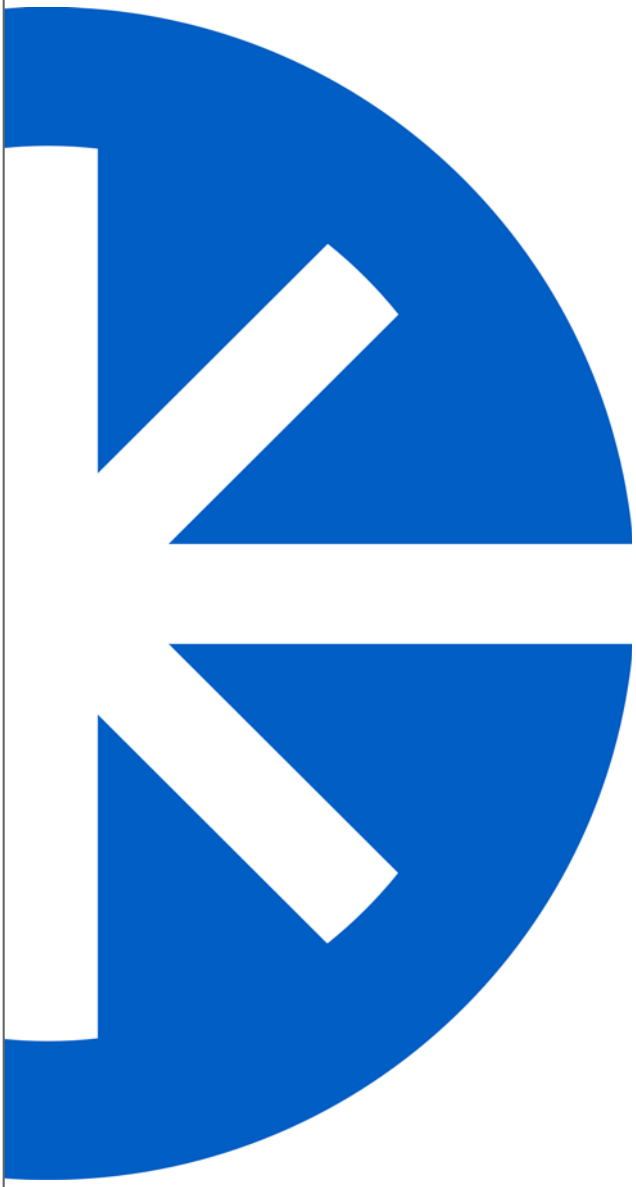

RSM PowerLine F

Repair Manual

COHERENT

Contents

1 General Information

1.1 Identification data

Identification data	
Machine type:	
Model designation:	
Serial number:	
Order number:	
Parts list number:	
Manufactured on:	

1.2 Customer data

Customer data	
Inventory number:	
Location:	

1.3 Introductory information

1.3.1 Explanation of symbols

Attention: *This symbol appears in all safety instructions in the repair manual. Possible risks are thus specially marked.*
Non-observance of these safety instructions can lead to severe injury (including death) and/or to considerable property damage!

Note: *This symbol indicates information and advice regarding operation and maintenance in the repair manual.*

1.3.2 Scope of the repair manual

Attention: *This repair manual is intended solely for maintenance personnel trained and authorized by ROFIN-SINAR for PowerLine E series lasers.*
This repair manual is valid for lasers of the ROFIN-SINAR PowerLine E series.

This repair manual must be read, comprehended and observed by the competent maintenance personnel. ROFIN-SINAR Laser GmbH shall not be liable for damage and operating failure resulting from the non-observance of the repair manual. The copyright on this repair manual is exclusively reserved to ROFIN-SINAR. This manual is only entrusted to the owner of the laser for his/her personal use.

No part of this repair manual nor technical regulations nor drawings may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise without the prior consent of Rofin-Sinar.

Note: *We reserve the right to make technical changes in the information in this repair manual in order to improve the laser system.*

1.3.3 Contact addresses

In case of any questions regarding the content of this repair manual or the laser system itself, please contact:

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2 Safety

This laser system may only be installed, operated, serviced and repaired by specially trained personnel who have received instruction concerning the hazards involved in its operation. This includes reading this repair manual and especially this chapter.

Please contact ROFIN-SINAR Laser or the system manufacturer if you have questions regarding this chapter or the safety of the laser system in general.

Attention: *The safety instructions in the other laser system documents (operating instructions, maintenance manual) and the peripheral component documents must also be observed! These documents remain valid without limitations!*

2.1 Operation according to regulations

The laser system has been designed to mark workpieces. The use of the laser for applications other than the intended ones are considered misuse and the laser manufacturer is not liable for any damage thereby caused. In this case, the user assumes the entire responsibility.

The laser manufacturer is not liable for damage caused by modifications made to the machine without consulting the manufacturer.

ROFIN-SINAR lasers have been manufactured in accordance with the following safety regulations:

– EN ISO 12100
– EN 60204
– EN 60825
– VDE 0837 (IEC 825)
– UVV BGV B2
– BGI 832
– VDE 0100
– VDE 0105
– 21 CFR - National Center for Devices and Radiological Health - CDRH No. 0121857-004

CE

ROFIN-SINAR lasers correspond to the valid EU guidelines:

– 73/23/EEC (Low-Voltage Directive)
– 89/336/EEC (EMC Directive)
– 98/37/EC, Appendix IIA (Machinery Directive [if there is machine status])

2.2 Operation of the laser

The rules for the prevention of accidents by laser radiation (UVV) BGV B2 (formerly VBG 93) must be observed when operating the laser in the area within which these rules and relating instructions are valid. The implementation of the accident prevention regulation UVV BGV B2 "Laser Irradiation" can be found in BGI 832 - Operation of Laser Equipment. Under UVV BGV B2, a person must be appointed to take charge of laser safety, and the professional association and the appropriate work safety authorities for lasers from class 3B or 4 must also be informed.

Outside the area within which the BGV B2 is valid, the national regulations of the user’s country must be observed with regard to the rules for prevention of accidents by laser radiation.

The laser system may only be operated by trained and authorized personnel. Training courses are offered by:

– ROFIN-SINAR Laser GmbH (maintenance, repair application, operation)
– OEM suppliers (operation)
– Professional Association of Precision Mechanics and Electronic Textile Technique (UVV)
– PTB Physical and Technical Federal Institute Braunschweig (UVV)
– Technical Supervisory Associations (UVV)

2.3 General safety instructions

- The plant owner must make sure that no unauthorized personnel work on the laser system or in its vicinity.
- The laser system may be operated only by qualified personnel. The plant owner is responsible for the selection and training of the personnel. The personnel must have annual training on laser-specific risks. This training must be documented. The personnel must be taught to handle the laser system at set intervals, for which a written record must be kept.
- The laser system may be operated only in a malfunction-free state. Safety equipment may be neither dismantled nor deactivated, not even upon instruction.
  The machine's own safety technology should be checked at regular intervals for proper function and effectiveness.
- In case of changes to the laser system that impair safety, the laser system must be shut down. Before turning the laser system on again, the faults have to be remedied.
- Due to a possible risk of injury, the laser system should be clearly surveyable and clean.
- The personnel is obliged to wear the required personal protective equipment (PSA). E. g. protective goggles with the corresponding protective class adapted to the wavelength of the laser (see BGI 5092 "Selection and use of protective goggles and adjustment goggles").
- Every manner of working that impairs the safety of the laser system or people is prohibited. Improper use of the laser system must be ruled out.
- Operating the system under the influence of drugs, alcohol or medications that influence perception and reactions is prohibited!
- When switched on, the laser system must be monitored by operating personnel. Personnel must refrain from any manner of working that impairs safety.
- The plant owner is obliged to check the system for visible damage and faults at least once a shift. Changes that appear that impair safety must be eliminated immediately.
- During operation, you absolutely may not reach into the working range of the laser system with your hand or tools; safety equipment may not be evaded. A risk of injury exists!
- The laser system may only be operated using the provided controls. In this case, the use of tools (screwdrivers, or similar) is prohibited.

- Adjustment tasks may only take place during the setup mode. Personnel must take special care. These adjustment tasks may be performed only by qualified personnel using the provided controls.
- If unexpected risks arise during the operation of the laser system, operation must stop until the risks have been eliminated.
- The responsibilities for the various tasks within the scope of the operation of the system must be clearly defined. This applies particularly for work on electrical equipment and on beam-guiding components.
- Electrically unsecured doors or covers that can be opened or removed only with tools may be opened or removed only when the main switch is turned off.
- Before powering up the laser system, all tools and aids must be removed from the working area to exclude an endangerment of people and property.
- When the laser system is shut down, the main switch should be shut off and secured.
- In case of unexpected risk situations, the laser system must be shut down immediately using the emergency stop button.
- Emergency stop mechanisms may not be used as off switches in normal situations.
- After the emergency stop is pressed or after a serious fault, a safety check is required.
- Work in the electrical switch cabinet or on the control panel or electrical system may only be performed by qualified personnel. Control and switch cabinets must always be kept closed.
- Wet and compressed-air cleaning of the laser system is prohibited and only permitted under the following conditions:
  - Wet-clean the outside with mild soapy solution or mild cleaning agents.
  - Compressed air from a can (water-free and oil-free, nitrogen (1 - 2 bar).

Attention: *There is a risk of suffocation in case the nitrogen concentration in the ambient air is too high! Never exceed the permissible limit values!*

- Supply lines for the laser system (electrical power, cooling water) are to be laid in cable seats so that no one can trip over them.
- During work performed on additionally purchased function parts, the technical documents of the manufacturers must be observed.
- All safety notices and warnings attached to the laser system may not be removed and must always be legible. Damaged or illegible safety symbols must be exchanged immediately.

2.4 Safety notices for the laser system

Attention: *Laser radiation is very hazardous for the eyes. Radiation of the skin can cause severe burns. Diffuse, secondary (reflected) radiation is also dangerous. Laser radiation can cause fire risk or risk of explosion. Avoid any exposure to direct or secondary laser radiation at all times during installation, operation, maintenance or service of the laser. Never look into the laser beam directly or with optical devices. The organizational and personal protective measures must be observed!*

Attention: *Laser radiation can lead to permanent eye damage and skin burns!*

Attention: *After the cover of the laser head has been opened, the laser beam can be accessed freely! Laser operation with removed cover is prohibited! After completing service and repair work for which the laser head must be opened, the labels ("Do not open") must be pasted over the two top fastening screws of the laser head cover again!*

Attention: Warning against laser radiation!
A laser without any special protective unit corresponds to hazard class 4. A laser beam is invisible at a wave length of 1064 nm. If the positioning laser is activated (wavelength 660 nm, red laser beam, hazard class 3R), the laser beam is visible.

Laser class 1
Lasers that are safe under reasonably predictable conditions; this includes the use of optical instruments for the direct observation of the beam.
The accessible laser radiation is classified as safe.

Laser class 3R
Lasers emitting in the waverange of 302.5 nm to 1,000,000 nm (1,000 µm) and where directly looking into the beam may be hazardous. The limit of accessible emission is within five times of the limit value (GZS) of class 2 in the wavelength range of 400 nm to 700 nm and within five times of the limit value (GZS) of class 1 for other wavelengths.
"Visible laser radiation" is present if the emitted radiation lies within of the visible radiation (wavelength range between 400 nm and 700 nm).

Laser class 4
Lasers that can also generate dangerous, diffuse reflections. They can lead to skin injuries and the risk of fire. Their use requires extreme caution.
"Invisible laser radiation" is present if the emitted radiation lies outside of the visible radiation (wavelength range between 400 nm and 700 nm).
These areas are to be labeled with the corresponding warning symbols and the additional text "INVISIBLE LASER RADIATION – avoid irradiation of eyes and skin through direct or scattered radiation – LASER CLASS 4."

Attention: *Depending on the layout of the laser marker, the beam is emitted from the optics of the marking head. The optics in these beam guide systems can point in any direction (360°).*

Attention: *If no galvo head is attached, the laser beam is emitted out of the front of the laser head.*

- The owner of a laser system of laser classes 3B or 4 is obliged to name a laser protection officer for the operation of the plant.
- When the protective housing is installed completely, the machine has laser protection class 1. This means that no dangerous radiation can escape from the protective paneling and thus no risk exists for the machine operator or other people in the vicinity.

Attention: *If the machine is serviced and the protective paneling is removed, the machine has laser protection class 4. In this state, all applicable laser protection measures must be complied with.*

Attention: *The protective goggles used must be adapted to the wavelength of the laser and have the corresponding protection class.*

- To counteract potential malfunctions arising from inadvertent laser radiation, we remind you to comply with the proper use of the safety shutter (hereafter "Shutter").

Attention: *If the laser system has to be switched on for testing/measuring purposes, measures for protection against laser radiation must be taken (use of protective goggles, setup and positioning of partition walls, attachment of warning signs and barriers, etc.). These measures must be coordinated with the laser protection officer.*
The DIN EN 207 Filter und Augenschutzgeräte gegen Laserstrahlung (BS EN 207 Filters and Eye-Protectors Against Laser Radiation (Laser Eye-Protectors)), DIN EN 60825-1 Sicherheit von Lasereinrichtungen (BS EN 60825-1 Safety of Laser Products), and DIN EN 60825-4 Sicherheit von Laserschutzwänden (BS EN 60825- 4 Safety of Laser Products: Laser Guards) standards must be observed.

2.4.1 Beam path

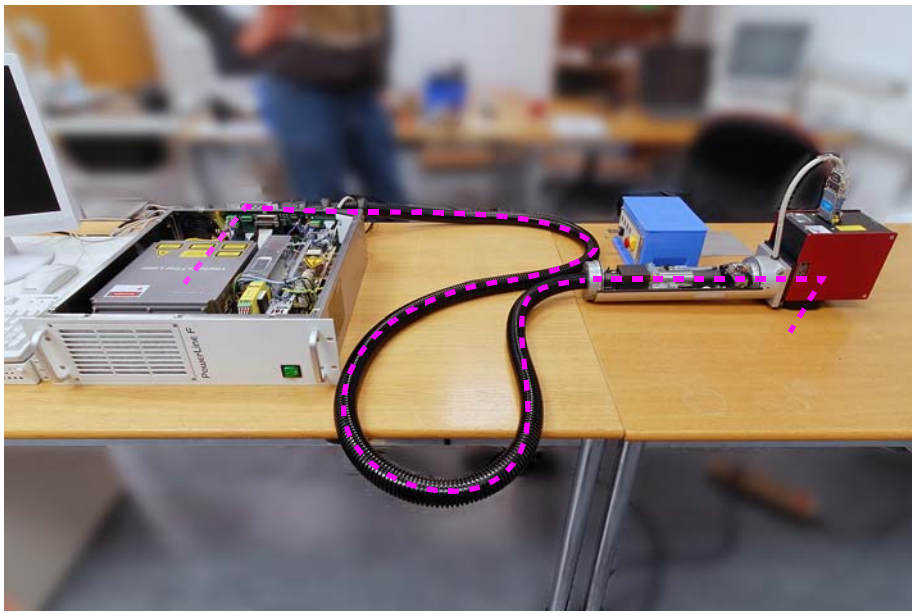

Figure 2.1 *Beam path*

The dashed line designates the beam path of the laser. The same applies to to the alignment laser (if applicable).

2.4.2 Alignment laser[1]

The alignment laser is a laser diode of protection class 3R. The accessible laser emission is within the wavelength range from 302.5 nm to 10^6 nm and is hazardous for eyes. The power or energy equals a maximum of five times of the limit value of the accessible radiation of class 2 in the wavelength range of 400 nm to 700 nm and within five times of the limit value of class 1 for other wavelengths.

Remark:

Class 3R laser devices are potentially hazardous to eyes as are Class 3B laser devices. The risk of eye injury is lower because the limit value of accessible radiation (GZS) in the visible wavelength range is limited to five times of the limit value of the accessible radiation (GZS) of class 2, and in the other wavelength ranges to five times of the limit value for accessible radiation (GZS) of class 1.

For continuously radiating lasers of class 3R, the limit value of accessible radiation (GZS) P_{limit} = 5 mW (with small sources C_6 = 1) in the wavelength range 400 nm to 700 nm.

Attention: *Never look into the beam of the alignment laser directly or with optical devices.*

2.5 Safety instructions for maintenance and setting tasks

Attention: *During the performance of maintenance, repair, setting, and monitoring tasks, the system must be shut down and secured against restarting. The warning sign "System shut down - activation prohibited!" must be attached to the laser system.*

Attention: *For the observance of laser protection class 1, the operation of the system with partially or completely dismantled protective housing is fundamentally prohibited.*

- After the mounting of the electrical systems or servicing, the function of the existing protective devices should be checked and the protective measures tested.
- Electrically unsecured doors or covers that can be opened or removed only with tools may be opened or removed only when the main switch is turned off.
- Work in the electrical switch cabinet or on the control panel or electrical system of the machine may only be performed by qualified personnel. Control and switch cabinets must always be kept closed.
- If safety devices are removed during repair work, the machine may not be restarted until all safety devices have been attached and checked for proper function.
- During maintenance work, make sure that electrical and media lines are not damaged or crushed.
  During this work, the main switch should be shut off and secured.

Attention: ***Laser radiation danger:*** *If parts of the protective housing are removed for work on beam-guiding units, operation of neighboring systems must be shut down. Authorized personnel located in the vicinity of the laser system during this work must wear protective goggles according to DIN 207. The working area must be labeled (laser class 4) (**see Section 2.4, page 10**).*

1. Installation depends on the respective laser type

Attention: *After the cover of the laser head has been opened, the laser beam can be accessed freely! Laser operation with removed cover is prohibited! After completing service and repair work for which the laser head must be opened, the labels ("Do not open") must be pasted over the two top fastening screws of the laser head cover again!*

Attention: *The mechanical processing of parts of the laser system (grinding, drilling, separating, etc.) must fundamentally take place outside of the working area!* ***The processing of support subassemblies is fundamentally prohibited!***

2.6 Electrotechnical safety instructions

- Wiring, electrical connection, commissioning, maintenance, and repair may only be performed by qualified electricians.
- Work may not be performed on live parts under any circumstances. The system or parts of it must be electrically disabled and secured against unintentional reactivation.
- When working on the electrical systems, turn off and secure the main switch.

Attention: High voltage! Extreme danger!
The devices marked with lighting bolts signs in the switch cabinet (main switch, repair socket, mains connection terminals) remain live after the main switch is turned off.
The switch cabinet may only be opened by electricians for repair purposes.

Attention: *Additional devices connected to the laser system may have their own mains supply line and thus be live when the main switch of the system is turned off.*

- The control and main power lines are to be laid separately from each other.
  Non-observance may result in the following:
  - Failure of the machine function
  - Endangering malfunctions
  - Destruction of electrical and mechanical components
- Electrical equipment must be checked regularly. Loose connections must be retightened. Damaged lines or cables should be exchanged immediately.
- The switch cabinet and all electrical supply units must always be kept locked. Access is permitted only to authorized personnel with a key or special tool.
- PCBs or plug connection may be removed only when the system is shut down. Do not mix up PCBs or plug connections. The label or coding must be observed.
- In case of measurements on live subassemblies or lines, a second person must always be present who can turn off the main switch in case of an emergency.
- When working with grounded measuring devices (oscilloscope), make sure that the ground bushing of the measuring device is always connected with the ground point of the control system (measuring cable). According to requirements, isolation amplifiers should be used for perfect measurements.

Attention: *Never clean electrical equipment with water or other liquids.*

2.7 Electrostatic sensitive devices (ESD)

Attention: *The electronic components of the PC plug-in are electrostatic sensitive devices (ESD)! Protective measures must be observed when working on these components!*

Protective measures to be performed:

- Ensure constant equipotential bonding!
- Make sure that personnel is grounded with wristbands and shoes!
- Make sure that clothing is closed and has discharge capacity!
- Materials that can charge electrostatic energy such as normal PE, PVC, styrofoam, etc. must be avoided!
- Avoid electrostatic fields >100 V/cm!
- Use only marked and defined packaging and transport materials!

Attention: When the power connection is disconnected as required prior to opening the PC plug-in, the PE connection will also be disconnected!
The PC plug-in must be properly grounded before work is performed on electronic components! The external connection to ground must be established at a marked PE terminal of the plug-in and a marked PE terminal in the system area! A measurement must be performed to ensure correct equipotential bonding). The ESD wrist band must then be connected to a PE terminal of the plug-in!
No work may be performed on electronic components prior to that!

Attention: *All personnel working on electronic components must comply with the required measures to protect electrostatic sensitive devices! The work area must be secured!*

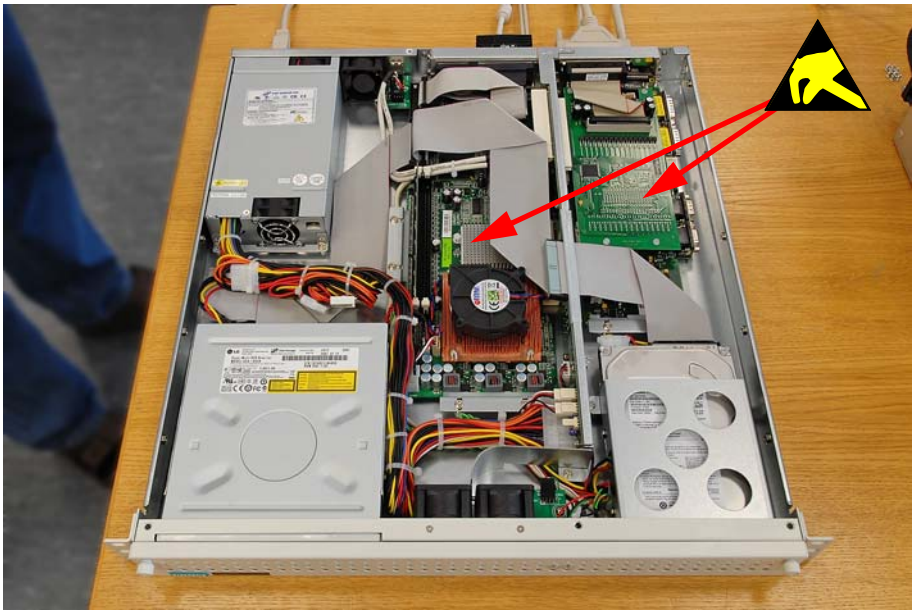

Figure 2.2 *PC plug-in*

2.8 Emergency stop mechanisms and safety equipment

2.8.1 Emergency stop mechanisms

The emergency stop is caused by operating the red emergency stop push button. The emergency stop switches off the laser as quickly as possible and stops all movements of the operation process and used to prevent injury to persons, or damage to the machine or workpiece.

Depending on the system layout, the Emergency stop pushbutton is located on the external control panel or the supply plug-in.

Figure 2.3 *Emergency stop push button external control panel*

Figure 2.4 *Emergency stop push button supply plug-in*

Note: *The emergency stop should not be used to end a normal working cycle.*

2.8.2 Safety equipment

Figure 2.5 *Warning lamp laser head*

There are two warning lamps opposite each other in the laser head.

These warning lamps will illuminate when the laser system is switched on with the main switch and the key switch is set to position I (system closed in operating mode/shutter) or position II (Open activation system in operating mode/shutter, i. e. when the laser radiation is generated.

The warning lamps flash when an error occurs.

2.9 Other dangers

2.9.1 Ultraviolet radiation

Attention: *The metal vapor plasma which emerges when welding and marking certain metals with a laser beam emits intense invisible ultraviolet radiation which can cause severe damage to the eyes and the skin!*

Attention: *The laser protective goggles for 1064 nm or 532 nm specified by DIN EN 207 or EN 208 do not offer protection from this ultraviolet radiation.*

Note: *Special goggles which protect the eyes against ultraviolet radiation are commercially available.*

2.9.2 Hazardous materials

Attention: *Hazardous fumes and dust may be given off during the marking process or when carrying out service tasks (e. g. replacing contaminated filters). The regulations of the supplier in regard to safety must be observed. When handling hazardous materials, a suitable breathing mask and protective gloves shall be used.*

2.10 Personal protective measures

Attention: *Laser radiation is very hazardous for the eyes. Radiation of the skin can cause severe burns. Diffuse, secondary (reflected) radiation is also dangerous. Laser radiation can cause fire risk or risk of explosion.*

Attention: *After the cover of the laser head has been opened, the laser beam can be accessed freely! Laser operation with removed cover is prohibited! After completing service and repair work for which the laser head must be opened, the labels ("Do not open") must be pasted over the two top fastening screws of the laser head cover again!*

- Avoid any exposure to direct or secondary laser radiation at all times during installation, operation, maintenance or service of the laser. Never look into the laser beam directly or with optical devices. The organizational and personal protective measures must be observed!
- Wear suitable protective goggles in the laser area according to DIN EN 207 and EN 208 – eye protection against laser radiation at a wavelength of 1064 (660) nm.

2.11 Administrative precautions

The following regulations must be observed. The detailed organizational protective measures and guidelines of DIN EN 60825, Classification VDE 0837 (IEC 825), must be observed.

- The operators must be instructed in safety regularly.
- Attach warning signs to warn against laser radiation.
- Deny access to the laser system to anybody not working on it.
- The laser area must be sufficiently labeled.
- Due to a possible risk of fire and explosion, no flammable or easily flammable gases, liquids, or solids may be brought into the laser area.
- Toxic decomposition products may develop when certain materials (e. g. metals or plastics) are processed. Information on possible risks that can appear should be obtained, e. g. from professional organizations.
- Objects that can endanger people through the uncontrolled reflection of the laser radiation must be removed from the laser area.
- Have authorized and purposely appointed persons check the effectiveness of integrated safety equipment (e. g. emergency stop) according to defined test cycles. All relevant national safety regulations and guidelines must be observed (see "Operation according to regulations" on page 7).
  Existing safety equipment must be actuated during operation. Any endangering functions must immediately be stopped or interrupted. Before renewed powering up the laser system, the corresponding displays or error messages must be acknowledged. Make sure that the laser system can be restarted. If this is confirmed the safety equipment is in proper working order.
- Make sure that the warning lamps regarding laser radiation function properly. A defective lamp must be replaced immediately. The laser radiation warning lamps are located on top of the laser head.

2.12 Waste disposal information

Comply with all national and regional regulations regarding waste disposal.

2.13 Labeling

All locations which, under certain circumstances (e. g. when protective covers are opened), represent a potential risk, are labeled with the required warning labels. The location of the individual signs are marked in the Safety chapter in the user manual.

Attention: *These labels must not be removed.*

Notes

3 Required tools, measuring devices, and aids

In addition to a standard tool set, the tools, measuring devices, and aids listed in the following are required for performing repair work on lasers of the RSM PowerLine F series:

Figure 3.1 *Protective goggles*

- Protective goggles*

Attention: *The protective goggles must be adapted to the wavelength of the laser that is used.*

Note: *The protective goggles shown in Figure 3.1 are suitable for all wavelengths that may occur with the RSM PowerLine F. If protective goggles are used that do not cover the entire wavelength range, multiple protective goggles must be used accordingly.*

Figure 3.2 *Power measurement device*

- Power measurement device including sensor and fitting for power measurement head LM 200*

Attention: *When the power measurement device is used, protective goggles adapted to the wavelength of the laser must be used!*

Figure 3.3 *Adjustment tube of galvo head with base plate*

- Adjustment tube of galvo head with base plate*

- Cross wires with seat D=16 mm, cross wires D=25 mm*

Figure 3.4 *Cross wires with seat*

- Transducer disk "Beam catcher"*

⚠ ***Attention:*** *When the transducer disk is used, protective goggles adapted to the wavelength of the laser must be used!*

Figure 3.5 *Transducer disk*

- Multimeter

Figure 3.6 *Multimeter*

- Fine measuring tips

Note: *Various measuring points cannot be reached with standard measuring tips.*

Figure 3.7 *Fine measuring tips*

- Measuring adapter for galvo voltage*

Figure 3.8 *Measuring adapter for galvo voltage*

- Scotch tape no. 6877 50x66*

Attention: *Only tape that can be completely removed without residue may be used!*

Figure 3.9 *Scotch tape no. 6877 50x66*

- Precision level gauge

Figure 3.10 *Precision level gauge*

- Lens cleaning paper pack*

Figure 3.11 *Lens cleaning paper pack*

- Isopropyl alcohol for the cleaning of optical components*

Figure 3.12 *Isopropyl alcohol*

Figure 3.13 *Compressed air can*

- Compressed air can*

Figure 3.14 *Rubber gloves and dust protection mask*

- Rubber gloves and dust protection mask for cleaning tasks*

Figure 3.15 *ESD wrist band with spiral cord*

- ESD wrist band with spiral cord*

- M-Function PL-CF test box*

The test box can be used to externally activate the functions of the laser. The connection is established at plugs -X42a and -X42b of the supply plug-in.

Figure 3.16 *M-Function PL-CF test box*

*. For the order number, see the ROFIN-SINAR measuring and adjusting device catalog

4 Commissioning the laser for testing and measuring purposes

4.1 Settings in the VLM software

Note: *The main or alignment laser will only start while a VLM program is running.*

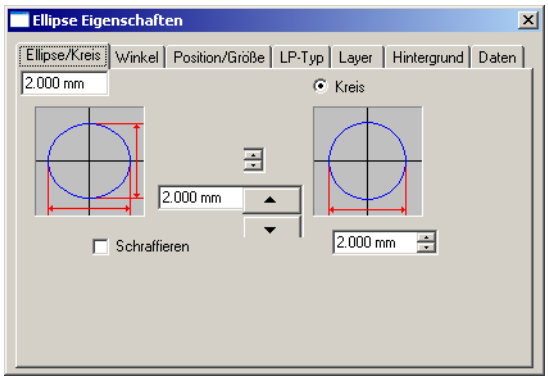

Figure 4.1 *Ellipse properties - dimensions*

1. Starting the PC.
2. Starting the VLM software.
3. Create the ellipse and assign a height and width of 2 mm in the properties.

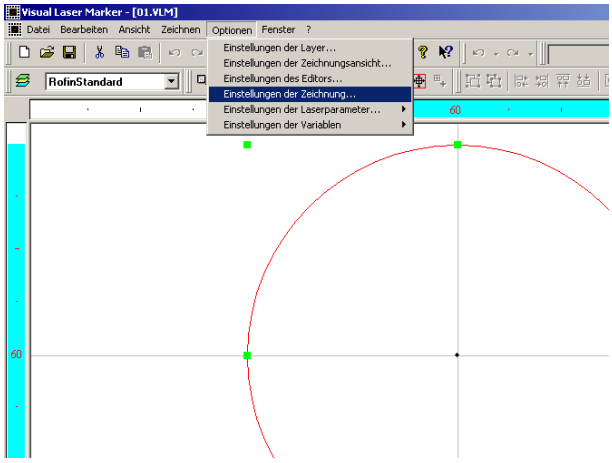

Figure 4.2 *Calling drawing settings*

4. Calling "Drawing settings" under "Options".

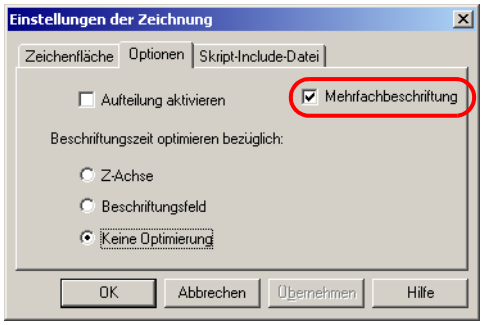

Figure 4.3 *Drawing settings*

5. Check the "Multiple marking" box.
6. Click the [Apply] and [OK] buttons to activate changes.

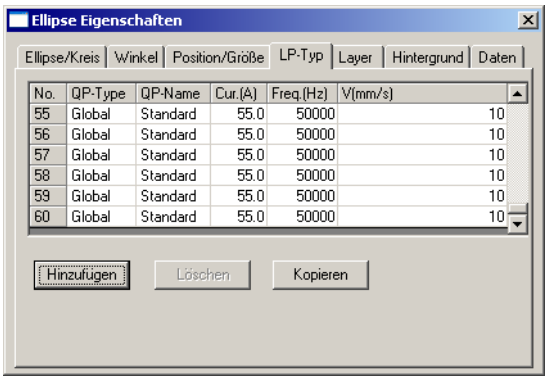

Figure 4.4 *Ellipse properties - LP type*

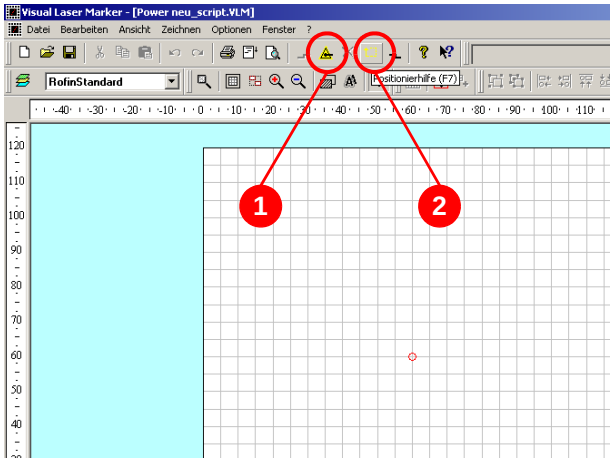

Figure 4.5 *Start laser*

7. Call "Ellipse properties" again and select the "LP type" tab.

8. Enter the values for current and frequency.

Note: *Do not enter an absolute value under "Cur.(A)" but a percentage of the maximum current.*

9. Copy the entry with the "Add" button until a total of about 50 to 60 repeats are performed and set the speed [V] to 10 mm/s.

Note: *The laser is only in operation during marking.*

10. Start the program and thereby the main laser using Button (1) (Figure 4.5) or the alignment laser using Button (2).

Note: *The main or alignment laser can only be started individually. The two lasers cannot be operated simultaneously.*

4.2 Settings in the machine configuration

Note: *In order to be able to start the laser with disassembled galvo head, enter the following settings in the machine configuration. These settings must be reset after testing and measuring has been completed.*

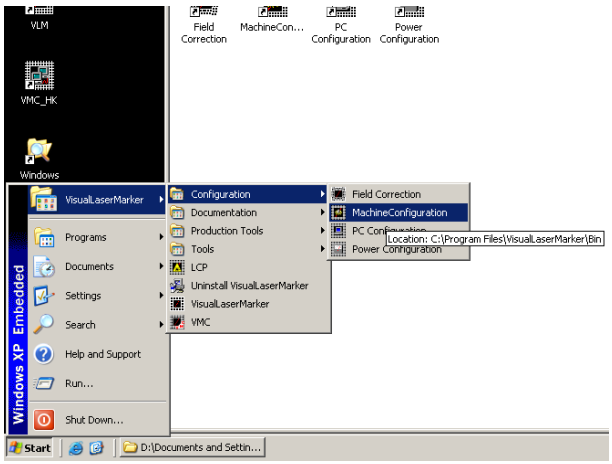

Figure 4.6 *Starting the machine configuration*

1. Starting the PC.
2. Starting the machine configuration.

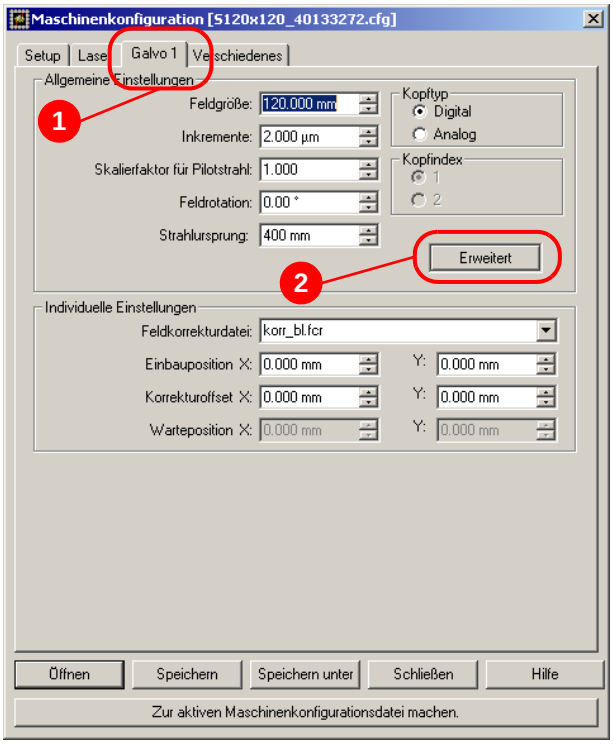

Figure 4.7 *Machine configuration*

3. Select the "Galvo 1" (1) tab and click on the "Expanded" (2) button.

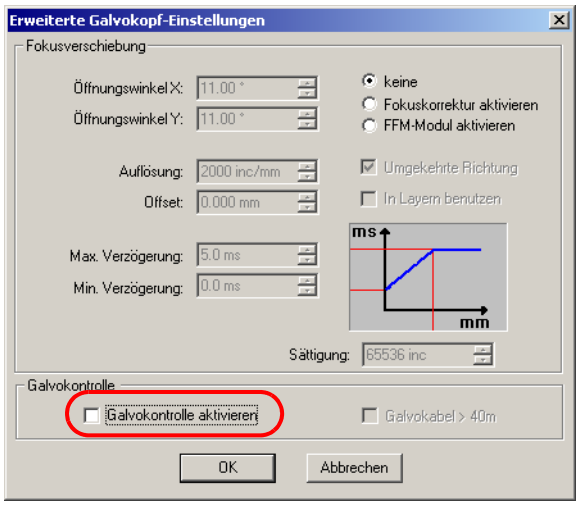

Figure 4.8 *Advanced galvo head settings*

4. Uncheck the "Activate galvo check" box.
5. Click the "OK" button.

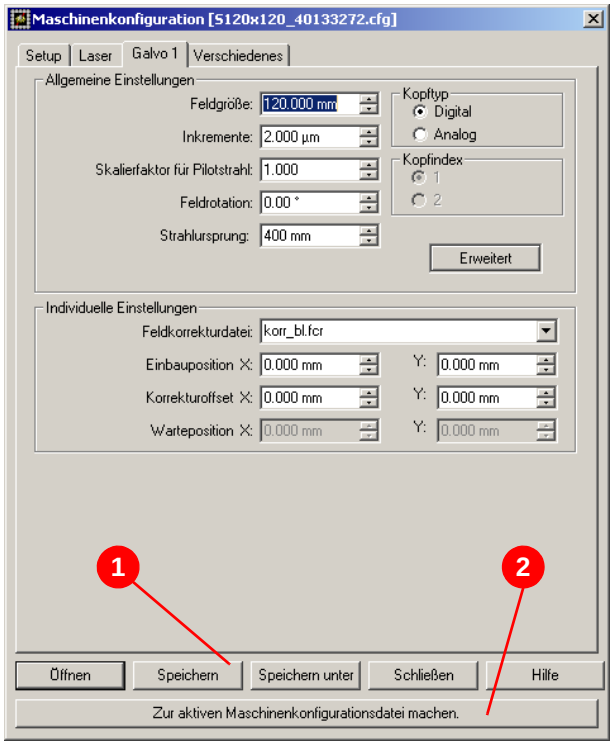

Figure 4.9 *Activating the machine configuration*

6. Click on the "Save" (1) and "Convert to active machine configuration file" (2) buttons.

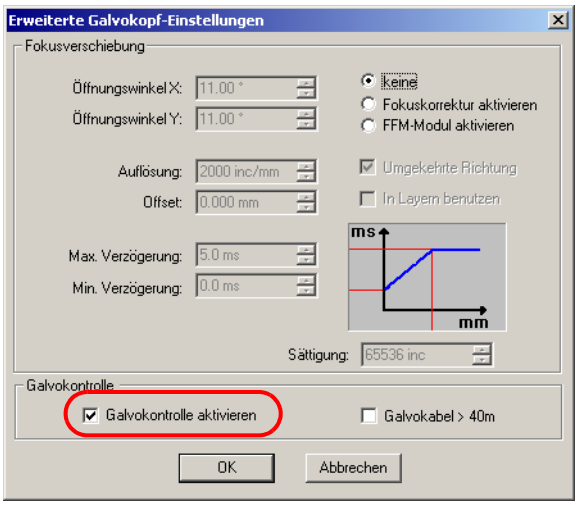

Figure 4.10 *Enable galvo check*

7. Reactivate the galvo check after completing tests and measurements.

4.3 Starting the main laser from the VLM software

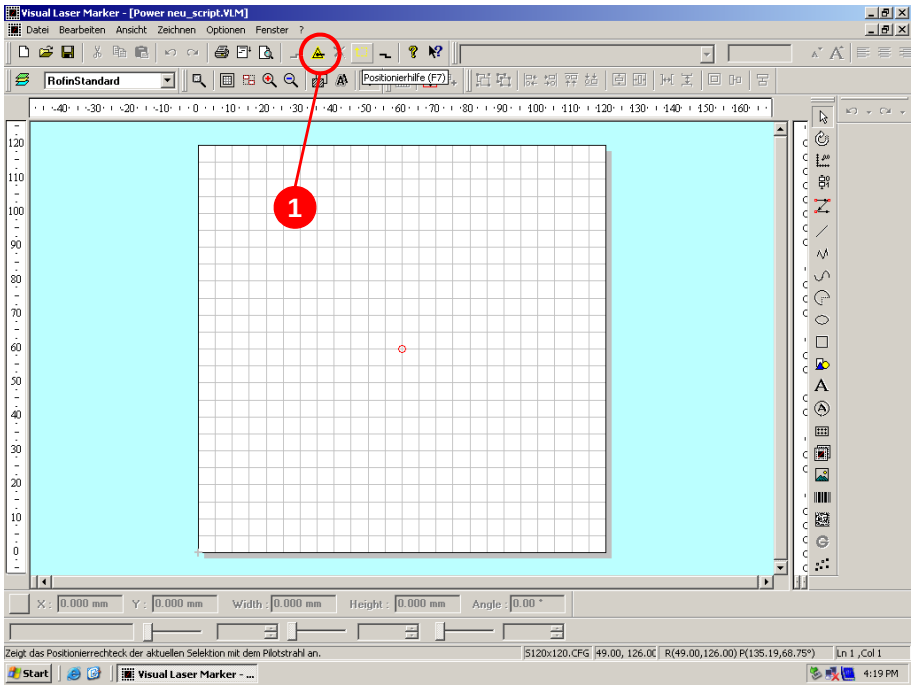

Figure 4.11 *Start the main laser*

The laser must be started according to the instructions in the user manual.

The main laser is started in the VLM software using the corresponding button (1) (Figure 4.11).

Note: *The main laser can only be started when the alignment laser is out of commission. A VLM program must be running (see Section 4.1, page 27).*

4.4 Starting the alignment laser[1] from the VLM software

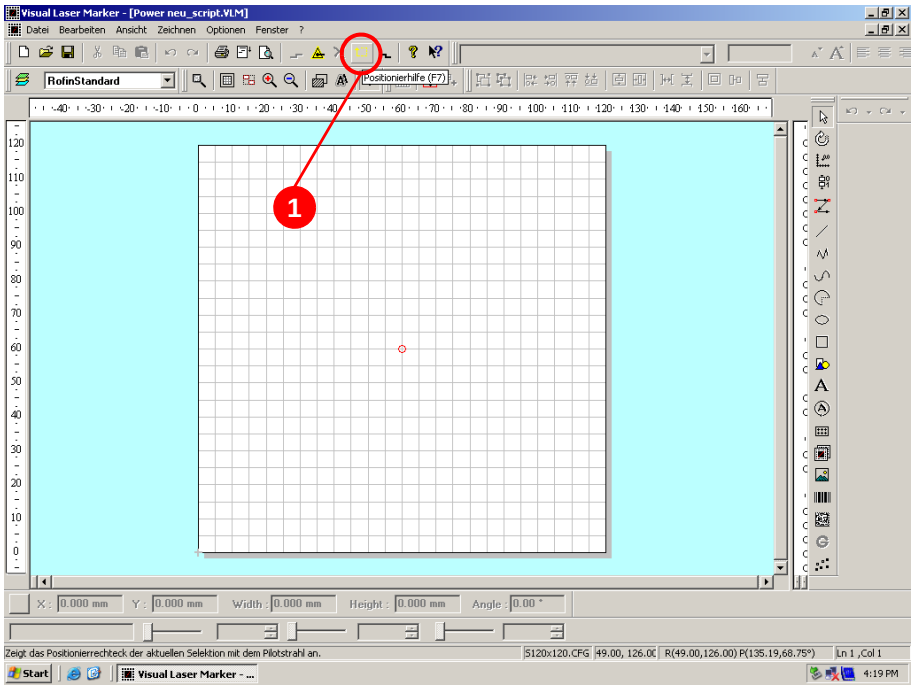

Figure 4.12 *Starting the alignment laser*

The laser must be started according to the instructions in the user manual.

The main laser is started in the VLM software using the corresponding button (1) (Figure 4.11).

Note: *The main laser can only be started when the alignment laser is out of commission. A VLM program must be running (see Section 4.1, page 27).*

1. Installation depends on the respective laser type

Notes

5 Troubleshooting

5.1 Image errors

Note: *For the precise assessment of the image faults, a measuring magnifier or microscope is required.*

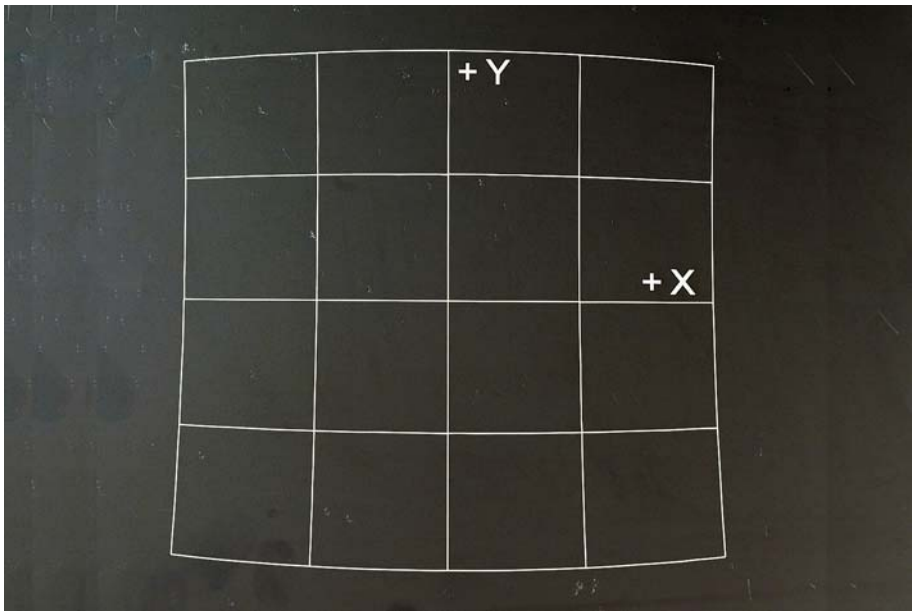

Figure 5.1 *Barrel or pillow shaped distortion*

Error	Remedy
Barrel and/or pillow shaped distortions in the X and Y directions	Load the compensation file belonging to the optics.

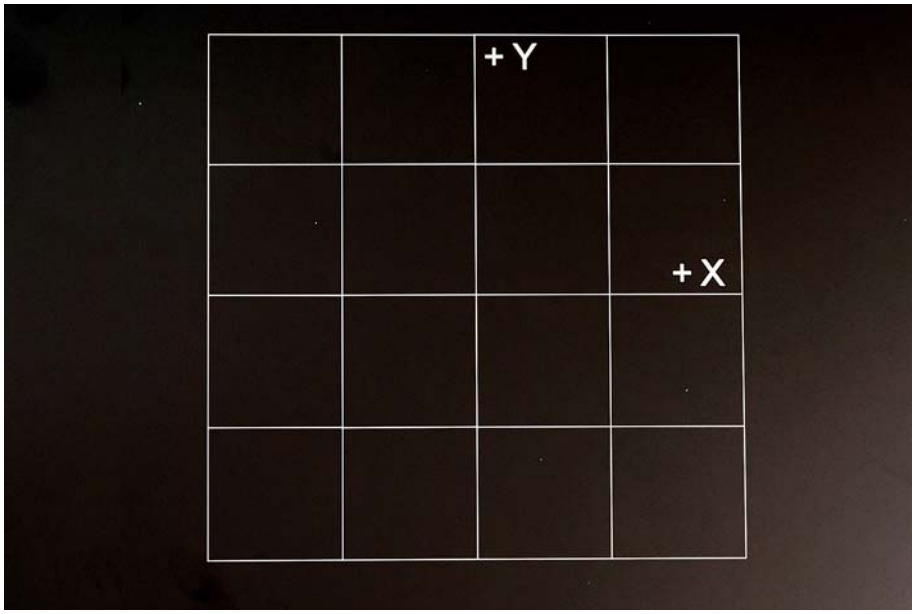

Figure 5.2 *Compensation file loaded*

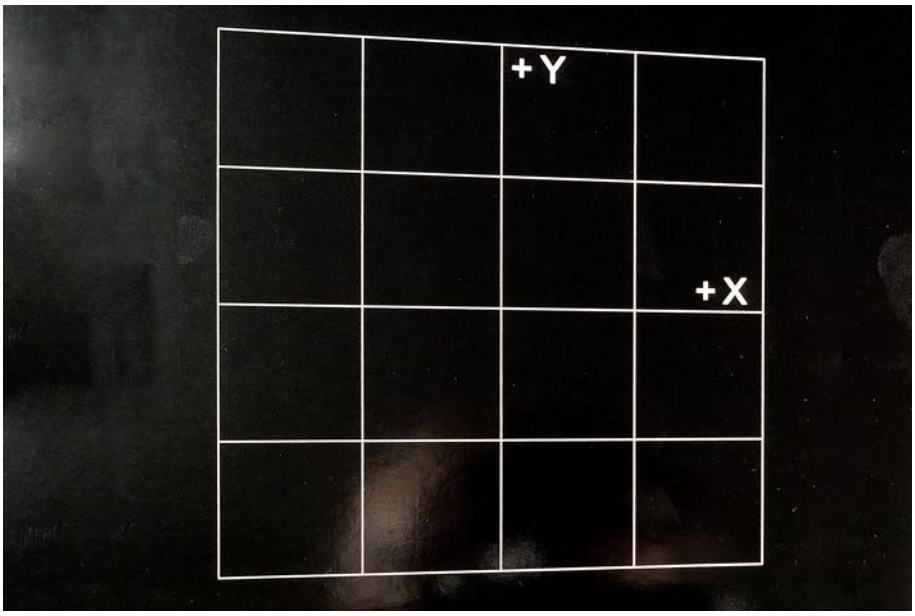

Figure 5.3 *Trapezoidal distortion*

Error	Remedy
Trapezoidal distortions in the X and Y directions	Check the adjustment of the workpiece support plate and the galvo head (see Section 7.1, page 61).

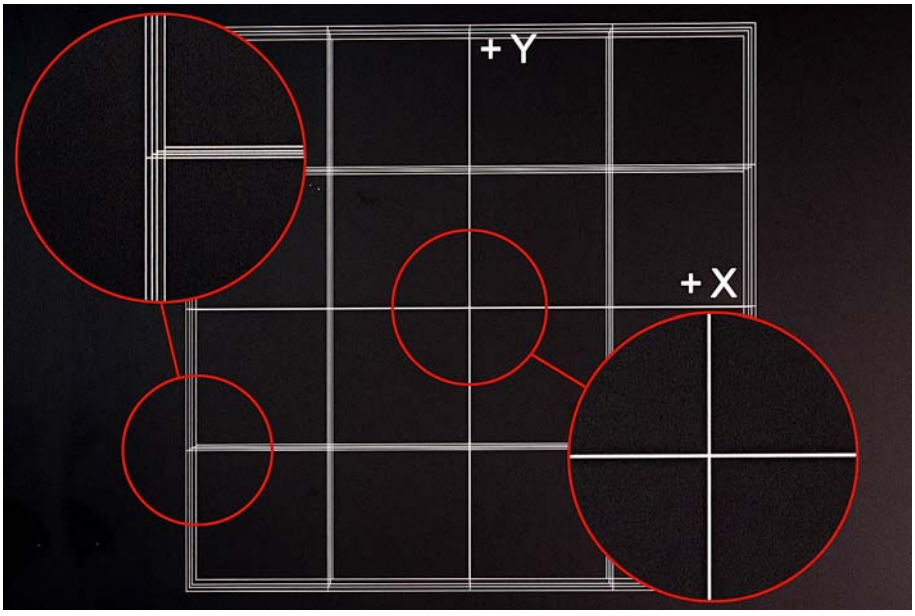

Figure 5.4 *Focusing errors*

Error	Remedy
Focusing error (center point okay, deviation at edge)	Checking the focal distance of the galvo head (see Section 7.1, page 61).

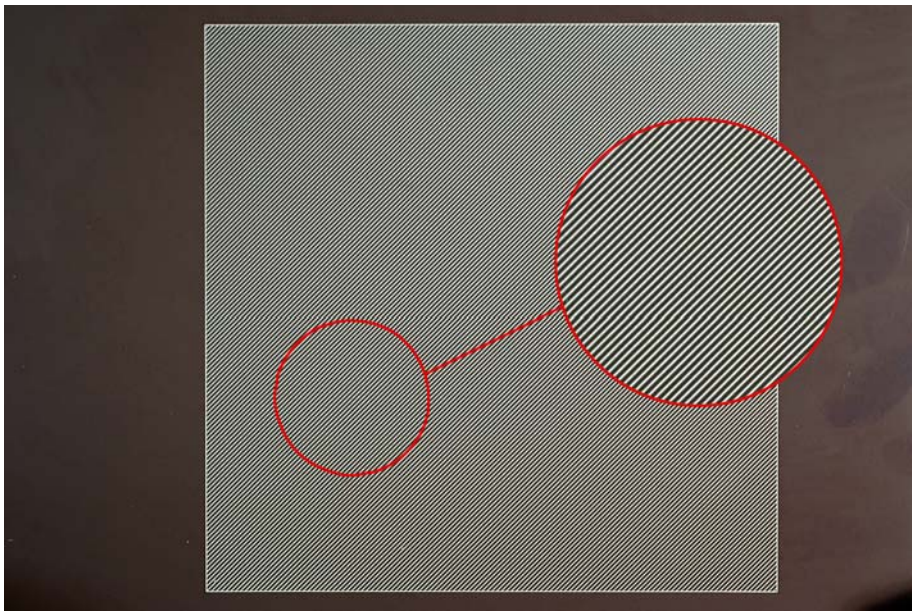

Figure 5.5 *Correct image*

Note: *A test program should be created to test the image (see the VLM user manual).*

Sample settings for the test program:

- Square 120 mm x 120 mm (congruent with the maximum marking field of the laser)
- Hatching 45°
- Hatching distance approximately 0.5 mm ... 2.0 mm
- The speed, current and frequency must be adapted to the material being marked.

The image of the lines must be clean and have a high acutance.

Attention: *The laser system and the workpiece support plate must be absolutely vibration-free! The suction system must be switched on since vapors obstruct/weaken the laser radiation!*

Note: *To prevent errors due to the material being marked, let the test program run through several test patterns.*

Note: *For the precise assessment of the image faults, a measuring magnifier or microscope is required.*

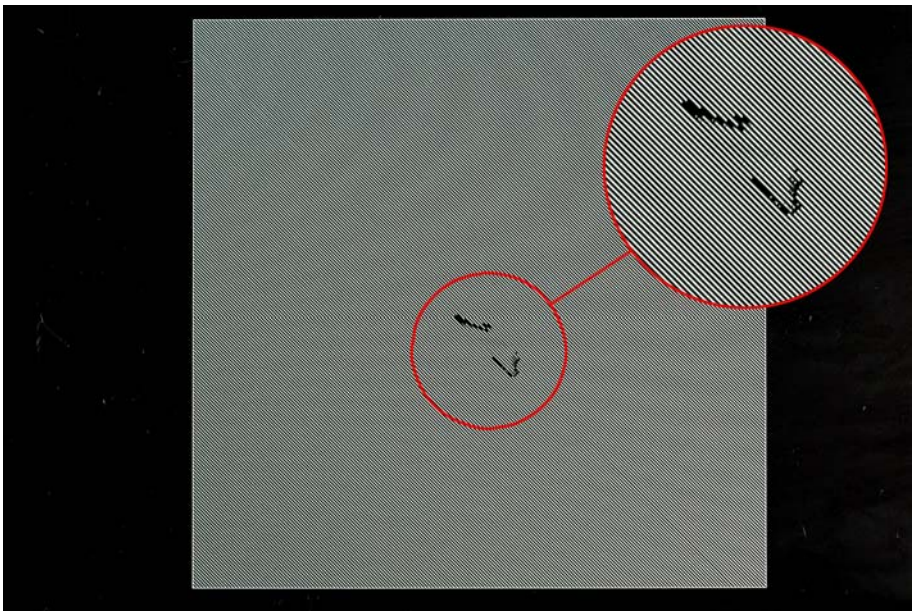

Figure 5.6 *Irregular power fluctuations*

Error	Remedy
Irregular power fluctuations	Check the optics for soiling and burning (see Chapter 6).

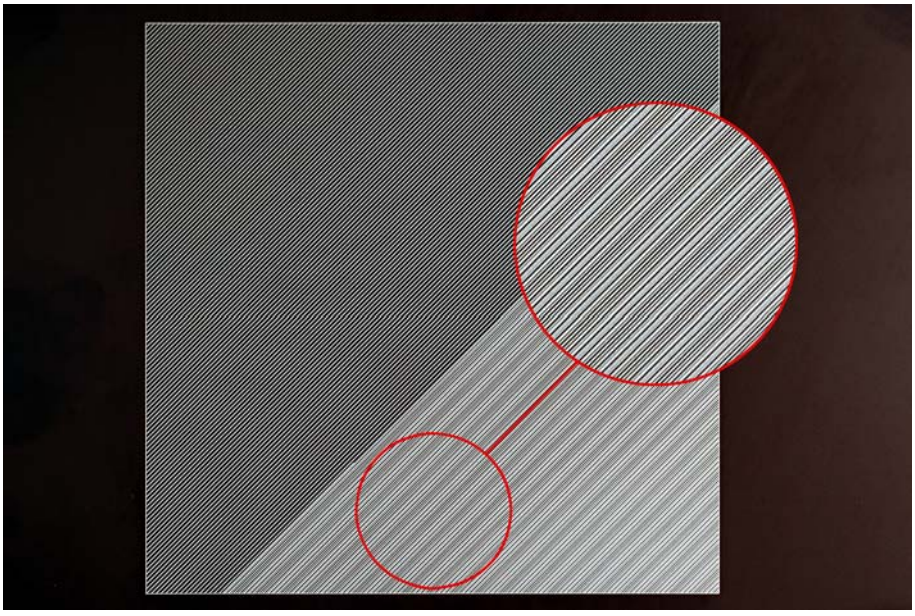

Figure 5.7 *Regular power fluctuations*

Error	Remedy
Regular power fluctuations due to internal or external influences	Check or change the laser unit. Check system for vibrations.

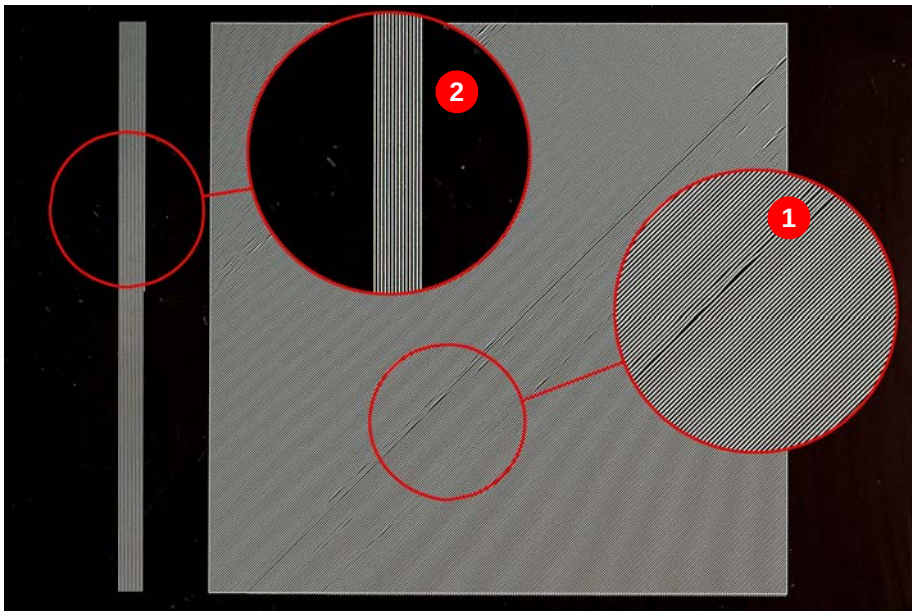

Figure 5.8 *Positioning error of galvo head*

Error	Remedy
Positioning error of galvo head (1) (X or Y direction)	Check/exchange the galvo head or ALI board. Check the system for vibrations.

Note: *If the test matrix is not hatched in a 45° angle, errors will possibly not be recognized (2).*

5.2 Marking errors

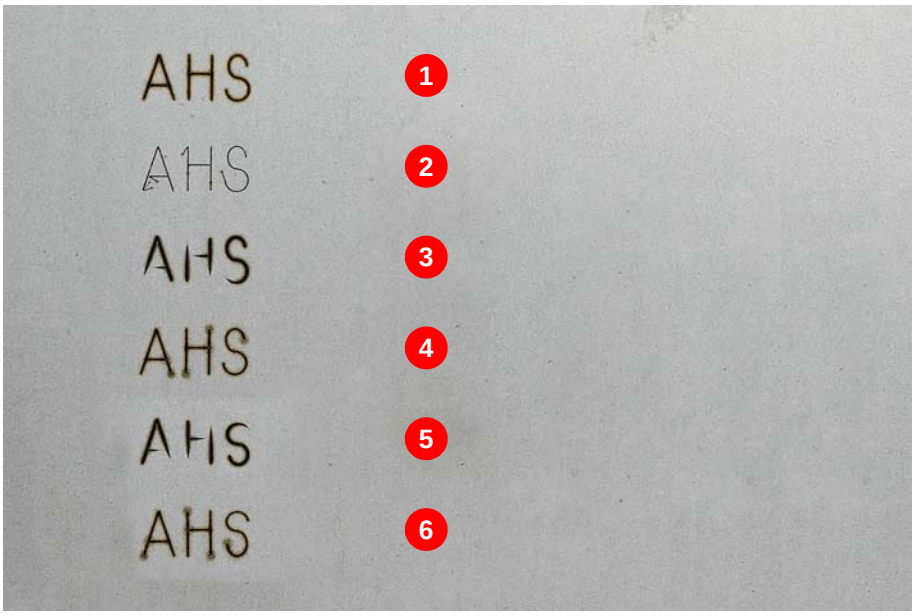

Figure 5.9 *Marking errors*

No.	Error	Remedy
1	No error	–
2	Distortions	• Check the parameters and hardware.
3	The first pulse is too strongly attenuated.	• Check the parameters and hardware.
4	LASER-OFF-DELAY too long	• Check the parameters and hardware.
5	LASER-OFF-DELAY too short	• Check the parameters and hardware.
6	The first pulse is not attenuated enough.	• Check the parameters and hardware.

5.3 Emergency stop circuit

Attention: *The peripheral components of the laser system should be shut down and secured against reactivation.*

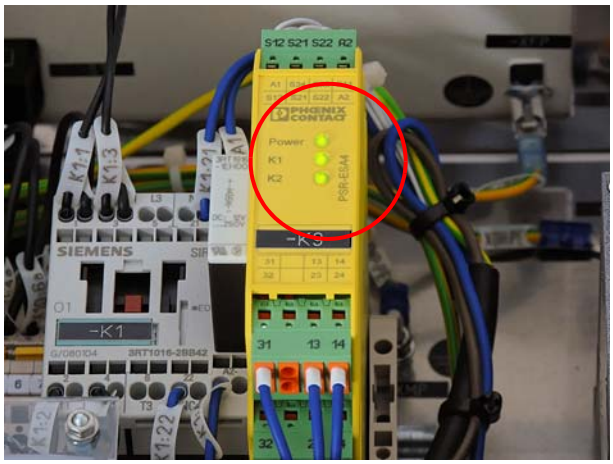

Figure 5.10 *Emergency stop relay – OK*

- Emergency stop circuit OK

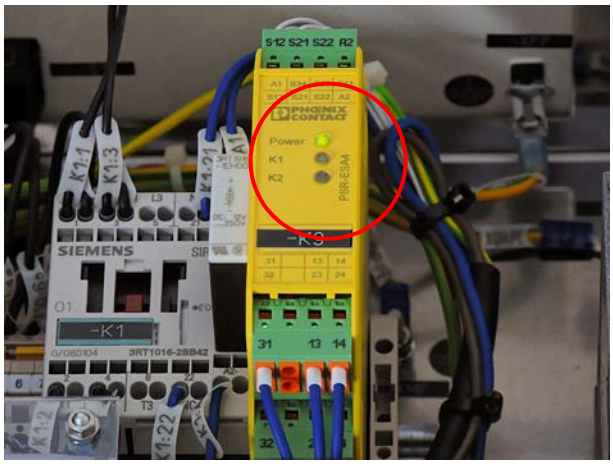

Figure 5.11 *Emergency stop relay – Triggered*

- Emergency stop circuit triggered

5.4 Measurement of the laser power

Attention: *For the measurement of the laser power, a power measurement device with a measuring adapter for the respective laser type is required (see Chapter 3). The operating instructions of the measuring device absolutely must be observed!*

Attention: *If the laser system has to be switched on for testing/measuring purposes, measures for protection against laser radiation must be taken (use of protective goggles, setup and positioning of partition walls, attachment of warning signs and barriers, etc.). These measures must be coordinated with the laser protection officer.*
The DIN EN 207 Filter und Augenschutzgeräte gegen Laserstrahlung (BS EN 207 Filters and Eye-Protectors Against Laser Radiation (Laser Eye-Protectors)), DIN EN 60825-1 Sicherheit von Lasereinrichtungen (BS EN 60825-1 Safety of Laser Products), and DIN EN 60825-4 Sicherheit von Laserschutzwänden (BS EN 60825- 4 Safety of Laser Products: Laser Guards) standards must be observed.

Attention: *During the measurement of the laser power, a second person must always be present to press the emergency stop button/main switch of the laser system in case of an emergency.*

Attention: *The peripheral components of the laser system should be shut down and secured against reactivation.*

5.4.1 Measuring points

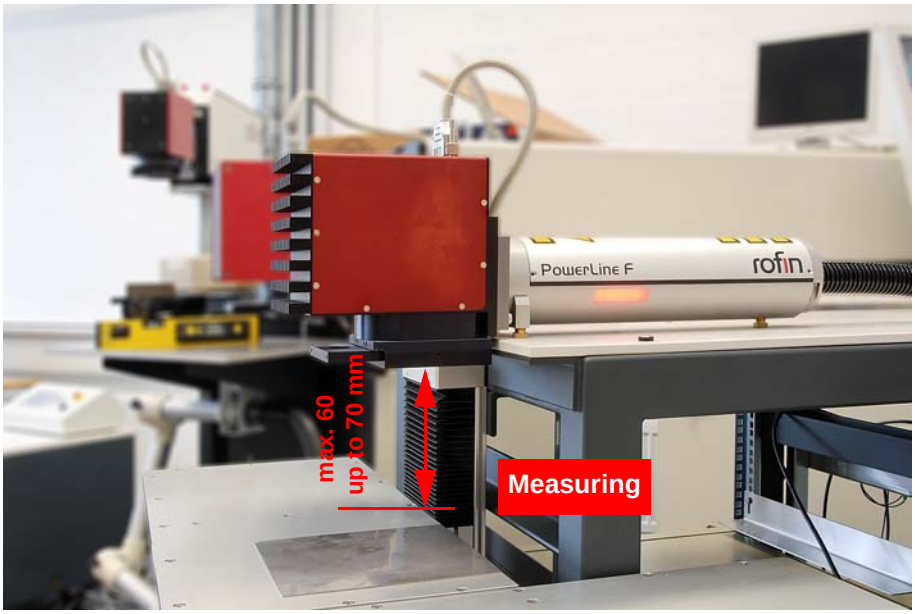

Figure 5.12 *Laser power after the galvo head*

Attention: *The laser power after the galvo head must fundamentally be measured outside of the focus to prevent burning or other damage to the measurement head! At a burning width of e. g. 160 mm, measures a maximum of 60 to 70 mm underneath the protective glass!*

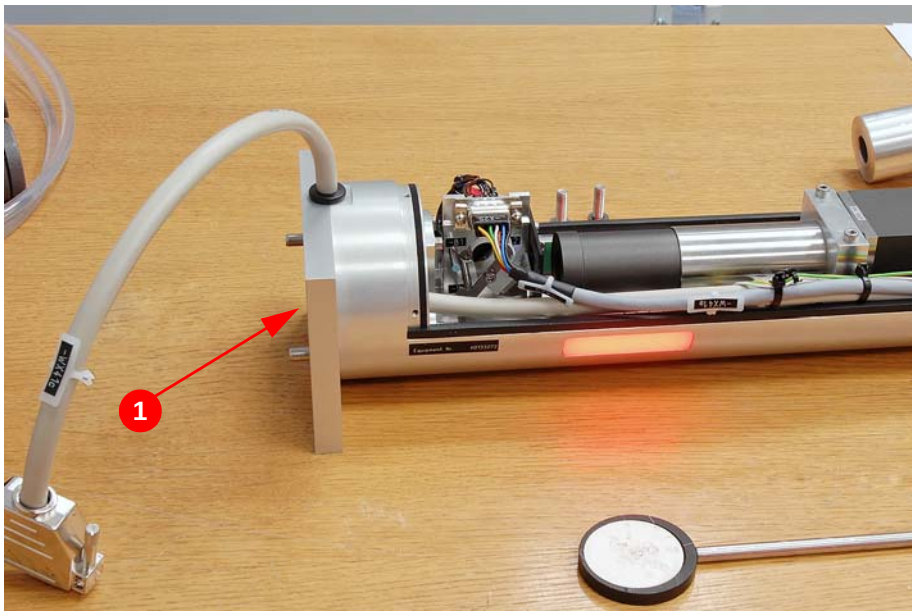

Figure 5.13 *Laser power measuring point on the galvo flange*

No.	Measuring point
1	Galvo flange*

*. Perform the measurement with and without the installed beam expansion and with and without built-in shutter.

Laser type	Power
PWL 10 F	• 60 kHz, 100 % Current: > 9.00 W
PWL 20 F	• 60 kHz, 100 % Current: > 18.00 W

5.4.2 Performing the measurement

Attention: *Before powering up the laser for measuring purposes, the measurement head should be positioned at the measuring point!*

Attention: *Do no move the measurement head through the activated laser beam! There is a risk of an uncontrolled deflection of the laser beam!*

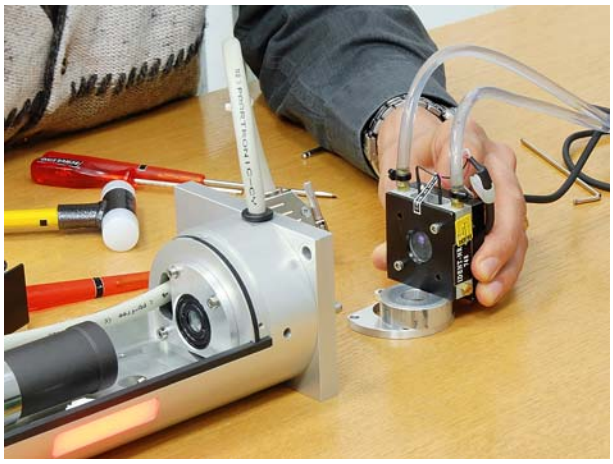

Figure 5.14 *Measuring the laser power*

1. Secure the shutter against activation.
2. Disassemble galvo head and enter settings in the machine configuration (see Section 4.2, page 29).

Attention: *Take measures for protection against laser radiation (see page 42)!*

3. Position the measurement head.

Attention: *Set the measuring device to the wavelength of the laser! Observe the operating instructions of the measuring device!*

4. Activate the main switch of the laser system.

Attention: *If the emergency stop button/main switch of the laser system is out of reach, a second person must always be present who can press the emergency stop button/main switch in case of an emergency.*

5. Starting the VLM program (see Section 4.1, page 27).

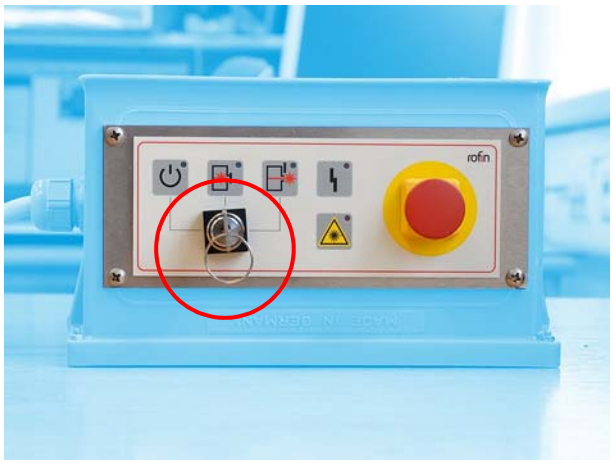

Figure 5.15 *Key switch / shutter*

6. Open the shutter.
7. Perform the measurement.

Note: *Compare the measured power with the power after the galvo head to detect any power losses. The measurement should be performed with and without an installed beam expansion and with and without a built-in shutter to detect any power losses due to these components.*

Attention: *Perform the measurement only for a short time to prevent damage to the measuring head! Follow the instructions in the operating instructions of the measuring device!*

8. Close the shutter.
9. Remove the measurement head.
10. Switch off the laser equipment.
11. Completely mount the components.
12. Commission the laser system.

5.4.3 Assessment of the measurement

Error	Possible Reasons	Remedy
Power okay, marking result faulty	Focal distance incorrectly adjusted	• Adjusting
	Focal point incorrectly adjusted	• Adjusting
	Optical components have changed their properties	• Perform further power measurements
	Handling system faulty	• Check it. • Adjusting
Power too low	Voltage and current supply	• Checking the power supply
	Laser beam	• Check the beam adjustment. • Check the optical components.
Power fluctuations	Voltage and current supply	• Checking the power supply
	Vibrations	• Check it.
Power loss	Soiling, protective glass damage, focusing lens, beam expansion, galvo mirror	• Clean, exchange ***Note:*** *In case of damage to the galvo head, the complete head must be exchanged.*
	Galvo head voltage supply fault	• Measure the voltage and adjust it if necessary. • Checking the power supply
	Defective galvo head	• Check its function. • Exchange the galvo head or the ALI card for the optics if necessary.
	Contamination of beam expander:	• Clean it.
	Defective shutter module	• Exchange the shutter module

5.5 Loading a new ALI configuration

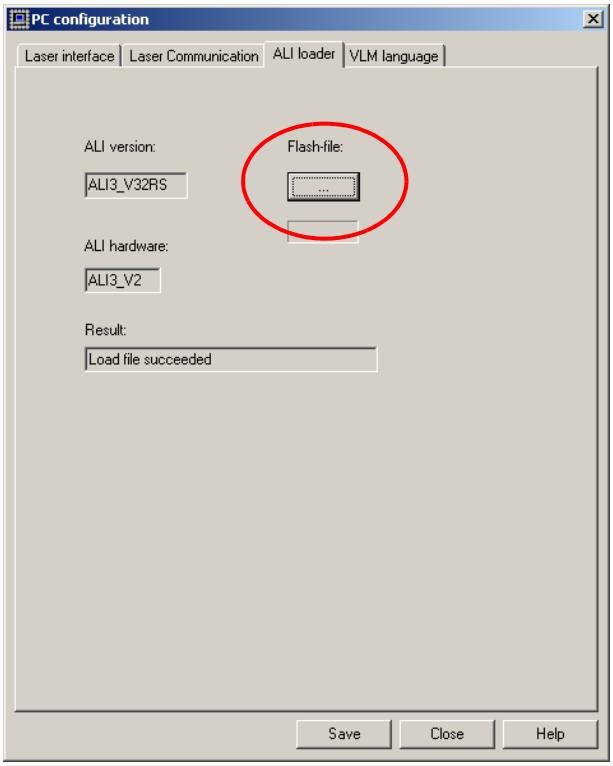

Figure 5.16 *VLM PC configuration*

Note: *The "New Hardware Found" dialog is called if the version difference between the old and new ALI card is too great (e. g. Version 1 to Version 3).*

1. After the change of the ALI card on the laser PC, call the VLM PC configuration (VisualLaserMarker > Configuration > PC Configuration).
2. Call the ALI loader.
3. Press the "FlashFile" button

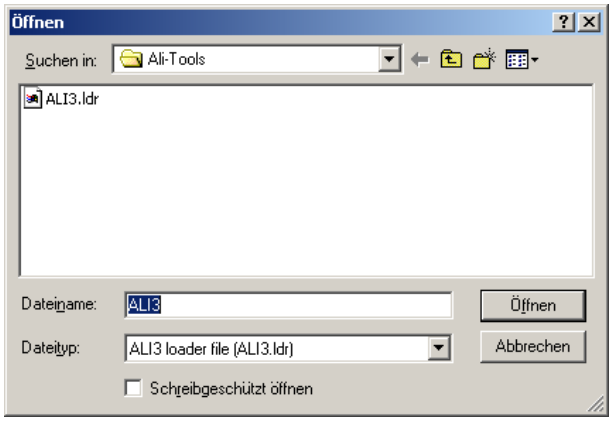

Figure 5.17 *Selecting the ALI loader file*

4. Select and open the corresponding ALI loader file.

Figure 5.18 *Installation ended*

5. Wait until the installation of the FlashFile is complete.

Note: *In this way, any test program on the ALI card is overwritten.*

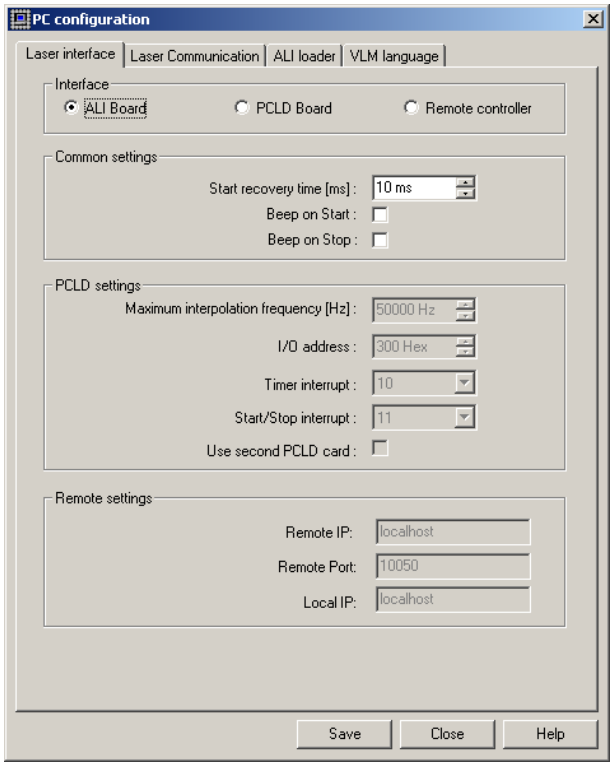

Figure 5.19 *Laser interface*

6. Adapt the settings in the laser interface.

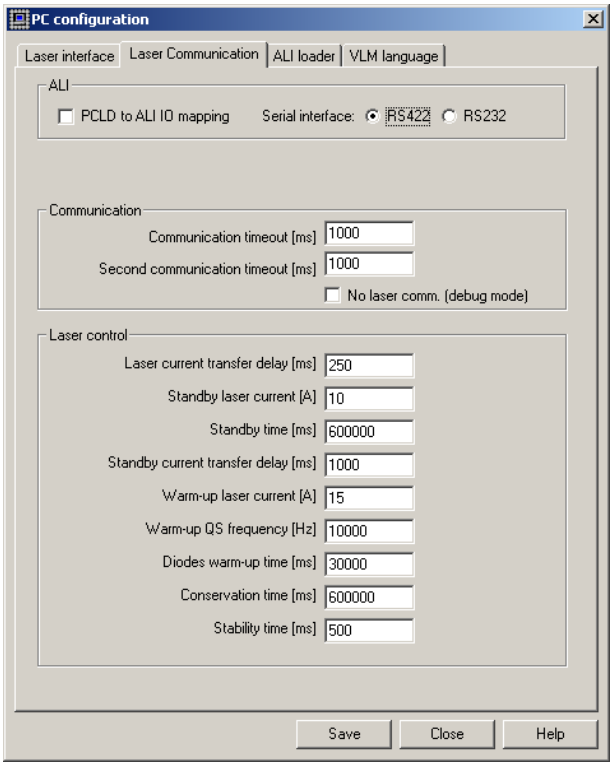

Figure 5.20 *Laser communication*

7. Adapt the settings in the laser communication.

5.6 Checking the ALI system settings

Figure 5.21 *Call the computer administration*

1. Call the computer administration (right click on My Computer > Administer).

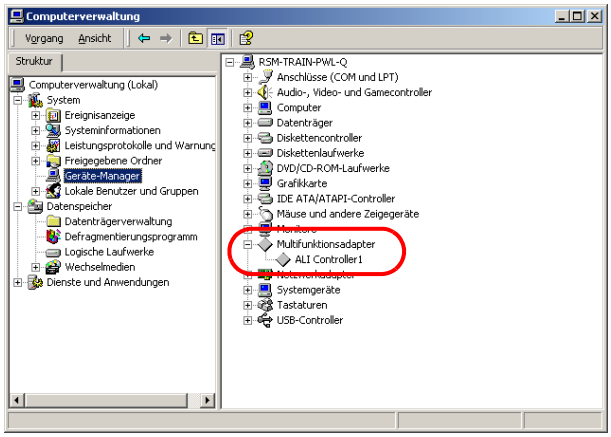

Figure 5.22 *Device Manager*

2. Open the Device Manager.
3. Under "Multifunction Adapters", check whether the ALI controller exists.

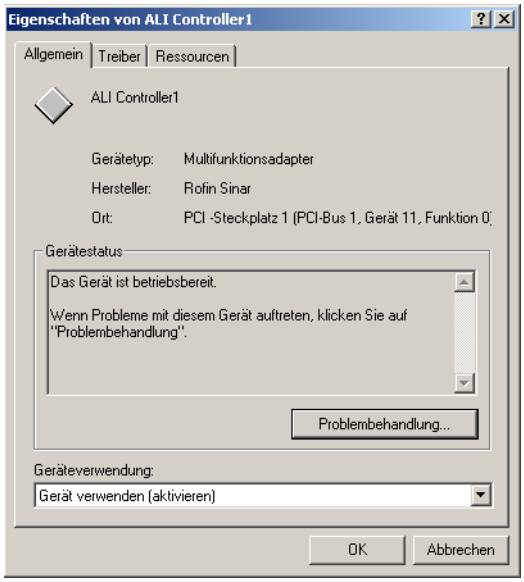

Figure 5.23 *Device properties*

4. Check the device properties.

5.7 Settings in the RCU and VLM software

For more information about the installation of the software and required settings, refer to the applicable software manuals.

Notes

6 Cleaning optical components

Note: *The surfaces of the optical components are to be cleaned according to the maintenance schedule.*

Note: *The ambient conditions must be as dust-free as possible while cleaning optical components to prevent repeated contamination.*

Attention: *For cleaning, lens cleaning paper and isopropyl alcohol or purified compressed air should be used!*

Cleaning of the optical components:

1. Dismantle optical components as described below.
2. Blow fine dust particles off the surfaces using purified compressed air.
3. Clean optical components using lens cleaning paper and isopropyl alcohol.
   – With a pipette, apply 1-2 drops of isopropyl to the surface to be cleaned.
   – Apply lens cleaning paper and carefully remove or wipe off the isopropyl alcohol.

Attention: *Always work with clean, non-greasy hands so as not to soil the optical components! Use gloves if necessary!*

   – Repeat the cleaning procedure until the surface of the optics is clean.

Attention: *Do not damage optical components during cleaning! Do not apply pressure! Remove the lens cleaning paper only in one direction. Use a new piece of lens cleaning paper each time you clean!*

   – Always clean both sides of lenses or partially two-way mirrors. In the process, make sure that both previously cleaned surfaces are not soiled further.

6.1 Galvo head

6.1.1 Protective glass

1. Depending on the galvo type, pull the protective glass mount from the protective glass slide or unscrew the retaining ring of the protective glass.
2. Loosen the respective fastening of the protective glass and remove it.
3. Clean it.
4. Put the protective glass back in place and fasten it.
5. Push the protective glass mount into the protective glass slide or screw the retaining ring of the protective glass in.

Note: *Make sure that the protective glass and protective glass mount are installed on the right side.*

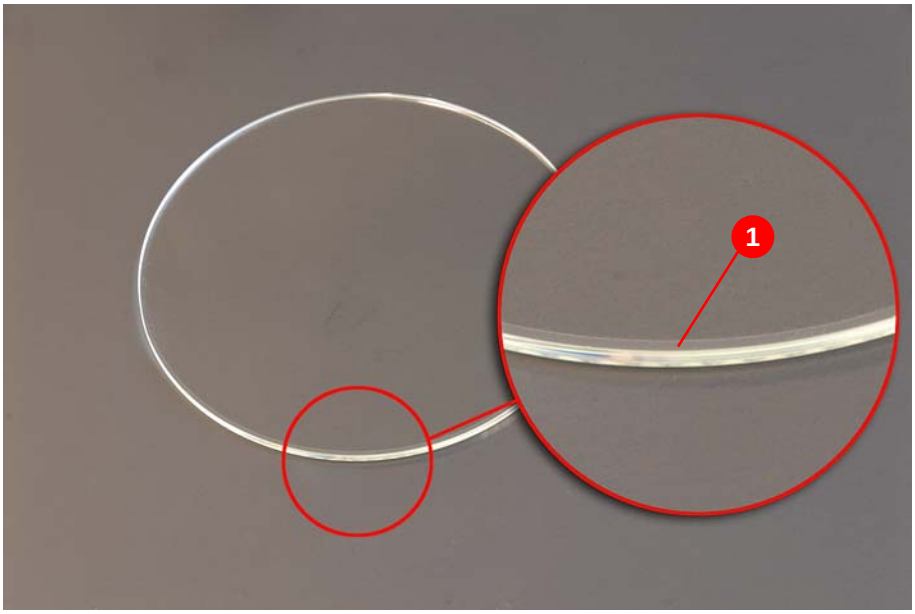

Figure 6.1 *Protective glass*

Note: *The gold colored ring (1) (Figure 6.1) on the protective glass must always be positioned toward the laser beam (inside of the galvo head). Incorrect installation may lead to marking errors.*

6.1.2 Focusing lens

Attention: *Switch off the laser system and secure it against reactivation. Pull the mains plug. The peripheral components of the laser system should also be shut down and secured against reactivation.*

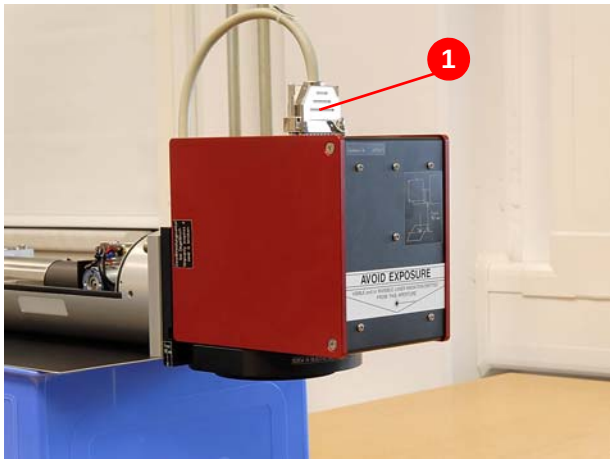

Figure 6.2 *Galvo head connecting plug*

1. Loosen and remove the connecting plug of the galvo head (1) (Figure 6.2).

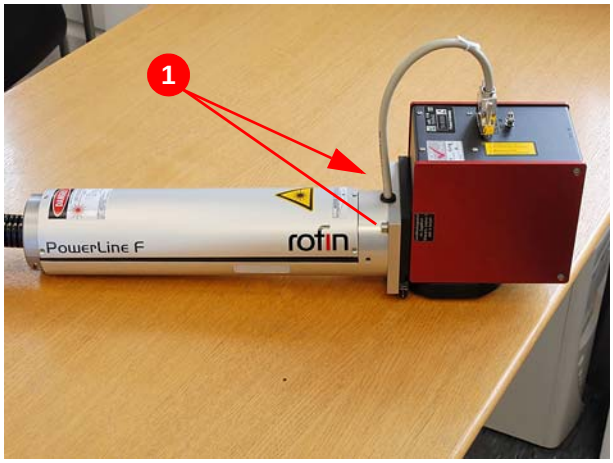

Figure 6.3 *Dismantling the galvo head*

2. Loosen the fastening screws (1) (Figure 6.3).
3. Remove the galvo head.

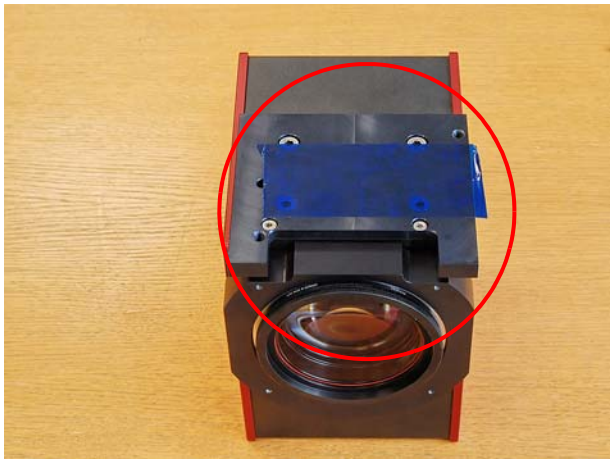

Figure 6.4 *Covering the entry openings*

4. Cover the entry openings with tape (tape to be used: see Chapter 3) to prevent the inside of the galvo head from getting dirty.

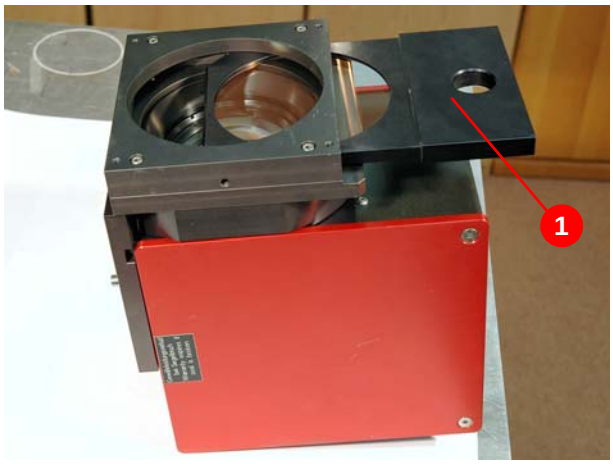

Figure 6.5 *Removing the protective glass (protective glass slide)*

5. **Protective glass slide:**Remove the protective glass (1) (Figure 6.5).
Remove screwed protective glass: Unscrew retaining ring (1) (Figure 6.6) and remove protective glass.

Note: *If the protective glass is damaged, it must be exchanged (see Section 8.1.2, page 81).*

Note: *All parts must be marked for reinstallation with suitable tools.*

6. Clean the protective glass (see page 53).

Figure 6.6 *Remove the protective glass (screwed protective glass)*

Figure 6.7 *Dismantling the guide plate (protective glass slide)*

7. **Protective glass slide:** Loosen the screws (Figure 6.7) of the guide plate for the protective glass.

Figure 6.8 *Removing the focusing optics*

8. Unscrew the focusing optics (1) (Figure 6.8).
9. Clean it (see page 53).

Figure 6.9 *Removing the distance ring*

10. Removing the distance ring (1) (Figure 6.9).

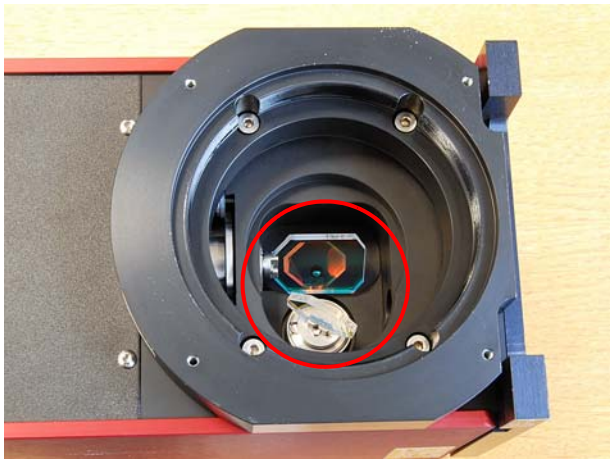

Figure 6.10 *Checking the cleaning state*

11. Clean the deflecting mirror (Figure 6.10) (see page 53).
12. Clean (see Section 6.1, page 54) if necessary.
13. Mount the galvo head in the reverse order.

Note: *When mounting the galvo head, pay attention to the correct position of the distance ring (see Figure 6.9) and the position of the protective glass (see Section 6.1.1, page 54).*

14. Remount the galvo head to the laser and connect it.
15. Commission the laser system.

6.2 Beam expander[1]

Attention: *Switch off the laser system and secure it against reactivation. Pull the mains plug. The peripheral components of the laser system should also be shut down and secured against reactivation.*

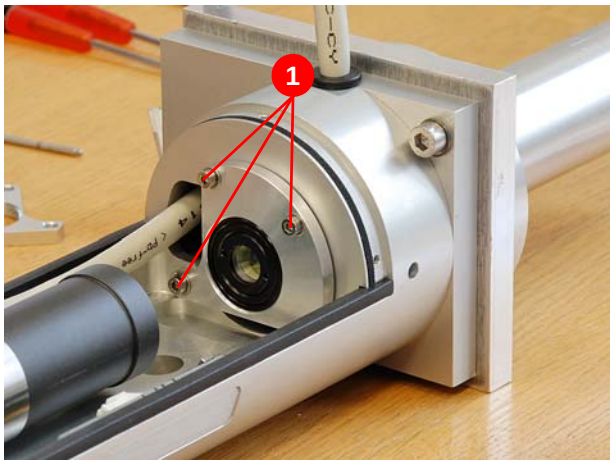

Figure 6.11 *Loosening the beam expander mount*

Figure 6.12 *Remove the beam expander*

1. Remove the shutter (see Section 8.2, page 83).
2. Loosen the three attachment screws (1) (Figure 6.11) on the beam expander mount.
3. Carefully remove the beam expander (1) (Figure 6.12) and the mount (2).

Note: *The current setting of the beam expander should be noted so that the correct focal distance can be reset after any false adjustment of the beam expander.*

4. Unscrew the beam expander from the mount.
5. Clean it (see page 53).
6. Screw the beam expander into the mount and reinstall the mount.

Attention: *Do not crush or jam the cables and lines inside the laser head during installation!*

7. Check the adjustment of the laser beam and adjust it if necessary (see Section 7.2.1, page 63).
8. Check the adjustment of the beam expander; set the value read before the cleaning procedure if necessary.
9. Mount the cover of the laser head.
10. Commission the laser system.
11. Check the laser power behind the galvo head (on the workpiece) using the power measurement device and perform a test marking procedure. Enter the measurement values in the logbook.

1. Installation depends on the respective laser type

6.3 Laser source

Attention: *No cleaning tasks are required on and in the laser source. If necessary, the laser source should be exchanged as a complete unit. Repair and cleaning inside the laser source may be performed only by ROFIN-SINAR. In case of non-observance, the warranty is no longer valid.*

Notes

7 Adjustment tasks

7.1 Adjusting the laser head

Attention: *Switch off the laser system and secure it against reactivation. Pull the mains plug. The peripheral components of the laser system should also be shut down and secured against reactivation.*

Attention: *If the laser system has to be switched on for testing/measuring purposes, measures for protection against laser radiation must be taken (use of protective goggles, setup and positioning of partition walls, attachment of warning signs and barriers, etc.). These measures must be coordinated with the laser protection officer.*
The DIN EN 207 Filter und Augenschutzgeräte gegen Laserstrahlung (BS EN 207 Filters and Eye-Protectors Against Laser Radiation (Laser Eye-Protectors)), DIN EN 60825-1 Sicherheit von Lasereinrichtungen (BS EN 60825-1 Safety of Laser Products), and DIN EN 60825-4 Sicherheit von Laserschutzwänden (BS EN 60825- 4 Safety of Laser Products: Laser Guards) standards must be observed.

Figure 7.1 *Checking the position of the workpiece support plate*

1. Check the X and Y directions of the position of the workpiece support plate using a level gauge.
2. Perform an adjustment if necessary.

Figure 7.2 *Checking the position of the galvo head*

3. Check the X and Y directions of the position of the galvo head using a level gauge.

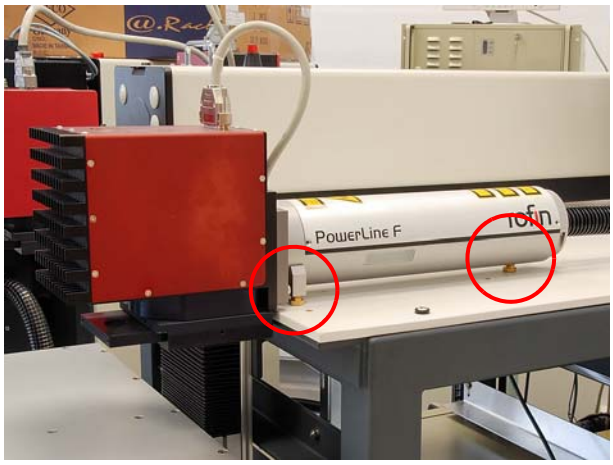

Figure 7.3 *Adjusting the laser head*

4. Adjust the position of the galvo head using the three-point support plate of the laser head parallel to the workpiece support if necessary.

Note: *If the workpiece support plate cannot be aligned to be absolutely straight, the galvo head must be adjusted in parallel at the value measured under 1.*

Figure 7.4 *Adjusting the focal distance*

5. Check the focal distance using the stickers on the galvo head and the logbook entries and adjust it if necessary.

7.2 Adjusting the laser beam

7.2.1 Main laser

Attention: *Switch off the laser system and secure it against reactivation. Pull the mains plug. The peripheral components of the laser system should also be shut down and secured against reactivation.*

Attention: *If the laser system has to be switched on for testing/measuring purposes, measures for protection against laser radiation must be taken (use of protective goggles, setup and positioning of partition walls, attachment of warning signs and barriers, etc.). These measures must be coordinated with the laser protection officer.*
The DIN EN 207 Filter und Augenschutzgeräte gegen Laserstrahlung (BS EN 207 Filters and Eye-Protectors Against Laser Radiation (Laser Eye-Protectors)), DIN EN 60825-1 Sicherheit von Lasereinrichtungen (BS EN 60825-1 Safety of Laser Products), and DIN EN 60825-4 Sicherheit von Laserschutzwänden (BS EN 60825- 4 Safety of Laser Products: Laser Guards) standards must be observed.

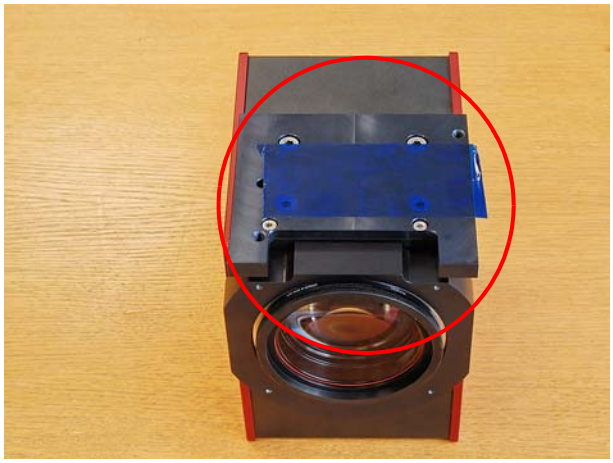

Figure 7.5 *Dismantling the galvo head*

1. Dismantle the galvo head, set it aside, and cover the entry openings with tape (tape to be used: (see Chapter 3) to prevent the inside of the galvo head from getting dirty.
2. Open the cover of the laser head.

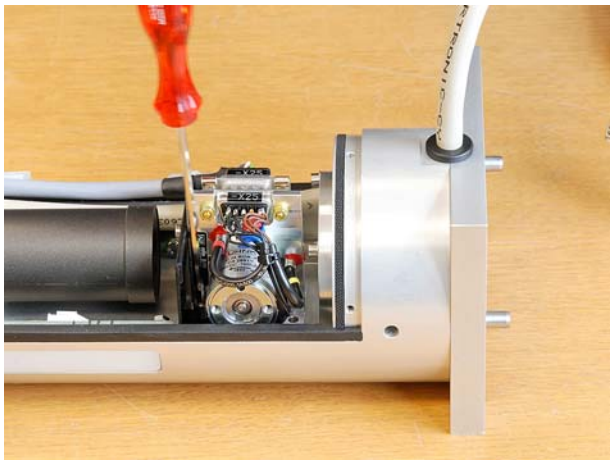

Figure 7.6 *Dismantle the shutter*

3. Unscrew the shutter and lay it down next to the laser head.

Note: *Do not disconnect the plug-in connection (-X25) because the laser will not be activated.*

Attention: *Position the shutter so that damage (e. g. when opening the shutter) cannot occur! The shutter remains in operation!*

Attention: *The shutter will no longer block the laser beam!*

4. Secure the laser against activation.

Attention: *Take measures for protection against laser radiation (see page 63)!*

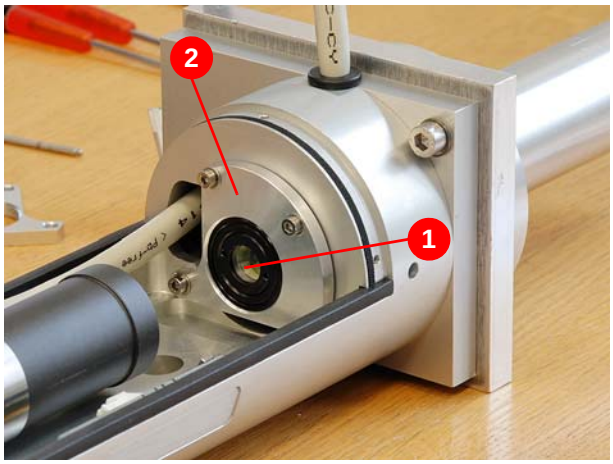

Figure 7.7 *Remove the beam expander*

5. If applicable, remove the beam expander (1) (Figure 7.7) including the mount (2).

Note: *The current setting of the beam expander should be noted so that the correct focal distance can be reset after any false adjustment of the beam expander.*

Figure 7.8 *Mounting the transducer disk*

6. Insert the mains plug of the laser system and switch on the main switch.

Attention: *If the emergency stop button/main switch of the laser system is out of reach, a second person must always be present who can press the emergency stop button/main switch in case of an emergency.*

7. Record the laser power curve.

Note: *The power curve serves to set the corresponding power and as a reference value to determine whether the shutter, beam expander and galvo head are causing a loss of power (cutting the beam, defective optical components, etc.)*

8. Across from the galvo flange, mount a transducer disk (see Chapter 3) on a surface that absorbs laser beams using suitable equipment.

9. Activate the laser system and set the power in the VLM program (approx. 7 ... 10 W).

Note: *Maximum output power PWL 10 F: 10 W, PWL 20 F: 20 W.*

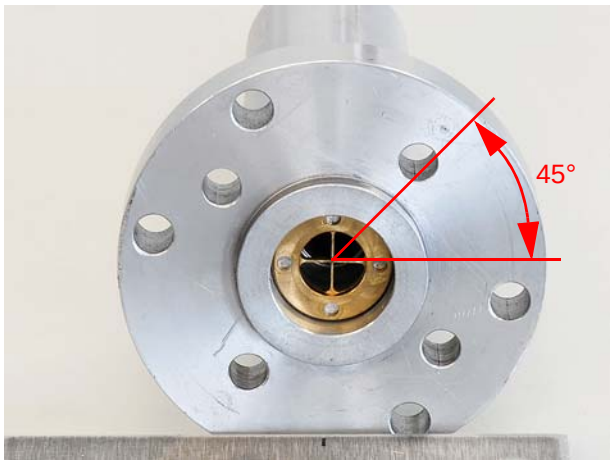

Figure 7.9 *Mounting the cross wires*

10. Enter the settings in the machine configuration (see Section 4.2, page 29), open the shutter, start the VLM program (see Section 4.1, page 27) and check the emission of the main and alignment lasers on the transducer disk.
11. Switch of the laser.
12. Insert the cross wires and their seat as shown in Figure 7.9 into the adjustment tube. This will ensure that a vertical cross is displayed during the adjustment.

Note: *In the following steps, make sure that the cross wires are always in the same installation position.*

Attention: *Careful handling of the adjusting aids must be guaranteed (no deformation of the cross-wires, no excessive laser power)! Damaged adjusting aids lead to imprecise adjusting results!*

Note: *Adjusting aids to be used: see Chapter 3.*

13. Screw the adjustment tube (1) (Figure 7.10) onto the base plate (2).

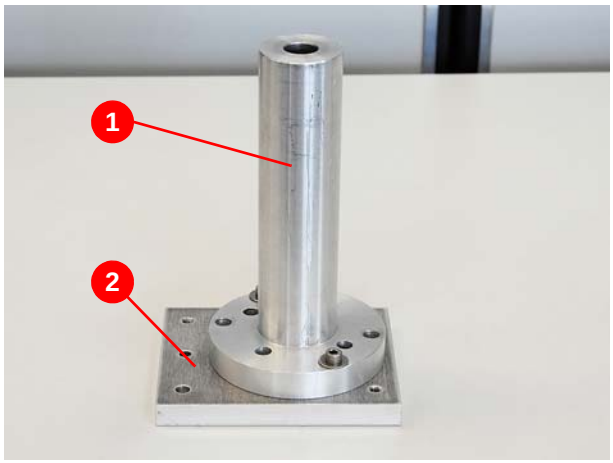

Figure 7.10 *Adjustment tube and base plate*

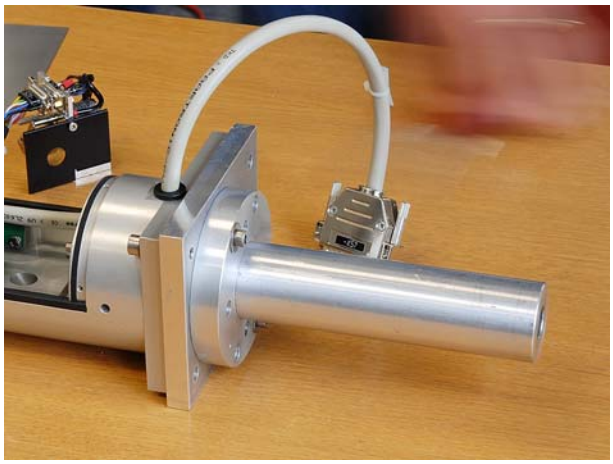

Figure 7.11 *Installation on the galvo flange*

14. Screw on the base plate of the adjustment tube to the galvo flange.

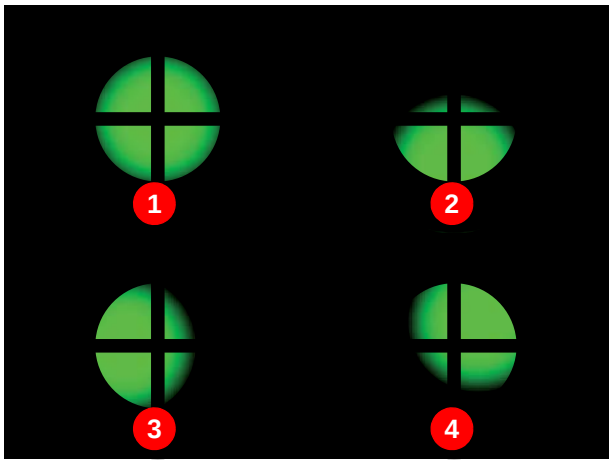

Figure 7.12 *Checking the beam adjustment*

15. Switch on the laser, start the VLM program and check the image of the laser on the transducer disk. Figure 7.12 shows examples for possible image:

- Adjustment OK (1)
- Emission too low (2)
- Emission too far to the left (3)
- Emission too far to the right (4)

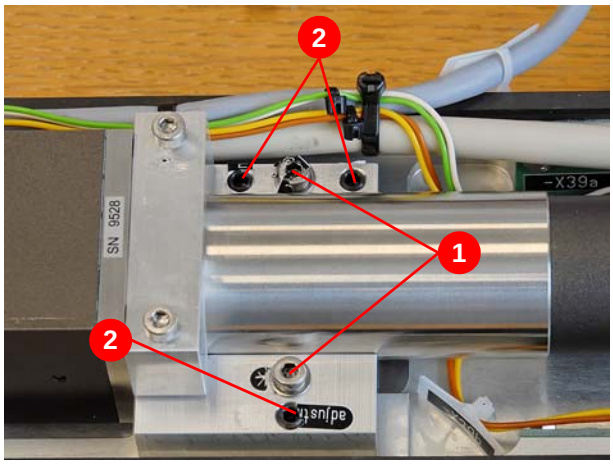

Figure 7.13 *Beam adjustment*

16. Adjust the beam by adjusting the support block.

- Loosen the fastening screws (1) (Figure 7.13).
- Adjust using the support screws (2).
- Retighten the fastening screws after the adjustment.

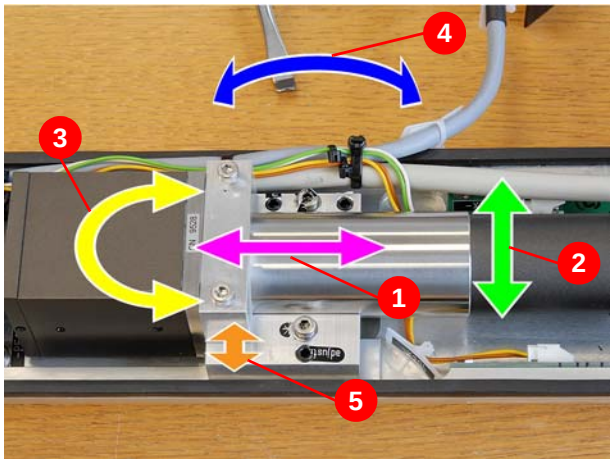

Figure 7.14 *Setting options*

The following settings are possible:
(1) Moving lengthwise,
(2) Moving across,
(3) Twisting,
(4) Tilt,
(5) Height adjustment.

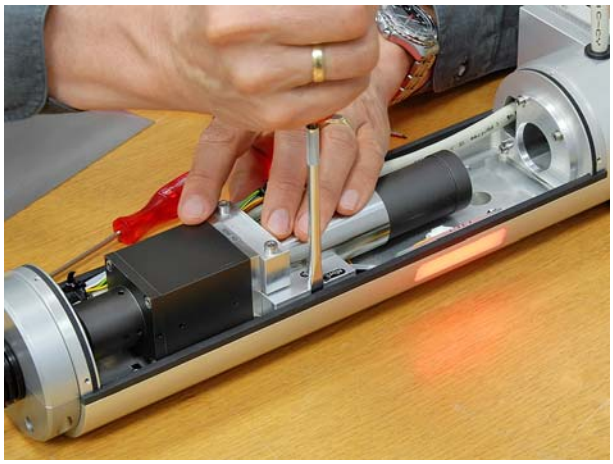

Figure 7.15 *Moving the support block*

⚠ ***Attention:*** *If tools are used to move the support block (see Figure 7.15), make sure that cables in the laser head are not crushed or damaged!*

17. Shut the laser off after the adjustment.

Figure 7.16 *Mount the second set of cross-wires*

18. Mount the second set of cross-wires on the adjustment tube.

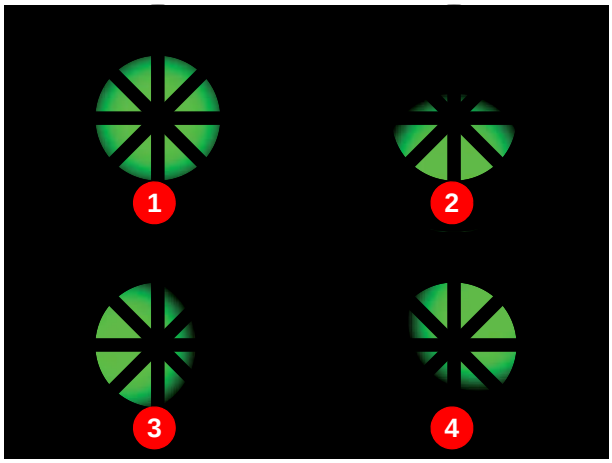

Figure 7.17 *Checking the beam adjustment*

19. Switch on the laser, start the VLM program and check the image of the laser on the transducer disk. Figure 7.17 shows examples for possible image:

- Adjustment OK (1)
- Emission too low (2)
- Emission too far to the left (3)
- Emission too far to the right (4)

Note: *The front cross-wires must be turned by 45° for more exact control of the laser beam.*

Attention: *Do not reach into the laser beam when turning the cross wires!*

20. Shut the laser off after the adjustment.

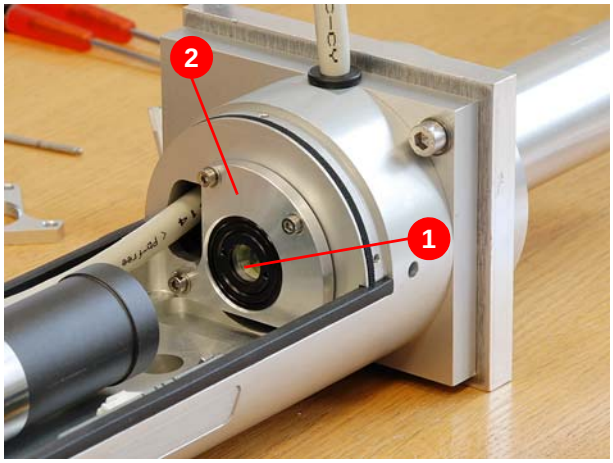

Figure 7.18 *Mount the beam expander*

21. If applicable, mount the beam expander (1) (Figure 7.18) including the mount (2).

22. Switch on the laser, Start the VLM program and check the image of the laser on the transducer disk (see Figure 7.12 and Figure 7.17).

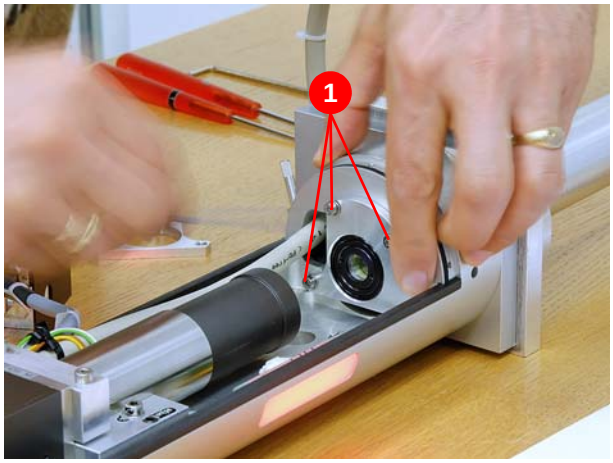

Figure 7.19 *Setting the beam expander*

23. Move the beam expander after loosening the three fastening screws (1) (Figure 7.19) and use them to set it (roundness of the laser beam, center beam emission). Figure 7.20 shows examples for possible image.

Attention: *Do not reach into the laser beam when setting the beam expander!*

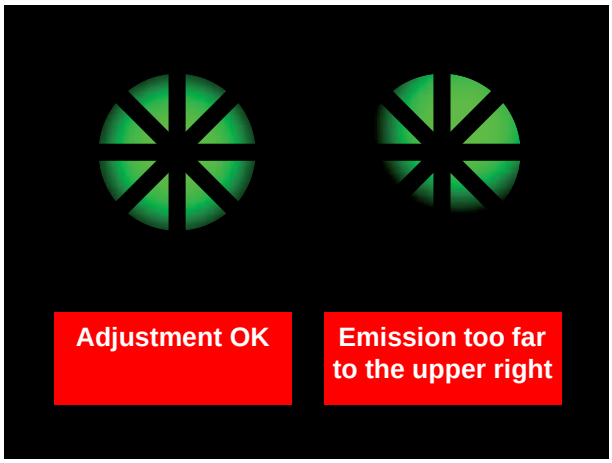

Figure 7.20 *Beam adjustment beam expander*

24. Readjust the support block, if necessary (see steps 15 to 19).
25. Compare the power to determine whether the beam expander (if applicable) causes a loss of power. Clean the beam expander, if necessary.
26. Shut the laser off after the adjustment.

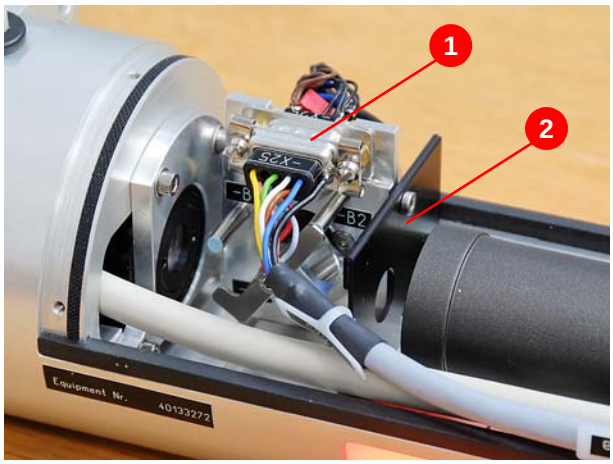

Figure 7.21 *Mount the shutter*

27. Mount the shutter (1) (Figure 7.21) including the strip (2).

Attention: *Do not crush or jam the cables and lines inside the laser head during installation!*

28. Switch on the laser, Start the VLM program and check the image of the laser on the transducer disk (see Figure 7.12 and Figure 7.17) and adjust as needed.
29. Compare the power to determine whether the shutter causes a loss of power. Realign the shutter as needed.
30. Shut the laser off after the adjustment.
31. Remove the cross wires and their seat from the adjustment tube.

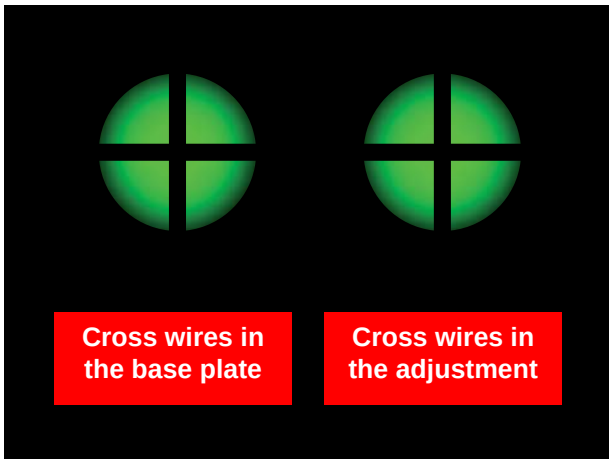

Figure 7.22 *Beam adjustment OK*

32. Switch on the laser, Start the VLM program and check the image of the laser on the transducer disk. Adjust as needed.
33. Shut the laser off after the adjustment.
34. Remove the cross wires and their seat from the base plate.
35. Screw the adjustment tube to the base plate of the galvo flange.
36. Switch on the laser, Start the VLM program and check the image of the laser on the transducer disk. Adjust as needed.

Note: *Repeat adjustments until no more deviations can be determined in the image after the installation position changes.*

Note: *If power losses due to the shutter are still present after multiple adjustments, contact ROFIN-SINAR.*

37. If no more deviations in the image can be determined, the adjustment is okay (see Figure 7.22).
38. Check the adjustment of the beam expander; set the value read before the adjustment procedure if necessary.
39. Mount the galvo head.
40. Mount the cover of the laser head.
41. Commission the laser system.
42. Check the laser power behind the galvo head (on the workpiece) using the power measurement device and perform a test marking procedure. Enter the measurement values in the logbook.

7.2.2 Focal point

Note: *The following tasks only apply to laser systems with installed beam expanders.*

Attention: *Switch off the laser system and secure it against reactivation. Pull the mains plug. The peripheral components of the laser system should also be shut down and secured against reactivation.*

Attention: *If the laser system has to be switched on for testing/measuring purposes, measures for protection against laser radiation must be taken (use of protective goggles, setup and positioning of partition walls, attachment of warning signs and barriers, etc.). These measures must be coordinated with the laser protection officer.*
The DIN EN 207 Filter und Augenschutzgeräte gegen Laserstrahlung (BS EN 207 Filters and Eye-Protectors Against Laser Radiation (Laser Eye-Protectors)), DIN EN 60825-1 Sicherheit von Lasereinrichtungen (BS EN 60825-1 Safety of Laser Products), and DIN EN 60825-4 Sicherheit von Laserschutzwänden (BS EN 60825- 4 Safety of Laser Products: Laser Guards) standards must be observed.

Attention: *To adjust the focal point, the distance between the galvo head and workpiece may not be changed as the field size otherwise shifts!*

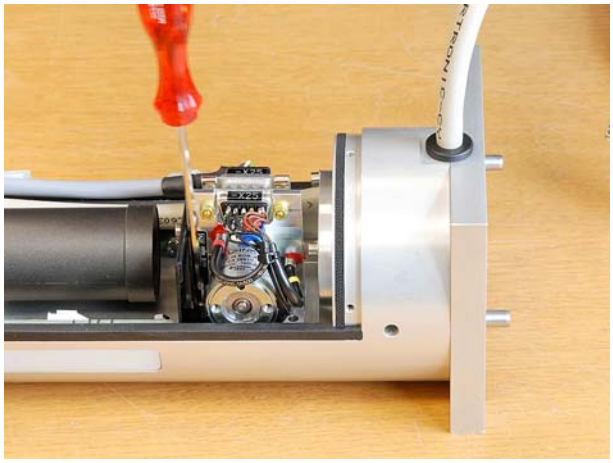

Figure 7.23 *Dismantle the shutter*

1. Unscrew the shutter and lay it down next to the laser head.

Note: *Do not disconnect the plug-in connection (-X25) because the laser will not be activated.*

Attention: *Position the shutter so that damage (e. g. when opening the shutter) cannot occur! The shutter remains in operation!*

Attention: *The shutter will no longer block the laser beam!*

2. Secure the shutter against activation.

Attention: *Take measures for protection against laser radiation (see page 71)!*

3. Insert the mains plug of the laser system and switch on the main switch.

Attention: *If the emergency stop button/main switch of the laser system is out of reach, a second person must always be present who can press the emergency stop button/main switch in case of an emergency.*

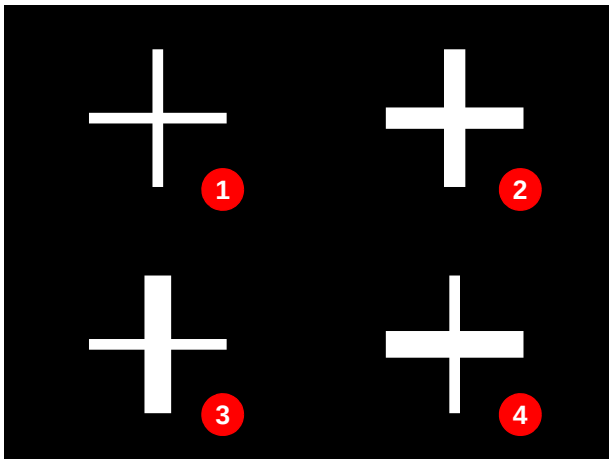

Figure 7.24 *Checking the focus setting*

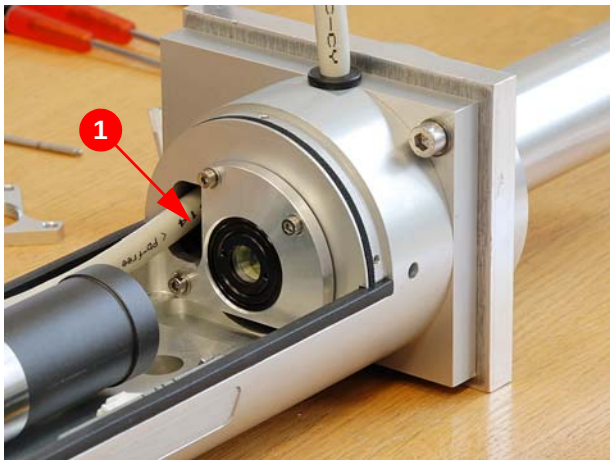

Figure 7.25 *Setting the focal point*

4. Lay material (an anodized metal sheet, coated paper) under the galvo head.
5. Switch on the laser system using the key switch.
6. Open the shutter.
7. Let the program for the cross in the middle of the field with the material run according to the laser parameters.
8. Switch of the laser.
9. Check the image of the cross. The focal point is correctly set when both laser lines in the X and Y direction have the same dimensions at the smallest possible width.
   - Adjustment OK (1) (circular cross-section)
   - Too wide (2) (circular cross-section)
   - Y dimension too wide (3) (cross-section elliptical, X axis > Y-axis)
   - X dimension too wide (4) (cross-section elliptical, X axis < Y-axis)
10. If necessary, change the focal point by adjusting the adjusting ring (1) (Figure 7.25) on the beam expander.

Attention: *Do not reach into the laser beam when turning the adjusting ring!*

Note: *If the adjusting ring cannot be adjusted, remove the beam expander and loosen the locking screw (1) (Figure 7.26, page 73).*

11. Move material under the galvo head, open the shutter, and let the program run.
12. Check the image of the cross.

Note: *Repeat Steps 6 through 12 until the focal point is correctly set.*

13. Shut the laser off after the adjustment.

Figure 7.26 *Fixing the beam expander*

14. Removing the beam expander.
15. Fix the position of the beam expander using the locking screw (1) (Figure 7.26).
16. Mount the beam expander
17. Setting the beam expander (see page 68).

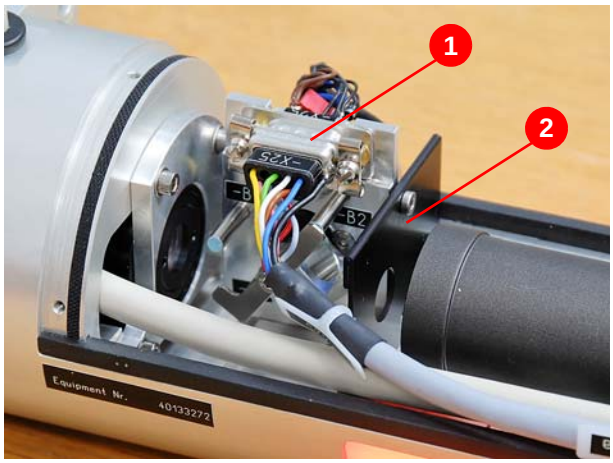

Figure 7.27 *Mount the shutter*

18. Mount the shutter (1) (Figure 7.27) including the strip (2).

⚠ ***Attention:*** *Do not crush or jam the cables and lines inside the laser head during installation!*

19. Check the adjustment of the laser (see page 69).
20. Compare the power after the galvo head to determine whether the beam expander (if applicable), shutter or galvo head causes a loss of power. Clean, repair or align the beam expander, if necessary.
21. Shut the laser off after the adjustment.
22. Mount the cover of the laser head.
23. Commission the laser system.

7.2.3 Alignment laser[1]

The alignment laser has the same beam emission as the main laser. No additional adjustment tasks are necessary.

1. Installation depends on the respective laser type

Notes

8 Repair work

Note: *The "Maintenance Schedule" chapter in the RSM PowerLine F user manual must also be observed. The necessary aids are listed in Chapter 3 of this repair manual and in the "Spare Parts" chapter of the RSM PowerLine F user manual.*

8.1 Changing the optical components

Attention: *When changing the optical components, make sure that the surfaces of the new components are always free of grease and dust.*

8.1.1 Galvo head

Attention: *Switch off the laser system and secure it against reactivation. Pull the mains plug. The peripheral components of the laser system should also be shut down and secured against reactivation.*

Note: *The necessary spare parts of the galvo head can be ordered individually from ROFIN-SINAR. To observe the field geometry/correction after the change of the galvo head and/or focusing optics, we recommend that you order the components with a compensation file created by ROFIN-SINAR.*

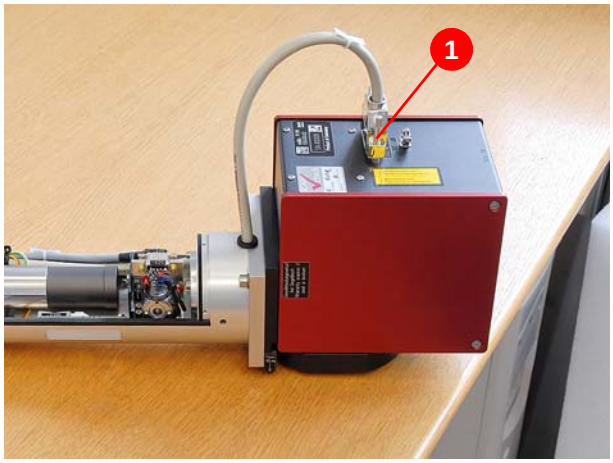

Figure 8.1 *Galvo head connecting plug*

1. Loosen and remove the connecting plug of the galvo head (1) (Figure 8.1).

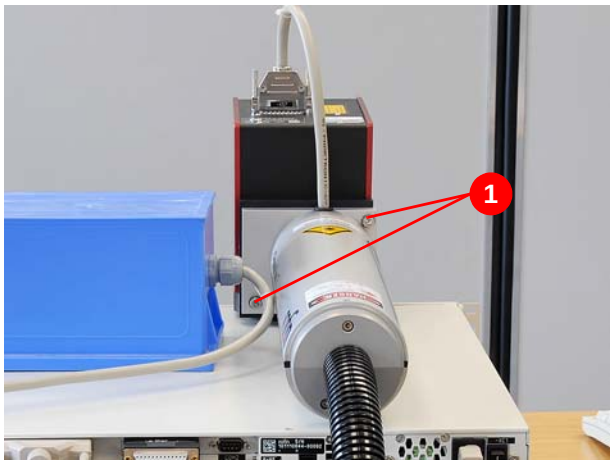

Figure 8.2 *Dismantling the galvo head*

2. Loosen the fastening screws (1) (Figure 8.2).
3. Remove the galvo head.

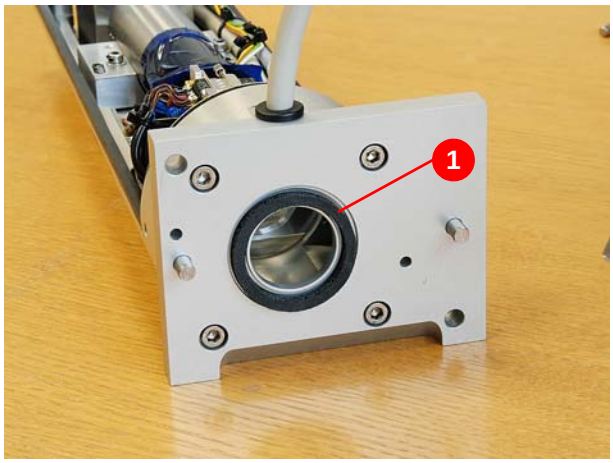

Figure 8.3 *Removing the distance ring*

4. Removing the ring seal (1) (Figure 8.3).

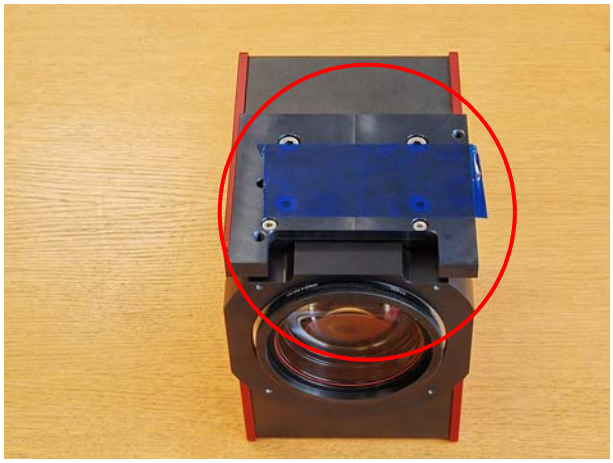

Figure 8.4 *Covering the entry openings*

5. Cover the entry openings with tape (tape to be used: see Chapter 3) to prevent the inside of the galvo head from getting dirty.

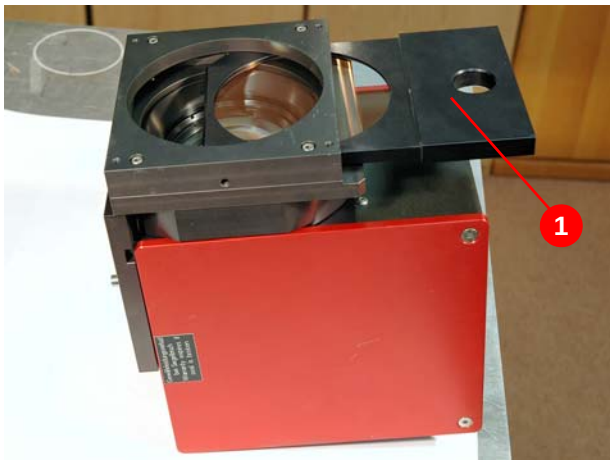

Figure 8.5 *Removing the protective glass (protective glass slide)*

6. **Protective glass slide:**Remove the protective glass (1) (Figure 8.5). **Remove screwed protective glass:** Unscrew retaining ring (1) (Figure 8.6) and remove protective glass.

Note: *If the protective glass is damaged, it must be exchanged (see Section 8.1.2, page 81).*

Note: *All parts must be marked for reinstallation with suitable tools.*

Figure 8.6 *Remove the protective glass (screwed protective glass)*

Figure 8.7 *Dismantling the guide plate (protective glass slide)*

7. **Protective glass slide:** Loosen the screws (Figure 8.7) of the guide plate for the protective glass.

Figure 8.8 *Removing the focusing optics*

8. Unscrew the focusing optics (1) (Figure 8.8).

Figure 8.9 *Removing the distance ring*

9. Removing the distance ring (1) (Figure 8.9).

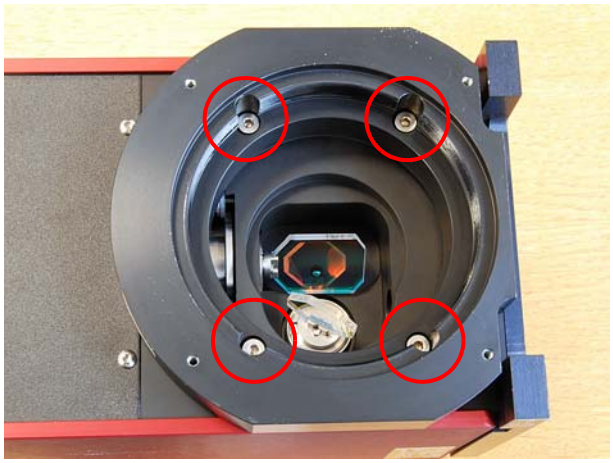

Figure 8.10 Removing the optics mount

10. Loosen the four fastening screws (Figure 8.10) of the optics mount and remove it.

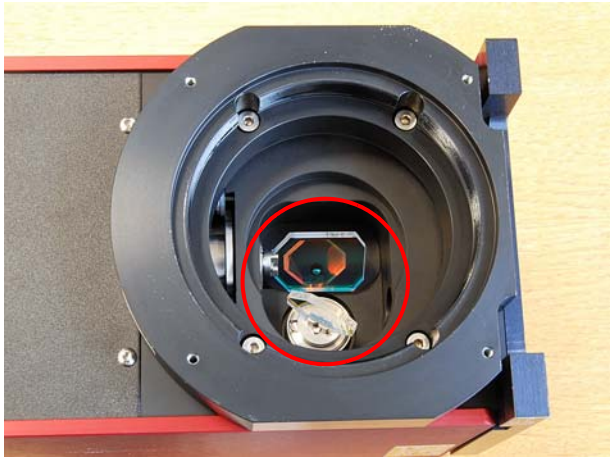

Figure 8.11 *Checking the cleaning state*

11. Check to see if the deflecting mirror (Figure 8.11) is clean.
12. Clean (see Section 6.1, page 54) if necessary.
13. Mount the galvo head in the reverse order.

Note: *When mounting the galvo head, pay attention to the correct position of the distance ring (see Figure 8.9).*

14. Remount the galvo head to the laser.

Note: *Replacing the ring seal (see Figure 8.3, page 76).*

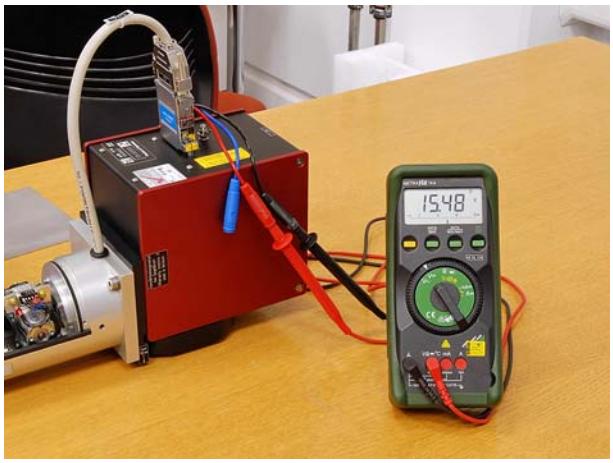

Figure 8.12 *Setting the operating voltage -1*

15. Mount the measuring adapter (see Chapter 3) between the galvo head and the connecting cable.

Attention: *Unplug the measuring adaptor or connecting cable of the galvo head from power!*
Non-compliance may result in damage to the galvo head!

16. Commission the laser system.
17. Measure the voltage (+15.5 V).

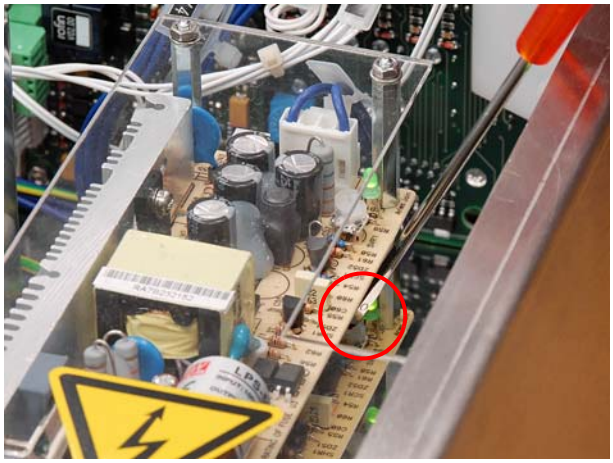

Figure 8.13 *Setting the operating voltage - 2*

18. Set the operating voltage (+15.5 V) on the power supply -G3 using a small screwdriver. Setting precision: ±0.2 V.

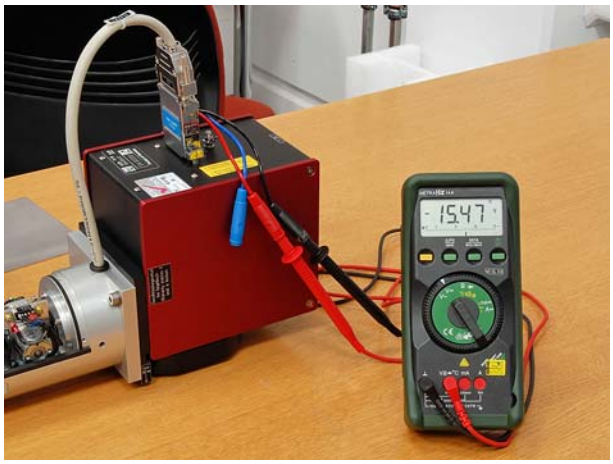

Figure 8.14 *Setting the operating voltage - 3*

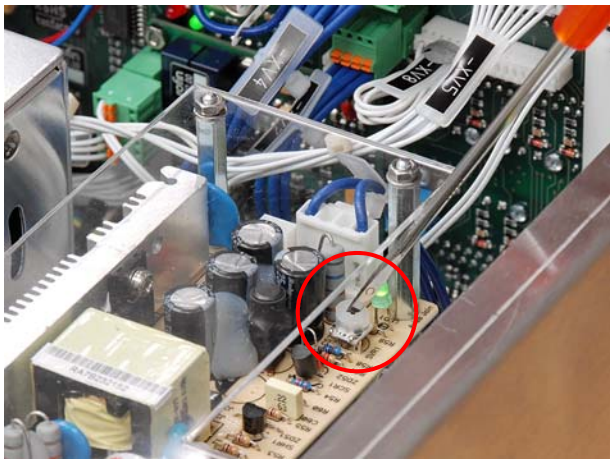

Figure 8.15 *Setting the operating voltage -4*

19. Measure the voltage (-15.5 V).

20. Set the operating voltage (+15.5 V) on the power supply -G4 using a small screwdriver. Setting precision: ±0.2 V.

21. Switch off the laser system.

22. Remove the measuring adapter.

Attention: *Unplug the measuring adaptor or connecting cable of the galvo head from power!*
Non-compliance may result in damage to the galvo head!

23. Plug in the connecting plug.

24. Commission the laser system.

25. Check the focal point of the laser and adjust it if necessary (see Section 7.2.2, page 71).

26. Check the field geometry/correction and load a new compensation file if necessary.

8.1.2 Protective glass

1. Depending on the galvo type, pull the protective glass mount from the protective glass slide or unscrew the retaining ring of the protective glass.
2. Loosen the respective fastening of the protective glass and remove it.
3. Put and fix new protective glass in place.
4. Push the protective glass mount into the protective glass slide or screw the retaining ring of the protective glass in.

Note: *When changing the protective glass, make sure that the new protective glass is installed on the right side.*

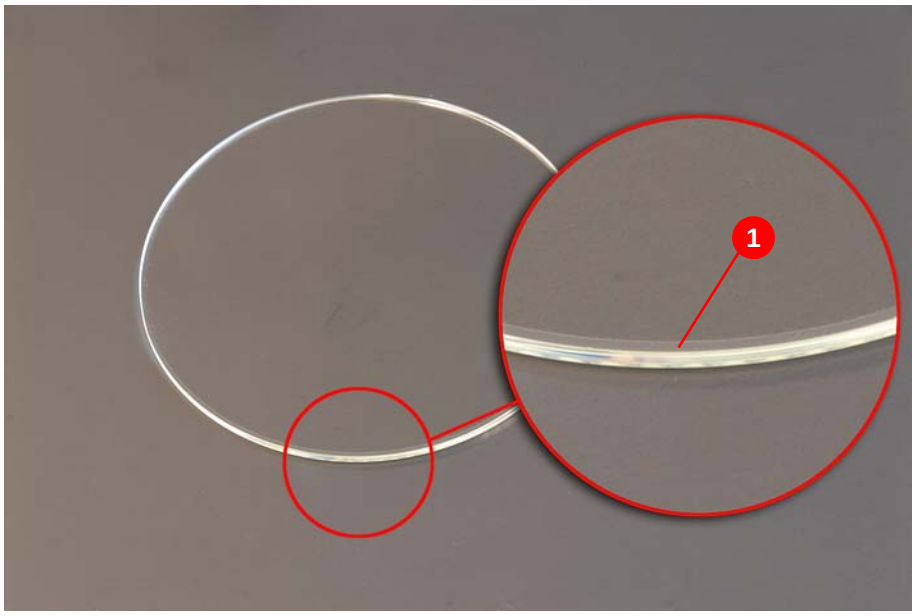

Figure 8.16 *Protective glass*

Note: *The gold colored ring (1) (Figure 8.16) on the protective glass must always be positioned toward the laser beam (inside of the galvo head). Incorrect installation may lead to marking errors.*

8.1.3 Beam expander[1]

Attention: *Switch off the laser system and secure it against reactivation. Pull the mains plug. The peripheral components of the laser system should also be shut down and secured against reactivation.*

Attention: *If the laser system has to be switched on for testing/measuring purposes, measures for protection against laser radiation must be taken (use of protective goggles, setup and positioning of partition walls, attachment of warning signs and barriers, etc.). These measures must be coordinated with the laser protection officer.*
The DIN EN 207 Filter und Augenschutzgeräte gegen Laserstrahlung (BS EN 207 Filters and Eye-Protectors Against Laser Radiation (Laser Eye-Protectors)), DIN EN 60825-1 Sicherheit von Lasereinrichtungen (BS EN 60825-1 Safety of Laser Products), and DIN EN 60825-4 Sicherheit von Laserschutzwänden (BS EN 60825- 4 Safety of Laser Products: Laser Guards) standards must be observed.

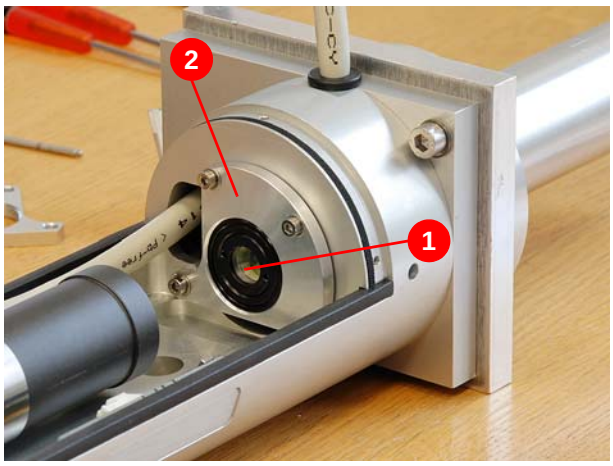

Figure 8.17 *Remove the beam expander*

Figure 8.18 *installing the galvo cable*

1. Open the cover of the laser head.
2. Remove the shutter (see Section 8.2, page 83).
3. Remove the beam expander (1) (Figure 8.17) and the mount (2).
4. Unscrew the beam expander from the mount.
5. Screw a new beam expander into the mount.
6. Check the adjustment of the laser beam and adjust it if necessary (see Section 7.2.1, page 63).
7. Reinstall the beam expander with the mount.

Attention: *Do not crush or jam the cables and lines inside the laser head during installation!*

Note: *The galvo cable (see Figure 8.18) must be installed so that the setting of the beam expander is not hindered.*

8. Setting the beam expander (see page 68).
9. Check the focal point of the laser and adjust it if necessary (see Section 7.2.2, page 71).
10. Mount the cover of the laser head.
11. Commission the laser system.

1. Installation depends on the respective laser type

8.2 Changing the shutter

Attention: *Switch off the laser system and secure it against reactivation. Pull the mains plug. The peripheral components of the laser system should also be shut down and secured against reactivation.*

Attention: *If the laser system has to be switched on for testing/measuring purposes, measures for protection against laser radiation must be taken (use of protective goggles, setup and positioning of partition walls, attachment of warning signs and barriers, etc.). These measures must be coordinated with the laser protection officer.*
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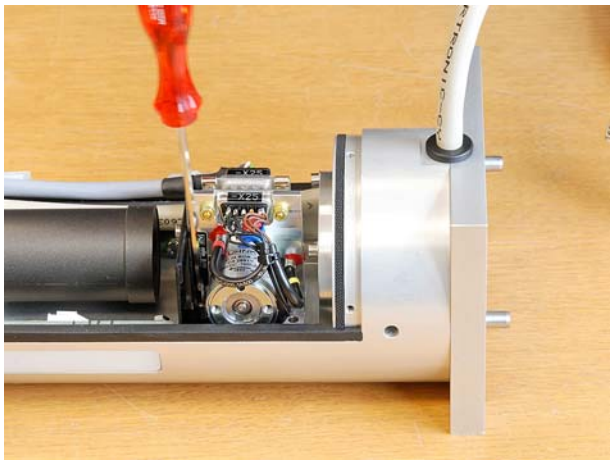

Figure 8.19 *Removing the shutter*

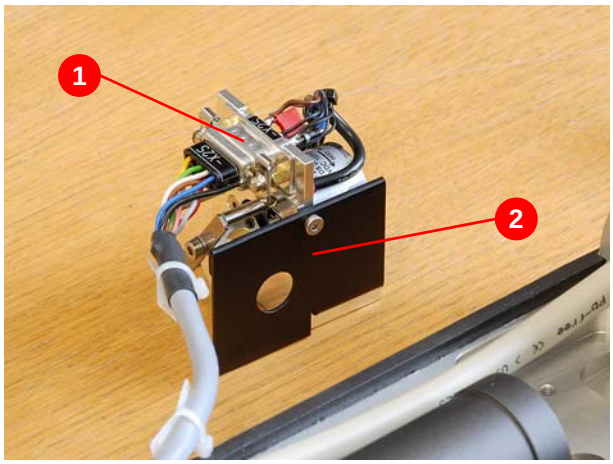

Figure 8.20 *Plug-in connector -X25 / Shutter strip*

1. Open the cover of the laser head.
2. Loosen the fastening screws of the shutter (Figure 8.19).
3. Removing the shutter from the laser head.
4. Disconnect the plug-in connector -X25 (1) (Figure 8.20).

Note: *Do not disconnect the plug-in connection (-X25) if the shutter has to be removed for adjustment work on the laser because the laser will then not be activated.*

5. Unscrew the strip (2) from the shutter.
6. Mount the strip on the new shutter.
7. Plug the connector -X25 into the shutter.
8. Measuring the laser power (see Section 5.4, page 42).
9. Reinstall the shutter.

Attention: *Do not crush or jam the cables and lines inside the laser head during installation!*

10. Remeasure the laser power after installing the shutter to make sure that the laser beam is not partially cut off because the shutter is not precisely aligned.
11. Realign the shutter as needed.
12. Mount the cover of the laser head.
13. Commission the laser system.

8.3 Changing the laser source

Attention: *Switch off the laser system and secure it against reactivation. Pull the mains plug. The peripheral components of the laser system should also be shut down and secured against reactivation.*

Note: *After changing the laser source, check the adjustment of the laser beam.*

Figure 8.21 *Supply plug-in*

1. Remove the supply plug-in and remove the upper cover.

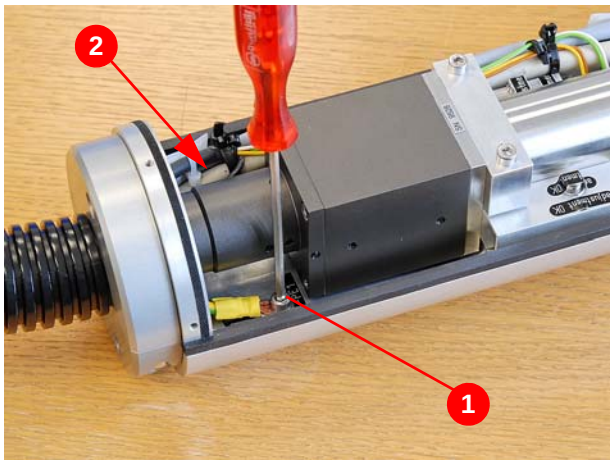

Figure 8.22 *PE connection laser head*

2. Open the cover of the laser head.
3. Loosen the PE connection in the laser head - PE1 (1) (Figure 8.22) and the screen connection -SK1 (2) positioned opposite in the laser head.

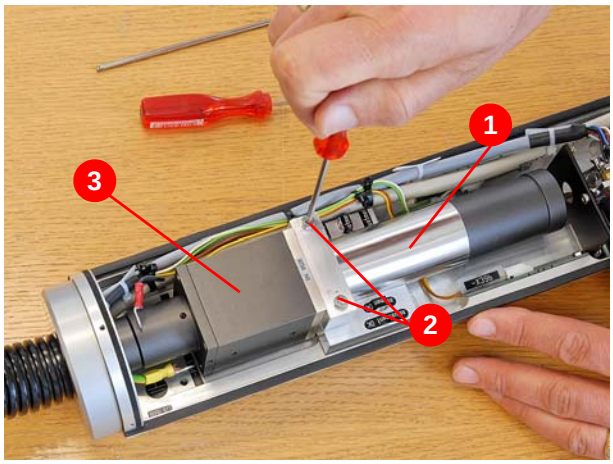

Figure 8.23 *Dismantling the emergence unit*

4. Loosen the two attachment screws (2) to remove the Decoupling unit (1) (Figure 8.23).

⚠ ***Attention:*** *The optical isolator (3) is magnetic! Do not bring objects near the isolator that may be damaged or destroyed by magnetic fields (e. g. check boards)!*

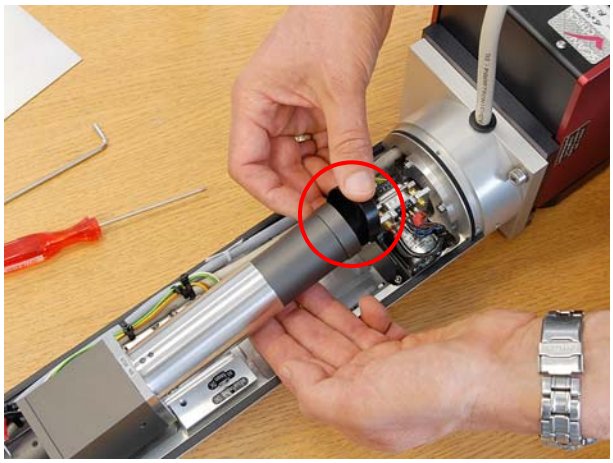

Figure 8.24 *Mount the dust protection cap.*

5. Place the dust protection cap that is included in the delivery onto the beam output of the decoupling unit to prevent contaminations on the output optics.

Figure 8.25 *Fix the dust protection cap.*

6. Fix the dust protection cap at the beam emitter with adhesive tape (adhesive tape to be used: see Chapter 3).

Figure 8.26 *Fixing screw hose inlet*

7. Loosen the top rear fastening screw of the hose inlet.

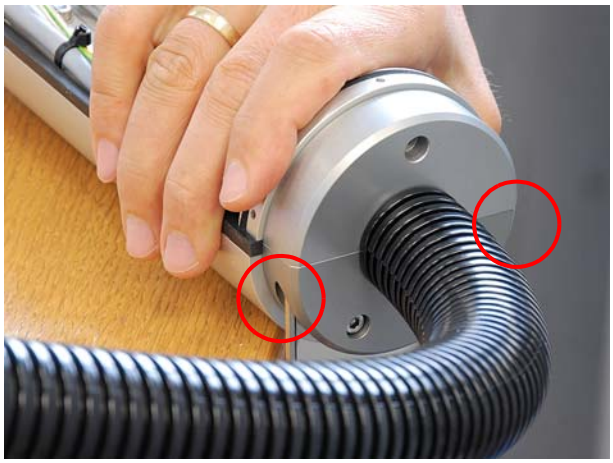

Figure 8.27 *Loosen the upper half-shell*

8. Remove the upper half-shell of the hose inlet after loosening the two screws on the side.

Figure 8.28 *Unscrew the lower half-shell*

9. Loosen both inner fastening screws from the lower half-shell of the hose inlet.

Note: *The lower half-shell must be removed to be able to pull the decoupling unit out of the laser head.*

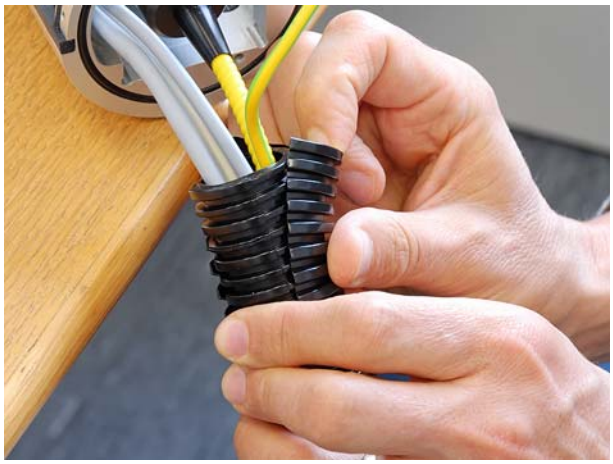

Figure 8.29 *Pull the corrugated hose apart*

10. Pull the corrugated hose (Figure 8.29) apart for a length of approximately 30 cm for more room to move with the subsequent steps.

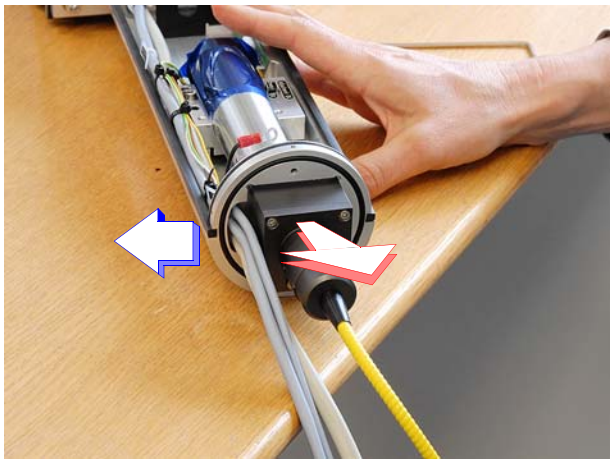

Figure 8.30 *Removing the decoupling unit*

11. Move the cable in the laser head to the left and pull the decoupling unit out.

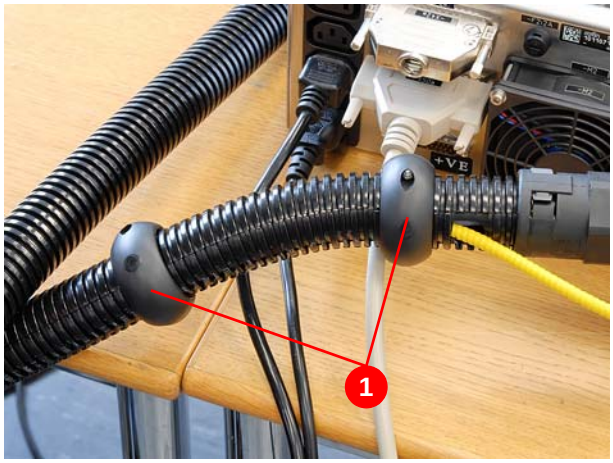

Figure 8.31 *Dismantling the scouring protection sleeves*

12. Remove both scouring protection sleeves (1) (Figure 8.31) from the corrugated hose.

Note: *The scouring protection sleeve that is removed further away from the connection plug can be rotated on the corrugated hose and cannot be fixed.*

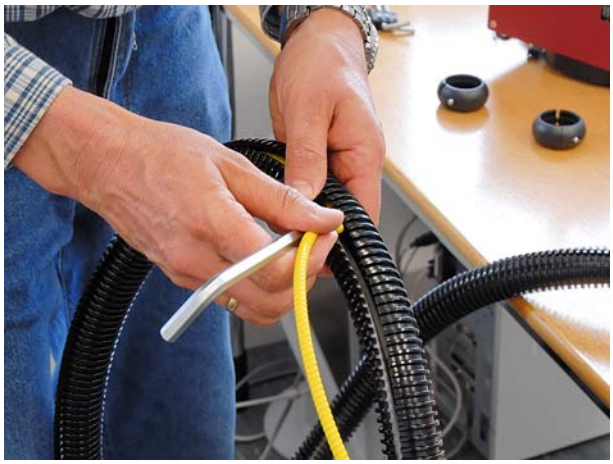

Figure 8.32 *Open the corrugated hose*

13. Completely open the corrugated hose, using a suitable tool as needed, and pull the fiberglass of the laser out.

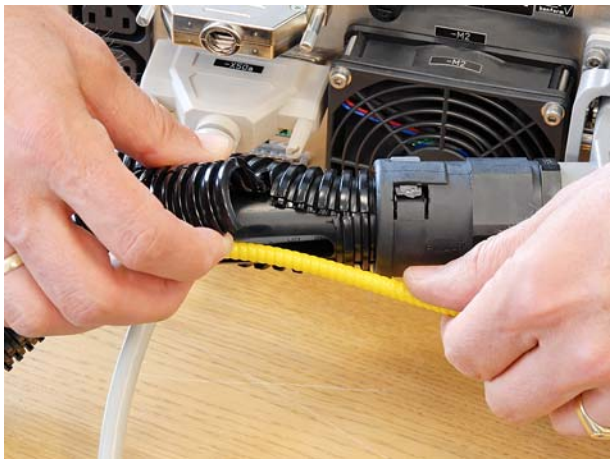

Figure 8.33 *Spread the corrugated hose*

14. Spread the corrugated hose apart at the -X41 connector and pull the fiberglass out of the inlet.

Attention: *To prevent damage due to pulling to the fiberglass, the connector -X41 may not be pulled from the supply plug-in until the fiberglass has been removed completely from the corrugated hose.*

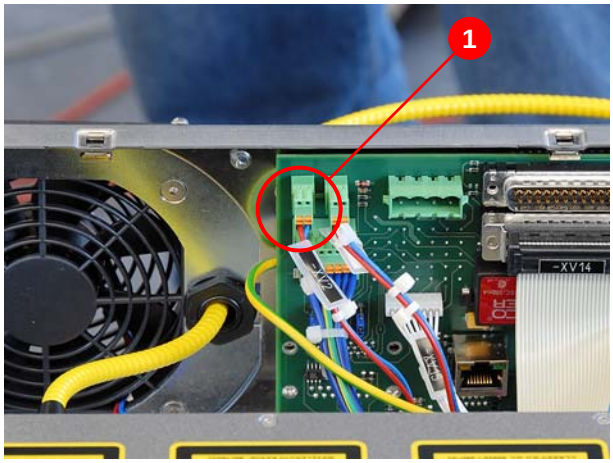

Figure 8.34 *Connector -XV2*

15. Unplug the connector for the power supply of the fan -M1 (-XV2) (1) (Figure 8.34).

Figure 8.35 *Tension relief on fan -M1*

16. Remove the fan -M1 with bracket.
17. Loosen the tension relief of the fiberglass on the bracket of the fan -M1 and pull the tension relief from the bracket.
18. Remove the fan with bracket.

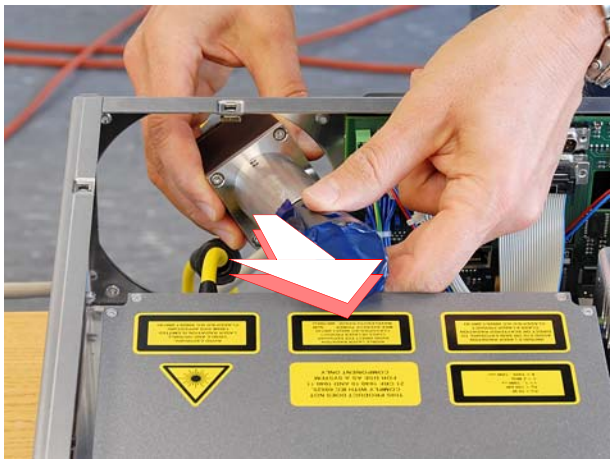

Figure 8.36 *Pull the decoupling unit through*

19. Pull the decoupling unit through the fan opening.

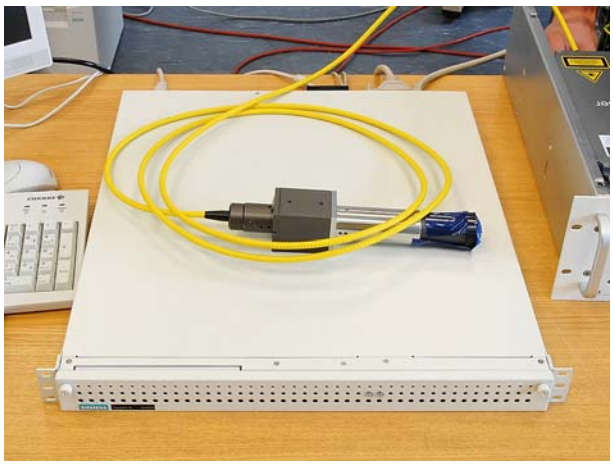

Figure 8.37 *Roll the fiberglass up*

20. Roll the fiberglass up.

Attention: *Be careful when handling fiberglass lines! Do not bend glass fiber lines and do not expose lines rolled up in a torsion-free manner to shocks. Do not get glass fibers dirty (prevent contact with dust and do not let them get on the floor)!*

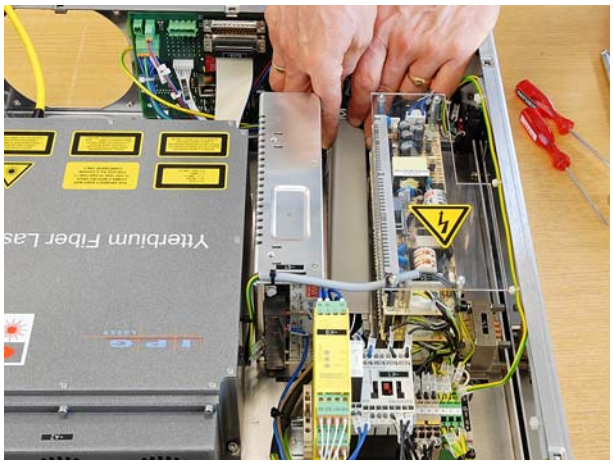

Figure 8.38 *Open the cable channel.*

21. Open the cable channel in the supply plug-in (see Figure 8.38).

22. Remove the supply from the power supply -G1 to the laser source from the cable channel.

Note: *If necessary, open the cable binders carefully.*

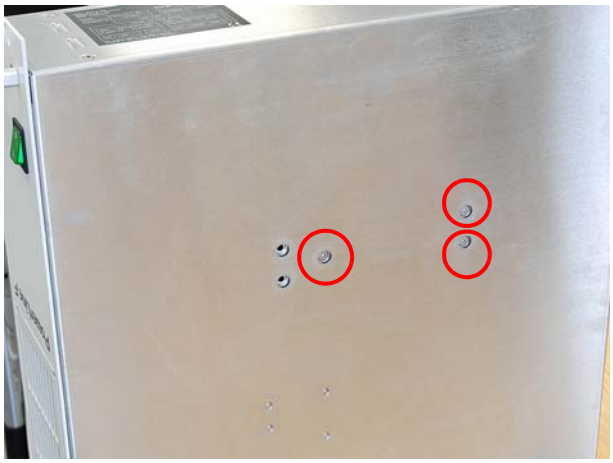

Figure 8.39 *Mount supply unit -G1*

23. Loosen the three fastening screws of the power supply -G1 on the bottom of the supply plug-in.

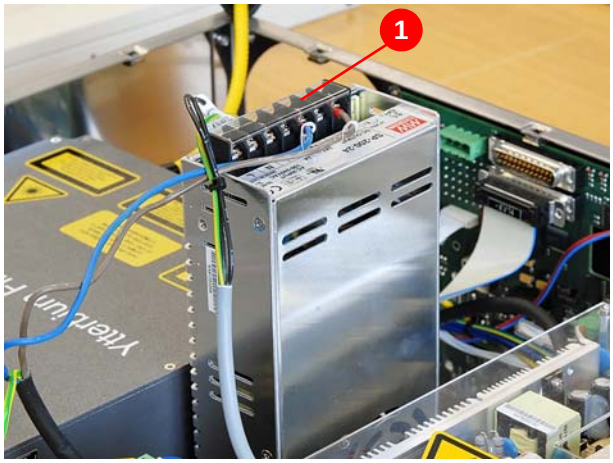

Figure 8.40 *Touch protection*

24. Remove the touch protection (1) (Figure 8.40) above the terminals of the power supply -G1.

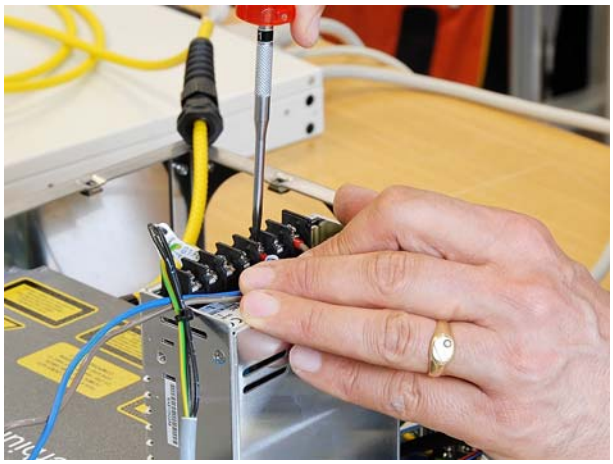

Figure 8.41 *Disconnect the supply line.*

25. Disconnect the supply from the power supply -G1 to the laser source.

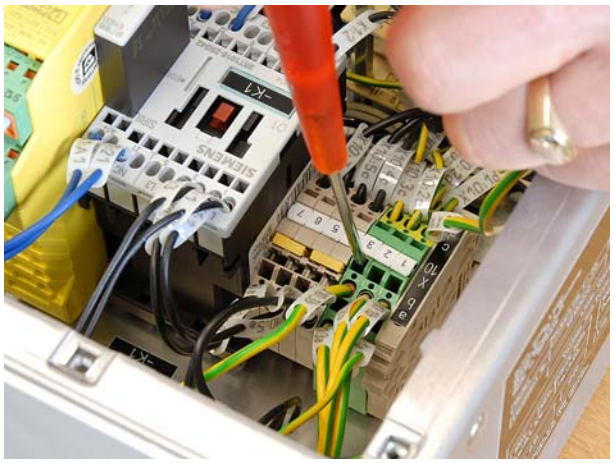

Figure 8.42 *Disconnect the PE connection*

26. Disconnect the PE connection of the laser source in the supply plug-in.

Note: *Apply counter-pressure with a suitable screwdriver to loosen the terminal connection.*

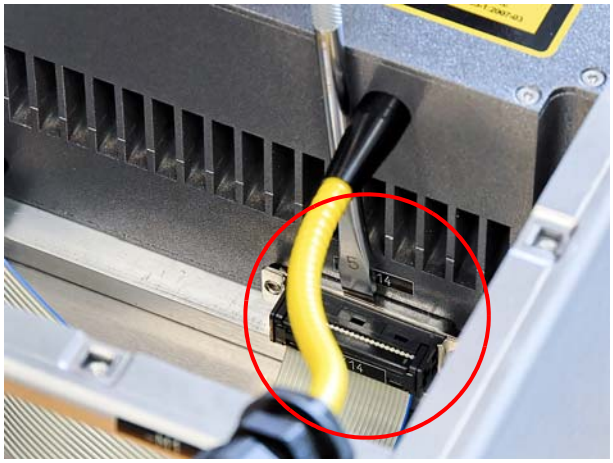

Figure 8.43 *Open connector -X14*

27. Carefully open the connector -X41 of the control cable at the laser source.

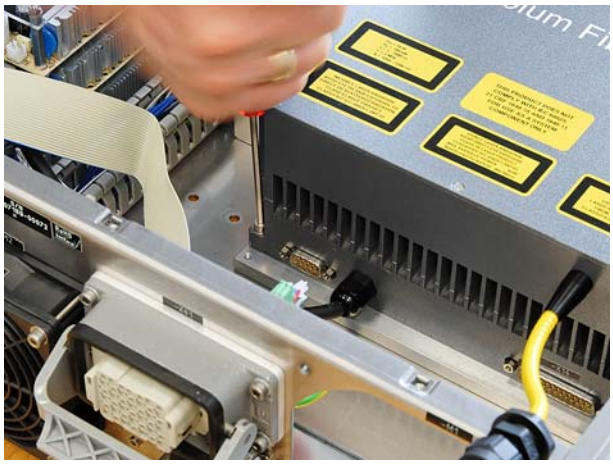

Figure 8.44 *Loosen the laser source bracket*

28. Loosen the four fastening screws of the laser source in the supply plug-in.
29. Remove the laser source from the supply plug-in.
30. Pull the labels off the connecting line.

Figure 8.45 *Unpack /pack laser source*

31. Remove the new laser source from the packaging and return the removed laser source to ROFIN-SINAR using this packaging.

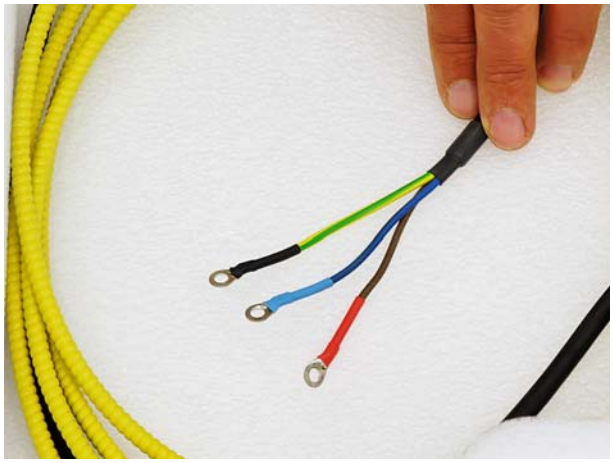

Figure 8.46 *Connecting line of the new laser source*

32. Remove the eyelets from the connecting line of the new laser source and replace them with wire end ferrules (1.5 mm²).
33. Attach markings of the connecting line on the new laser source.

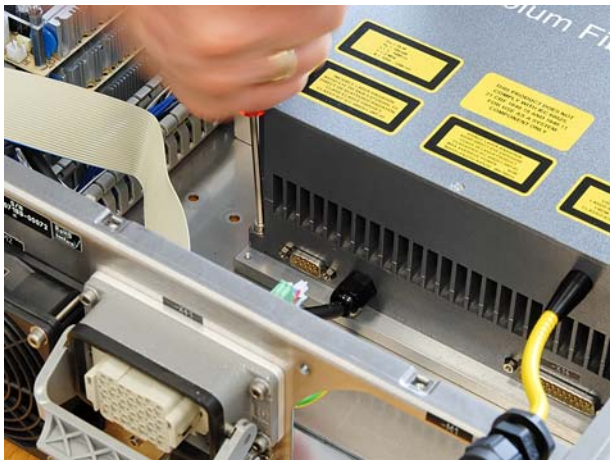

Figure 8.47 *Fasten laser source*

34. Place the laser source into the supply plug-in.
35. Screw the four fastening screws of the laser source into the supply plug-in.

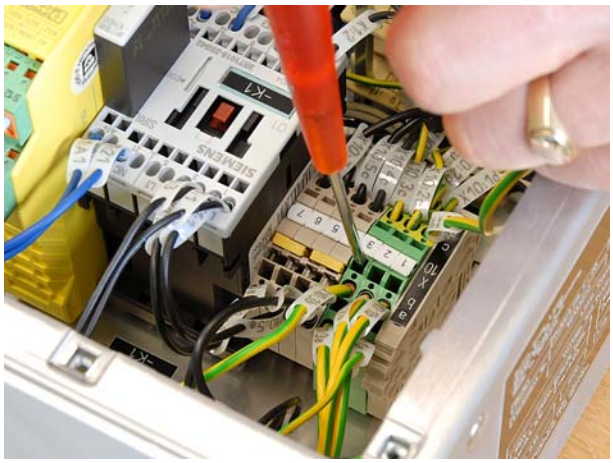

Figure 8.48 *Connect the PE connection*

36. Connect the PE connection of the laser source in the supply plug-in.

Note: *Apply counter-pressure with a suitable screwdriver to open the terminal connection.*

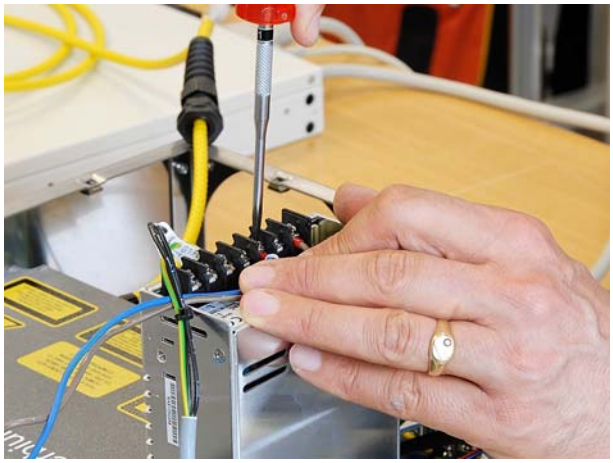

Figure 8.49 *Connect the supply line*

37. Connect the supply from the power supply -G1 to the laser source.

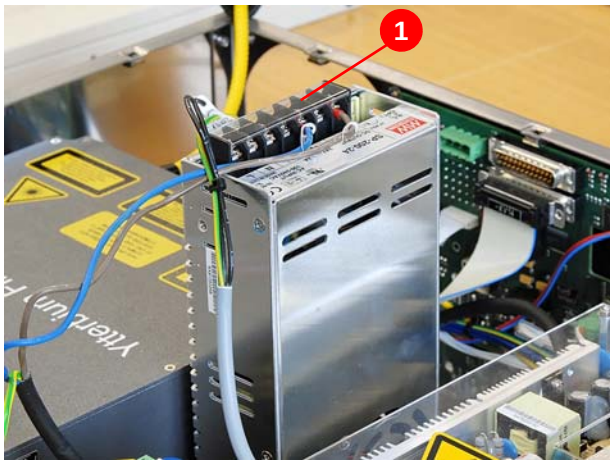

Figure 8.50 *Touch protection*

38. Mount the touch protection (1) (Figure 8.50) above the terminals of the power supply -G1.

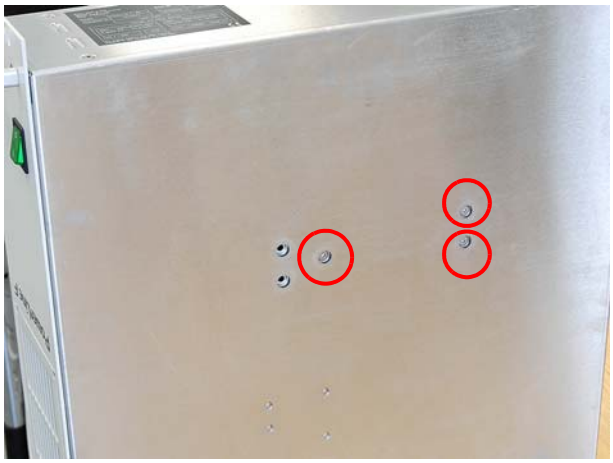

Figure 8.51 *Mount supply unit -G1*

39. Attach the power supply -G1 with three fastening screws on the bottom of the supply plug-in.

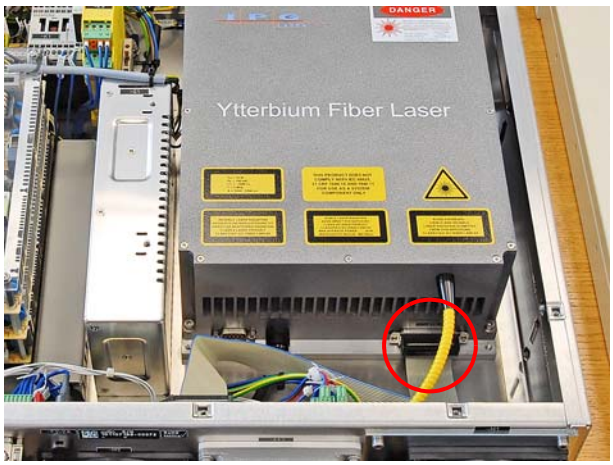

Figure 8.52 *Connect connector -X14*

40. Connect the connector -X41 of the control cable at the laser source.

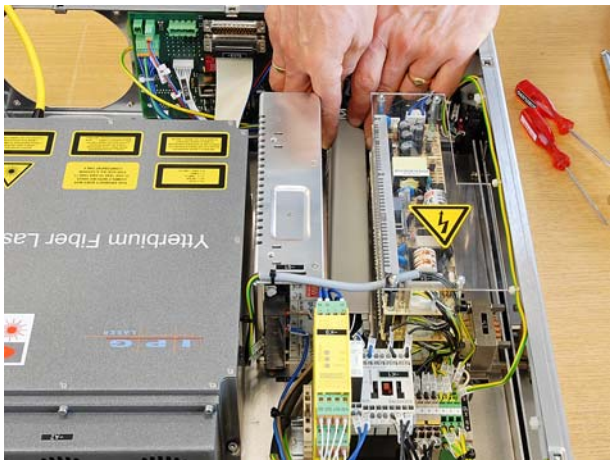

Figure 8.53 *Close the cable channel*

41. Install the supply line from the power supply -G1 to the laser source in the cable channel.
42. Close the cable channel in the supply plug-in (see Figure 8.53).

Note: *Replace cable binders that were removed.*

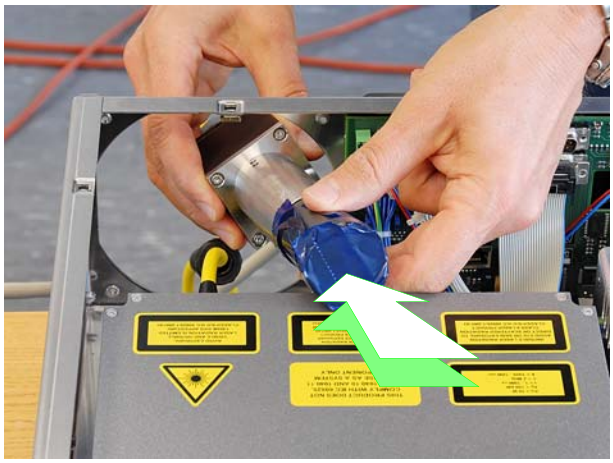

Figure 8.54 *Pull the decoupling unit through*

43. Pull the decoupling unit through the fan opening.

Figure 8.55 *Tension relief on fan -M1*

44. Slide the tension relief of the fiberglass to the bracket of the fan -M1 and tighten the tension relief.
45. Mount the fan -M1 with bracket.

Figure 8.56 *Installing the fiberglass*

Note: *Install fiberglass between the laser source and tension relief on the fan shield as shown in Figure 8.56 to prevent stressing the connection at the laser source when pulling the fiberglass.*

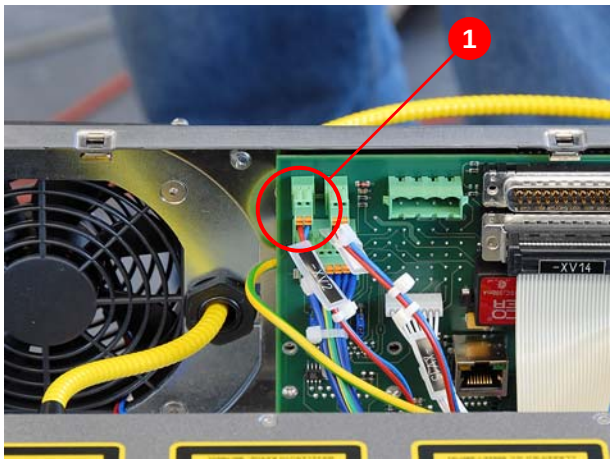

Figure 8.57 *Connector -XV2*

46. Connect the connector for the power supply of the fan -M1 (-XV2) (1) (Figure 8.57) to the PL-CF board.

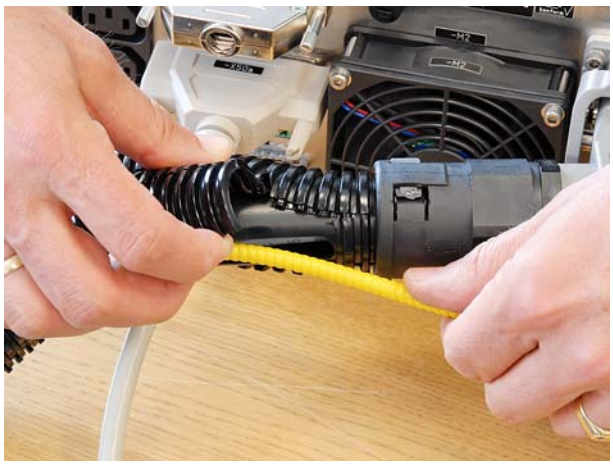

Figure 8.58 *Spread the corrugated hose*

Attention: *To prevent damage due to pulling to the fiberglass, the connector -X41 must be plugged in and locked in place before placing the fiberglass into the corrugated hose.*

47. Spread the corrugated hose apart at the -X41 connector and slide the fiberglass into the inlet.

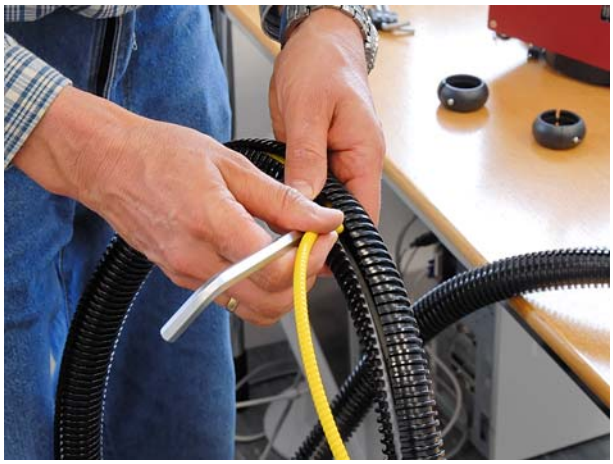

Figure 8.59 *Open the corrugated hose*

48. Open the corrugated hose, using a suitable tool as needed, and insert the fiberglass of the laser into the corrugated hose.

Figure 8.60 *Close the corrugated hose*

49. Close the corrugated hose absolutely free of any bends and without overlaps.

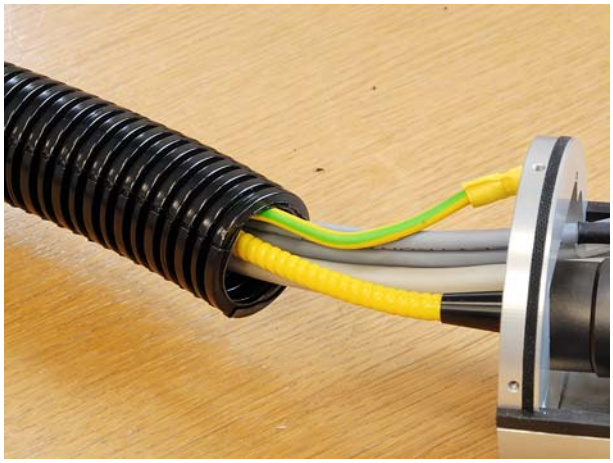

Figure 8.61 *End of corrugated hose*

⚠ ***Attention:*** *The end of the corrugated hose on the laser head may not have any overlaps after closing! Otherwise, the correct tension relief at the laser head cannot be guaranteed!*

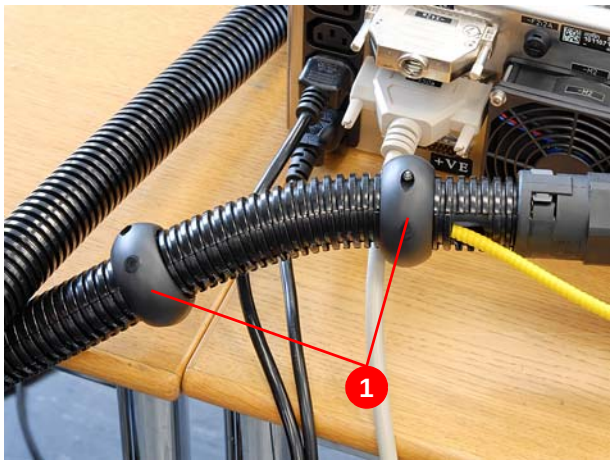

Figure 8.62 *Mount the scouring protection sleeves*

50. Mount both scouring protection sleeves (1) (Figure 8.62) at a distance of 100 mm on the corrugated hose.

Note: *The scouring protection sleeve that is removed further away from the connection plug can be rotated on the corrugated hose and cannot be fixed.*

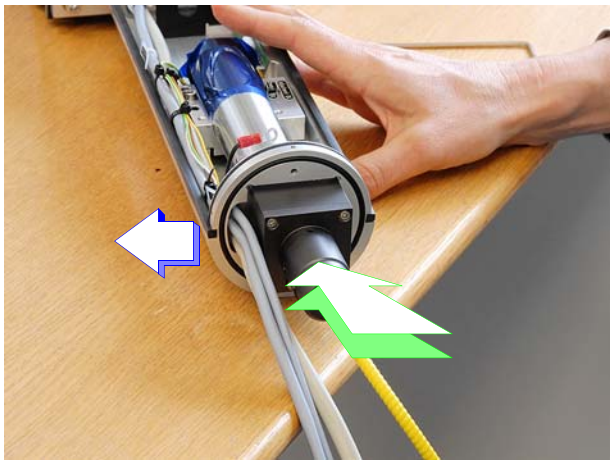

Figure 8.63 *Slide the decoupling unit in*

51. Move the cable in the laser head to the left and slide the decoupling unit into the laser head.

Figure 8.64 *Screw the lower half-shell on*

52. Place the lower half-shell of the tension relief onto the laser head and tighten the two fixing screws.

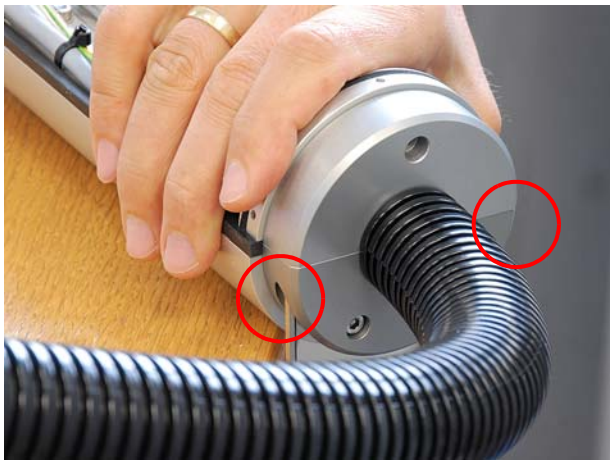

Figure 8.65 *Fasten the upper half-shell*

53. Screw the upper half-shell of the hose inlet onto the upper half-shell with the two screws on the side.

Figure 8.66 *Fixing screw hose inlet*

54. Screw the top rear fastening screw of the hose inlet tight.

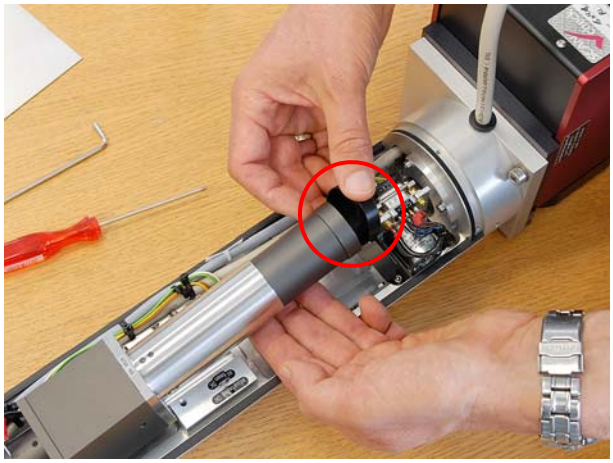

Figure 8.67 *Remove the dust protection cap.*

55. Remove the adhesive tape from the dust protection cap.

56. Pull the dust protection cap off the radiation emitter of the emergence unit.

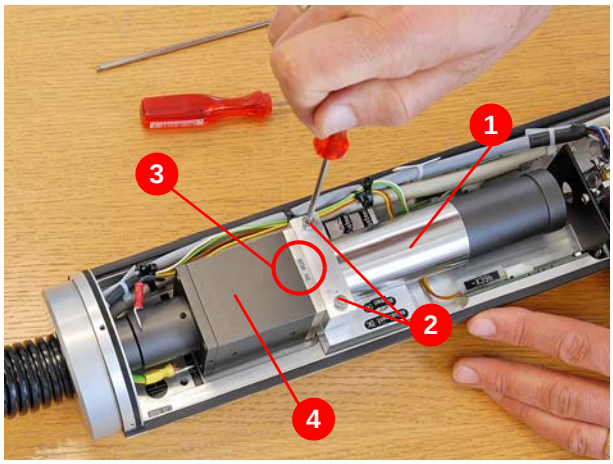

Figure 8.68 *Mount the emergence unit*

57. Mount the decoupling unit (1) (Figure 8.68) with the two fastening screws (2).

Note: *Insert the emergence unit so that the serial number (3) is on top.*

58.

Attention: *The optical isolator (4) is magnetic! Do not bring objects near the isolator that may be damaged or destroyed by magnetic fields (e. g. check boards)!*

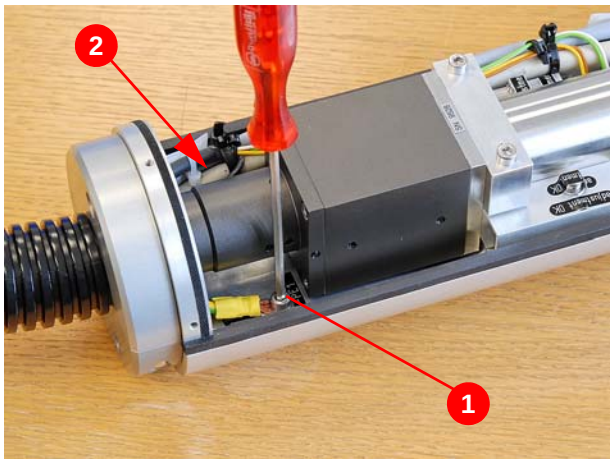

Figure 8.69 *PE connection laser head*

59. Fasten the PE connection in the laser head - PE1 (1) (Figure 8.69) and the screen connection -SK1 (2) positioned opposite in the laser head.

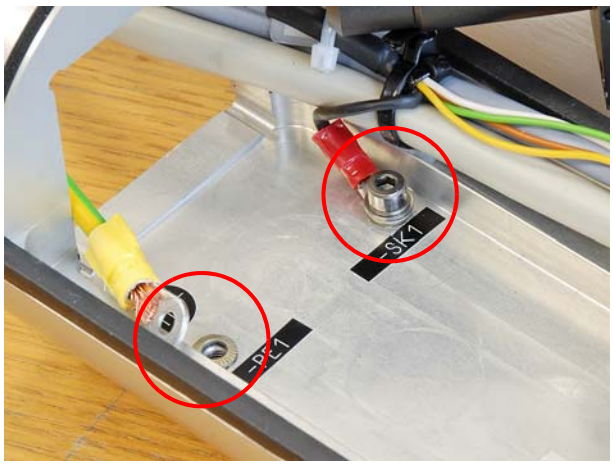

Figure 8.70 *Mounting the PE connection*

Attention: *When mounting the PE and screen connection in the laser head, make sure the lower disks are present and positioned correctly ("Claws" pointing down). These disks warrant the correct grounding of the laser head!*

60. Check the adjustment of the laser and readjust as needed (see Section 7.2.1, page 63).

61. Mount the cover of the laser head.

62. Close and reinstall the supply plug-in.

63. Commission the laser system.

8.4 Changing the PL-CF board

Attention: *Switch off the laser system and secure it against reactivation. Pull the mains plug. The peripheral components of the laser system should also be shut down and secured against reactivation.*

Attention: *If the laser system has to be switched on for testing/measuring purposes, measures for protection against laser radiation must be taken (use of protective goggles, setup and positioning of partition walls, attachment of warning signs and barriers, etc.). These measures must be coordinated with the laser protection officer.*
The DIN EN 207 Filter und Augenschutzgeräte gegen Laserstrahlung (BS EN 207 Filters and Eye-Protectors Against Laser Radiation (Laser Eye-Protectors)), DIN EN 60825-1 Sicherheit von Lasereinrichtungen (BS EN 60825-1 Safety of Laser Products), and DIN EN 60825-4 Sicherheit von Laserschutzwänden (BS EN 60825- 4 Safety of Laser Products: Laser Guards) standards must be observed.

Figure 8.71 *Supply plug-in*

1. Remove the supply plug-in and remove the upper cover.
2. Carefully pull the connector -X41 out of the supply plug-in and fasten it on the plug-in using suitable accessories (e. g. cable binder) so that it cannot slide.

Attention: *Sliding or moving the connector -X41 may lead to tension loads on the fiberglass and thereby cause damage!*

3. Disconnect all plug connections from the back of the supply plug-in.

Figure 8.72 *PL-CF board*

4. Disconnect all connectors from the PL-CF board.

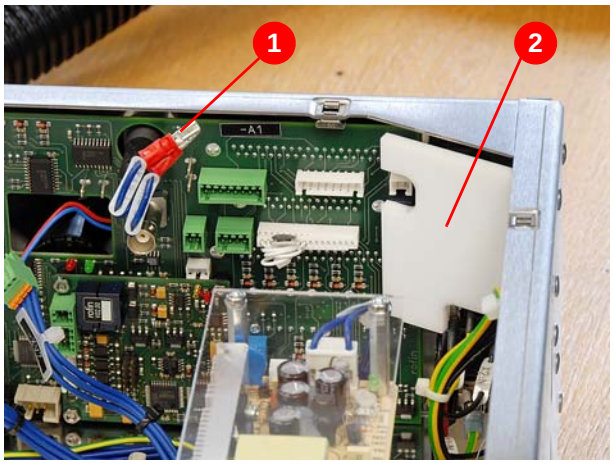

Figure 8.73 *Fuse / protective cover power connection*

5. Disconnect the plug-in connector of the fuse -F2 (1) (Figure 8.73) from the board.
6. Remove the protective cover (2) above the power connection.

Figure 8.74 *Unscrew the plug-in connections*

7. Unscrew all screwed connections of the plug-in connections from the supply plug-in.

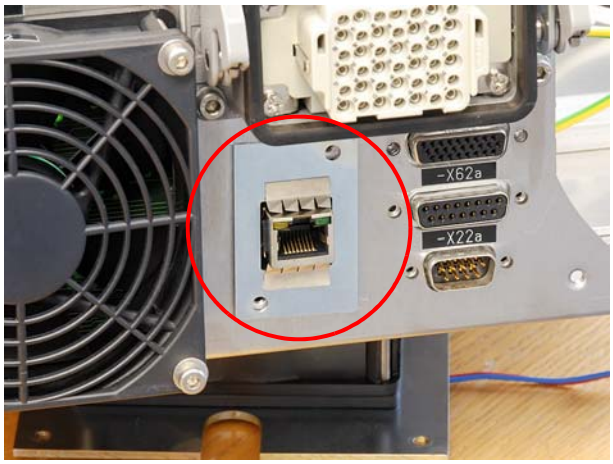

Figure 8.75 *Ground terminal on connector -X40*

⚠ ***Attention:*** *Carefully remove the ground terminal from connector -X40 without damaging it!*

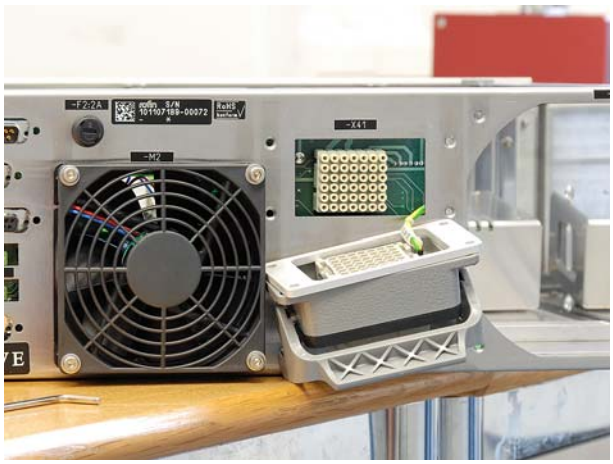

Figure 8.76 *Remove connector -X41*

8. Carefully pull connector -X41 apart and remove it.

Note: *Do not disconnect the PE connection in the connector.*

9. Remove the PL-CF board from the supply plug-in.

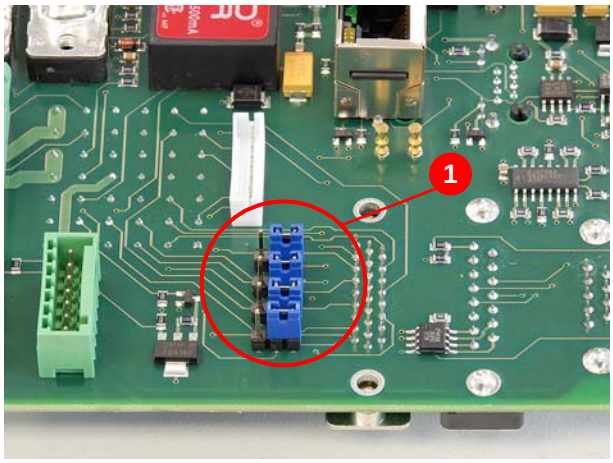

Figure 8.77 *Jumper PL-CF board*

10. Compare the jumpers (1) (Figure 8.77) on the new PL-CF board with those of the removed boards. Adjust the settings on the new boards as needed.

Attention: *In the process, do not use rough tools! Risk of damage!*

Figure 8.78 *Mount connector -X41*

11. Insert the new PL-CF board in the supply plug-in.
12. Connect connector -X41.

Note: *Due to the large number of pins in the connector, the connector -X41 must be plugged onto the PL-CF board by hand. Support the other side of the PL-CF board with the other hand.*

Note: *Make sure there is a spacer between the connector and supply plug-in.*

13. Lightly tighten the fastening screws of the connector.

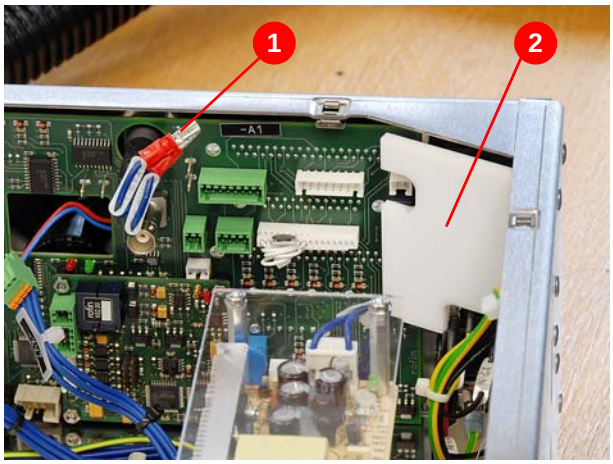

Figure 8.79 *Fuse / protective cover power connection*

14. Connect the plug-in connector of the fuse -F2 (1) (Figure 8.79) on the board.
15. Mount the protective cover (2) above the power connection.

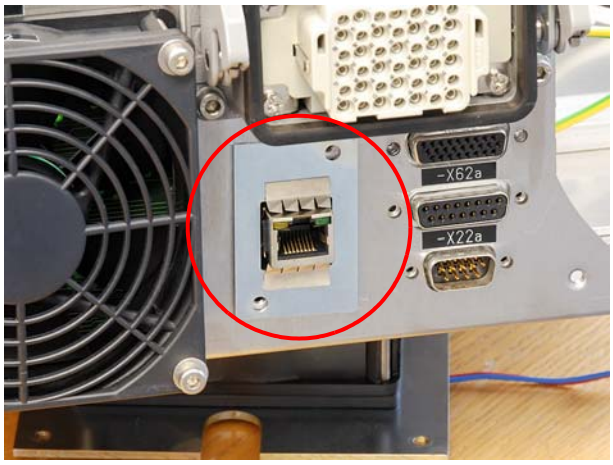

Figure 8.80 *Ground terminal on connector -X40*

16. Mount the ground terminal on connector -X40.
17. Mount the protective cover above the connector.

Figure 8.81 *Screw the plug-in connections on*

18. Loosely screw all screwed connections of the plug-in connections onto the supply plug-in.

Note: *Do not tighten the screws in the beginning so that the PL-CF board can still be aligned if necessary.*

19. Hand-tighten all fastening screws of the plug-in connectors.

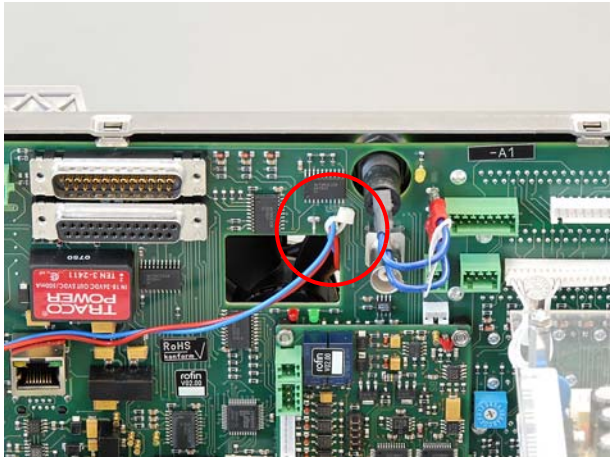

Figure 8.82 *Supply fan -M2*

20. Fix supply of the fan -M2 with a cable binder (see Figure 8.82).

⚠ ***Attention:*** *The fan wheel must rotate freely (no collision with the connecting line, for example)!*

21. Connect the connecting plugs on the PL-CF board according to the wiring diagram.

22. Connect all plug connections to the back of the supply plug-in.

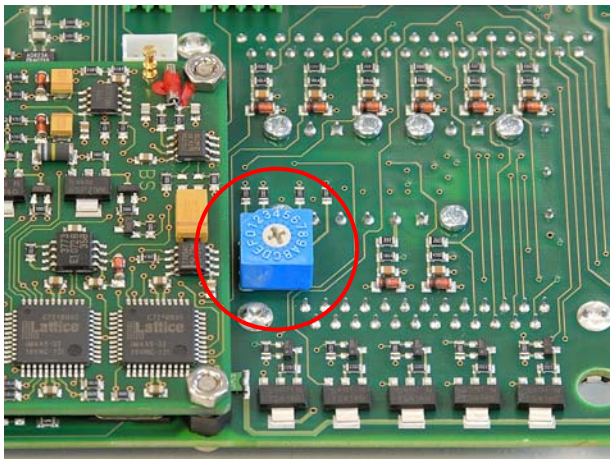

Figure 8.83 *Turn switch PL-CF board*

23. Performing basic settings for the PL-CF board:

a) Switch off the main switch on the supply plug-in.

b) Set the arrow tip of the turn switch (Figure 8.83) to the "F" position.

c) Switch on the main switch on the supply plug-in. The three LEDs on the PL-CF board (see Figure 8.84, page 105) will light up.

d) Switch the main switch on the supply plug-in off again.

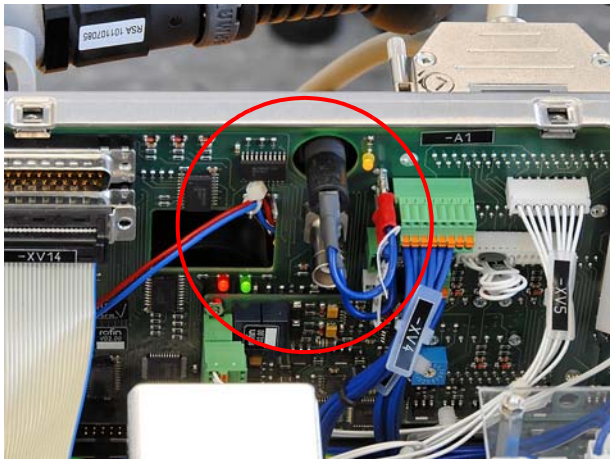

Figure 8.84 *LEDs PL-CF board*

e) Set the arrow tip of the turn switch (see Figure 8.83, page 105) to the "3" position.

f) Switch on the main switch on the supply plug-in. The three LEDs on the PL-CF board (Figure 8.84) will flash. The green LED will then flash with a frequency of 1 Hz.

ℹ ***Note:*** *In the event of an error (e. g. incorrectly set laser type, incorrect initialization), the green LED will flash with a frequency of approximately 4 Hz.*

24. Mount the cover of the supply plug-in.

25. Slide the supply plug-in back and fasten it.

26. Commission the laser system.

27. Perform the function test for the laser system (test marking, test processing).

8.5 Changing the -G1 power supply unit

Attention: *Switch off the laser system and secure it against reactivation. Pull the mains plug. The peripheral components of the laser system should also be shut down and secured against reactivation.*

Attention: *If the laser system has to be switched on for testing/measuring purposes, measures for protection against laser radiation must be taken (use of protective goggles, setup and positioning of partition walls, attachment of warning signs and barriers, etc.). These measures must be coordinated with the laser protection officer.*
The DIN EN 207 Filter und Augenschutzgeräte gegen Laserstrahlung (BS EN 207 Filters and Eye-Protectors Against Laser Radiation (Laser Eye-Protectors)), DIN EN 60825-1 Sicherheit von Lasereinrichtungen (BS EN 60825-1 Safety of Laser Products), and DIN EN 60825-4 Sicherheit von Laserschutzwänden (BS EN 60825- 4 Safety of Laser Products: Laser Guards) standards must be observed.

Figure 8.85 *Supply plug-in*

1. Remove the supply plug-in and remove the upper cover.

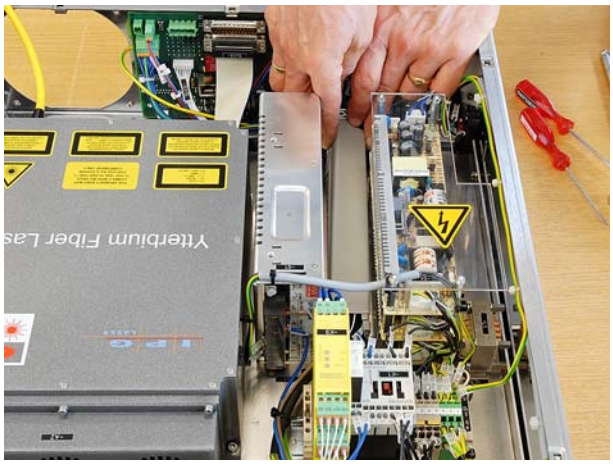

Figure 8.86 *Open the cable channel.*

2. Open the cable channel in the supply plug-in (see Figure 8.86).
3. Remove the supply from the power supply -G1 to the laser source from the cable channel.

Note: *If necessary, open the cable binders carefully.*

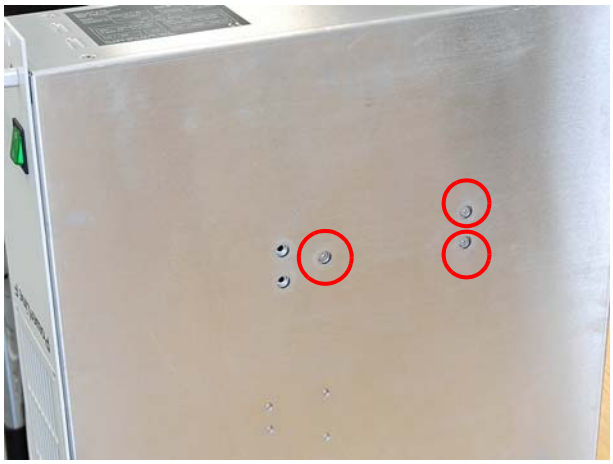

Figure 8.87 *Mount supply unit -G1*

4. Loosen the three fastening screws of the power supply -G1 on the bottom of the supply plug-in.

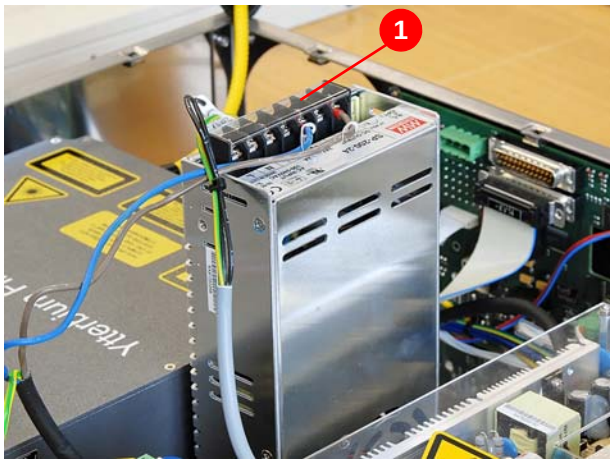

Figure 8.88 *Touch protection*

5. Remove the touch protection (1) (Figure 8.88) above the terminals of the power supply -G1.

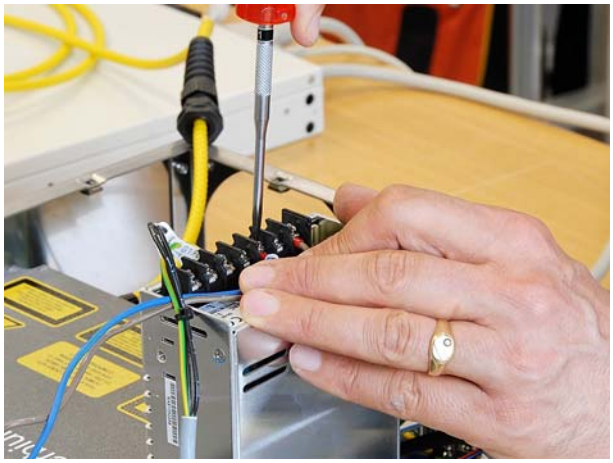

Figure 8.89 *Supplies -G1 power supply*

6. Disconnect the supply from the power supply -G1 to the laser source and the power supply line of the power supply unit.
7. Changing the power supply unit.
8. Reconnect the supply from the power supply -G1 to the laser source and the power supply line of the power supply unit.

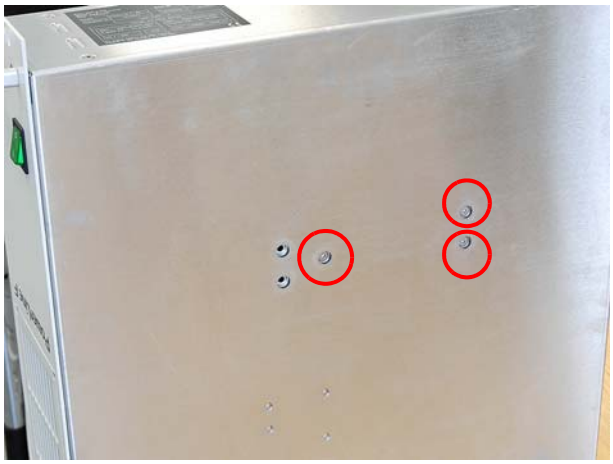

Figure 8.90 *Mount supply unit -G1*

9. Attach the power supply -G1 with three fastening screws on the bottom of the supply plug-in.
10. Measure the output voltage on the -G1 power supply and adjust as needed (24 V ±0.2 V).
11. Mount the touch protection (1) (see Figure 8.88, page 107) above the terminals of the power supply -G1.

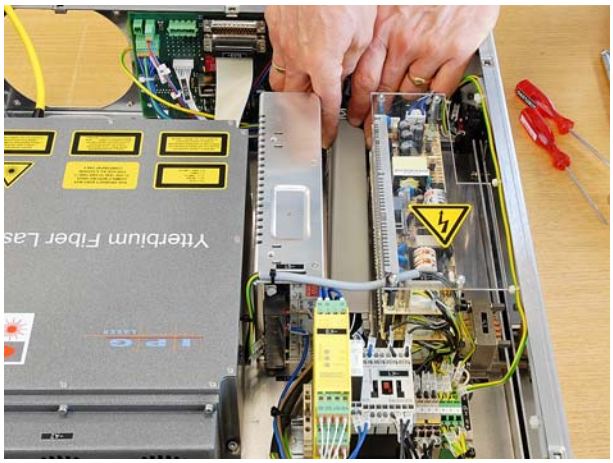

Figure 8.91 *Close the cable channel*

12. Install the supply line from the power supply -G1 to the laser source in the cable channel.
13. Close the cable channel in the supply plug-in (see Figure 8.91).

Note: *Replace cable binders that were removed.*

14. Mount the cover of the supply plug-in.
15. Slide the supply plug-in back and fasten it.
16. Commission the laser system.
17. Perform the function test for the laser system (test marking, test processing).

8.6 Changing power supplies -G2, -G3 and -G4

Attention: *Switch off the laser system and secure it against reactivation. Pull the mains plug. The peripheral components of the laser system should also be shut down and secured against reactivation.*

Attention: *If the laser system has to be switched on for testing/measuring purposes, measures for protection against laser radiation must be taken (use of protective goggles, setup and positioning of partition walls, attachment of warning signs and barriers, etc.). These measures must be coordinated with the laser protection officer.*
The DIN EN 207 Filter und Augenschutzgeräte gegen Laserstrahlung (BS EN 207 Filters and Eye-Protectors Against Laser Radiation (Laser Eye-Protectors)), DIN EN 60825-1 Sicherheit von Lasereinrichtungen (BS EN 60825-1 Safety of Laser Products), and DIN EN 60825-4 Sicherheit von Laserschutzwänden (BS EN 60825- 4 Safety of Laser Products: Laser Guards) standards must be observed.

Figure 8.92 *Supply plug-in*

1. Remove the supply plug-in and remove the upper cover.

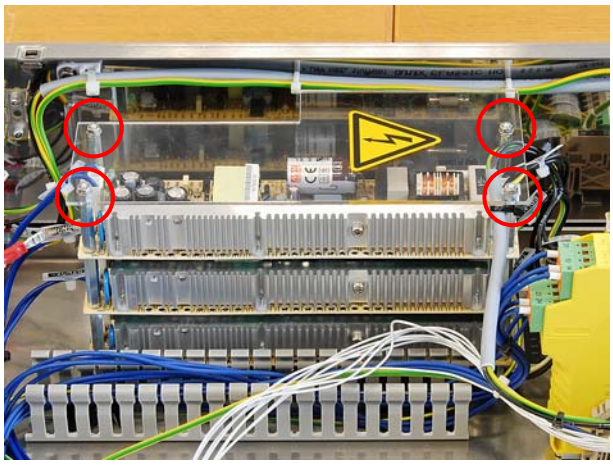

Figure 8.93 *Touch protection*

2. Remove the touch protection (Figure 8.93) above the power supply units.

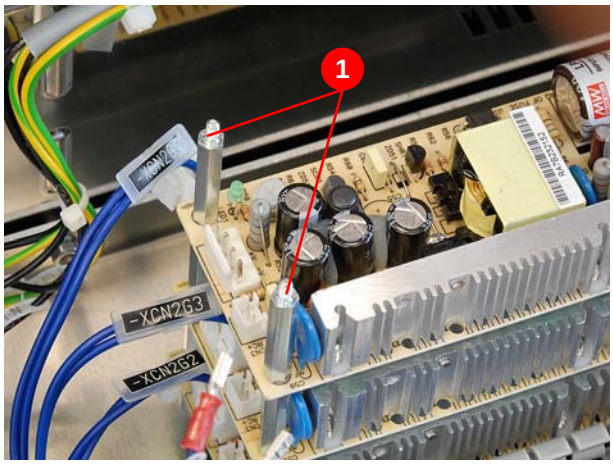

Figure 8.94 *Removing power supply units*

3. Unplug supply lines of power supply units to be removed.
4. Remove bolts (1) (Figure 8.94) and power supply.
5. Changing the power supply unit.
6. Mount power supply unit(s) and bolts.

Attention: *Make sure that the installation sequence of the power supply units is correct. Incorrect connections may lead to malfunctions or damage due to incorrect voltage at the galvo head and/or control plug-in!*

7. Reconnect the supply lines.
8. Mount the touch protection (see Figure 8.93, page 109).
9. Check the operating voltage galvo head at the power supplies -G2, -G3 and -G4 and adjust (seePage 79 to Page 80). Check the control voltage (24 V ±0.2 V) at the -G2 power supply and adjust as needed (procedure as with -G3/-G4, Page 79).
10. Mount the cover of the supply plug-in.
11. Slide the supply plug-in back and fasten it.
12. Commission the laser system.
13. Perform the function test for the laser system (test marking, test processing).

8.7 Changing the warning lights in the laser head

Attention: *Switch off the laser system and secure it against reactivation. Pull the mains plug. The peripheral components of the laser system should also be shut down and secured against reactivation.*

Attention: *If the laser system has to be switched on for testing/measuring purposes, measures for protection against laser radiation must be taken (use of protective goggles, setup and positioning of partition walls, attachment of warning signs and barriers, etc.). These measures must be coordinated with the laser protection officer.*
The DIN EN 207 Filter und Augenschutzgeräte gegen Laserstrahlung (BS EN 207 Filters and Eye-Protectors Against Laser Radiation (Laser Eye-Protectors)), DIN EN 60825-1 Sicherheit von Lasereinrichtungen (BS EN 60825-1 Safety of Laser Products), and DIN EN 60825-4 Sicherheit von Laserschutzwänden (BS EN 60825- 4 Safety of Laser Products: Laser Guards) standards must be observed.

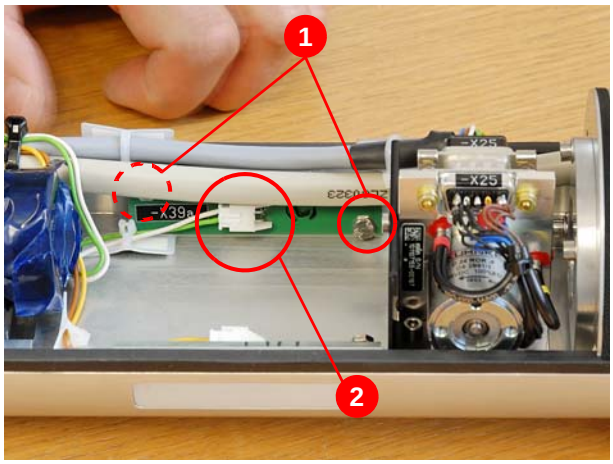

Figure 8.95 *Fastening the warning lights*

1. Open the cover of the laser head.
2. Unplug the connector -X25 from the shutter, if necessary.
3. Dismantle the fasteners of the warning lamps (1) (Figure 8.95).

Note: *When changing the warning lamps, make sure that the position or alignment of the decoupler unit does not change. Otherwise, the decoupling unit must be realigned.*

4. Unplug the connecting plug (2) from the PCB.

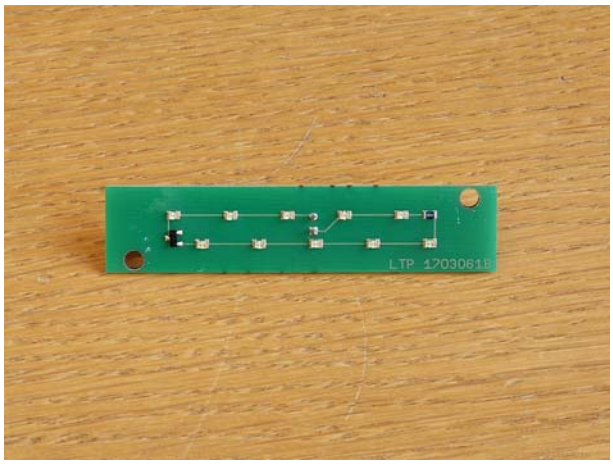

Figure 8.96 *Warning light*

5. Changing the warning light.
6. Mounting the warning light.
7. Reconnect the supply.
8. Connect the connector -X25 to the shutter as applicable.
9. Mount the cover of the laser head.
10. Commission the laser system.

8.8 Changing the ALI board

Attention: *Switch off the laser system and secure it against reactivation. The peripheral components of the laser system should also be shut down and secured against reactivation.*

Attention: When the power connection is disconnected as required prior to opening the PC plug-in, the PE connection will also be disconnected!
The PC plug-in must be properly grounded before work is performed on electronic components! The external connection to ground must be established at a marked PE terminal of the plug-in and a marked PE terminal in the system area! A measurement must be performed to ensure correct equipotential bonding! The ESD wrist band must then be connected to a PE terminal of the plug-in!
No work may be performed on electronic components prior to that!

Attention: *All personnel working on electronic components must comply with the required measures to protect electrostatic sensitive devices! The work area must be secured!*

Attention: *If the laser system has to be switched on for testing/measuring purposes, measures for protection against laser radiation must be taken (use of protective goggles, setup and positioning of partition walls, attachment of warning signs and barriers, etc.). These measures must be coordinated with the laser protection officer.*
The DIN EN 207 Filter und Augenschutzgeräte gegen Laserstrahlung (BS EN 207 Filters and Eye-Protectors Against Laser Radiation (Laser Eye-Protectors)), DIN EN 60825-1 Sicherheit von Lasereinrichtungen (BS EN 60825-1 Safety of Laser Products), and DIN EN 60825-4 Sicherheit von Laserschutzwänden (BS EN 60825- 4 Safety of Laser Products: Laser Guards) standards must be observed.

Figure 8.97 *PC plug-in*

1. Remove the PC plug-in and remove the upper cover.
2. Disconnect all connecting lines from the back of the PC plug-in.

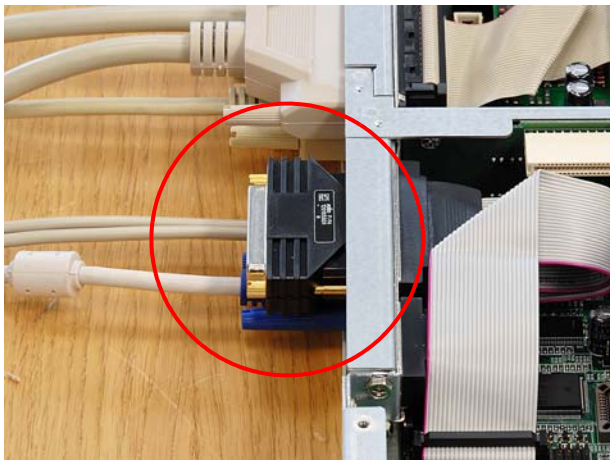

Figure 8.98 *Dongle for VLM software*

Note: *A dongle for the VLM software (see Figure 8.98) is located on the back of the PC plug-in. This dongle does not have to be removed when changing the ALI board!*

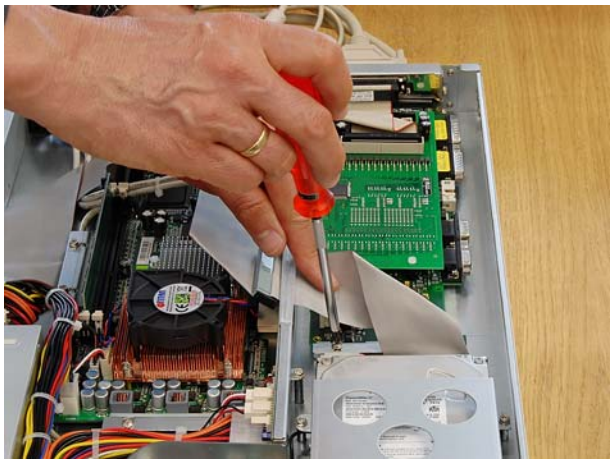

Figure 8.99 *Loosen the ALI board*

3. Loosen the front fastener of the ALI board (3 screws).

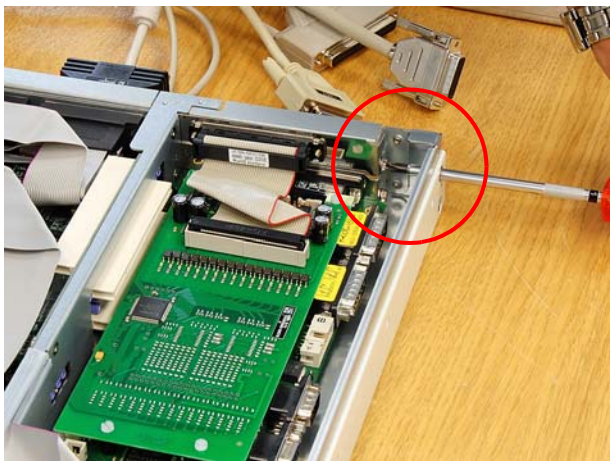

Figure 8.100 *Loosen the boards*

4. Loosen the fastener of the top board.

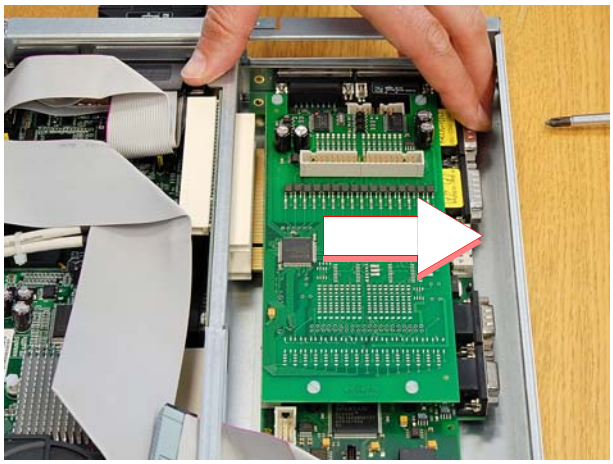

Figure 8.101 *Remove the boards*

5. Pull the board out on the side.
6. Disconnect the connector from the board.

⚠ ***Attention:*** *Do not pull on the cables of the connector!*

Figure 8.102 *Fasten board*

7. Insert and fasten new boards.

⚠ ***Attention:*** *Do not damage the boards and components with fastening elements (see Figure 8.102)!*

8. Connect the new boards according to the wiring diagram.
9. Connect all connecting lines on the back of the PC plug-in.
10. Mount the cover of the PC plug-in.
11. Slide the PC plug-in back and fasten it.
12. Load the new ALI configuration (see Section 5.5, page 47 and Section 5.6, page 50).

8.9 Changing the PC

Attention: *With a laser system, the operator or his administrator must back up data in regular intervals (the ACRONIS software is provided by ROFIN-SINAR) and backed up to DVD (the burning software NERO OEM and a DVD burner are installed on the PC).*
The owner of the laser system is responsible for the data backup! ROFIN-SINAR is not liable for lost data due to a lack of backups!

Attention: *Switch off the laser system and secure it against reactivation. The peripheral components of the laser system should also be shut down and secured against reactivation.*

Attention: When the power connection is disconnected as required prior to opening the PC plug-in, the PE connection will also be disconnected!
The PC plug-in must be properly grounded before work is performed on electronic components! The external connection to ground must be established at a marked PE terminal of the plug-in and a marked PE terminal in the system area! A measurement must be performed to ensure correct equipotential bonding! The ESD wrist band must then be connected to a PE terminal of the plug-in!
No work may be performed on electronic components prior to that!

Attention: *All personnel working on electronic components must comply with the required measures to protect electrostatic sensitive devices! The work area must be secured!*

Figure 8.103 *PC plug-in*

1. If possible, repeat the data backup.
2. Switch off the laser system and secure it against reactivation.
3. Remove the PC plug-in and remove the upper cover.
4. Disconnect all connecting lines from the back of the PC plug-in.

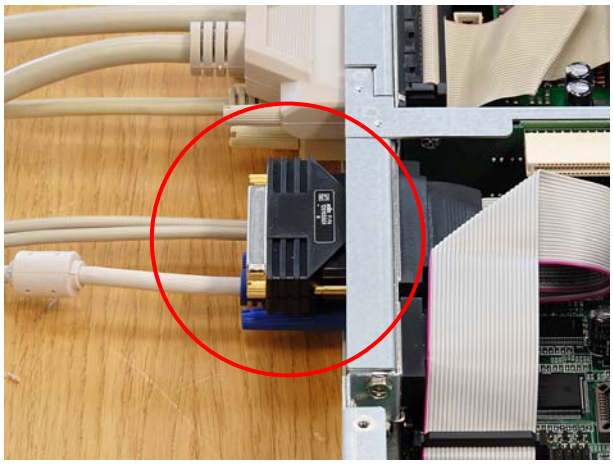

Figure 8.104 *Dongle for VLM software*

5. Remove the dongle for the VLM software from the printer port on the back of the PC plug-in.
6. Remove the ALI board including all plug-in boards and connecting cables that are connected to the board (see Section 8.8, page 112).
7. Reclose and package the PC plug-in and send it to ROFIN-SINAR.
8. Check the license label for WINDOWS® XP on the new PC.
9. Open the new PC plug-in.
10. Mount the ALI board including all plug-in boards and connecting cables that are connected to the board in the PC plug-in (see Section 8.8, page 112).
11. Connect the new boards.
12. Connect the dongle for the VLM software to the printer port on the back of the PC plug-in.
13. Connect all connecting lines on the back of the PC plug-in.
14. Mount the cover of the PC plug-in.
15. Slide the PC plug-in back and fasten it.
16. Install the existing customer backup using the ACRONIS software on the new PC (ACRONIS True-Image license is included in the delivery and preinstalled on every system/ PC) or use the included restoration DVD and restore the delivery state on the new PC.
17. Load the new ALI configuration (see Section 5.5, page 47 and Section 5.6, page 50).

8.10 Changing the filter pad

Note: *The changing of the filter pads is described in Chapter 2 of the ROFIN-SINAR Maintenance and Integration Manual.*

Notes

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