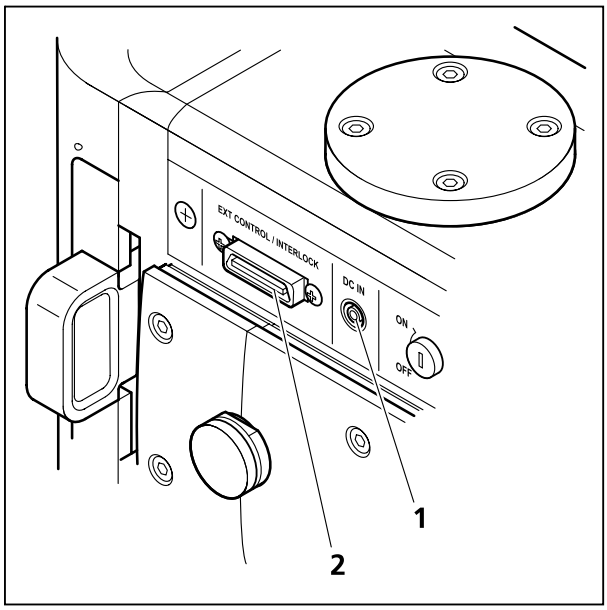


Fig. 3-6 Connection points of Cell Observer SD

3.6.2 Connecting the CSU-X1M 5000/5000 Dual Cam or CSU-X1A 5000 Spinning Disc Unit

- Connect the power supply unit of the spinning disc unit table to the power strip (refer to section 3.1.2 on page 38).
- Connect DC outlet of the table power pack to jack **DC IN** (Fig. 3-6/**1**).
- Plug the CSU-X1 control box cable into jack terminal **Ext. Control / Interlock** (Fig. 3-6/**2**).

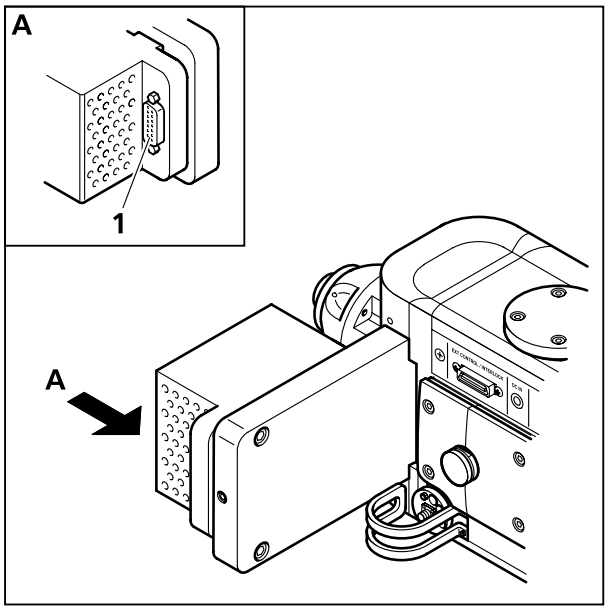


Fig. 3-7 Filter wheel connection

3.6.3 Connecting the Filter Wheel

For operation with a filter wheel, the wheel must also be connected:

- Connect control cable with filter wheel (Fig. 3-7/**1**). Secure connector with two screws.
- Connect control cable to CSU-X1 control box (refer to section 3.7).

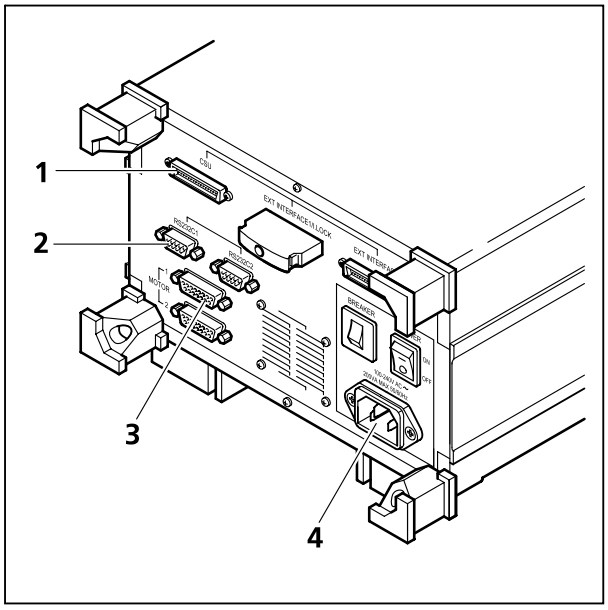


Fig. 3-8 CSU-X1 control box connection points

3.7 Connecting the CSU-X1 Control Box

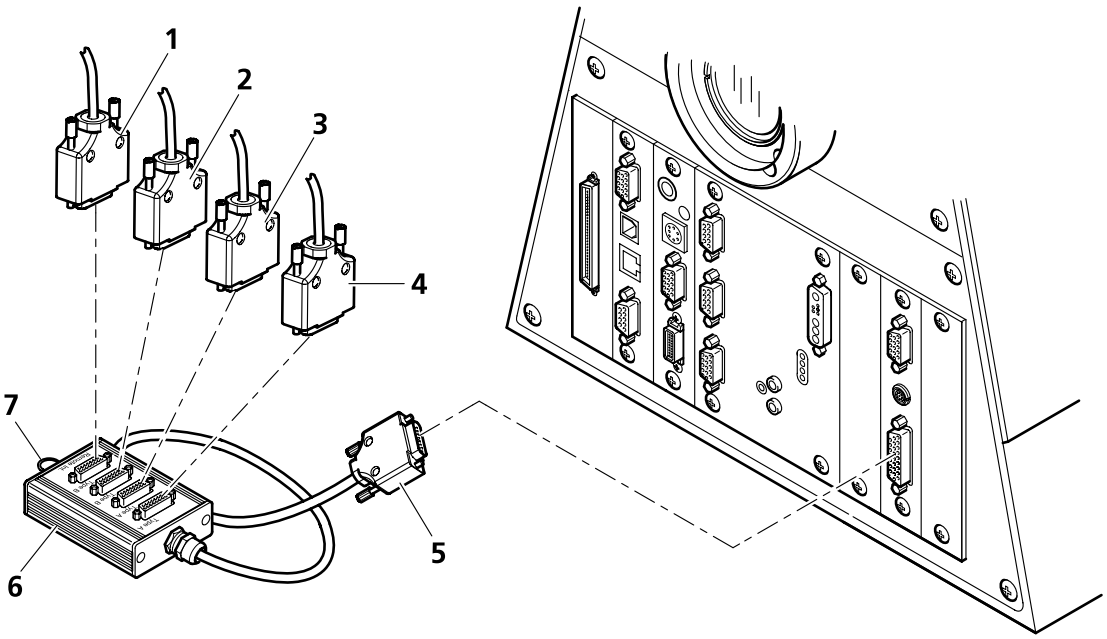
- Connect terminal **RS232C1** (Fig. 3-8/**2**) of the CSU-X1 control box to the computer.
- Plug the control cable of the CSU-X1 spinning disc unit into terminal **CSU** (Fig. 3-8/**1**) of the CSU-X1 control box.
- Connect the control cable of the filter wheel (if installed) to terminal **Motor 1** (Fig. 3-8/**3**).
- Connect the line power cable to the CSU-X1 control box (Fig. 3-8/**4**) and a suitable line power socket.

☞ Do not use terminal jacks of any type other than specified herein. Disregarding this advice may cause malfunction of the spinning disc unit.

3.8 Connecting the Distribution Box for Laser Safety

- Connect:Connection the 25-pole sub-D connector (Fig. 3-9/**5**) of the distribution box for laser safety (Fig. 3-9/**6**) to the safety jack on the rear of the stand.
- To connect the sub-D connectors to the four 15-pole Sub-D jacks at the distribution box for laser safety signals (Fig. 3-9/**6**), proceed as follows:
  - laser protection cover/incubator or interlock connector → **Type B** jack (Fig. 3-9/**1**),
  - multi laser module → **Type B** jack (Fig. 3-9/**2**),
  - TIRF slider or interlock connector → **Type A** jack (Fig. 3-9/**4**).
- Jumpers must be installed onto unused jack terminals of the safety distribution box. This is necessary for the laser shutter (inside the laser module) to be able to open.
- For operation with your own laser, the laser shutter of the TIRF laser safety kit for Customer-provided laser modules (432921-0000-000) must be mounted in such a position that it will block the laser beam when in closed state. Connect the laser shutter with the distribution box via the converter board (included), using the connection cable (Fig. 3-9/**6**; refer to section 2.3.7 on page 29).

Laser safety can only be warranted if the laser shutter is correctly placed in front of the selected laser's outlet opening and connections were made in a conforming manner.



1 Connector for TIRF laser protection cover/incubator or interlock
2 Connector for multi laser module
3 Connector for TIRF slider or interlock connector
4 Connector for TIRF remote control switch or interlock connector
5 Connector for Stativ Axio Observer.Z1 microscope stand
6 Distribution box for laser safety signals
7 Door switch terminal (interlock)

Fig. 3-9 Connection of distribution box for laser safety to the Axio Observer.Z1

In addition to that, the distribution box for laser safety has an optional connection for a door interlock switch (Fig. 3-9/**7**).

You are advised to contact your Laser Safety Officer for connection of the door switch.

- Unplug the green plug (Fig. 3-9/**7**) from the distribution box for laser safety.
- Loosen the two screws of the plug and remove the jumper cable.
- Connect the cable of the door interlock switch to the plug and tighten the two screws.
- Insert the plug (Fig. 3-9/**7**) again into the distribution box for laser safety.

3.9 Coupling a Customer-Provided Laser to the Cell Observer SD System

Customers using their own lasers will be solely responsible for overall laser safety of the Cell Observer SD system. They shall also check for further required laser safety precautions and validity of all laser warning labels affixed to the system, including the microscope.

The Manufacturer will refuse liability for modifications performed on the Cell Observer SD system.

To operate the system with a total laser power > 300 mW, further laser safety precautions will be required for the microscope.

Where lasers with a total laser power > 300 mW or other wavelengths are used, the Cell Observer SD protection system must be reviewed for protective effect.

Notify your Laser Safety Officer before proceeding with the initial system start-up.
Valid national laser protection requirements must be met.

Note: This work step is only required for integration of a Customer laser. A special optical fiber cable is necessary for coupling a laser to the Cell Observer SD system (refer to section 2.6 on page 31). If you intend to mount your own laser, you should consult the related manufacturer manual for details and instructions regarding installation and alignment of the coupling device in front of the laser.

For operation with your own laser, the laser shutter for the laser module must always be mounted in a position between the coupling device and the laser outlet. The laser beam must be completely blocked by the shutter flag when in lower (de-energized) position.

Switch the laser off before mounting the optical fiber!

3.10 Safety Check before Laser Start-up

Check for proper function of the laser safety device before you proceed with initial start-up actions or after each re-installation of the Cell Observer SD system.

1. Activate the laser safety device by turning the microscope on.
2. Remove the tube as described in the Axio Observer.Z1 Microscope Operating Manual (B 46-111) to be able to see the eyepiece shutter.
3. Check the following action items now:

Action	System state
Turn reflector turret until it is unlocked or remove the turret from the turret compartment	• Laser shutter closed • Eyepiece shutter open
Reflector turret locked inside turret compartment and rotate turret into locked position	• Laser shutter open • Eyepiece shutter closed
Remote connector detached from distribution box for laser safety signals	• Laser shutter closed • Eyepiece shutter open
Remote connector plugged in distribution box for laser safety signals	• Laser shutter open • Eyepiece shutter closed
Transmitted-light arm of stand in beam position	• Laser shutter closed • Eyepiece shutter open
Transmitted-light arm of stand in off-beam position	• Lasers shutter open • Eyepiece shutter closed
Distribution box for laser safety signals not connected to microscope	• Laser shutter closed • Eyepiece shutter open
Some plug-in positions of distribution box for laser safety signals unused	• Laser shutter closed • Eyepiece shutter open

If your safety device is not found to function as described above, shut the system down, mark it clearly as defective and contact the Service Department of Carl Zeiss MicroImaging GmbH immediately.

☞ Attach the microscope tube again after successful safety check.

3.11 Laser Safety Check

Check the laser safety device for proper function with a laser connected.

1. Switch on the microscope.
2. Switch on the laser.
3. Check the following action items:

Turn reflector turret out of locked position	Laser shutter closes and laser light point on opaque laser protection cover extinguishes.
Turn reflector turret into locked position	Laser shutter opens and laser light point appears on opaque laser protection cover.
Swing transmitted light arm out of working position	Laser shutter closes and laser light point on opaque laser protection cover extinguishes.
Swing transmitted light arm into working position	Laser shutter opens and laser light point appears on opaque laser protection cover.

You are requested to contact Carl Zeiss MicroImaging GmbH if you intend to use a laser with wavelengths that differ from those quoted in section 2.7 Technical Data.

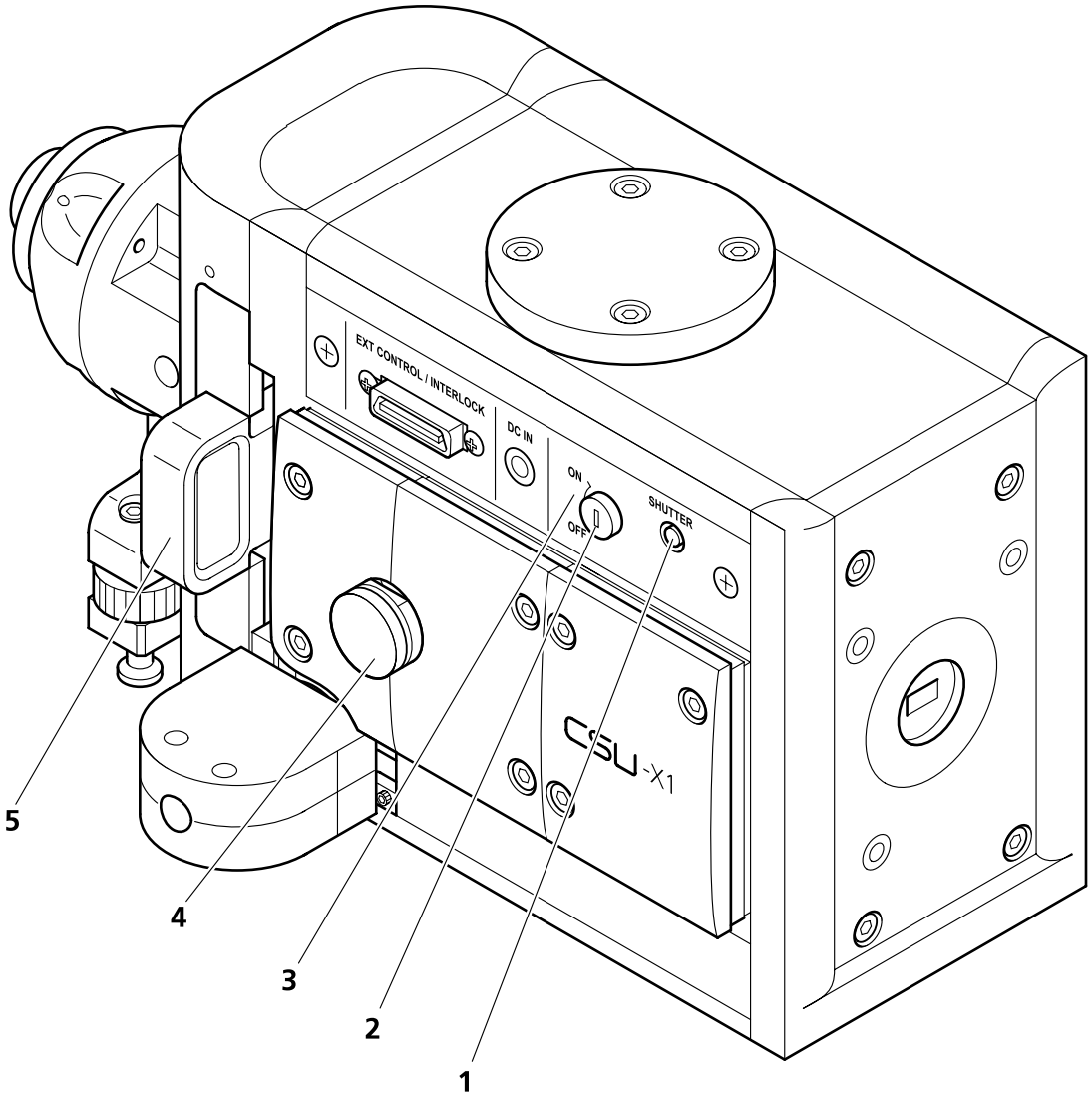
If the safety device is found to function in a non-conforming manner, you should shut the system down, mark it clearly as defective and contact the Service Department of Carl Zeiss MicroImaging GmbH immediately.

4 OPERATION

The Cell Observer SD is a class 3B laser device 3B and is labelled as such. WARNING: This risk category includes medium-power lasers. Make sure to prevent exposure to radiation from such lasers. Do not look directly into the laser beam!

4.1 Control and Functional Components

4.1.1 CSU-X1 Spinning Disc Unit

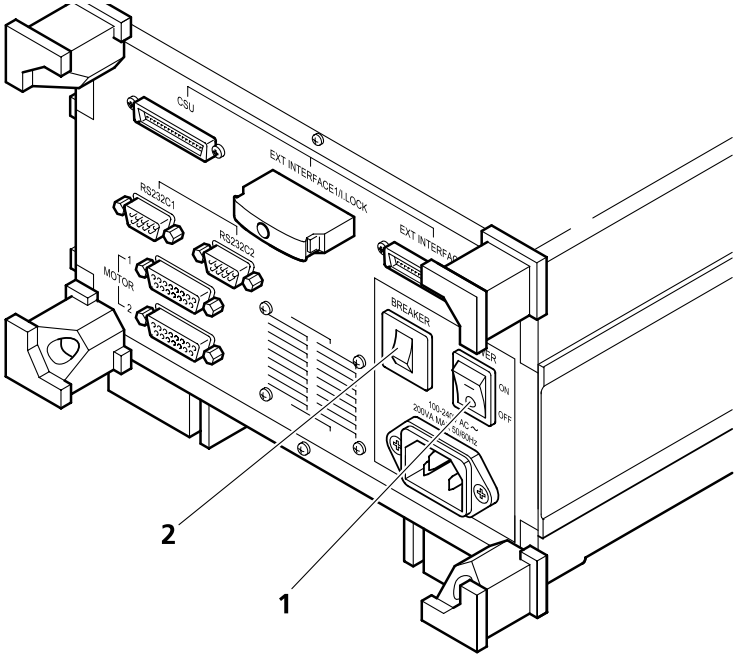


1 **Shutter** hbutton
2 **ON/OFF** key switch with control LED
3 Control LED
4 Push-rod for camera channel switching
5 Emission filter slide

Fig. 4-1 Control and functional components at the CSU-X1 spinning disc unit

☞ The CSU-X1M 1800/5000 Dual Cam type spinning disc units have two emission filter slides.

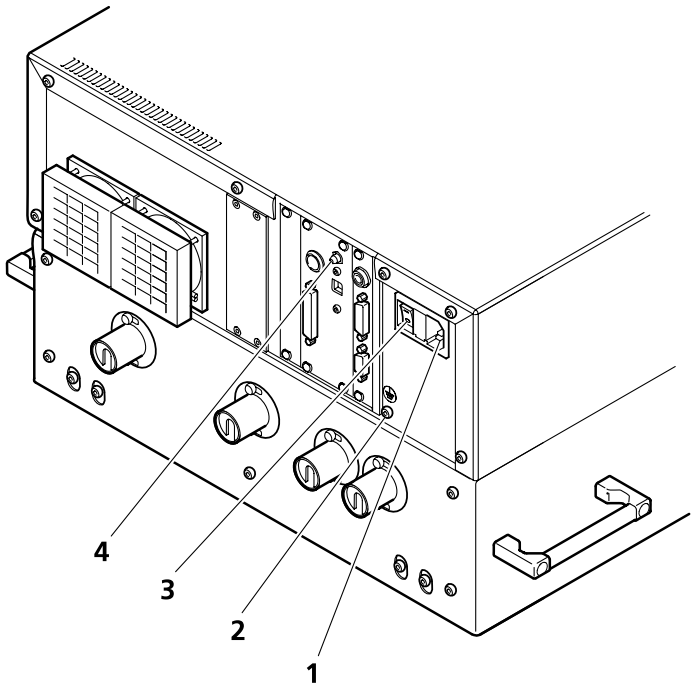
4.1.2 CSU-X1 Control Box



1 Main power switch
2 Automatic circuit breaker switch

Fig. 4-2 Control and functional components of CSU-X1 control box (rear-side view)

4.1.3 Multi Laser Module



1 Line power inlet port
2 PE conductor terminal for PE cable (included in delivery)
3 Main power switch
4 **AOTF Reset** button

Fig. 4-3 Control and terminal components of multi laser module

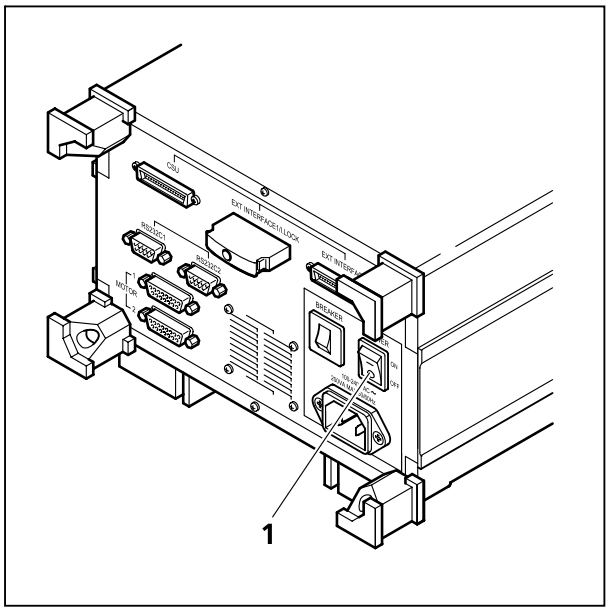


Fig. 4-4 Turning the CSU-X1 control box on

4.2 Switching the System on

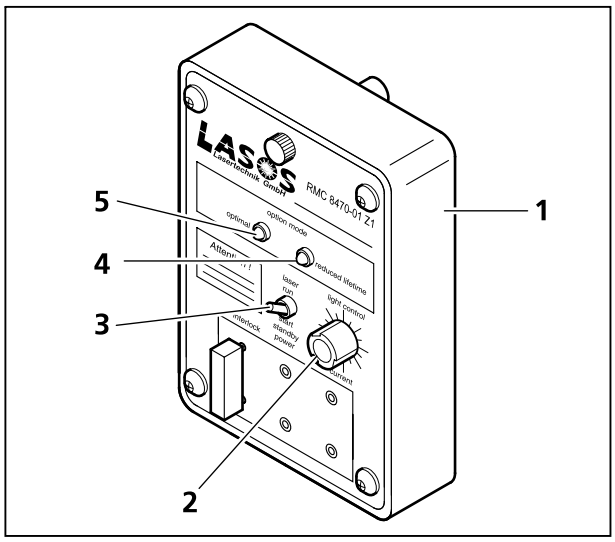
4.2.1 Turning the CSU-X1 Spinning Disc Unit On

- Switch the microscope on.
  Set reflector turret position must be empty!
- Transfer main power switch of the CSU-X1 control box into **ON** position (Fig. 4-4/**1**).
- Select a suitable emission filter. Refer to section 4.6 for details regarding conversion to another emission filter.
- Turn the key switch at the spinning disc unit (Fig. 4-1/**2**) to position **ON**. The green control LED (Fig. 4-1/**3**) will light.
- Turn the laser on (refer to sections 4.2.2 and 4.2.3).

If the safety device is found to function in a non-conforming manner, you should shut the system down, clearly mark it as defective and contact the Service Department of Carl Zeiss MicroImaging GmbH immediately.

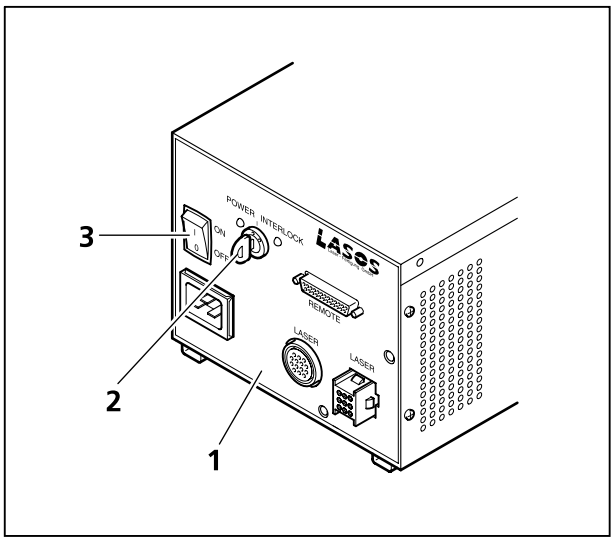
4.2.2 Turning the Multiline Argon Laser On

- Make sure that the toggle switch (Fig. 4-5/**3**) at the laser power pack control module (Fig. 4-5/**1**) is in **Standby** position (down) and the power controller (Fig. 4-5/**2**) in left stop position before you turn the laser on.
- Transfer the On/Off switch at the power pack into position **I** (Fig. 4-6/**3**). Power is supplied to the argon laser.
- Turn the key switch at the power pack into position **I** (Fig. 4-6/**2**) to trigger the argon laser.



1 Casing
2 Potentiometer for power control
3 Standby switch
4 Green LED **optimal** (lights when laser energy within nominal range)
5 Red LED **reduced life time** (lights when laser energy too high)

Fig. 4-5 Control unit of multiline argon laser



1 Power supply unit of 100 mW laser
2 Key switch
3 On/Off switch

Fig. 4-6 Power supply unit of multiline argon laser

Nominal laser power will be available within a few seconds. Operation at nominal power and the specified laser lifetime can only be warranted if the power selection potentiometer (Fig. 4-5/**2**) is in a position approximately 12 hours. The green LED (Fig. 4-5/**4**) will light in this case. For operation at a lower power setting, the potentiometer can be rotated anticlockwise. If operated with a power setting above nominal level (potentiometer in a position greater than 12 hours), the laser's lifetime will be reduced. The red LED will light (Fig. 4-5/**5**).

If the safety device is found to function in a non-conforming manner, you should shut the system down, clearly mark it as defective and contact the Service Department of Carl Zeiss MicroImaging GmbH immediately.

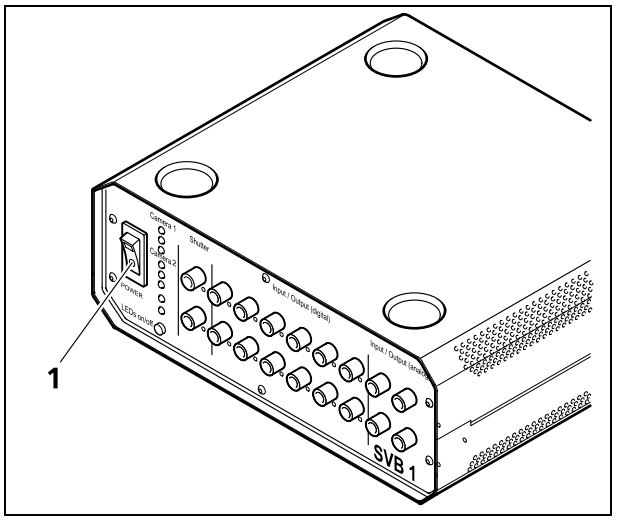


Fig. 4-7 Turning the signal distribution box on

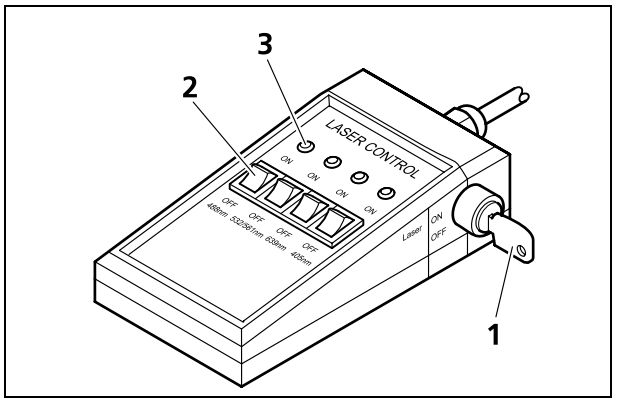


Fig. 4-8 Turning the laser controller on

4.2.3 Turning the Multi Laser Module On

- Close laser protection cover or laser protection incubator.
- Turn the power strip on to supply power to the multi laser module.
- Transfer the On/Off switch (Fig. 4-7/**1**) of the signal distribution box into On position.
  The green control LED (built into the switch) lights.
- Trigger AxioVision software session.
- Turn the key switch (Fig. 4-8/**1**) of the laser controller into position **ON**.
- To turn a desired laser line on, press the related button (Fig. 4-8/**2**).
  The corresponding red control LED (Fig. 4-8/**3**) will light.

If the safety device is found to function in a non-conforming manner, you should shut the system down, clearly mark it as defective and contact the Service Department of Carl Zeiss MicroImaging GmbH immediately.

Place the laser controller directly beside the microscope. This enables you to track which laser is currently on (LED **ON** (Fig. 4-8/**3**)).

4.3 Switching the System off

4.3.1 Turning the Cell Observer SD Off

- Press the **Shutter** key (Fig. 4-1/**1**) or use the related Axio Vision software tool to close the shutter.
- Turn the laser off (refer to sections 4.3.2 and 4.3.3).
- Turn the key switch (Fig. 4-1/**2**) at the spinning disc unit into position **OFF**.
  The control LED (Fig. 4-1/**3**) extinguishes.
- Transfer the main power switch (Fig. 4-4/**1**) of the CSU-X1 control box into Off position.
- Turn the microscope off.

4.3.2 Turning the Multiline Argon Laser Off

- Set the laser power controller to minimum level on completion of a working session (potentiometer (Fig. 4-5/**2**) in left stop position).
- Transfer the laser power controller into **Standby** mode by flipping the toggle switch (Fig. 4-5/**3**) down.
- Turn the key switch (Fig. 4-6/**2**) into position **0** to turn the laser off. The fan will continue to run for some minutes until the laser head cooled down.

Once the fan has switched off, you can turn the On/Off switch (Fig. 4-6/**3**) at the power supply unit off.

4.3.3 Turning the Multi Laser Module Off

- Turn the key switch (Fig. 4-8/**1**) of the laser controller into position **OFF**.
  This will shut all laser lines down. The red control LED's extinguish.
- Terminate your AxioVision software session.
- Toggle the On/Off switch into position **0** to turn the signal distribution box off (Fig. 4-7/**1**).
  The green control LED (built into On/Off switch) extinguishes.
- Turn the power strip off. This will cut power supply to the multi laser module.

4.4 Operation Control of Spinning Disc Unit via AxioVision

Once electric power is available to the spinning disc unit, the Cell Observer SD can be completely controlled via AxioVision software tools.

☞ For information about AxioVision software control actions, you should consult the *AxioVision Operating Manual*.

The shutter of the CSU-X1 spinning disc unit can also be released and closed by manual action. The **Shutter** key (Fig. 4-1/**1**) must be pressed for this purpose.

4.5 Switching Between Camera Ports

Spinning disc units with Dual Cam option allow you to switch between two camera ports.

- Pull the push rod out (Fig. 4-1/**4**) to switch to the upper camera port.
  If a secondary color splitter is installed, the short-wave emission light portion will be directed onto the lateral camera adapter and the long-wave emission light portion onto the upper camera adapter when the push rod is fully extracted.
- Push the push rod in again, in order to work with the lateral camera port.

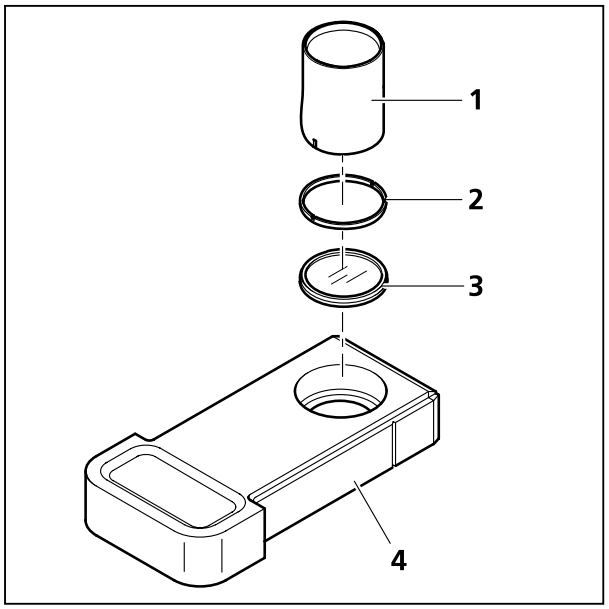


Fig. 4-9 Exchange of emission filter

4.6 Exchange of Emission Filter

To exchange a currently installed emission filter, proceed as follows:

- Extract emission filter slide (Fig. 4-1/**5**) from the spinning disc unit.
- Use multi-purpose tool (Fig. 4-9/**1**) to unscrew the retainer ring (Fig. 4-9/**2**). Take the filter out (Fig. 4-9/**3**).
- Insert a new filter.
- Screw retainer ring (Fig. 4-9/**2**) on again.
- Introduce emission filter slide (Fig. 4-9/**4**) into spinning disc unit until mechanical stop position.

4.7 Exchange of Camera Adapter

For operation with a Photometrics QuantEM camera, a special EMCCD camera adapter (423638-9260-000) is required.

- Use the key switch to turn the spinning disc unit off (Fig. 4-1/**2**).
- Hold the camera (Fig. 4-10/**3**) adapter in a stable position.
- Loosen the four fixing screws (Fig. 4-10/**1**) of the camera adapter.
- Take the camera adapter (Fig. 4-10/**3**) off.
- Insert the EMCCD camera adapter into the spinning disc unit in such a position that the two screws (Fig. 4-10/**2**) point to the top.
- Tighten the four fixing screws.

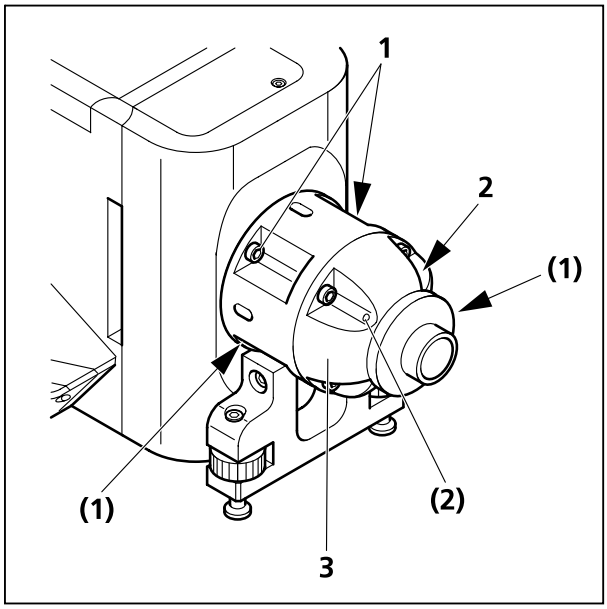


Fig. 4-10 Exchange of camera adapter

☞ Make sure that the camera adapter is correctly oriented before you mount it!
The fixing screws (Fig. 4-10/**2**) of the adapter end piece must face towards the top. Otherwise, there may be malfunction.

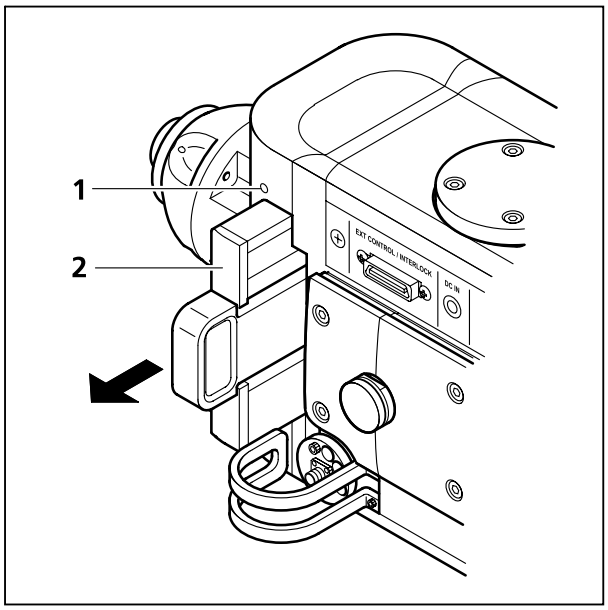


Fig. 4-11 Removal of emission filter insert

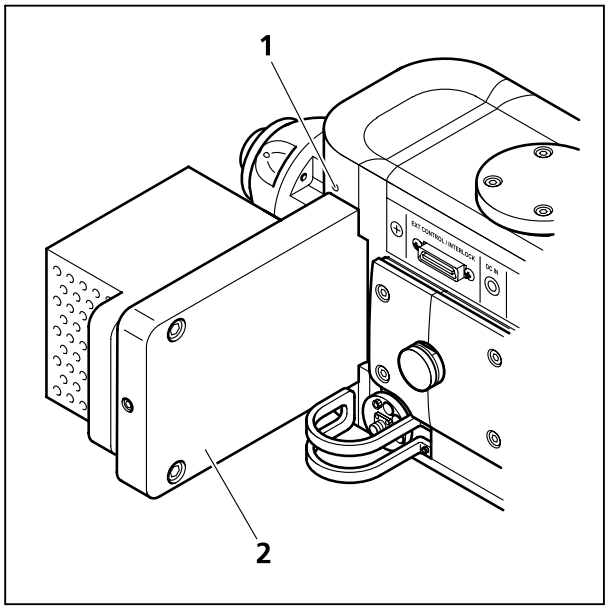


Fig. 4-12 Mounting the filter wheel

4.8 Mounting the Filter Wheel

- Use the key switch (Fig. 4-1/**2**) to turn the spinning disc unit off.
- Remove the power plug from the power pack.
- Release the clamping screw (2.5" Allen key) (Fig. 4-11/**1**) at the spinning disc unit.
- Extract the filter insert (Fig. 4-11/**2**) from the front.
- Introduce the filter wheel (Fig. 4-12/**2**) into the spinning disc unit until mechanical stop position.
- Tighten the clamping screw (2,5" Allen key) (Fig. 4-12/**1**).
- Connect the filter wheel to the CSU-X1 control box (refer to section 3.6.2).

Exchange of filter(s) in filter wheel:

Necessary actions for replacement of a filter or filters are described in the "Filter Wheel CSUX1FW" manual (supplied) (IM 85A07C27-01E) from Yokogawa. However, users are advised to contact the Service Department of Carl Zeiss MicroImaging GmbH or specially **authorized** expert personnel for necessary filter replacement.

4.9 Dual Cam Option

The Dual Cam option allows you to connect two cameras to a spinning disc unit.

The Dual Cam option may solely be retrofitted by Service Department personnel of Carl Zeiss MicroImaging GmbH or expert technicians specifically **authorized** to perform such work!

To switch between the two camera channels, move the push rod in or out as necessary (Fig. 4-1/**4**). The lateral camera channel will be active when the push rod is fully inserted, the upper camera channel when the rod is fully extracted.

Where a secondary color splitter is installed, the short-wave emission light portion will be directed onto the lateral camera adapter and the long-wave emission light portion onto the upper camera adapter when the push rod is fully extracted.

5 CARE, MAINTENANCE, TROUBLESHOOTING AND SERVICE

5.1 Care

Routine care which may be performed by operating personnel is limited to the following work items:

Cell Observer SD systems include no special precautions to protect from etching, potentially infectious, toxic, radio-active or other samples that are harmful to people's health. Where samples of this kind are handled, all requirements, notably, national accident prevention regulations must be properly observed in accordance with statutory law.

- Break power supply to all system units with a line supply inlet and detach the line plugs before you proceed with work for cleaning.

Cleaning of paint-coated surfaces

- Always use a clean, slightly moistened piece of cloth. The water for cleaning may be laced with a mild detergent.
- Do not allow liquid to penetrate into the inner system space.
- Refrain from the use of solvents.
- Use a non-shedding piece of cloth to wipe the surfaces clean and dry.

Cleaning of glass surfaces

- Use a clean optical wipe to clean glass surfaces that are soiled or covered with fingerprints.
- To remove stubborn soiling, dip the optical wipe into a mixture of distilled water and and a small portion of detergent.
- For completion of cleaning, slightly breathe upon the glass concerned and wipe it down with a clean piece of cloth.
- Fluff or dust should preferentially be removed with a clean natural hair brush.

5.2 Maintenance

- Perform a laser safety check each time before you make the system operational.
- For more detailed information about routine maintenance actions, you should refer to the *Axio Observer Operating Manual* and the user manual of your computer system.

There are no further Cell Observer SD system maintenance actions which may be performed by Customers. Please contact your appropriate Carl Zeiss service point for any kind of maintenance work.

5.3 Troubleshooting

Fault	Cause	Fault removal
Spinning disc unit does not function	Power supply unit disconnected	Connect power supply unit
	Turnkey switch not in **ON** position	Rotate turnkey switch into position **ON**
	Terminals at spinning disc unit / CSU-X1 control box unplugged or make loose contact	Inspect terminal connections (refer to sections 3.6 and 3.7)
No laser light on sample / safety shutter closed	Transmitted-light arm tilted back	Tilt transmitted-light arm into vertical position
	Reflector turret unlocked or fully extracted	Lock or push reflector turret in
	Shutter at Cell Observer SD closed	Open shutter by pressing the **Shutter** button (Fig. 4-1/**1**)
Rotation speed of spinning disc unit cannot be set	CSU-X1 control box not **ON**	Turn CSU-X1 control box on (refer to section 4.2.1)
	CSU-X1 not connected to CSU-X1 control box	Connect CSU-X1 (refer to section 3.6.3)
CSU-X1 control box cannot be turned on	Fuse of CSU-X1 control box was triggered	Turn safety switch (refer to page 51, Fig. 4-2/**2**) on again
Switch buttons of laser lines in AxioVision software are inactive	AOTF detection failure / faulty AOTF connection	Press **AOTF Reset** button (refer to page 51, Fig. 4-3/**4**) at the multi laser module and launch new AxioVision software session
CSU-X1M 5000, CSU-X1M 5000 Dual Cam, CSU-X1A 5000 spinning disc unit:		
Spinning disc unit is On, control LED lights, but no function available	Fuse of CSU-X1 control box was triggered	Turn automatic circuit breaker at the back of the CSU-X1 control box on again
	Shutter closed	Open the shutter

5.4 Replacement of Fuses

Disconnect the power plug in any case before replacing the fuses.

Axio Observer, HBO, XBO, CTI-Controller, Tempcontrol, Definite Focus: consult pertaining manual.

CSU-X1 spinning disc unit: There are no fuses with external access for replacement. Please contact the Service Department of Carl Zeiss MicroImaging GmbH.

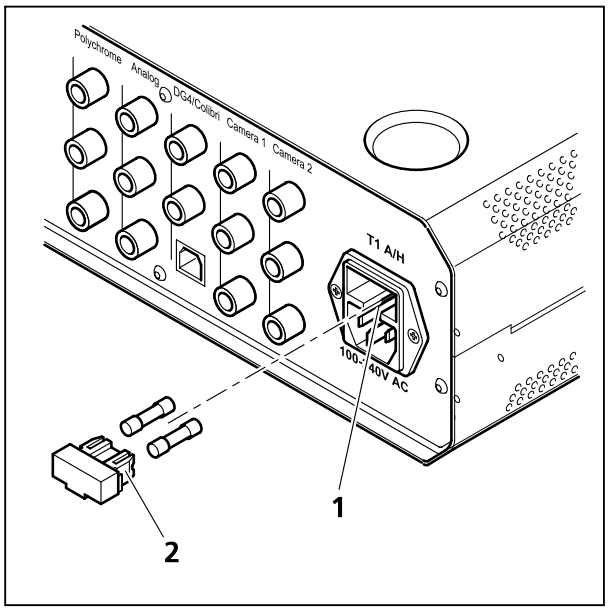


Fig. 5-1 Replacement of fuses in signal distribution box

Signal distribution box:

The fuse compartment is combined with the inlet connector. It contains two fuses.

- Use main power switch to turn the module off.
- Pull the main power plug.
- Pull fuse holder (Fig. 5-1/**2**) out from the front. Use a small screwdriver for convenience.
- Extract fuses from the fuse holder and replace them with new fuses of type T 1A/H/250 V.
- Insert fuse holder into the fuse compartment until mechanical stop position (Fig. 5-1/**1**).
- Re-connect main power plug.

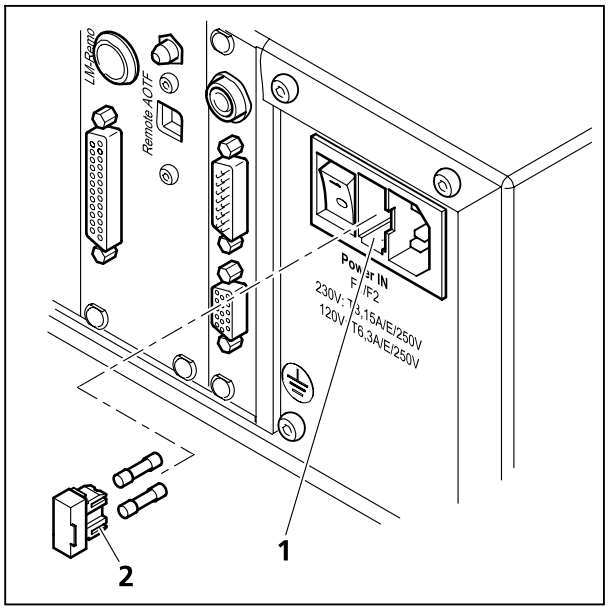


Fig. 5-2 Replacement of fuses in multi laser module

Multi laser module:

The fuse compartment is combined with the inlet connector and the main power plug. It contains two fuses.

- Use main power switch to turn the module off.
- Pull the main power plug.
- Pull fuse holder (Fig. 5-2/**2**) out from the front. Use a small screwdriver for convenience.
- Extract fuses from the fuse holder and replace them with new fuses of following types: T 3.15A/E/250 V for 230 V operation and T 6.3A/E/250 V for 120 V operation.
- Insert fuse holder into the fuse compartment (Fig. 5-2/**1**) until mechanical stop position.
- Re-connect main power plug.

Definite Focus controller:

This fuse holder of this controller module is located on the rear panel.

In the event of a fuse failure, the cause of such failure must be determined and a technical fault – if found to be the cause – removed in a proper manner at first.

Disconnect the power plug in any case before replacing the fuses.

- Disconnect the main power plug.
- Pull fuse holder (Fig. 5-3/**1**) out of the fuse compartment from the front.
- Replace defective **T 2.0 A/H** fuse.
- Push fuse holder back until it clicks into locked position inside the fuse compartment.
- Re-connect main power plug.

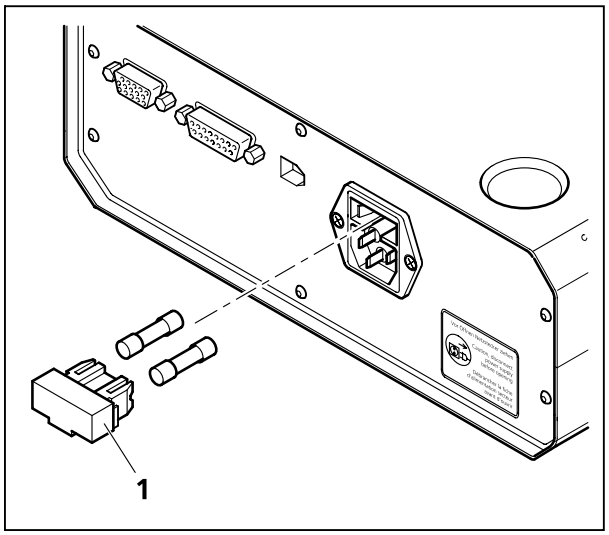


Fig. 5-3 Sicherungen am Controller wechseln

5.5 Replacement of HAL Halogen Lamp

The halogen lamp of the HAL illuminator may not be replaced by anyone other than service personnel of Carl Zeiss MicroImaging GmbH or expert technicians specially **authorized** to handle such work!

On removal of the halogen lamp, there may be emergence of laser radiation (laser class 3B)!

5.6 Connecting the TIRF Laser Module 2 to the Multi Laser Module

Connection of a version 2 laser module to the multi laser module may not be performed by anyone other than service personnel of Carl Zeiss MicroImaging GmbH or expert technicians specially **authorized** to handle such work!

5.7 Laser Unit Retrofit

Laser units may not be retrofitted by anyone other than personnel of Carl Zeiss MicroImaging GmbH!
A retrofit procedure will incur additional cost.

5.8 Requesting Service

Any kind of work on mechanical, optical and electronic parts requiring intervention into the inner system space and work on electronic modules of the spinning disc unit may only be performed by service personnel of Carl Zeiss MicroImaging GmbH or specifically **authorized** expert technicians.

In order to keep your spinning disc unit in an optimally adjusted and faultlessly operating condition for an extended period of time, we recommend you to conclude a service and maintenance contract with Carl Zeiss MicroImaging GmbH.

For follow-up orders or requested service work, you should contact your competent representative office of Carl Zeiss MicroImaging GmbH.

Further information is also available at this Internet address:

mikro@zeiss.de

http://www.zeiss.de

6 APPENDIX

6.1 List of Abbreviations

AOTF	Acousto-Optical Tunable Filter
CSA	Canadian Standards Association
CSU	Confocal Scan Unit
DIN	German Institute for Standardization (Deutsches Institut für Normung)
EN	European Standard
EMV	Electromagnetic Compatibility
HBO	Mercury Vapor Short Arc Lamp for Fluorescence
IEC	International Electrotechnical Commission
IP	Internal Protection Standard (degree of protection provided by casing)
ISO	International Organization for Standardization
NA	Numerical Aperture
Sub-D	Subminiatur Typ D (connector standard)
T	Transmission
UL	Underwriter Laboratories (US-American audit authority)
UV	Ultraviolet
XBO	Xenon Short Arc Lamp for Fluorescence

6.2 Index

Page

M

O

S

T

W